The Labour Market in Three Countries: An International Comparison of Relative Earnings in Australia, Great Britain and the United States

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Declaration

Apart from the assistance indicated in the acknowledgements, this thesis is my own original work

Anne Daly
December 1990.

Acknowledgements

I would like to thank my supervisor Professor Bob Gregory and my two advisors, Dr. George Fane and Dr. Bruce Chapman, for their comments and advise in the preparation of this thesis. I have learnt many things from them over cappucinos at Katarina's. I would also like to thank Vivian Ho for her help in getting me started in the use of of these large data sets and Francis Teal for his comments on various parts of the thesis. The members of the Economics PhD Workshop at ANU provided many useful comments during presentations based on this thesis.

This thesis is a development of the theme of international comparisons begun with Bob Gregory in the comparison of the introduction of the effects of equal pay on the relative earnings of women in Australia, Great Britain and the United States. Although this work does not appear directly in the thesis, it underlies much of the discussion in chapters 7 and 8.

Abstract

This thesis investigates the relationship between age and earnings for men and women in Australia, Great Britain and the United States. The facts for full-time workers in the three countries can be summarised in the following way:

1. There was greater variation in earnings with age in the US than in either of the other countries. This was particularly apparent for men. In the US, 45 year old men earned on average, 42 per cent more than 25 year old men while in Great Britain, they earned 21 per cent more and in Australia, 13 per cent more.
2. Women's earnings varied less with age than did men's in each country and peaked much earlier than male earnings. At their peak in their early 30s, American women's earnings were about 20 per cent above those of a 25 year old, in Great Britain they were 8 per cent above a 25 year old's and in Australia they were about the same.
3. In each country, women's earnings varied less with age than did male earnings. If we take the proportionate difference between male and female earnings at each age between 16 and 64, the largest gap, relative to the gap at age 25, was between men and women in Australia in their late 30s. The relative difference between men and women in Australia was twice as large as in the other countries.

There are a number of theories which have been put forward to explain why earnings vary with age. This thesis considers some of the factors suggested as being important; sex, experience in the workforce, education, industry of employment, the level of unionisation in an industry and cohort size. Our results show that within each country for both men and women, education, experience and industry of employment are important determinants of earnings. The evidence presented here is consistent, at least for men, with the hypothesis that higher levels of unionisation in an industry are associated with flatter age earnings profiles than in the less unionised industries. Our results on the effect of cohort size on earnings

were less conclusive.

The earnings regressions for each country were used to decompose the differences in the relative earnings by age into that part which can be attributed, at least in an accounting sense, to endowments and that part which can be attributed to coefficients or the rewards to these endowments. We found that differences in both the stocks and the rewards to the basic human capital variables, education and experience, were the major sources of differences between the countries in the shapes of the age earnings profiles for both men and women. The evidence presented here suggests that at least with respect to age earnings profiles for men, the centralised system of wage determination in Australia has not led to very different results than those found in Great Britain. However, the results for women are consistent with the hypothesis that the Australian system has produced flatter profiles than found in the other countries.

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Chapter 1
Introduction

The main purpose of this thesis is to investigate the relationship between age and earnings for men and women in Australia, Great Britain and the United States. The facts at an aggregate level are summarised in three figures (figures 1.1-1.3) relating to the relationship between age and earnings for full-time workers in the three countries in 1981. The figures show that there was greater variation in earnings with age in the US than in the other two countries and that in each country, average weekly earnings varied more with age for men than for women. The differences between the sexes were particularly pronounced in Australia.

In this thesis we shall examine the competing explanations of these facts and ask to what extent they can explain both the differences and the similarities between the countries in the shapes of the age earnings profiles for men and women. The emphasis of the thesis is on the presentation of data and empirical results. Most of the results confirm those of earlier studies of the earnings function. What is new is the presentation of results on a consistent basis for three countries. This enables us to see both the common themes across the three countries and to highlight the differences.

Many of theoretical arguments which have been put forward to explain the rise in earnings with age are observationally equivalent at least with the data available in writing this thesis. As well as these general explanations of the shape of age earnings profiles, applicable across all the countries, country specific factors, particularly the wage determination system, may be important in explaining differences between the countries. There are of course, many country specific factors which may influence the shapes of these profiles, for example the tax system, which we have not considered here.

We shall consider, in an international framework, the factors which various theories suggest may be important in explaining the shape of the age earnings profile;

sex, working experience, education, industry of employment, the extent of trade union membership in an industry and cohort size. We shall see whether these variables are important in explaining earnings within one country and also the extent to which differences between the countries in both the endowments of these factors and the rewards to these endowments explain the differences in the shapes of the age earnings profiles. In Australia there has been considerable debate as to the effect of the centralised wage determination system on the distribution of earnings. Our international comparison will enable us to see whether at least with respect to age earnings profiles, the outcome of the Australian system is very different from that of other countries.

This introductory chapter contains three sections; the first one presents the facts about the aggregate age earnings profiles of men and women in the three countries and the different effect of aging on earnings for men and women. The second section presents an outline of the wage determination system in each country.This will be used as background material in some of the discussion of the later chapters. A final section includes the plan of the thesis.

1.1 Age Earnings Profiles of Men and Women in Three Countries.

In figures 1.1 and 1.2, we have measured the earnings of males and females in each country relative to the average earnings of a 25 year old of the same gender, so the earnings of a 25 are set at one by construction. (1) Figure 1.1 relates to weekly earnings of men aged 16-64 working full-time in 1981. The picture is one of a steeper earnings profile in the US than in Australia and Great Britain. In the US, earnings peaked later and at a higher level than in the other two countries. The earnings of American men in the 1981 cross section peaked in their late 40's at 3.7 times the earnings of a sixteen year old. In Australia and Great Britain, earnings peaked in the late thirties and were 2.7 times and 3 times respectively, the earnings of sixteen year olds.

Figure 1.2 compares the results for the whole sample of women working full-time in each of the countries. Average weekly earnings of 16 year old women in Australia

were a smaller proportion of a 25 year olds than in the other two countries. Australian earnings peaked in their late 20's while earnings in Great Britain and the US continued to rise into the early 30's. In Australia, the earnings of the average full-time working woman over 32 in 1981 were in fact lower than those of a 25 year old. In Great Britain, the average declined from the peak in the early 30's but only fell below the earnings of a 25 year old for a few years for women in their early 40's. In the US, earnings of the average woman fell after age 32 but never below those of 25 year olds.

Figure 1.3 summarises the differences by age in relative male and female earnings in the three countries in order to show how the difference in the average weekly earnings of men and women vary with age between the countries. We have set the difference in average weekly earnings at age 25 equal to one. At ages where the difference in average earnings of men and women was greater than at age 25, the size of the gap was bigger than one. An earnings gap of less than one shows that the difference between the average earnings at that age was smaller than at age 25. (2) The largest difference between the earnings of men and women at most ages compared with the relative earnings of men and women aged 25 was in Australia. Earnings for Australian women grew more slowly compared with their male counterparts than in either Great Britain or the United States. (3)

In summary, there was greater variation in earnings with age for men than for women in each country. A comparison between the countries for each sex shows that earnings varied more with age in the US than in either of the other countries. It was however, in Australia that the difference in the relationship between age and earnings was greatest between the sexes. In Australia, male earnings grew much more with age than female earnings. If we take the gap in male-female earnings at 25 and set it equal to one, in their late 30s, the gap was four times larger between Australian men and women compared with about twice as large in Great Britain and the US.

Figure 1.1: Average Weekly Earnings of Full-time Men, Australia, Great Britain and the US, 1981.
Earnings of men aged 25=1.

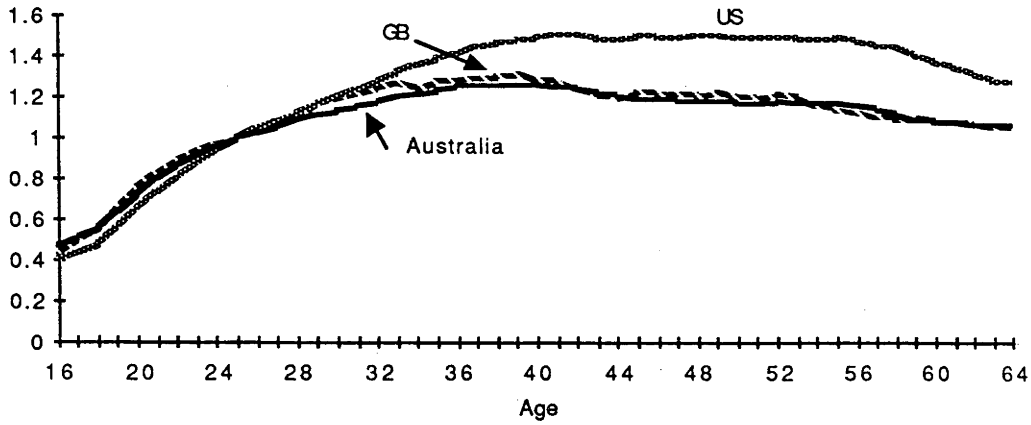


Figure 1.2: Average Weekly Earnings of Full-time Women, Australia, Great Britain and the United States, 1981.
Earnings of women aged 25=1.

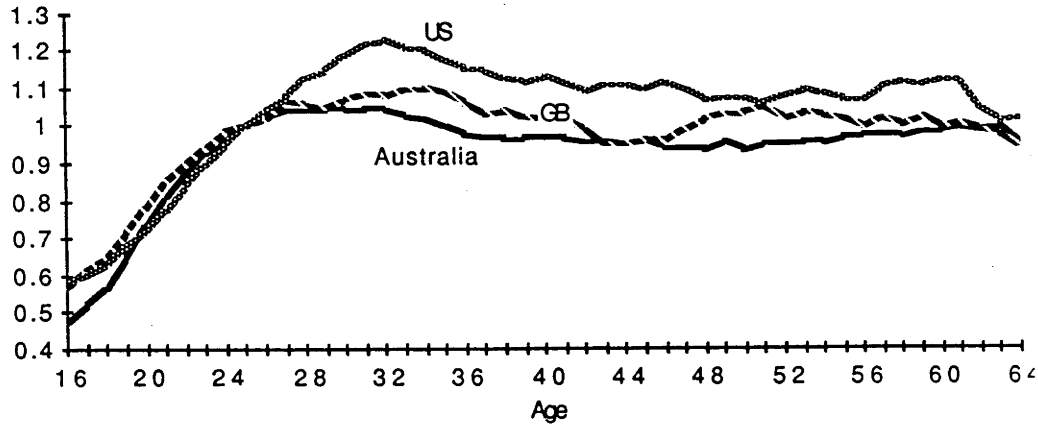
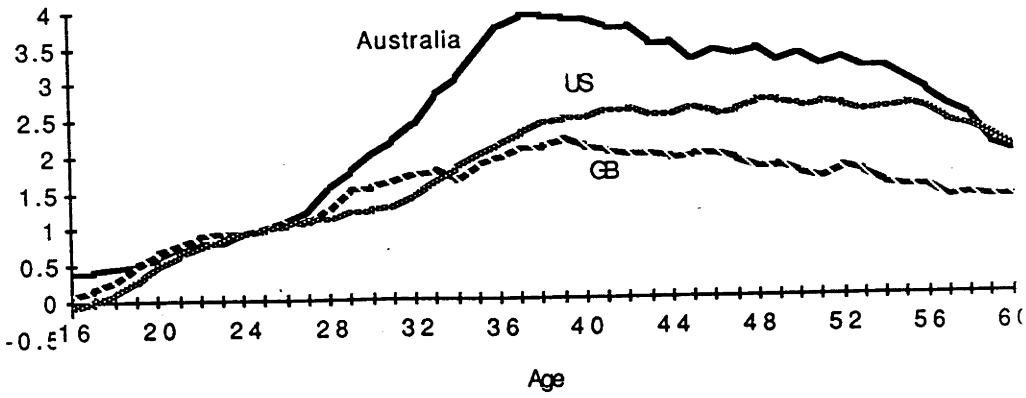


Figure 1.3: The Gap in Average Weekly Earnings of Men and Women at each Age as a Proportion of the Gap in Average Weekly Earnings between Men and Women aged 25; Australia, Great Britain and the United States, 1981.



1.2 Some Institutional Backgound to Wage Determination in Each Country.

In this section we briefly outline some of the major features of the wage setting institutions for each of the three countries in the early 1980s. (4) The wage bargaining systems of the three countries have been classified in the following way (see for example Hughes (1984)); Australia as centralised, Great Britain as collective bargaining and the US as a free market. The industrial relations systems of each of these countries do not in fact fit exactly into each of these categories. There are laws, for example minimum wage and health and safety laws, which influence the practice of industrial relations in the US. Similarly, not all wages are set by the central authorities in Australia; not only are some groups outside the system, but there is also scope for consent awards for which the arbitration system is a formality.

Under the Australian system of state and federal arbitration tribunals, there are legally binding minimum rates of pay set across most occupations and industries. These cover about 85 per cent of employees. There is scope for workers to be paid above the minimum award rate but most receive the rate fixed for the job. For the economy as a whole, overaward payments are about 2 to 3 per cent of ordinary time pay for male employees and 1 to 2 per cent for female employees. Awards can be made by arbitration or by the mutual agreement of the parties. In addition to changes in individual awards, workers receive pay increases through national wage cases which cover all those working under the award system. The pay increases which flow from these decisions, taken in most years, are usually based on changes in the cost of living and/or on productivity growth for the whole economy.(5)

The Australian labour force is highly unionised. In 1982, 53 per cent of male and 43 per cent of female employees were union members. Unions are organised chiefly

along occupational lines but there are also general unions which cut across occupations particularly at the less skilled level.

There are many similarities between the industrial relations systems of Australia and Great Britain. They share a common union structure of predominantly occupationally based trade unions. The British labour force was also highly unionised in 1981, over half of all employees were union members. The big difference between Great Britain and Australia was that there were no centralised wage fixing tribunals in Great Britain. (6) Although there was not a minimum wage rate covering the whole economy, agreements between trade unions and employers set minimum rates. For those not covered by agreements, there was an alternative formal wage fixing system. Industry wage councils covered about 18 per cent of the full-time adult work force in 1982 and set legally binding minimum wages for these industries.

Pay in Great Britain is determined by negotiations at a number of different levels; between national unions and employer associations and at the corporate and plant levels. The results of a survey conducted in 1980 showed the most important level of bargaining for private sector employees was with a single employer. This category covered about 50 per cent of employees and was in turn split into two groups; 18 per cent of employees chiefly bargained under multi-plant agreements and 30 per cent under single plant agreements. For about a quarter of private sector employees, pay was chiefly determined by management and for the remaining quarter, wages councils and national agreements were most important. (7)

Trade unions in the US cover a much smaller proportion of employees than in either Australia or Great Britain.(8) In the early 1980s only about 20 per cent of the labour force were members of trade unions or associations. Industrial unions were more important in the US than in either Australia or Great Britain. The level at which bargaining over pay and conditions took place varied between industries. So, for example, in steel and car manufacture, the bargaining was mainly at a national level and

in construction at a local level. American industrial relations has been described as "extremely litigatious" in comparison with other countries. (9) There is a minimum wage which is set by Congress in nominal terms and changed at irregular intervals. In 1981 about 80 per cent of non-supervisory workers were covered by its provisions.

In conclusion, the British system of collective bargaining and the smaller role of collective bargaining activity in the US would, on the face of it, appear to give scope for greater variability in wage outcomes between individuals than the centralised Australian system. We would expect to observe a smaller variance in earnings in Australia than in the other countries.

1.3. The Plan of the Thesis

The thesis chapters are organised around the central theme of an international comparison of age earnings profiles for men and women in Australia, Great Britain and the United States. We shall consider the role of both general and country specific factors in explaining the shapes of the age earnings profiles. It is structured as follows. Chapter 2 presents a survey of the theoretical explanations of the shape of the age earnings profile. Chapter 3 is a description of the data to be used in the estimation of regression results for both men and women in the remaining chapters. Chapters 4-6 present results from the estimation of earnings functions for men working full-time in the three countries. Chapter 4 presents our basic model, a human capital earnings function. We estimate this model using a variety of functional forms for experience for the male sample. We use our preferred functional form to decompose the differences between the countries in earnings with age, into that part which can be attributed to endowment differences and that part which can be attributed to differences in the rewards for these endowments or the coefficient differences. In chapters 5 and 6 we extend the basic model to include in turn, cohort variables (chapter 5) and industry effects (chapter 6) on the shape of the age earnings profile. Chapter 7 presents the results of a comparison between the countries of the shape of the age earnings profile for women and includes a

decomposition of the differences in relative earnings by age into that part which can be attributed to endowments and that part which can be attributed to coefficients. Chapter 8 considers the question, as to why the age earnings profiles of women systematically differ from those of men. Chapter 9 presents a summary and conclusion.

Footnotes.

1. For a discussion of the data sets used for these figures see chapter 3.
2. The figure was constructed in the following way. We firstly took the difference, measured in the national currencies, between the average weekly earnings of men and women at each age. We set the difference at age 25 equal to one and took the difference at each age as a proportion of this gap.
3. This result was also found for single women. The largest gap between the average earnings of men and single women relative to the gap at 25 was in Australia.
4. The introduction of the Prices and Incomes Accord in Australia, the changes in industrial relations law in Great Britain and the harder line adopted by the Reagan administration against trade unions are among the changes in the industrial relations environment in these countries since 1981. For discussions of the more recent experience see Chapman and Gruen (1990) and Moore (1989) for Australia, Metcalf (1990) for Great Britain and Flanagan (1990) for the US.
5. For a fuller discussion of the Australian system of industrial relations see Dufty and Fels (1989).
6. For a fuller discussion of the British system of industrial relations in the early 1980s see Sisson and Brown (1983), Winchester (1983) and Pond (1983).
7. These figures were taken from Table 6.1 of Sisson and Brown (1983) p 144.
8. For a fuller discussion of collective bargaining and labour law in the US see Ehrenberg and Smith (1988).
9. Flanagan, Smith and Ehrenberg (1984) p 379.

Chapter 2.
Some Theoretical Explanations of the Shape of Age Earnings Profiles

The purpose of this chapter is to set out some of the theories which have been used to explain why earnings vary with age and to consider them in the light of the similarities and differences in the age earnings profiles in the three countries. We have concentrated on four groups of explanations; human capital (including segmented labour market theory and the cohort model), efficiency wages, a group of theories which combine elements of these approaches and the role of trade unions and institutional factors. These explanations are not mutually exclusive and indeed there is some difficulty in distinguishing between them even at the theoretical level.

There are a number of reasons why earnings differ among individuals. Inherited abilities, family background and good luck are among them. The theory of compensating differentials offers one explanation of why the earnings of otherwise identical individuals may differ. (1) Workers may be willing to forego earnings in order to work in a job, for example, with low risks to life and health or with particular climatic or environmental advantages. Individuals may also have different attitudes to risk which encourage some to languish in low paying jobs in the hope of one day becoming a superstar. (2) It is not proposed to examine explanations of earnings differentials between individuals such as these, which are not dependent on age and experience. Rather we shall concentrate here on theories which explain why earnings differ with age and experience.

1. The Human Capital Model

1.1 The General Framework

The human capital framework is the basis of several explanations of the shape of the age earnings profile. In this framework, education, on-the-job training, migration and health care are treated as forms of investment which raise productivity and therefore earnings.(3) In our discussion we shall concentrate on education and on-the-job training

as investments. The individual's problem is to maximise lifetime earnings given the costs and benefits associated with investment in human capital. The model has been presented formally by among others, Ben-Porath (1967) and Siebert (1985). The predictions of most relevance for this thesis include the proposition that most investment in human capital will take place among the young and that people who invest in human capital will have steeper age earnings profiles than people who do not.

Productivity enhancing investment in human capital may take place in a formal school environment or on-the-job. In the case of formal schooling, individuals, according to this hypothesis, pay the direct costs of tuition and forego current earnings in order to raise their future productivity. On-the-job training may involve direct training costs such as instructors time and work materials or it may just arise from learning-by-doing, that is repetition of the same task, without either the employer or employee incurring additional direct costs.(4)

As it is very difficult to get a monetary measure of investment in human capital, Mincer (1974) proposed a time equivalent measure of investment in both schooling and on-the-job training. Let k_j be the ratio of investment costs C_j to gross earnings E_j in period j so that net earnings are smaller in year j by the amount of investment during the year

$$C_j = k_j E_j \qquad (1)$$

and

$$E_j = E_{j-1} + rC_{j-1} = E_{j-1}(1 + rk_{j-1}). \qquad (2)$$

If we consider all past investments

$$E_j = E_o (1 + rK_o)(1 + rk_1).....(1 + rk_{j-1}) \qquad (3)$$

where r is the rate of return to investment. Assuming that $k < 1$ and r is relatively small, this is approximately :

$$\ln E_j = \ln E_o + \Sigma r_t k_t \qquad (4)$$

and as $Y_j = E_j (1-k_j)$ where Y is annual earnings

$$\ln Y_j = E_0 + \Sigma r_t k_t + \ln (1-k_j) \quad (5)$$

and where full-time schooling raises the investment ratio k_j to one

$$\ln Y_j = E_0 + r_s s + r_p \Sigma k_t + \ln(1-k_j) \quad (6)$$

where r_s is the return to schooling and r_p the return to post school investment.

If we assume that the rate of return to post schooling investment is the same across these types of investment, we can calculate the cumulative amount of "time" spent on this investment before year j as

$$K_j = \Sigma k_t \quad (7)$$

$$\text{and } \ln E_j = \ln E_o + r_s s + r_p K_j \quad (8)$$

The shape of the log-earnings profile is upward sloping as long as $k_j > 0$. The model can be easily extended to include depreciation of human capital and can be approximated by various functional forms for the time equivalent investment in human capital (to be discussed in chapter 4). This time equivalent measure of investment in on-the-job training has been used to consider the different types of on-the-job training to be outlined in the next section.

1.2 On-the-job Training

Becker distinguished two types of on-the-job training, general and specific. "General training is useful in many firms besides those providing it" (Becker (1975) p19). "Employees pay for general on-the-job training by receiving wages below what they would receive elsewhere" (p21). In contrast, "Completely specific training can be defined as training that has no effect on the productivity of trainees that would be useful in other firms" (p26). The costs and benefits of specific training are shared by the employer and employee. "The shares of each depend on the relations between quit rates and wages, layoff rates and profits, and on other factors not discussed here, such as the cost of funds, attitudes toward risk and desires for liquidity" (p30). (5)

Training may have both general and specific elements. Both sorts of training, Becker argued, have a similar effect on age earnings profiles, making them steeper and

more concave (p32). The concavity of age earnings profiles arises for two reasons. There is assumed to be a depreciation of human capital with age and a reduction in the amount of investment by an individual as the period to reap the benefits of investment is reduced and the opportunity cost of foregone earnings rises.

Figures 2.1 and 2.2 present the stylised age earnings profiles for pure cases of general and specific training. In figure 2.1, the individual has the option of choosing earnings path W_O with no investment in training or the alternative W_T which includes an investment in general training. General training is of equal value both inside and outside the firm so the firm will only be willing to provide such training if the wage equals the worker's marginal product. In the initial learning phase the marginal product of a trainee is below that of someone receiving no training. Trainee earnings (ob) begin below the earnings without training (oa) but as the marginal product of the trained worker grows so their earnings rise above those of an untrained worker.

Figure 2.2 presents an example of specific training. The alternative wage without training is once again W_O. In the case of specific training, the firm bears some of the costs and benefits of the training so in the initial training period, the workers earnings are above his marginal product, (oc) compared with (ob). In the later period, the firm receives some of the benefits from training as the individual's marginal product is greater than their wage. Thus steeper age earnings profiles are associated with investment in on-the-job training.

1.3 Predictions of Human Capital Theory.

We wish to consider some predictions of the theory relevant for our comparison of age earnings profiles in Australia, Great Britain and the United States. Firstly, flat age earnings profiles are associated with a lack of human capital investment, while steep ones imply large investments. This theory would be consistent with figure 1.1, chapter 1, if the average man in the US had undertaken more on-the-job training since age

Figure 2.1: The Relationship between Experience and General Training.

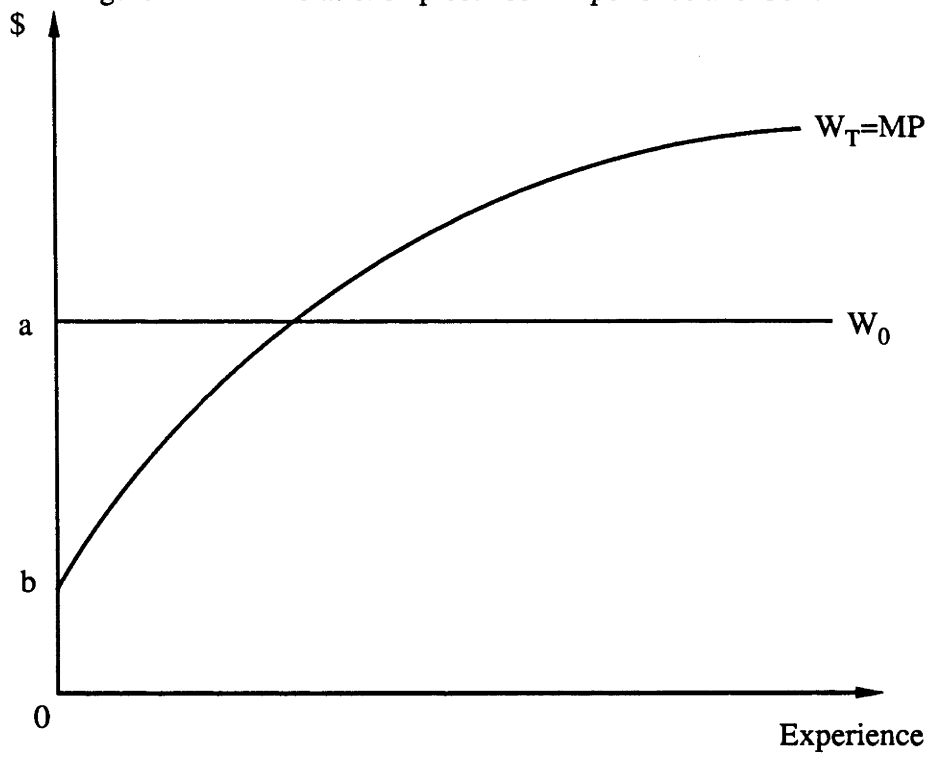
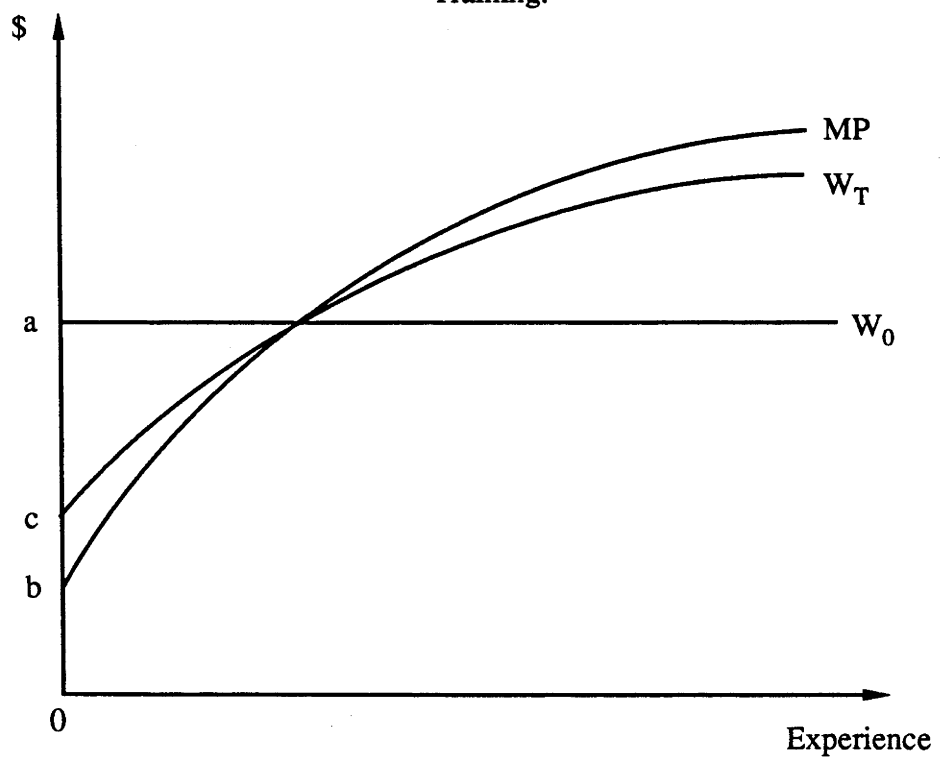


Figure 2.2: The Relationship between Experience and Earnings with Specific Training.



sixteen and continued to invest over a longer period of his adult life than the average man in Australia.

The theory predicts that the more educated will earn more than the less educated but this may arise for several reasons. Welch (1970) argued that education may not only increase earnings by directly raising output for a given level of inputs but also by raising allocative efficiency. He used evidence on the productivity of US farmers with different levels of education to support this view. Education may increase the effectiveness with which individuals collect and use information for managerial decisions about such things as choice of inputs and outputs. In periods of rapid technical change, education may also enable individuals to adapt more readily and to see the potential for the adoption of new methods.(6)

This addition to human capital theory predicts that where technical change is slow, the profiles of the more educated will be flatter than in a more innovative and changing environment. These arguments would explain figure 1.1, chapter 1, by a faster rate of technical change in the US and Great Britain compared with Australia providing greater scope for improvements in allocative efficiency and hence for greater rewards to the educated.(7)

A related prediction of human capital theory concerns the role of industry mix in explaining differences in the aggregate age earnings profiles of the three countries. Industries differ in their level of technical sophistication and in the extent of on-the-job training required. Some industries require periods of intensive training before individuals become fully productive while in other industries unskilled labour predominates. For example, agriculture and the distributive industries have a high proportion of unskilled labour in each of the countries and relatively flat age earnings profiles. In contrast, the banking and finance industry has a more skilled workforce and a steeper age earnings profile. Human capital theory can explain these differences in terms of the amount of general and specific training being undertaken within each industry.

Of course the stock of human capital will affect the industry mix of a country. We do not expect a country where illiteracy predominates to have a large amount of technically sophisticated industry. The industry mix, however, will influence the amount of training going on and therefore the stock of human capital and the shape of the age earnings profile in aggregate. The industry mix in Australia may be such as to produce a flatter age earnings profile in aggregate than in the other countries.

In summary, this model would explain the flatter aggregate age earnings profiles of Australia and Great Britain compared with the US by a lower level of investment in human capital. The stock of formal education was greater in the US in 1981 than in Australia and Great Britain (see Tables 3.1 and 3.8, chapter 3) but we can only infer differences in the amount of on-the-job training being undertaken from the shapes of the age earnings profiles. The flatter aggregate age earnings profiles in Australia and Great Britain compared with the US are consistent with there being less on-the-job training undertaken in these countries than in the US.

1.4 Segmented Labour Markets

A theory we would like to mention briefly which adds institutional factors to the human capital theory outlined above is the theory of segmented or dual labour markets.(8) According to this approach, institutional factors such as the existence of unions and the advantageous position of large companies in the product market divide the labour market into a primary and secondary part. In the primary labour market conditions are good; wages are relatively high and there is considerable on-the-job training. The primary labour market consists of a set of labour markets internal to each firm where specific rules and institutions (for example relating to seniority) govern the allocation and pricing of labour. There are a limited number of entry points to this labour market and individuals are willing to sustain periods of unemployment in order to facilitate entry to the primary labour market. In contrast, the secondary labour market offers badly paid jobs with poor conditions, no career structure and little on-the-job

training. Taubman and Wachter ((1986) p1185) argued that any training undertaken in the secondary labour market can be considered as the equivalent of negative general training and individuals may actually be "scarred" by this experience.

There are numerous variations on the theme of segmented labour markets. We have concentrated on the effects of the combination of human capital and institutional factors as the source of the difference between the two labour markets but there are alternative hypotheses. Bulow and Summers (1986) present a dual labour market model based on the idea of efficiency wages to be discussed below. Workers in the primary market are paid above their alternative wage while workers in the secondary market are paid a competitive wage. The model presented by Akerloff (1982) offers another interpretation. He characterises the primary labour market as that part of the economy where the 'gift' of hard work by workers is reciprocated by the 'gift' of high pay by the employers. In the secondary labour market gifts are not exchanged and competitive wages apply.

In many discussions of segmented labour markets, the allocation of individuals to the primary and secondary markets is due to factors beyond an individual's control. Individuals find themselves in these different markets not because of differences in abilities but because of factors such as discrimination by colour and sex. Whatever the source of differences between these markets, the result that the age earnings profiles of workers in the primary market are steeper than for workers in the secondary market holds in general.

Unfortunately we shall be unable to test this explanation of differences in age earnings profiles across the three countries. Our data do not enable us to distinguish between these two parts of the labour market as we would need individual data on such things as union membership, job tenure and firm size.(9) However, if this hypothesis were to explain the differences in the age earnings profiles of men in figure 1.1, chapter 1, we would have to show that Australia had more secondary jobs than the US associated with a lower level of unionisation and/or more discrimination.

1.5 The Cohort Model

A further extension of the human capital model considers the role of cohort size in determining earnings.The cohort model can be thought of as part of the human capital approach because it focuses on the lack of substitutability between workers of different ages and education levels. On-the-job training and experience are key factors in explaining why earnings differ by age and are affected by cohort size. The cohort model has implications for the expected shape of a cross section age earnings profile. According to this theory, the presence of a large cohort of young workers would make the cross section age earnings profile appear steeper by depressing the earnings of young workers relative to older workers.

It has been argued that the size of a birth cohort will have a significant effect on its relative earnings when the group enters the labour force and this may persist throughout the working life of the cohort (see, for example Welch (1979)). Large birth cohorts are associated with low relative earnings. A second potential cohort effect relates to changes in the educational mix of those beginning work. Even without demographic changes, we would expect a rise in the number of young people completing tertiary education to have an effect on the earnings of young graduates relative to old graduates. Evidence from a number of studies, mainly using US data, shows that in the 1970's the entry of a large cohort to the labour force depressed the earnings of young males relative to prime age males, though researchers dispute whether this was likely to continue into the later working life of this group. (10)

The "career phase" model used to explain the importance of cohort size, emphasises the lack of substitutability between workers of different ages. According to the model, a large cohort entering the labour market competes for a limited number of jobs appropriate for those in the early part of their career and bids down its own wage relative to those well established in the labour market. Alternatively, where relative wages are fixed, for example by union agreement, we may expect to observe a relatively

high level of unemployment among members of a large cohort. One (or both) of these effects should be in evidence whenever a large increase in the size of a cohort has been experienced.

The cohort effect on earnings has been analysed in a production function framework by Welch (1979). Given a production function

$$Q= f (N1, N2,.....Ni, K) \qquad (9)$$

where N1, N2,...Ni are the number of workers in each education category, 1, 2,..i.

K is the physical capital input

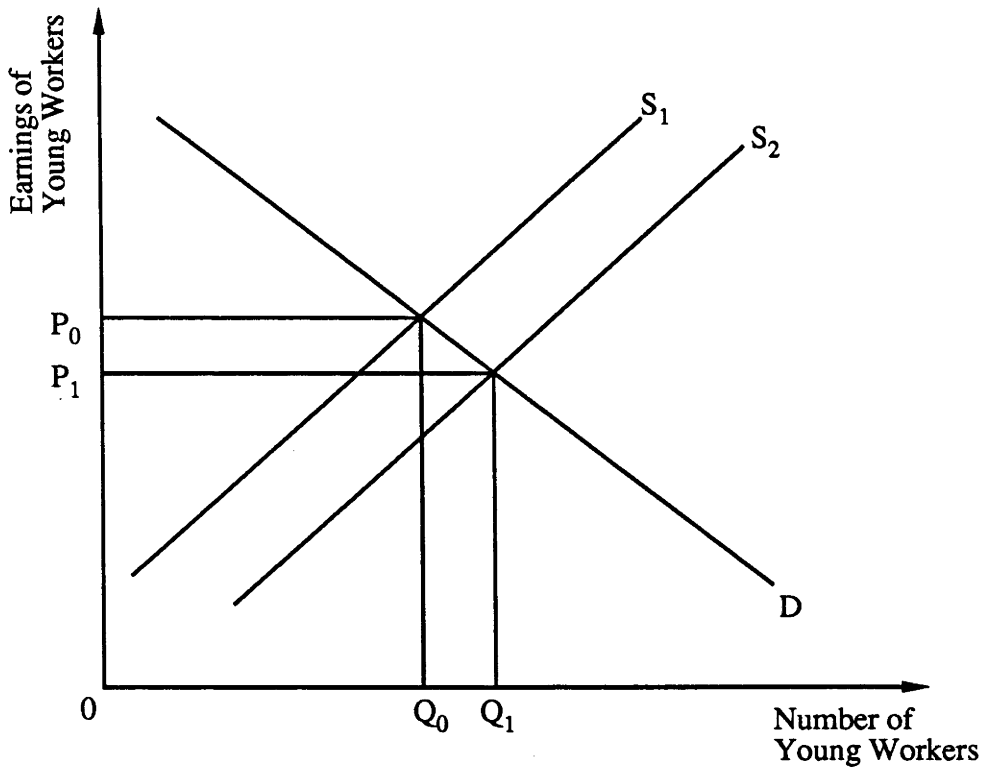
Each schooling group is assumed to form a separable branch of the aggregate production process and within each schooling group, there are workers of different ages providing different labour services. Welch considered two types of labour, 'learners' (a) and 'qualified workers' (b).

$$N_i=g (N_{ia}, N_{ib}) \qquad (10)$$

From such a production function, we can generate inverse demand functions relating the earnings of an age group to the quantity of its own labour input and the input of other types of labour of the same educational background but different ages. The theory as developed by Welch, with the assumption of the separability of labour of different educational backgrounds, does not allow for any cross effects between educational groups.

Inputs are defined to be q complements if an increase in the input of factor 1 raises the marginal product and wage of factor 2 and q substitutes if an increase in the input of factor 1 lowers the marginal product of factor 2. For a large increase in the size of a particular age group to reduce only its wage and not that of all other workers within the educational group, this group must not be a close substitute for workers of any other age. In terms of Figure 2.3, a shift in the supply curve say of young workers, from S1 to S2, would reduce their wage, ceteris paribus. If young workers were a small fraction

Figure 2.3: The Effect of Cohort Size on Earnings.



of the total work force and they were close substitutes for older workers, then the demand curve for young workers would be highly elastic and an increase in the proportion of young workers in the workforce would have a small effect on their wage. If workers were q complements, an increase in the number of say young workers, would raise the wage of the group with whom they were complementary.

In the simple case where there are only two types of labour input, learners and fully trained workers, the career phase model predicts that members of a large cohort will always earn less than members of a normal cohort particularly in the learner phase. A big cohort has a large proportionate impact on the stock of learners and therefore on their wage but a much smaller impact on the stock of qualified workers and consequently a smaller impact on the wage of qualified workers. A cross section taken when there is a

large cohort in the learner phase will therefore exhibit a steep earnings profile. Another cross section taken when this group is in the worker phase and followed by an average size cohort, will be flatter but not very different from the cross section profile in the absence of a large cohort.

An inference of the model is that the effects on wages of membership of a large cohort is greater the smaller the elasticity of substitution between learners and workers. We expect this elasticity to vary between groups with different levels of schooling. This model predicts that the relative earnings of the educated young will suffer a greater reduction than the uneducated. Welch argued that as those with more schooling are also more likely to receive more on-the-job training, these groups take longer to move from learner to worker status and experience larger reductions in their relative wage during the learner phase. So, for example, while a twenty year old labourer can provide much the same service as a forty year old labourer, this is not the case for professionals such as doctors and lawyers. For these groups, there is a period during which they are in the workforce but still learning on-the-job and the growth of experience is expected to make them better at their profession.

This model has been criticised on a number of grounds. Berger (1985) argued that "adverse cohort size effects on earnings do not diminish rapidly as Welch suggests and may actually increase throughout the career of individuals in large cohorts" (p562). Membership of a large cohort may retard the acquisition of on-the-job training and impede progress up a career ladder for several reasons. Members of a large cohort may face greater probability of unemployment, find themselves forced into jobs with little on-the-job training or encounter greater competition for a small number of high level positions. These groups moving from "learner" to "qualified worker" status should, like a normal cohort, become close substitutes for other "qualified workers" but their restricted opportunities in their early period in the labour market may prevent them from ever being close substitutes for workers of other ages but similar formal education

levels. Reasons such as these would produce a flatter earnings profile for the group than for a normal-sized cohort .

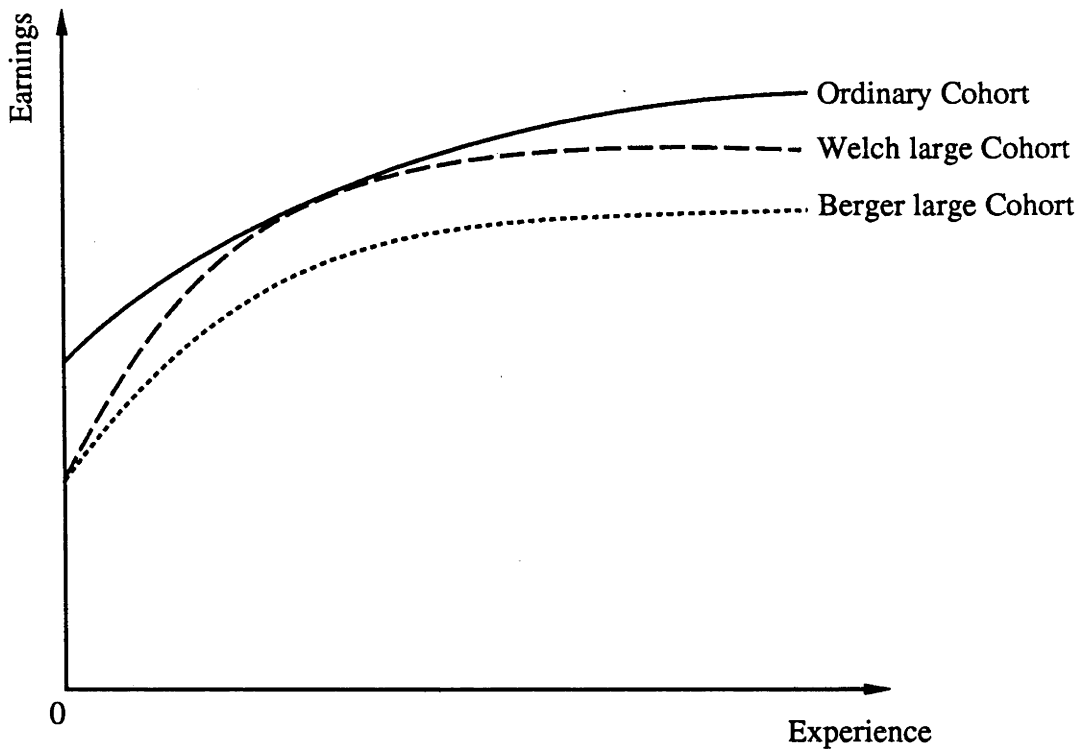
Figure 2.4 summarises the possible outcomes suggested by Welch and Berger. Welch hypothesised that a large cohort entering the labour force would experience a substantial reduction in their earnings in the learner phase but once they had achieved worker status their earnings would remain only slightly below those of a normal-sized cohort. In contrast Berger predicted a persisting adverse effect of large cohort size on its members earnings. Welch and Berger's predictions are therefore similar for the early part of working life and differ for older workers. A further issue which is not covered by the simple career phase model is the effect of cross elasticities of substitution between workers with different educational backgrounds.(11)

The cohort model thus implies that the differences in the aggregate male age earnings profiles of the three countries, may be explained by the relative size of young cohorts in each of the countries. A large young cohort would depress its earnings relative to the earnings of prime age males and produce the appearance of a steeper cross section age earnings profile.

1.6 Some General Criticisms of the Human Capital Approach

It is not proposed here to outline in detail the criticisms which have been made of the human capital approach. The main criticisms relate to whether education and training of itself raises productivity. There has also been little research done in comparing the

Figure 2.4 The Effect of Cohort Size over Time.



human capital approach with theories from outside economics. Blaug (1976) argued that " any psychological theory of "learning curves"[or learning by doing], in which appreciation over time is partly offset by depreciation and obsolescence will likewise account for concave age-earnings profiles." (p 837).(12)

The screening hypothesis has challenged the human capital model by arguing that education does not raise productivity but rather acts as a signalling device for pre-existing abilities.(13) Although education may not be productivity enhancing, if it acts as an efficient screening device, it may still perform the socially productive role of placing the right people in the right job. The issue then becomes one of finding the most efficient screening device.(14)

While the screening hypothesis offers an explanation of why starting salaries may differ by education level, it has more difficulty in explaining why these differences

should persist with experience. Employers may select employees on the basis of their educational qualifications but if these are in fact irrelevant to the individual's productivity, we would expect older people of similar ability to have more similar earnings regardless of educational qualifications compared to younger people and for the effect of education on earnings to diminish with experience. Layard and Psacharopoulos (1974) argued that the effects of education on earnings actually rise both proportionately and absolutely with age (p 992). We shall consider this point in the empirical estimation reported in the following chapters (see chapter 4 section 3.3).

The growth in the earnings differentials between educational groups may be explained either by differences in the amount of on-the-job training undertaken by each group (so the screening hypothesis finds itself reliant on human capital arguments), or as Layard and Psacharopoulos (1974) suggested

> " some would argue that the labour market is like a set of escalators. People are selected for a given escalator when they join the labor force and cannot thereafter easily jump from one escalator onto another. People with credentials are selected for escalators that rise rapidly and others for ones that move more slowly. People may of course walk at different speeds up their own escalator, but earnings differences between groups with different credentials are basically determined by the speeds at which their escalators are traveling."

In terms of our three country comparison, it would be necessary to explain why the escalators move at different rates in these countries for reasons other than on-the-job training.

A further argument made against human capital is based on the empirical research of Medoff and Abraham ((1980) and (1981)) who argued, on the basis of evidence from three US sets of company personnel records of professional and managerial workers, that there was no link between earnings within a particular grade and productivity levels. Older workers within a grade tended to earn more but they were not more productive.

This result was based on the assumption that job performance ratings done by immediate supervisors are valid indicators of the relative current productivity of the workers in the sample. Medoff and Abraham speculated as to the cause of the discrepancy between productivity and earnings using some of the theories to be outlined in the next section but did not come to any firm conclusions. Rather the result of their studies is a negative one,

> " our findings demonstrate only that productivity-augmenting on-the-job training should play a substantially smaller role in any new explanation [of the experience-earnings relationship] than it does under human capital theory." (p 733) (15)

It is a weakness of their argument that Medoff and Abraham offered no definite explanation as to why a company which constructed the job performance ratings in the first place, should ignore this information and continue to pay less productive workers more than the more productive ones.

1.7 Summary

In this section we have outlined the general human capital explanation as to why the earnings of individuals may differ. We have placed particular emphasis on the reasons suggested by human capital theory for an upward sloping age earnings profile. While differences in educational attainment may produce differences in the level of earnings between individuals, the main source of the upward sloping age earnings profile is on-the-job training. More training is associated with a steeper slope and a lower starting wage. Differences between the countries in access to on-the-job training, for example because of segmented labour markets or the relative size of birth cohorts, may also influence the shape of the aggregate age earnings profile.

We have also considered some of the general criticisms of human capital theory, namely the screening hypothesis and the empirical observation that individual pay does not seem to be closely associated with performance. In the next three sections we shall consider some alternative explanations of upward sloping age earnings profiles; efficiency wages, a mixed group of theories which combine elements of other

approaches and finally the role of trade unions and institutional factors in the labour market.

2. Efficiency Wage Models.

Human capital theory predicts that older workers are paid more than younger ones because they are more productive. A group of alternative hypotheses, collectively described as the efficiency wage hypothesis, suggest that the causation does not run from higher productivity to higher earnings but from higher earnings to higher productivity. Early modern explanations comes from the development literature where it was argued that additional wages for those at low levels of nutrition would boost their food consumption and hence their productivity. (16) Efficiency wage theories have since been used to explain differences in the level of wages between industries but here we are concentrating on them as possible explanations of the slope of age earnings profiles.(17)

> Three explanations of efficiency wages have been offered in the literature "In one case, firms pay higher wages than the workers' reservation wage so that employees have an incentive not to shirk. In a second version, wages greater than market-clearing are offered so that workers have an incentive not to quit and turnover is reduced. In a third version, wages greater than market-clearing are paid to induce loyalty to the firm." (Akerloff and Yellen (1985) p 829).(18)

The fact that efficiency wages may not be adopted equally by all firms across all industries, can be used to explain the effect of industry of employment on earnings. As Krueger and Summers (1988) noted

> "If all firms were identical, one would not expect to see different firms paying different wages even if efficiency wage considerations were important. But when there are differences in their ability to bear the costs of turnover, to supervise and monitor their workers, or to measure labor quality, either because of differences in management capacity, or because of differences in the technology of production,

then the optimal wage to pay will vary. Thus efficiency wage models unlike standard competitive formulations can explain why characteristics of firms that do not directly affect workers' utility can affect wage rates" (p261).

However, there is a limit to which these hypotheses can be thought of as contributing additional understanding of industry differentials to those already proposed by standard competitive theory. Rather than attributing earnings differences to unobserved characteristics of individuals, the efficiency wage interpretation attributes the differences to unobserved characteristics of an industry.

Most of the models consider why earnings for apparently similar individuals should differ between firms and industries for all workers and do not consider reasons for an upward sloping age earnings profile. Shapiro and Stiglitz (1984) and Bulow and Summers (1986) however, do discuss the possibility of an upward sloping age earnings profile as an alternative method to an efficiency wage for reducing shirking. In both these models workers are paid above their alternative wage in order to reduce shirking where monitoring costs are high. The higher wage encourages the worker not to shirk for fear of losing his job and returning to alternative employment at a lower wage. Alternatives to an efficiency wage which would also reduce shirking include the workers posting a performance bond or the adoption of an upward sloping age earnings profile. As these authors note, there are problems associated with either of these solutions. The firm has an incentive to renege on the contract and claim inaccurately that the worker shirked (a point to be discussed in more detail below). In addition, enforcement of such contracts, for example in a court of law, is likely to be expensive because objective measures of effort are difficult to find. Both these papers rely on the theory developed by Lazear (1981) to explain a rising age earnings profile. This is not an efficiency wage model so we shall present a fuller discussion in the following section.

In summary, efficiency wage models offer an alternative explanation of earnings differentials based on demand factors than that put forward by the simple neoclassical

version of the human capital approach. In the efficiency wage models surveyed, however, there were no specific developments of the basic model in order to explain rising age earnings profiles. Rather where rising age earnings profiles were considered they were seen as an alternative to an efficiency wage.

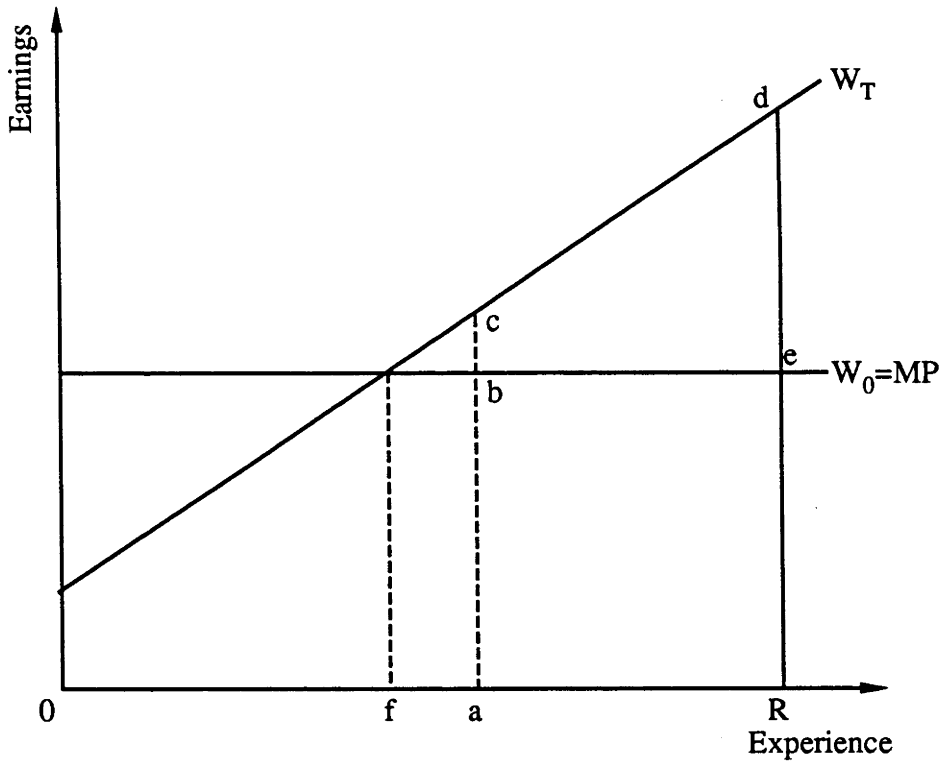
It is difficult to explain the other facts about earnings within the context of these efficiency wage models, basically because they were not formulated with these questions in mind. If the theory were going to explain why the more educated earned more than the less educated, it could be argued that the more educated tend to be in occupations or industries where monitoring costs or the cost of labour turnover is highest. The wages of the less skilled may be set at the competitive level while employers adopt an efficiency wage above the market clearing rate for the more highly educated. As the efficiency wage models surveyed did not include an upward sloping age earnings profile, they offered no explanation as to why earnings of the more educated peaked later than for the less educated.

3. Other Explanations of Rising Age Earnings Profiles

3.1 A Shirking Model

Lazear (1981) sets out a model which, in the absence of any on-the-job training, generates an upward sloping age earnings profile to encourage worker effort and reduce shirking.(19) The firm offers a contract for long term employment combined with an upward sloping earnings profile (see figure 2.5). Workers have the option of accepting the alternative wage (W_O) equal to their marginal product or opting for a wage (W_T) which is initially below their marginal product and eventually rises above their marginal

Figure 2.5: Lazear's Shirking Model.



product until their retirement at R. In equilibrium, the discounted value of these two income streams will be equated for the marginal worker and there would be no queuing for the job. However, in order to remain on the earnings path W_T , it is necessary that the employee continue to work hard. Once experience is greater than (f), dismissal involves a substantial loss of income. For example, an individual dismissed with experience level (a) in figure 2.5 would lose earnings represented by the area (bcde). The steeper the earnings profile the greater the incentive for the worker to work hard to keep his job. A steeper profile however, also gives the firm a greater incentive to cheat and to attempt to terminate contracts at (f). As long as new workers have information on the past history of the firm's hiring and firing practices, there is a cost to the firm of cheating which should encourage the firm to fulfill its part of the contract.

Lazear (1981) noted that the predictions from this model were difficult to distinguish from those of a standard human capital model. In particular, even though an

upward sloping age earnings profile consistent with each theory, may be observed, it is not possible to observe its relationship to the marginal product curve. Even a difference between marginal product and earnings would be insufficient evidence to support the shirking model against the human capital model. Human capital predicts that in the case of specific training, there will be a divergence between marginal product and earnings, with marginal product exceeding earnings in the post investment period. It is difficult to see how we could test between these two models without detailed knowledge of monitoring costs and firm specific investment.

An additional difficulty of the model comes from its justification of a rising age earnings profile on the basis of the monitoring costs of shirking alone. Although it may not be possible to monitor an individual's output on a daily basis, surely over a year the firm will have some idea of the employee's productivity. It is then difficult to justify the postponement of the bonus for not shirking to the end of their working life rather than the firm adopting the alternative of the payment of an annual bonus.

Lazear's shirking model suggests that the differences in the aggregate age earnings profiles of the three countries might be explained in terms of industry mix. It might be suggested that the industry mix is such that the potential for shirking created by such factors as the choice of technology and the size of firms is greater in the US than in Australia and produces a steeper earnings profile. We would expect on the basis of this model, that the returns to experience with one employer were higher in the US than in Australia and that workers tended to stay longer with a given employer in the US. We will, however, be unable to test these predictions given our data sets and in principle, they are difficult to distinguish from the predictions of the human capital model. So, for example, the prediction on job tenure would not help us to distinguish between shirking and the human capital model as this prediction also comes out of a specific human capital model.

3.2 The Labour Turnover Model.

The model presented by Salop and Salop (1976) offers an alternative rationale for an upward sloping earnings profile unrelated to higher levels of productivity among older workers. In this model, turnover is costly to the firm as it generates training, processing and other related costs. As there is inadequate information about potential workers and their propensity to quit, the firm has an incentive to adopt an earnings structure which encourages workers to "self select" into jobs for "quitters" and "stayers".

In the absence of self selection, all workers have the option of a wage equal to their marginal product less the turnover costs (initial training costs and processing costs)

$$W^* = M(L/N) - (R+Q)T \qquad (11)$$

where W^* is the market clearing wage.

Q = the average quit rate for all firms.

L = no. of workers who supply their services to the market inelastically.

n = the number of identical perfectly competitive firms with marginal revenue product functions M(L).

R = discount rate.

T = costs incurred per new employee.

The firm can alternatively offer a Two Part Wage (TPW) where the new employee pays an entrance fee of D1 and receives a wage (W*+D2). If a worker with a quit probability Q can borrow at rate R, he will prefer the steeper profile if the following expression, his net gain E(q), is positive and be indifferent between the TPW and the flat earnings profile if it equals zero.

$$E(q) = - D1 + D2(1/(R+Q)) \qquad (12)$$

The firm can then choose D1 and D2 so that slow quitters prefer the steep structure and apply to the firm while fast quitters prefer the flat structure and do not.

For this model to differ from a model where the firm invests in specific human capital, the costs of turnover must be in addition to any costs the firm incurs through investment in human capital. Otherwise we can just think of this model as another example of a human capital model.

Salop and Salop's model suggests two alternative explanations of the differences in the age earnings profiles of the three countries shown in Figure 1.1 chapter 1. Firstly, it is possible that turnover costs are lower either in general or in the mix of industries found in Australia compared with the US. This may arise, for example, because of differences in the costs of recruitment (advertising, travel costs and interviews). Alternatively, Australia may be peopled by fast quitters unwilling to make the initial sacrifices in order to get on the rising age earnings profile. Once again we would expect to observe differences in job tenure between the countries with higher job tenure in the US than in Australia.

3.3 Summary of These Models.

We are interested here in drawing together the predictions of these models which relate to our three country comparison. Whatever the rationale for an upward sloping earnings profile, that is to reduce shirking or turnover, these models predict less job turnover where there is a steeper profile. We would therefore expect lower labour turnover in the US than in Australia. We cannot test this given our data sets but other evidence suggests that turnover may be higher in Australia than in the US.(20)

Another prediction relates to the effect of industry mix on the aggregate age earnings profile. If these hypotheses were to explain the differences between Australia, Great Britain and the US in the shape of the age earnings profiles, it would be necessary to show that the potential for shirking created by such factors as the choice of technology and the size of firms is higher in the US or that the cost of labour turnover is higher in the mix of industries in the US than in Australia. Either of these explanations would generate a steeper aggregate earnings profile in the US than in Australia. It is however

difficult to distinguish these hypothesis from the standard human capital model on the basis of predictions. Human capital theory also predicts low labour turnover and an effect of industry mix on the aggregate earnings profile in the presence of industry-specific training.

4. The Role of Institutional Factors: Industrial Relations Systems and Trade Unions

The following discussion will focus on the role of institutional factors, particularly the industrial relations system and trade unions in explaining the shape of the age earnings profile. In the general context, several theories have been presented which attempt to explain why the presence of unions or the existence of minimum wage laws may lead to flatter age earnings profiles. In addition, there are many country specific factors which will affect the shape of the age earnings profile. The importance of these factors has received considerable attention in Australia.

4.1 The Effect of Minimum Wage Regulations

Consider, for example, the effect of minimum wage legislation on the accumulation of human capital. Assuming an initial market clearing wage below the chosen minimum level, the introduction of a minimum wage may have either a positive or negative effect on the amount of schooling undertaken by an individual. It raises the opportunity cost of continuing schooling for those who can find jobs but it also reduces the probability of finding a job. The decision to continue schooling will depend on the individual's assessment of the risk of unemployment and its effect on the cost benefit calculation for an additional year of schooling. If the risk of unemployment for a long period is high, the opportunity cost of staying at school is reduced.This will encourage individuals to remain at school. If the risk of unemployment is low, the opportunity cost of staying at school in terms of foregone earnings becomes higher. Individuals are therefore more likely to leave school.

The effect of a minimum wage on on-the-job training is unambiguous. It can be shown that binding minimum wage legislation reduces the level of on-the-job training (21). It does this both by reducing employment and by reducing on-the-job training. Figure 2.6 presents the case of general training. Without a minimum wage, the firm is willing to offer new employees the wage (oa), equal to their marginal product while training but the introduction of a minimum wage at the level (ob) prevents an employer from offering this wage. The employer is no longer willing to employ someone producing less than (ob) so the amount of general training falls. The individual's marginal product and therefore earnings does not rise as rapidly as it did prior to the introduction of a minimum wage. Similar effects can be shown for specific training. The introduction of a minimum wage reduces on-the-job training.

In terms of a shirking model, the introduction of a minimum wage can also be shown to produce flatter age earnings profiles than would otherwise exist. In this model, the firm would be less able to offer a steep earnings profile to encourage hard work and increase the cost of losing a job. In terms of figure 2.7 , if the introduction of a minimum wage (ob) prevents the firm from offering a starting wage of (oa), it will also reduce the extent to which the firm can pay an individual above his marginal product in later life. Similarly, in the Salop and Salop (1976) model, a minimum wage would limit the ability of firms to discriminate between slow and fast quitters by reducing the size of the "bond" that new workers were able to post.

4.2 The Institutional Background to Wage Determination.

Other aspects of the wage fixing system may also effect the shape of age earnings profiles. It is part of Australian folklore to assume that the operation of the arbitration system has produced a more egalitarian wage structure than might otherwise exist but this view has been challenged by several writers. Hughes (1984) compared average industry wages in Australia with those of both Great Britain and the US using 1962-63 data. Industry wages were more dispersed in the US than in Australia but he concluded

Figure 2.6: The Effect of Minimum Wage Regulations on General Training.

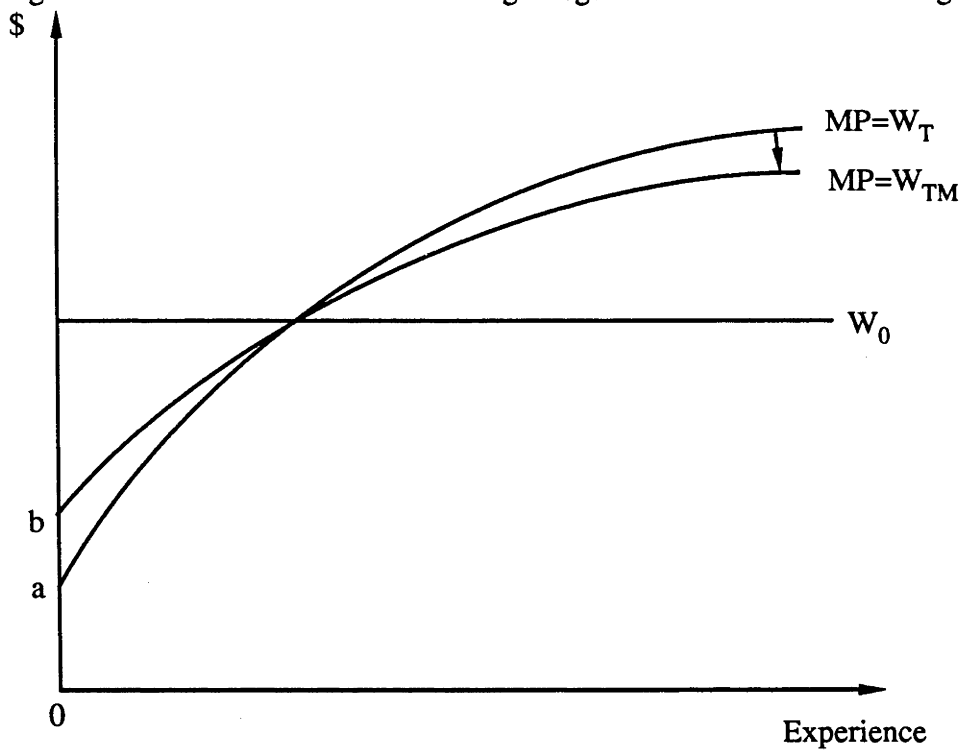
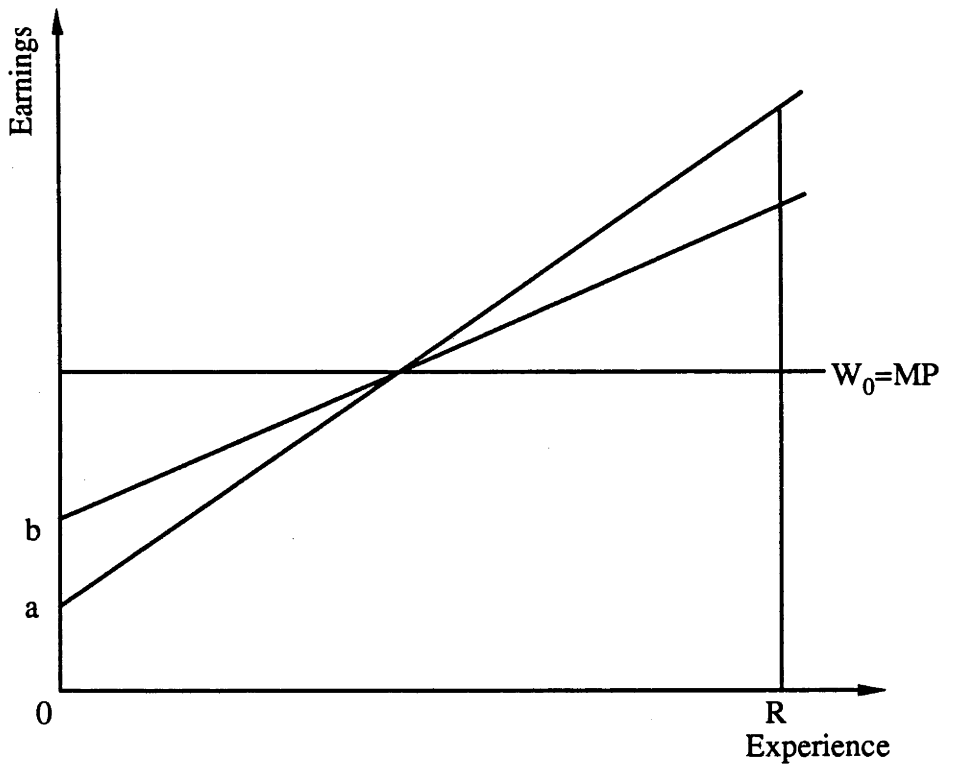


Figure 2.7: The Effect of Minimum Wage Regulations in a Shirking Model.



his Australian/British comparison by suggesting that "the Australian arbitration framework did not at that time [1962-63] exert much of an equalising effect on the industry wage structure."(p 161).

More recent comparisons tend to support the view that the Australian wage structure is more compressed than that found in the US and Great Britain (22). The authors vary in the extent to which they are willing to attribute these differences to the existance of the arbitration system. There are several ways in which the centralised arbitration system in Australia may reduce earnings differentials and create an inflexible wage structure. Firstly, in most years, there is usually a national wage case which awards pay increases across the whole of the Australian economy usually based on cost of living adjustments and the average growth in national productivity. Secondly the award system described in chapter 1 means that any increases granted to one group of workers are given to all others covered by the same award. A third factor is the concept of "comparative wage justice" whereby relativities between groups of workers are preserved. An increase for one group can be quickly passed on to others working under different awards. All of these factors would tend to reduce the extent to which wages vary between individuals.

None of the studies considered above have explicitly compared earnings by age across the three countries. Our data show that there is on average, less variation in earnings between age groups in Australia than in the US and Great Britain (that is the Australian profile is flatter). This suggests the hypothesis that the Australian arbitration system has reduced the variation in wages by age below that which would be produced by an alternative system. This should be apparent in lower returns to human capital in Australia than in the other two countries, although it is not the only possible explanation for lower returns. The arbitration system may also affect the accumulation of human capital, that is the stock of endowments, by reducing the incentives to invest in human capital. The effects of minimum wages on human capital accumulation outlined in the

previous section, are an example of a mechanism by which the arbitration system may affect the stock of human capital.

Although there is not a centralised wage fixing system in Great Britain, several of the possible suggested causes of reduced earnings differentails in Australia appear to exist in Great Britain as well. There is evidence that great emphasis has been placed on the preservation of existing wage relativities between workers in similar industries and geographical locations. (23) There is also evidence of some compression of wage relativities between skilled and unskilled workers in Great Britain compared with continental Europe. (24) So, although there are differences between the wage fixing systems of Australia and Great Britain, there is some evidence of similar effects on the earnings distribution, namely a compression of differentails between workers.

4.3 The Effect of Unionisation on the Age Earnings Profile.

In the Australian context, the operation of the arbitration system and the existence of a high level of unionisation are closely linked and probably make difficult the estimation of a separate effect of unionisation on wages profiles. A high level of unionisation could, a priori, lead to either flatter or steeper earnings profiles. In some occupations, for example, the presence of a union may lead to a steeper age earnings profile if the price of entry to a well paid union job is a long wait in a queue during which earnings are low. Empirically, however, union membership has been observed in Australia and the US to be associated with flatter age earnings profiles.(25) A number of possible explanations for this have been put forward.

The median voter model suggests that trade unions aim to negotiate a wage package attractive to a majority of union members. This is more likely to include flat rate increases for everyone rather than differential increases according to experience. In contrast, in the non union sector, the employer will aim to design a wage package which is particularly attractive to the valuable marginal worker who may move. It is asserted that such a package is more likely to be associated with greater variation in earnings with

age. The end result of these different priorities in the union and non union sectors is higher earnings for the older and younger union members compared with their non union counterparts.(26)

An alternative explanation for the flatter earnings profiles of union members comes from the role of unions acting as agents in the relationship between employers and employees. Unionisation can be thought of as an alternative to offering an efficiency wage or an upward sloping age earnings profile to reduce turnover or shirking. The exit-voice tradeoff is one such hypothesis. (27) According to this argument, unions reduce labour turnover not only because they increase the share of any monopoly rents going to workers but also because they act as an effective 'voice' for any grievances felt by the workforce. This 'voice' acts as an alternative to quitting. (28) For these reasons, the presence of unions counteract the need for an upward sloping age earnings profile in order to reduce turnover. (29)

The above discussion would suggest the following interpretation for figure 1.1 chapter 1. The institutional environment, that is the existence of minimum wage regulations and the role of the arbitration system and the associated level of unionisation, has led to flatter age earnings profiles in Australia than in the US. However, to explain differences within Australia between graduates and other education groups, it would be necessary to argue that the effect of minimum wage regulations and the arbitration system was smaller at higher levels of education. This seems plausible as the minimum wage regulations are less likely to be binding for the more highly educated; that is, employers are willing to pay new university graduates above the set minimum wage even if they are undertaking general or specific training. The award rates set by the arbitration commission may also be less relevant if factors such as the scarcity of individuals with the relevant skills encourage employers to pay above the award rate.

The institutional setting will affect both the level of endowments and the returns to those endowments. A binding minimum wage will reduce the amount of training being

undertaken and also change the rewards to that training. The evidence suggests that the arbitration system in Australia has compressed earnings differentials. This may work through the direct effect of reducing the returns to endowments and indirectly through a reduction in the incentives to invest in human capital. In this case the flatter age earnings profile in Australia compared with the US would reflect both lower levels of endowments and a smaller return to these endowments.

5. Conclusions

In this chapter we have outlined some theories which attempt to explain why earnings vary with age. There are three facts about earnings which we would like to be able to explain:

1. The more educated earn more than the less educated.
2. Older men earn more than younger men.
3. Earnings peak later for the more educated than the less educated.

We shall summarise the discussion of this chapter with reference to these three facts and to the extent to which the theories offer some explanation of the differences and similarities between the age earnings profiles of men in Australia, Great Britain and the United States.

The human capital model predicts that earnings will grow with experience as long as net investment in human capital continues. The model can offer an explanation of the higher earnings of the more educated both in terms of higher direct productivity and greater allocative efficiency. It has been suggested that there is a complimentarity between formal schooling and on-the-job training which encourages the more educated to invest for longer and therefore reach their peak earnings at a later age than other groups. The human capital approach would explain the flatter aggregate age earnings profiles of Australia and Great Britain compared with the United States by a lower level of investment in human capital in these countries.

The cohort model offers an additional factor in explaining the slope of the age earnings profile, namely the size of the cohort entering the labour market both in purely demographic terms and in terms of their educational attainment. The model emphasises the lack of substitutability between workers of different ages particularly new workers and fully qualified workers. The cohort model could explain differences between the three countries by the relative size of different cohorts. If there were a larger cohort of young workers in the US relative to Australia and Great Britain, this model would predict lower relative earnings for the young compared with the earnings of prime age males in the US. In the cross section this would produce the appearance of a steeper age earnings profile in the US than in the other countries.

The second group of theories which we have discussed in this chapter are the efficiency wage models. These models offer explanations of higher wages in some sectors than in others but do not offer an explanation of upward sloping age earnings profiles. Where efficiency wages were important we would expect to observe flat age earnings profiles.

Our third group of theories suggested some alternative justifications of upward sloping age earnings profiles apart from human capital investment. Lazear's shirking model proposed an upward sloping age earnings profile as a means of increasing worker effort. The Salop and Salop model justified an upward sloping profile as a method for reducing turnover. Both these models share the prediction of lower labour turnover where there are steeper age earnings profiles with the specific human capital model. If these hypotheses were to explain the differences between the three countries, it would be necessary to show that differences in the industry and occupational mixes of the three countries were associated with differences in the potential for shirking or the cost of labour turnover. Our data are not sufficiently refined to differentiate between these hypotheses but a finding that industry differences were important in explaining the differences in the shape of the age earnings profiles between the countries would

encourage further investigation of the underlying causes of the industry effect. This would include these hypotheses.

A final important group of factors affecting the shape of the age earnings profiles is labour market institutions and trade unions. The theoretical models presented suggest that where minimum wage regulations are binding and trade unions are stronger, we would expect to observe flatter age earnings profiles. Regulation of the labour market may result in flatter age earnings profiles by both reducing the rewards for skill and experience and by reducing the incentive to invest in skills, that is by reducing the stock of human capital.

These theories suggset that education, working experience, industy of employment and cohort size may be important in explaining differences between countries in the shape of the age earnings profile. In the following chapters we shall present evidence on the importance of these variables in explaining differences in the shape of age earnings profiles between the countries.

Footnotes

1. In a sense all earnings differentials are compensating differentials. Adam Smith summarised the theory of compensating differentials in the Wealth of Nations

> "The five following are the principal circumstances which, so far as I have been able to observe, make up for a small pecuniary gain in some employments, and counter-balance a great one in others: first, the agreeableness or disagreeableness of the employments themselves; secondly, the easiness or cheapness, or the difficulty and expense of learning them; thirdly, the constancy or inconstancy of employment in them; fourthly, the small or great trust which may repose in those who exercise them; and, fiftly, the probability or improbability of success in them." (pp116-117).

See Rosen (1986) for a more modern presentation of the same ideas.

2. Rosen (1981) examines the economics of superstars.

3. See, for example, Becker (1975), Mincer (1974) and Weiss (1986) for further discussions.

4. Arrow (1962) cites some examples of increased labour productivity which did not arise from increases in physical capital investment. He proposed a theory of technical change arising basically from an externality of production, namely learning by doing. "I advance the hypothesis here that technical change in general can be ascribed to experience, that it is the very activity of production which gives rise to problems for which favourable responses are selected over time" (p 156). This theory could also explain the observation that earnings increase with age.

5. See Hashimoto (1981) for a two period model of firm specific training as an investment shared by employers and employees.

6. Lillard and Tan (1986) provide some US evidence that earnings growth was particularly marked for the more educated in industries experiencing rapid technical change and that this group was also more likely to receive training.

7. It is not proposed to discuss the evidence here on the relative rates of technical change in these countries. In both Australia and Great Britain, official concern has been expressed at various times that the rate of technical change was in some sense "too slow". Elek, Camilleri and Lester (1989) present evidence that Australia had a relatively poor performance regarding technical change compared with other OECD countries in the post world war period. Various British Royal Commissions of the second half of the nineteenth century noted with concern the rising competitiveness of the Germans and the Americans and the danger of Britain falling behind her competitors in terms of technical achievement (see S. J. Prais et al. (1981) for some extracts from these reports and Habakkuk (1967) for a study of innovation in Victorian Britain compared with the US). The British have been writing on the topic ever since. See for example the reports of the Balfour Committee (1928), the Anglo American Council on Productivity written in the

early 1950's and the National Economic Development Office written in the 1960's and 1970's.

8. For a fuller discussion see Doeringer and Piore (1971), Cain (1976) and Taubman and Wachter (1986).

9. Taubman and Wachter (1986) suggest that research in the US aimed at finding the demarcation line between the primary and secondary labour markets has been unsuccessful. Attempts to identify the dual labour market in Britain have also produced negative results (see Sloane (1985) p117 for a summary of these studies). It has proved difficult to construct an objective test of the dual labour market hypothesis that does not presuppose the answer.

10. See for example Welch (1979), Berger (1983), (1985) and Freeman (1979). References to other studies and a discussion of empirical results are included in chapter 5.

11. See Connelly (1986) for a discussion of this point. Earnings of high school graduates, for example, may be affected by the size not only of the high school cohort but also of the university graduate cohort.

12. Mincer (1974) summarised the answer to this point by the supporters of human capital theory.

> "What is sometimes thought to be an alternative interpretation of the earnings profiles as "learning curves" is not at all inconsistent with the human capital investment interpretation, provided it is agreed that learning in the labor market is not costless: even if apparently costless differential "learning-by-doing" opportunities exist among jobs, competition tends to equalize the net returns, thereby imposing opportunity costs on such learning." (p132))

13. For a formal screening model see Arrow (1973). A major conclusion of his model is that while the screening role of education suggests positive private returns from undertaking higher education, under certain assumptions it suggests education adds nothing to social productivity. Arrow concluded on the basis of a one factor model of the

screening hypothesis that " an increase in the resources devoted to college education will have no positive effect on output in the non-educational sector, if all other variables are controlled for." (p 215).

14. The radical view puts a much more negative perspective on the role of education. Bowles and Gintis (1975), for example, argued that while education may be productivity enhancing, it may do this by socialising the workforce to accept the capitalist system. Education " segments the workforce, forestalls the development of working class consciousness, and legitimates economic inequality by providing an open, objective, and ostensibly meritocratic mechanism for assigning individuals to unequal occupational positions." (p 78). They do not offer any specific explanation of the rising age earnings profile. Perhaps it can be thought of as another device to segment the working class.

15. Blakemore and Hoffman (1988) dispute the Medoff and Abraham conclusion. On the basis of job tenure data for US manufacturing, they concluded that longer job tenure was associated with higher productivity. This link could be interpreted as arising from specific training.

16. Adam Smith noted the existance of an "efficiency wage" for goldsmiths. "The wages of goldsmiths and jewelers are every-where superior to those of many other workmen, not only of equal, but of much superior ingenuity; on account of the precious materials with which they are intrusted." (p 122 of Liberty Classic edition of the Wealth of Nations).

17. More general discussions of efficiency wage models can be found in Krueger and Summers (1988), Katz (1986), Dickens and Katz (1987) and Stiglitz (1986).

18. Shapiro and Stiglitz (1984) and Bulow and Summers (1986) are examples of these models motivated by the firms desire to reduce shirking. Salop (1979) is an example of a model based on the firm's desire to reduce turnover and Akerloff (1982) presents a sociological model based on the idea of a gift exchange between employers and employees.

19. The shirking hypothesis has also been used to explain other aspects of economic behaviour. Oi (1983) uses the idea of shirking and the costs of monitoring workers to develop a theory of differences between firms in the organisation of production and structure of employment in a given industry. He considers entrepreneurial skill as a scarce factor used to coordinate production and monitor workers. As entrepreneurial abilities vary between individuals so will the optimal size of a firm. This choice of optimal size given abilities generates the wide range of firm sizes which can be observed in a single industry.

20. See Dawkins (1988) and Norris (1984). Norris presents a comparison of average job durations for males in Australia, Great Britain and the United States. He used three estimates of job duration for Australia in 1976 and compared these with the British and American experience. There were no great differences between the countries in estimated job durations but the differences which did exist suggested shorter job durations in Australia than in either of the other two countries. However it is important to remember that average job duration for the whole workforce and labour turnover at each age are not the same thing. Young people typically change jobs more often than older people. Comparisons of average job duration can only be relevant for job turnover if the age distribution of the working populations are the same. If, for example, the US working population were on average older than the Australian population, we would expect to observe a higher average job duration even if the turnover rate at each age were the same in the two countries.

21. For a discussion of the general issues see Leighton and Mincer (1981). For a discussion of the issues in the Australian context see Chapman and Alston (1989) and Chapman (1988). Fane (1988) analyses the effect of minimum wages on employment in Australia.

22. See Mitchell (1984), Brown et al.(1980) and Norris (1986). However the Hancock Committee (1985) disputes this conclusion. In their summary of the evidence of the effect of the arbitration system on wages in Australia, they made four points -

1. There is little or no basis for the assertion that arbitration has compressed relativities.

2. Wage relativities in Australia are not entirely rigid.

3. The increase in relative pay for females and juveniles played a minor role in determining the labour market experience of these groups.

4. The structure of wages and salaries in Australia is consistent with the provision of broadly indicative signals, rationing scarce talents and acquiring skills.(see Appendix 2 pp 28-29).

They did not however, conclude on the basis of this summary that there was no role for the arbitration system in Australia.

23. For a survey of some of these studies see Carline (1985).

24. See for example Saunders and Marsden (1981), Marsden (1983) and Prais and Wagner (1988) for discussions of these issues and evidence of the compression of wage differentials in Britain in the 1970s.

25. See Hamermesh and Rees (1984) p263 and Lewis (1986) for US evidence and Mulvey (1986) for Australian evidence.

26.See Farber and Saks (1980) and Farber (1986) for a fuller discussion of these ideas.

27. See Freeman (1980) and Freeman and Medoff (1984) for US evidence and Miller and Mulvey (1989) for Australian evidence which support the exit voice hypothesis.

28. Pencavel (1986) cites British evidence to support this argument

> "There is little doubt that the union can serve the efficient processing of information between management and employees: routinely, union officials convey information to management about the operation of work processes and employee work performance and they assist in disciplinary matters; they are also used to disseminate information to their members concerning management's dissatisfaction with current procedures and concerning management's intention to be more vigilant monitors." (p 139)

29. Brown and Medoff (1978) present evidence of a positive relationship between the level of unionisation and productivity estimated from a Cobb Douglas production

function for twenty manufacturing industries in the US in 1972. The mechanism by which unions raise productivity in this study remain speculative. Case studies of productivity performance at the individual plant level in Australia and Great Britain suggest that the more unionised plants were not more productive (see for example, Daly, Hitchens and Wagner (1985), Daly (1986), BCA/NILS (1988) and BIE (1989)).

Chapter 3.
The Sample : Characteristics of Full-time Workers in Australia, Great Britain and the United States.

This chapter sets out the characteristics of both the male and female samples used to estimate the age earnings profiles reported in later chapters. The data sets offer a wide range of variables which we could use in our comparison. The focus of this chapter will be on the characteristics which are used as variables in the regression results reported later; namely weekly earnings, education, experience (or age), (1) industry and occupation. We shall also consider the extent of unionisation across industries. Section 1 describes the male sample and section 2 the female sample. A final section presents summary and conclusions.

Our data come from three household-based surveys. The Australian data are taken from the one per cent sample of the Australian Population Census of 1981. The British data are taken from the General Household Survey 1981, an annual survey of about 30,000 households in Great Britain. The American data also come from a household survey, the Current Population Survey of March 1982 with data referring to 1981. This survey covers approximately 60,000 households containing about 130,000 persons.

Cross country studies using large data sets are a relatively new innovation and there are many problems to be overcome, firstly in setting up the data on the computer and then in making the definitions of the variables as similar as possible across the countries. As the data from Gregory and Ho (1985) were already available at the Australian National University, it seemed sensible to build on that study by adding British data to the existing Australian and American data.

Although there are important shortfalls in these data in terms of the uses to which we wish to put them, the three surveys have the advantage of all relating to one year, making comparisons between the countries more reliable. While it would be possible to

find data sets which were better suited to answering some of the questions raised here, the data relate to very different years in each country making comparisons between the countries difficult. All the potential data sets have some problems and there is no one data set for each country which would answer all the questions raised. As an important focus of this thesis is the use of international comparisons to answer some questions about the determinants of relative earnings, we have opted for these comparable data sets collected from household sources and relating to the same year.

Our results are based on cross section data rather than the construction of actual age earnings profiles of individuals using longitudinal data. There are a number of limitations in the use of cross section data especially if one wishes to interpret the findings as actual outcomes for an individual over a lifetime. An individual's experience over time will differ from that of otherwise identical individuals observed at one point in time in the cross section. Each cohort could face, for example, different demand and supply conditions over their lifetimes and may receive a different quality of education. In addition, economic growth raises the average standard of living.(2) Data limitations, however, prevent us from constructing actual age earnings profiles for individuals over time in each of these countries. It is necessary for us to assume, therefore, that although the details of the international comparisons may vary between this cross section and any other cross sectional or longitudinal results, the broad description of the differences between the countries is persistent.

1. The Sample of Full-time Male Employees.

1.1 General Characteristics

Table 3.1 summarises the relevant characteristics of our sample of full-time male employees aged 16-64 for Australia, Great Britain and the United States in 1981. (3) The average weekly earnings of members of each sample corresponded fairly closely to the average weekly earnings of men in each country taken from an alternative source. (4) In section 5 of chapter 2, we presented some arguments as

to why labour market institutions may reduce the variation in earnings between individuals in Australia compared with other countries. The coefficient of variation reported for each sample of men support the hypothesis of less variation in individual earnings in Australia than in either Great Britain or the United States. Part of the smaller variation appears to be a result of the categorisation of the income data in the Australian census but calculations using categorised data for the US still show a larger coefficient of variation in the US than in Australia (see footnote (a) Table 3.1).

The Australian sample was somewhat younger than that of the other two countries and had over a year's less potential experience in the workforce than the Americans and three years less than the British. While the majority of men in each sample was married, the smallest percentage was in the Australian sample which had a correspondingly larger share of single men than in the other countries. The members of the sample who were widowed, separated or divorced accounted for 4.3 per cent of British men and 8.7 per cent of American men. The percentage of Australian men in this category fell in the middle of this range at 6.1 per cent. All three samples were concentrated among men living in urban areas but this was particularly the case for Australia.

Four education groups have been distinguished here. Firstly those who have not completed high school (the "unqualified"), those who have completed high school but have no further educational qualification ("high"), those who have completed some post secondary schooling or in Britain and Australia, a recognised apprenticeship ("post secondary") and finally those who have completed a university degree either at the bachelor or higher level ("graduate").

The British sample had completed less formal schooling than the samples from the other countries. In all three countries, the split between the bottom two educational groups (the unqualified and the high school group) and the top two (the post secondary and university graduates) was about 60:40 but within these

Table 3.1
Characteristics of Male Sample, Australia, Great Britain, United States, 1981.

	Australia	Great Britain	United States
Average Weekly Earnings of Sample	$A 272.5	£ 127.5	$US 416.5
Standard Deviation of Sample (a)	123.2	69.0	236.3
Coefficient of variation	45.25%	54.1%	56.7%
Average Weekly Earnings (b)	$A 306.8	£ 136.5	$US 347.0
Average Age	35.8 years	38.1 years	38.2 years
Average Potential Experience	19.0 years	22.1 years	20.4 years
Number in sample	12,533	5,681	7,288
Our sample as a % of total male sample aged 16-64 (c)	58.4	60.7	78.1
Marital Status -			
% of sample who were			
Single	28.4	24.0	13.9
Married	65.5	71.7	77.4
Widowed, separated, divorced	6.1	4.3	8.7
Residence -			
% of sample living in each area			
Rural	10.0	38.4	29.0
Urban	90.0	61.6	71.0
Educational Status -			
% of sample with the following education levels-			
Unqualified	32.5	44.3	20.9
High school graduates	29.0	14.5	38.3
Post secondary	27.7	36.3	17.4
University Graduates	10.8	5.0	23.4
Industry Composition -			
% of sample in each industry			
Agriculture	2.9	1.8	2.7
Energy and water	4.6	5.7	4.6

	Australia	Great Britain	United States
Manu. of metals, chemicals	7.6	6.1	6.3
Metal goods, engineering, vehicles	10.3	19.9	13.2
Other manufacturing	10.9	12.1	10.6
Construction	7.8	10.3	9.8
Distribution	18.7	12.5	18.5
Transport and communication	10.9	9.9	7.4
Banking and business services	7.7	6.6	6.3
Other services	18.5	15.1	20.8
Occupational Status			
% of sample in each occupation			
Managers	7.2	13.5	12.0
Professionals	12.2	5.0	17.1
Other non manual	22.8	18.9	17.8
Skilled	27.3	41.4	23.4
Semi and unskilled	27.2	19.4	27.9
Farm and agricultural workers	3.4	1.7	1.8

Source: Australia-1981 Census of Population and Housing, Households Sample File, ABS; Great Britain-General Household Survey, 1981, OPCS; United States-Current Population Survey,1982, Bureau of the Census, US Department of Commerce.

Footnotes - (a) The Australian data were presented in categories while the data for the other countries was not in categories. In order to get some idea of the effect of this categorisation on the size of the variance, we have also categorised the US data into 12 earnings categories. The standard deviation about the mean of $US 407.77 was 212.3 with a coefficient of variation of 52.1% which was somewhat smaller than that reported in the table for the uncategorised US data but still larger than for Australia.

(b) Sources :- Australia: Average Weekly Earnings Australia, ABS cat. no. 6302.0 These figures relate to men over 21 working full-time. A full-time worker is defined in Australian statistics as one working more than 30 hours a week. Great Britain : Annual Abstract of Statistics 1983, Table 6.20. The figures relate to men 21 years of age and over. Average weekly earnings for 16- 21 year old youths working full-time in 1981 were £ 73.7 per week. United States : Annual Abstract of Statistics 1982, Table 671. These figures relate to median weekly earnings of full-time wage and salary earners over 16 years of age.

Footnotes to Table 3.1 cont. (c) Our sample is smaller than the total sample for which data were collected because it relates only to men working more than 35 hours a week as employees, that is it excludes those not in the workforce (for example students and pensioners) and the self employed. It also excludes those individuals for whom the data were incomplete, for example those who did not disclose their earnings, industry of employment or educational attainment.

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two groups there were important differences. In the US, those who did not go beyond high school mainly completed high school but this was not so in Great Britain. Forty-four per cent of the British sample had left school without completing high school. The Australian sample with no tertiary qualifications divided fairly evenly into those who did and did not complete high school. In the US, the bulk of those who went on to some form of tertiary education completed at least four years of college (university graduates) where the opposite was true in Great Britain. About a third of the Australian sample with some tertiary qualification had completed a university degree.

The relatively large group with some post secondary qualification in both Australia and Great Britain can be explained by the importance of apprenticeships. The combination of on-the-job training and formal schooling provided by an apprenticeship, has been the major method used to train a range of skilled workers such as electricians, fitters and plumbers in these countries. The US data do not include information on completion of apprenticeships but in the US, apprenticeships have been much less important and are mainly confined to the construction and metal working industries (see Daly (1986)).

The next part of Table 3.1 relates to the industry of employment of the members of the three samples. The extent to which we were able to disaggregate the sample by industry was limited by the small number of industries distinguished in the British data. The industries we have identified here are broad aggregates which may conceal important differences between the countries. The distribution of men between industries was similar in Australia and the US but there were some differences between these two

countries and Great Britain. The British sample had a much larger percentage employed in manufacturing (the three component groups were manufacture of metals and chemicals; metal goods, engineering and vehicles, and other manufacturing). Distribution, other services and agriculture were less important in Great Britain than in the other countries.

The distribution of the male sample across the six broad occupational categories differed between the three countries. In each country over half the sample worked in manual occupations (skilled; semi skilled and unskilled workers). There were however, differences in the distribution of workers across the two sub categories. A much higher percentage of British workers were classified as skilled compared with the other countries. Among the non manual occupations which covered about 40 per cent of each sample, there was a relatively small percentage of male employees classified as managers in Australia and a relatively small percentage of professional workers in Great Britain. The percentage of farm and agricultural workers in the total was roughly twice as large in Australia as in the other two countries but remained of minor importance. Part of these differences in the occupational distributions between the countries may be attributable to differences in the mix of self employed and employees in particular occupational categories. The figures reported here relate only to employees.

1.2 Earnings by Age and Education.

Figures 3.1, 3.2 and 3.3 present data for the three countries on the relationship between age, education and earnings for full-time men. The data are presented as a five year moving average to reduce the effect of sampling variability. These data show three general patterns. Firstly, older people earn more than younger people. Secondly, the more educated earn more than the less educated and finally, that the earnings of the more educated peak later than those of the less educated. (5) Although the three stylised facts hold true for each country, there are important differences among them in the shapes of the age earnings profiles and it is these which we wish to focus attention on. (6)

Figure 3.1: Average Weekly Earnings by Age and Education for Men, Australia, 1981.

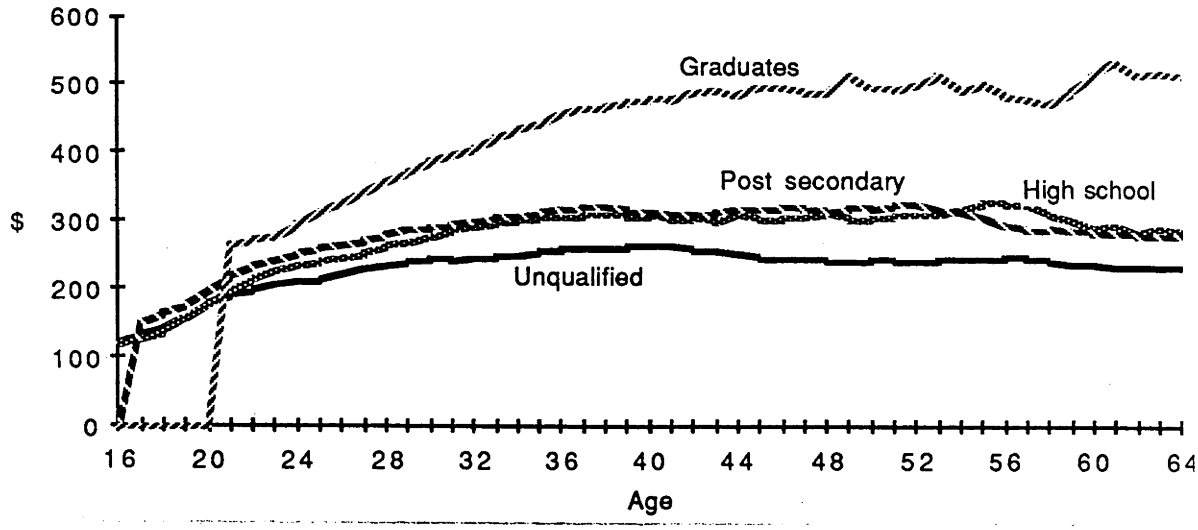


Figure 3.2: Average Weekly Earnings by Age and Education for Men, Great Britain, 1981.

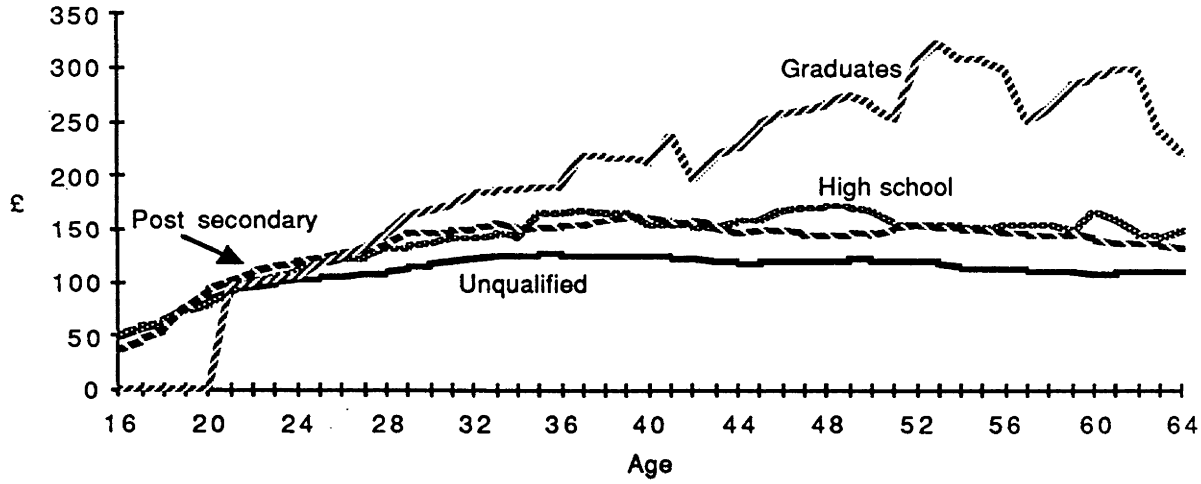
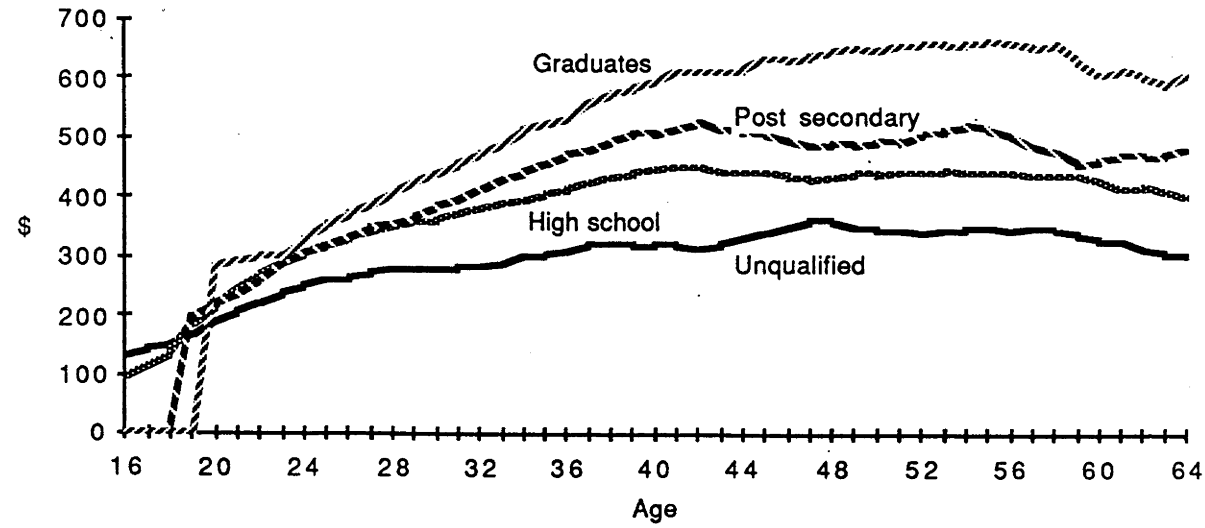


Figure3.3: Average Weekly Earnings by Age and Education for Men, United States, 1981.



The steeper aggregate age earnings profile in the US may in part be explained by differences in the educational mix of the male workforce in the three countries. Figures 3.4, 3.5, 3.6 and 3.7 present the data from figures 3.1 -3.3 in a form which enables comparisons within the same education group across the three countries.

In comparing Australia and the US the general result of a steeper profile in the US held for each education group. The comparison between Great Britain and the US was less clear cut. The American profile peaked above the British profile for the unqualified and the post secondary group but not for high school and university graduates.

The general pattern was for US earnings in each education group to continue to rise after earnings in the other countries had reached a plateau. Among the unqualified, earnings in Australia and Great Britain rose into their thirties but in the US, earnings of the unqualified continued to rise until their late forties. For the high school graduates, earnings flattened out in Australia in their early thirties, in Great Britain in their late thirties and in the US in their early forties. For those with some post secondary schooling, earnings rose rapidly in Australia and Great Britain for the first fifteen to twenty years of working life and them remained constant while American earnings continued to rise.

The earnings of graduates continued to rise for longer than the earnings of other education groups in all countries but this difference was particularly pronounced for Australia and Great Britain. In these countries, the earnings of graduates were still rising in their fifties while for the other education groups, earnings had ceased to rise in their late thirties.

1.3 Earnings by Age and Industry

Industries differ in the mix of jobs they provide and in the level of skill required of their workforce. It is not surprising, therefore, that average earnings differ among industries. The ranking of the ten industries by average earnings is quite close across the

Figure 3.4: Average Weekly Earnings of Unqualified Men, Australia, great Britain and the United States, 1981.
Earnings of an unqualified man aged 25=1.

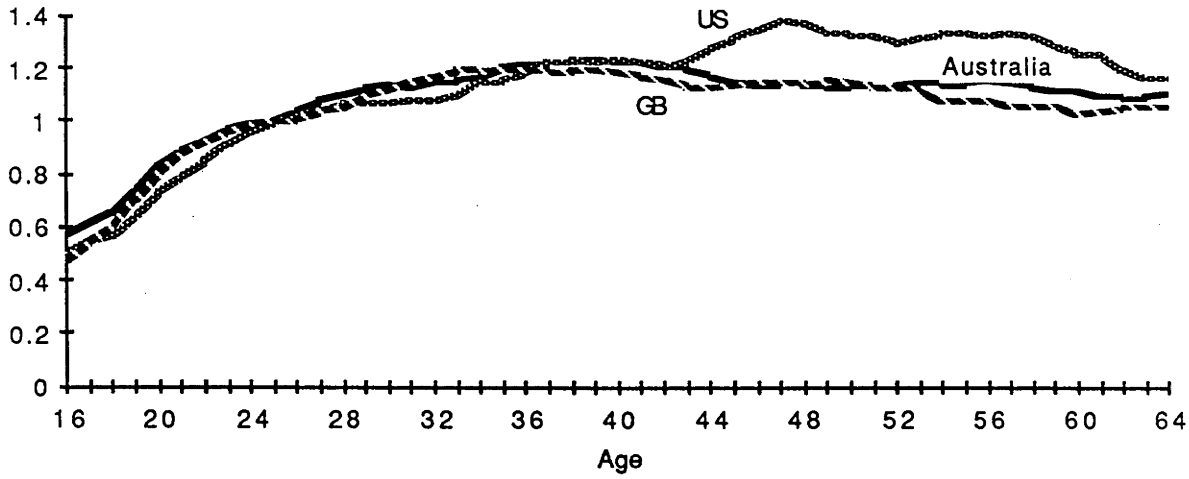


Figure 3.5: Average Weekly Earnings of Male High School Graduates, Australia, Great Britain and the United States, 1981.
Earnings of high school graduates aged 25=1.

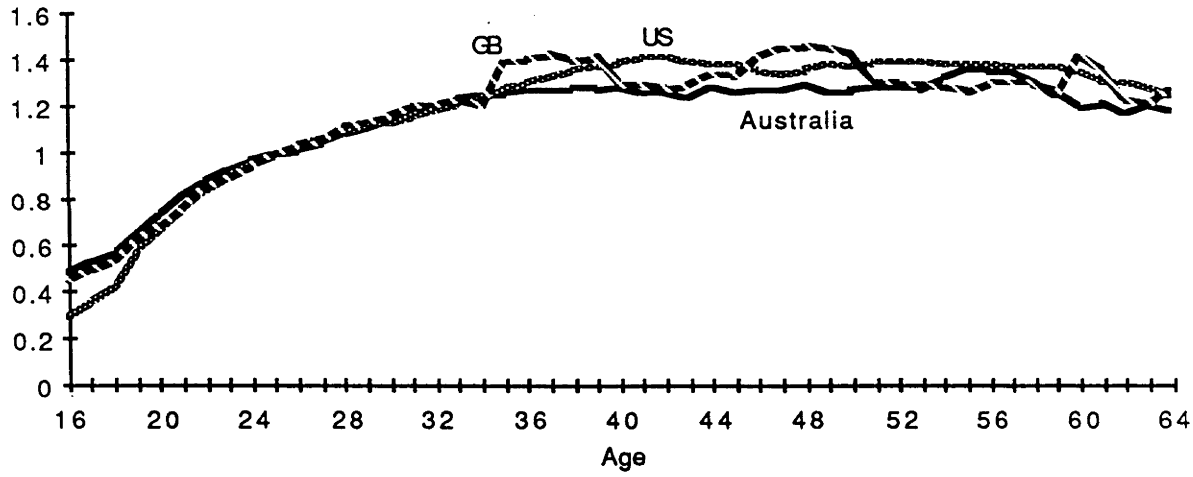
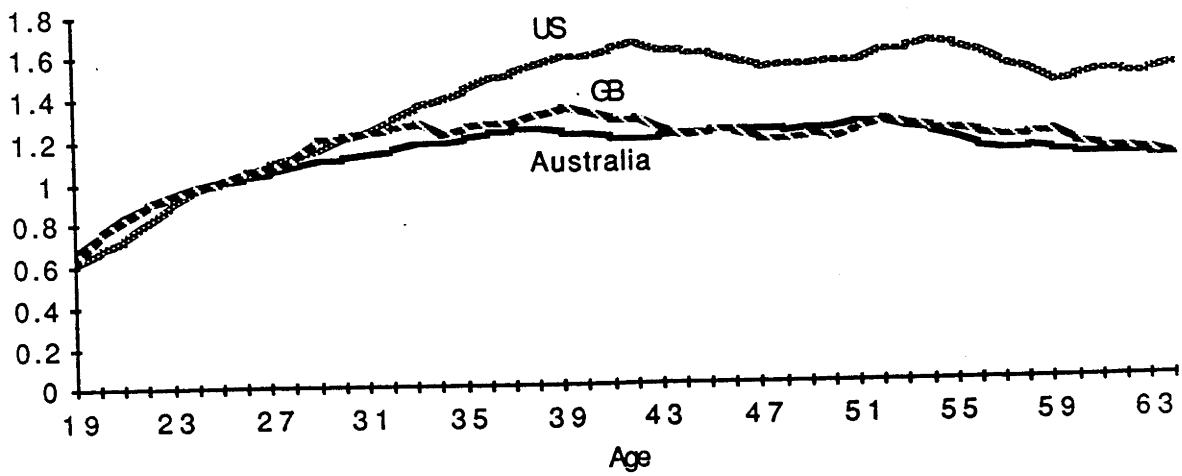


Figure 3.6: Average Weekly Earnings of Men with Post Secondary Qualifications, Australia, Great Britain and the United States, 1981.
Earnings of a man with post secondary qualifications aged 25=1.



three countries. The simple correlation coefficient, r, was 0.92 between Australia and Great Britain, 0.82 between Australia and the US., and 0.89 between Great Britain and the US. Agriculture and distribution were low paying industries in each of the three countries and energy and water, and banking and business services were high paying industries. (7) The average weekly earnings of men by industry are presented in Table 3.2. The coefficient of variation for the ten industries was greatest in the US compared with the other countries.

Industries which paid well on average also tended to pay well for men of all ages (see the second part of Table 3.2). Relatively high earnings in later life were not offset by relatively low earnings at the beginning of working life. This was true across all three countries.The correlation between average earnings by industry for those just starting full-time work, the 16-19 year olds, was high; r = 0.88 between Australia and Great Britain, r = 0.88 for Australia and the US, and r = 0.89 between Great Britain and the US.

Figure 3.7: Average Weekly Earnings of Male University Graduates, Australia, Great Britain and the United States, 1981.
Earnings of university graduates aged 25=1.

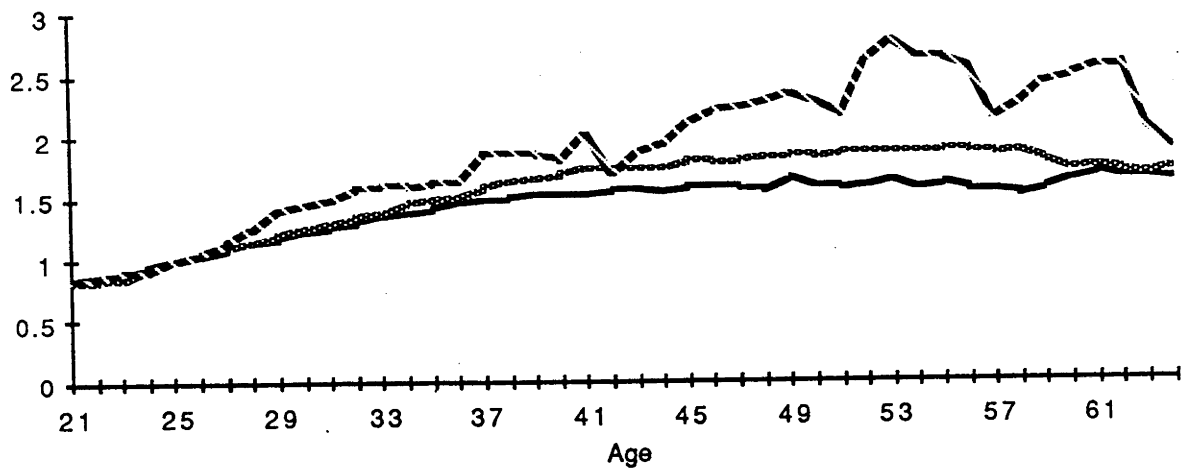


Table 3.2
Average Weekly Earnings of Men by Industry, Australia, Great Britain and the United States, 1981.

	Australia $A	Great Britain £	United States $US
All men-			
Agriculture	186	88	226
Energy and water	298	152	480
Manu. of metals, chemicals	295	129	464
Metal goods, engineering, vehicles	241	124	441
Other manufacturing	250	121	361
Construction	254	120	378
Distribution	245	105	347
Transport and communication	270	132	456
Banking and business services	318	152	455
Other services	317	142	420
Average of all industries	267.4	126.5	402.8
Coefficient of variation	15.3 %	15.8 %	19.2 %
Average Weekly Earnings of Men Aged 16-19 by Industry			
Agriculture	118	49	124
Energy and water	167	101	267
Manu. of metals, chemicals	152	68	202
Metal goods, engineering, vehicles	128	62	195
Other manufacturing	132	62	165
Construction	138	60	176
Distribution	125	53	153
Transport and communication	157	80	218
Banking and business services	139	53	154
Other services	133	68	141
Average of all industries	138.9	65.6	179.5
Coefficient of variation	11 %	23 %	24 %

Source: as for Table 3.1.

The distribution of employment across industries varies between age groups and may contribute to the differences in the shape of the age earnings profiles between the countries. We shall use Tables 3.3, 3.4 and 3.5 to show how each age group was distributed across the ten industies in each of the three countries. Among men over twenty-five, the distribution across the ten industries was much the same as in the total, although in each country, the 50-59 and 60-64 year old groups were slightly more concentrated in the three manufacturing industries and under represented in construction compared with the total.

The industrial concentration of 16-19 year olds was, however, particularly pronounced in each of the three countries, being highly concentrated in distribution and agriculture. The finding was less pronounced for the 20-24 year olds but was still in evidence. This suggests that there is something in the nature of these industries, for example, the level of skill or experience required, which enables young people to compete disproportionately for these jobs. The other industries which employed a relatively large proportion of 16-19 year olds in Australia were manufacturing and construction, probably reflecting the availability of apprenticeships for this age group in these industries. In Britain the percentage of 16-19 year olds in construction was well above the average for the total sample probably also because of apprenticeships. There was no evidence, however, of a particular concentration of young men in manufacturing. In the US, where apprenticeships are less important and are not age related, young men were under represented in manufacturing. In all three countries 16-19 year olds were under represented in other services (that is public administration, health and education etc.) and in banking and business services.

Table 3.3
The Percentage of Each Age Group by Industry, Australia, 1981.

	16-19	20-24	25-29	30-39	40-49	50-59	60-64	Total
Agriculture	5.4	3.7	2.7	2.6	2.6	1.8	2.9	2.9
Energy and water	3.5	4.1	4.1	4.6	4.4	6.6	4.0	4.6
Manu. of metals, chem	6.3	6.4	7.1	8.2	7.8	8.7	8.3	7.6
Metal goods, eng, veh	15.7	9.5	8.6	8.6	9.9	13.0	10.9	10.3
Other manu	14.1	10.0	10.6	9.9	10.6	12.3	11.6	10.9
Construction	10.8	9.5	7.5	7.5	7.1	6.1	5.7	7.8
Distribution	26.7	23.5	17.1	17.3	18.1	14.2	19.0	18.7
Trans and comm.	5.0	9.6	12.4	10.7	12.3	12.4	12.4	10.9
Banking and bus serv	6.2	7.7	9.8	8.6	7.5	6.0	5.5	7.7
Other services	6.3	15.9	20.2	22.0	19.6	19.1	19.7	18.5
Total	100	100	100	100	100	100	100	100
% of age group in total sample	9.0	14.4	13.5	26.3	18.0	15.4	3.3	100

Source: Australia 1981 Population Census.

1.4 Unionisation by Industry

It has proved very difficult to compare the level of unionisation by industry across the three countries. Statistics on union membership are not collected as part of the Australian and British data sets we have used and not in the particular CPS survey we have used for the US. It was therefore necessary to look for other sources on unionisation by industry and it was not always possible to match these data with our industry classification. Our comparisons can therefore only be made at a very general level. In the earnings regressions reported in chapter 6, we have split the sample into those in industries with high levels of unionisation and those in industries with low levels of unionisation and tested for any significant difference between the coefficients on the variables for these groups. It is therefore important, for these purposes, to be able to rank the industries by level of unionisation or in the British case, coverage by collective agreements, rather than to have an accurate and comparable measure of the

Table 3.4
The Percentage of Each Age Group by Industry, Great Britain, 1981.

	16-19	20-24	25-29	30-39	40-49	50-59	60-64	Total
Agriculture	2.9	2.6	1.2	1.3	1.7	1.9	2.3	1.8
Energy and water	2.6	6.0	5.0	5.7	5.9	7.0	5.8	5.7
Manu. of metals, chem	4.0	4.5	5.6	7.1	6.7	6.3	5.5	6.1
Metal goods, eng, veh	19.0	17.7	19.8	19.1	18.9	22.9	22.4	19.9
Other manu	14.5	11.6	10.6	11.6	12.6	11.9	13.4	12.1
Construction	17.4	11.5	11.7	8.8	11.4	8.0	6.1	10.3
Distribution	24.5	16.6	11.7	10.9	11.3	9.8	11.0	12.5
Trans and comm.	4.3	8.2	8.8	9.5	11.1	12.4	12.8	9.9
Banking and bus serv	3.8	8.9	7.7	8.6	5.6	4.6	4.1	6.6
Other services	6.9	12.4	18.0	17.5	14.7	15.1	16.6	15.1
Total	100	100	100	100	100	100	100	100
% of age group in total sample	7.4	11.6	11.9	25.1	19.3	18.6	6.1	100

Source: General Household Survey, 1981.

Table 3.5
The Percentage of Each Age Group by Industry, United States, 1981.

	16-19	20-24	25-29	30-39	40-49	50-59	60-64	Total
Agriculture	7.3	4.2	3.1	2.2	2.5	2.2	2.6	2.7
Energy and water	3.6	5.0	4.6	4.7	4.2	4.7	4.0	4.6
Manu. of metals, chem	2.6	4.7	5.9	6.4	6.2	7.2	7.8	6.3
Metal goods, eng, veh	5.6	12.5	13.3	12.7	13.4	14.6	12.5	13.2
Other manu	11.2	13.5	10.2	9.8	10.1	10.9	12.1	10.6
Construction	11.9	13.1	11.0	9.1	9.5	8.5	7.7	9.8
Distribution	37.0	25.8	21.6	17.5	15.8	14.9	16.5	18.5
Trans and comm.	3.0	5.7	7.4	7.9	7.6	7.8	6.8	7.4
Banking and bus serv	4.6	5.2	6.1	6.7	6.6	6.2	6.6	6.3
Other services	13.2	10.3	16.8	23.0	24.1	23.1	22.5	20.8
Total	100	100	100	100	100	100	100	100
% of age group in total sample	1.3	10.1	16.5	30.9	19.7	16.8	4.6	100

Source: Current Population Survey, 1982.

absolute level of unionisation by industry in each country. It has not proved possible to find the latter.

For both Australia and the US we have data on employees who were members of trade unions by industry of employment for years adjacent to 1981. These data for men are presented in Table 3.6. The level of unionisation in the US was about half of that in Australia. In the US the percentage of employees in an industry who were trade union members ranged from 4 per cent in agriculture to 52 per cent in transport and communications. In Australia, the percentage ranged from 21 per cent in agriculture to 81 per cent in transport and communications. Once again there was a close correlation between the countries in the level of unionisation of industries. The simple correlation coefficient for unionisation by industry was $r = 0.91$.

In accordance with legislative requirements, the Certification Office for Trade Unions and Employers Associations presents annual data about the number of trade unions and their membership in Great Britain. An industry breakdown is also published but all members of a union are classified to the industry where most members are found. For example, all members of the Transport and General Workers Union are classified to the transport industry. This produces rather misleading statistics, some industries having more than 100 per cent unionisation. It has therefore been necessary to use an alternative data source. In the New Earnings Surveys of 1978 and 1985, data were presented on the percentage of full-time adult employees who were affected by collective agreements. This is a much broader categorisation than the percentage of union members in an industry and the figures are correspondingly higher than for the other countries (compare Table 3.7 and Table 3.6). If we were to take account of all employees covered by conciliation and arbitration awards in Australia, the total figure would be about 85 per cent of all employees compared with 53 per cent who were actual union members. In our discussion of Table 3.7, it is therefore important to remember that these figure are not on the same basis as those in Table 3.6.

Table 3.6
Male Employees who were Trade Union Members by Industry, Australia, 1982, and the United States, 1980.

	% of Male Employment in Industry	
	Australia	United States
Agriculture	21	4
Mining	67	36
Manufacturing	56	37
Trans,comm. and gas, elec and water	81	52
Construction	52	34
Distribution	24	12
Finance, property and business services	44	9
Public administration	71	40
Personal services and private household	41	15
Community services	62	25
% of all male employees	53	28

Source: Australia: ABS Trade Union Members Australia, March to May 1982, Table 6 p 8 (cat no. 6325.0)
US: Statistical Abstract of the US, 1984, Table 729, p441.

Table 3.7
Percentage of Full-time Adult Males Affected by Collective Agreements by Industry, Great Britain, 1978 and 1985.

Industry	% of Male Employment in	
	1978	1985
Agriculture	37	39
Energy, water; extract of mins; metal, chem manu	84	75
Metal goods, engineering and vehicles	72	57
Other manufacturing	67	57
Construction	73	66
Distribution	36	34
Transport and communications	85	83
Banking and business services	44	38
Other services	78	90
% of all male employees	71	71

Source: The New Earnings Survey, 1978 and 1985.

In Table 3.7, we present data from the two New Earnings Surveys. We are interested in the level of unionisation or collective agreements in 1981 which fell about midway between the two surveys. This was a period of great change in the British labour market arising from the recession of the early 1980's and the Conservative government's policy changes in the industrial relations area.(8) An extrapolation of the trend between these two points therefore may provide a misleading estimate of the actual numbers of workers covered by collective agreements in 1981.

In some of the sectors, namely energy, water and mining, manufacturing and construction, the extent of coverage by collective agreements fell between 1978 and 1981. In other services (which includes public administration), it rose. The timing of these changes within the seven year period is not known. However, for the purposes of the earnings regressions presented in chapter 6, we are chiefly interested in the ranking of the industries. In both 1978 and 1985, agriculture, distribution and banking and business services were the industries with the lowest levels of coverage by collective agreements. The industries with relatively high levels of coverage by collective agreements in both years were energy and water etc, transport and communications and other services. Although it is not possible to match the industry classifications in Table 3.6 and 3.7 without considerable further aggregation, it appears that the ranking of industries by extent of collective agreements was similar to the ranking by unionisation in Australia and the US.

2. The Sample of Full-time Female Employees.

2.1 General Characteristics.

While over half the men aged 16-64 in the total samples available at the initial source were included in our sample of full-time employees, only about a quarter of women in Australia and Great Britain fell in this group. The largest percentage of the total population of women to be selected into our sample was in the United States. As there are reasons to expect differences in certain characteristics between the whole

population of women and the sample working full-time, the characteristics reported in Table 3.8 are likely to differ from those of the population as a whole.(9)

The broad characteristics of the samples of women working full-time in the three countries are set out in Table 3.8. The average weekly earnings of the members of our samples were similar to those reported in alternative sources and below those of the male samples. Once again there was less variation as measured by the coefficient of variation in the earnings of the sample of Australian women than in the other countries. The categorisation of the American data did not change the size of the coefficient of variation (see footnote (a) Table 3.8).

In comparison with the male sample, the female sample was younger and had less potential labour market experience. The American women were on average older than their Australian and British counterparts but the Australian women had the lowest potential experience. The fact that a higher average age in the Australian sample was not associated with a higher level of potential experience than in the British sample can be explained by the higher level of education of the Australian women compared with the British women.

About half of each sample of women was married, a smaller proportion than for the men. A relatively large percentage of the American sample fell in the category widowed, separated and divorced and a correspondingly small percentage was single compared with the other countries. Single women were much more important in the female samples for Australia and Great Britain than single men were in the male samples. These differences in the marital status of the samples in the three countries probably account for the differences in the percentage of women who lived in households with children. Over 40 per cent of the American women had children in their households while the Australian and British percentages were roughly half as big.

Table 3.8
Characteristics of the Female Sample, Australia, Great Britain, United States, 1981.

	Australia	Great Britain	United States
Average Weekly Earnings of Sample	$A 204.8	£ 80.4	$US 250.1
Standard Deviation of Sample (a)	81.2	33.1	130.7
Coefficient of variation	39.6%	41.2%	52.3%
Average Weekly Earnings (b)	$A 236.7	£ 89.3	$US 224.0
Average Age	33.2 years	31.2 years	37.9 years
Average Potential Experience	14.4 years	16.8 years	19.2 years
Number in sample	5,554	2,299	5,261
Our sample as a % of total female sample aged 16-64 (c)	26.4	23.1	42.2
Marital Status -			
% of sample who were			
Single	42.4	40.8	17.9
Married	46.8	50.5	59.1
Widowed, separated, divorced	10.8	8.7	23.0
% of sample with children in household	25.2	17.1	41.2
Residence -			
% of sample living in each area			
Rural	7.5	36.8	30.4
Urban	92.5	63.2	69.6
Educational Status -			
% of sample with the following education levels-			
Unqualified	32.4	42.6	15.7
High school graduates	38.0	38.8	49.2
Post secondary	16.6	16.1	16.4
University Graduates	13.0	2.5	18.7
Industry Composition -			
% of sample in each industry			
Agriculture	1.1	0.6	0.5
Energy and water	0.8	2.0	0.8

	Australia	Great Britain	United States
Manu. of metals, chemicals	2.0	2.9	2.7
Metal goods, engineering, vehicles	4.7	9.6	11.2
Other manufacturing	11.6	15.8	13.8
Construction	1.3	1.6	0.9
Distribution	21.7	18.6	15.8
Transport and communication	4.7	5.6	3.8
Banking and business services	14.9	12.0	12.2
Other services	37.2	31.3	38.3
Occupational Status			
% of sample in each occupation			
Managers	1.3	5.6	5.6
Professionals	20.1	1.0	19.2
Other non manual	55.0	62.7	41.5
Skilled	16.4	24.2	30.1
Semi and unskilled	6.2	6.1	3.0
Farm and agricultural workers	1.0	0.4	0.6

Source: Australia-1981 Census of Population and Housing, Households Sample File, ABS
Great Britain-General Household Survey, 1981, OPCS
United States- Current Population Survey,1982, Bureau of the Census, US Department of Commerce.

Footnotes (a), (b) and (c) see corresponding footnotes for Table 3.1. The standard deviation about the mean of $US 247.4 for the categorised US data was 128.9 with a coefficient of variation of 52.1%. Average weekly earnings for British women relate to women 18 years of age and over. The average weekly earnings of British women 16-18 in 1981 were £ 50.3

The British sample once again had relatively low levels of formal education and the US sample was the most educated. A greater percentage of the Australian and British female samples had no qualification beyond high school than was the case for men. Between 70 and 80 percent of women in these countries had no educational qualification beyond high school. While the Australian sample of women with some post secondary school education was evenly divided between those with a post secondary qualification and university degree holders, the British sample included a very small number of university graduates. The differences in the educational distributions of men and women working full-time were much less pronounced in the US than in the other countries. About half of these women were high school graduates and a third had completed some post secondary schooling.

Full-time female employment was particularly concentrated by industry in similar ways in each of the countries. Over half the women in each country were employed in two industry groups, distribution and other services. Manufacturing was a less important employer of full-time women in Australia than in the other countries. About 18 per cent of the Australian women working full-time were employed there compared with about 28 per cent in Britain and the US. Industries such as construction, transport and communications and energy and water were much less important employers of women than of men in each of the three countries.

Women working full-time were even more concentrated by occupational group than they were by industry group. Over half the women in the Australian and British samples and about 42 per cent of American women fell in the category of other non manual workers. The other two important occupational categories were skilled and professional workers. Women's full-time employment in these countries was much more concentrated by occupation than was the case for men.

2.2. Earnings by Education

In this section we shall compare the age earnings profiles of full-time women in the three countries for the four education groups we have distinguished. As we have show in chapter 1, the relationship between age and earnings was different for women than for men. There was little variation in earnings with age for women over the age of 30 in each of these countries.(10)

The earnings of each of the four education groups we have identified; the unqualified, the high school graduates, those with post secondary qualifications and the university graduates,were also fairly flat after about age 30. Figures 3.8, 3.9 and 3.10 plot five year moving averages for each of the education groups in each of the three countries.

Figure 3.8 for Australian women, shows little change in earnings with age for the unqualified, high school and post secondary groups after their mid 20's. The earnings of university graduates continued to grow for longer, into their early 30's. There were less than ten observations at each age for university graduates over the age of 45 and it is therefore difficult to make any general statement about the shape of the age earnings profile for older graduates. The average earnings changed quite sharply between one age and the next, presumably due to sampling variability.

Figure 3.9 shows the relationship betwen age and earnings for the unqualified, high school and post secondary groups of women in Great Britain. As there were only 58 female graduates working full-time in the British sample, we have been unable to plot an age earnings profile for this group. While there was little growth in earnings with age for the unqualified, the earnings of high school graduates grew into their early 30's and those of women with post secondary qualifications, into their mid 30's. As with the Australian university graduates, the small number of women with post secondary

Figure 3.8: Average Weekly Earnings of Full-time Women by Age and Education, Australia, 1981.

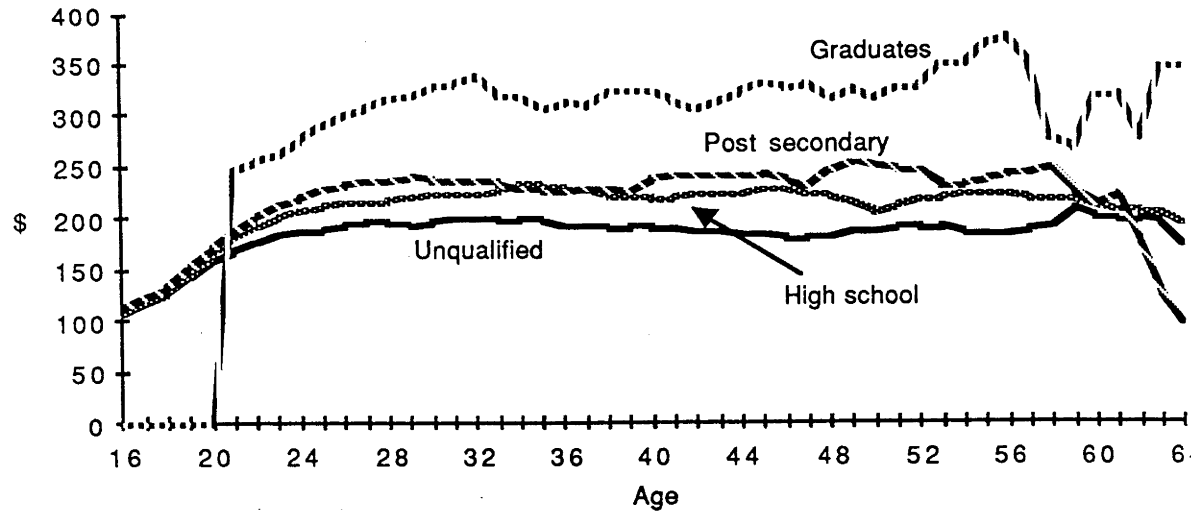


Figure 3.9: Average Weekly Earnings of Full-time Women by Education and Age, Great Britain, 1981.

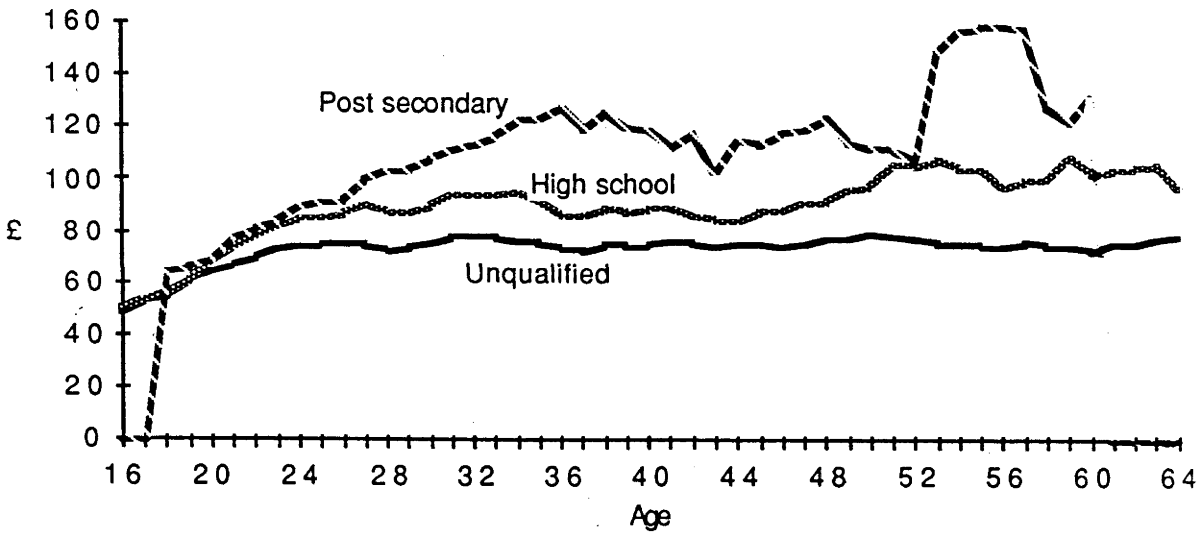
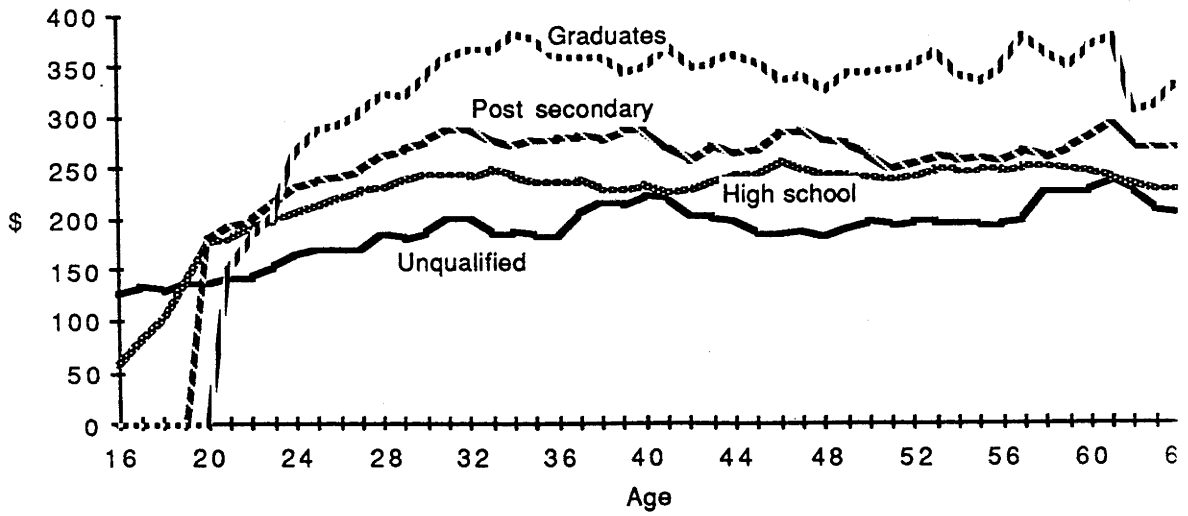


Figure 3.10: Average Weekly Earnings of Full-time Women by Age and Education, United States, 1981.



qualifications at each age over 35 was probably the cause of the variability in earnings with age among these women.

The age earnings profiles of women in each of the four education groups in the US are presented in Figure 3.10. While there was relatively little growth in earnings with age for the unqualified, the average earnings of female high school graduates more than doubled between the ages of 16 to 18 and their early thirties. The earnings of the post secondary and graduate groups also grew into their early 30's and thereafter remained fairly constant.

Figure 1.2 chapter 1 showed that in aggregate, the earnings of women appeared to decline with age much earlier than for men. This decline in earnings with age may reflect changes in the average educational attainment of each age. So for example, if 25 year olds are more highly educated than 45 year olds in the cross section, this would give the impression of declining earnings with age. In order to control for some of these changes in human capital endowments with age, we present figures 3.11 - 3.14 which compare the age earnings profiles of each education group in the three countries using the earnings of a woman aged 25 with the relevant education level as the reference point. In these figures, although the profiles were relatively flat, there was no evidence of the decline in weekly earnings apparent in the aggregate profile.

Figure 3.11 compares the earnings profiles of unqualified women in each of the countries. It is useful to consider the graph in two parts; firstly the comparison of relative earnings of those under 25 and secondly those aged 25 to 64. The earnings of teenage unqualified women in the US were higher relative to those of a 25 year old than the relative earnings for this group in Australia and Great Britain. In Australia and Great Britain, earnings rose into the mid-20's and then did not change with age. In the US the full-time weekly earnings of unqualified women rose less sharply for those under 25 but continued to rise into their early 30's and remained above the average earnings of a 25

Figure 3.11: **Average Weekly Earnings of Unqualified Women**, Australia, Great Britain and the United States, 1981
Earnings of unqualified women aged 25=1.

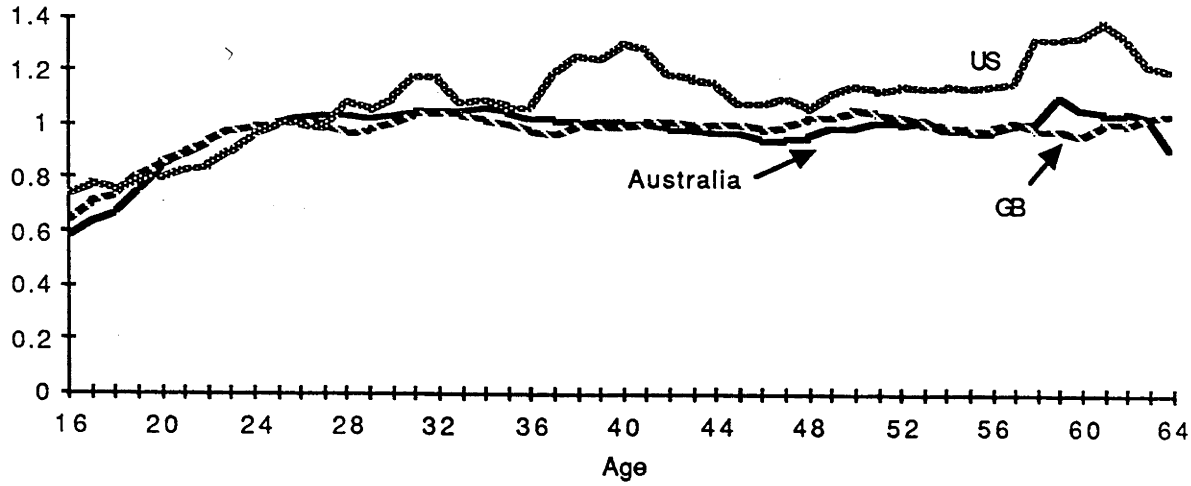


Figure 3.12: Average Weekly Earnings of Female High School Graduates, Australia, Great Britain and the United States, 1981.
Earnings of high school graduates aged 25=1.

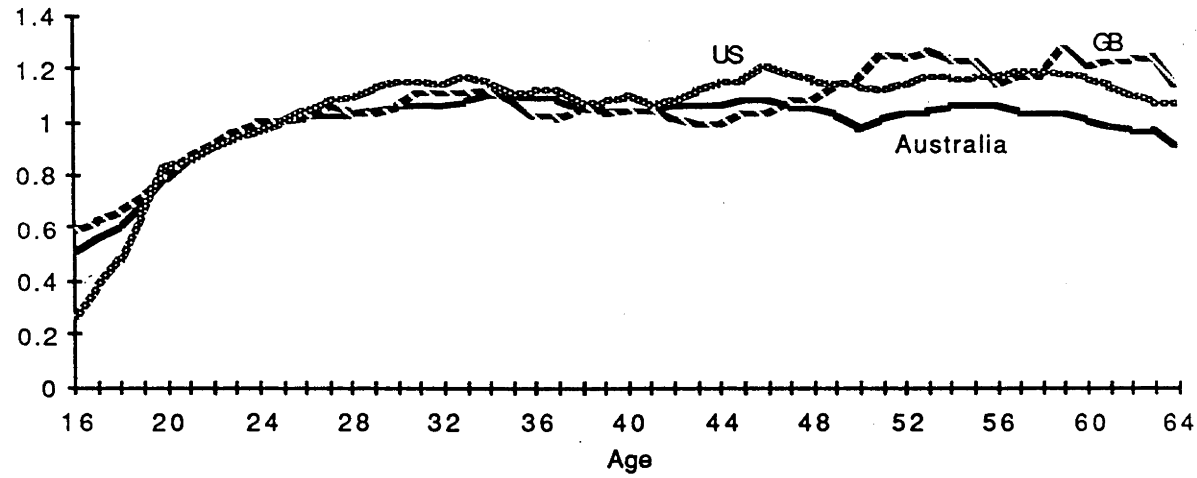
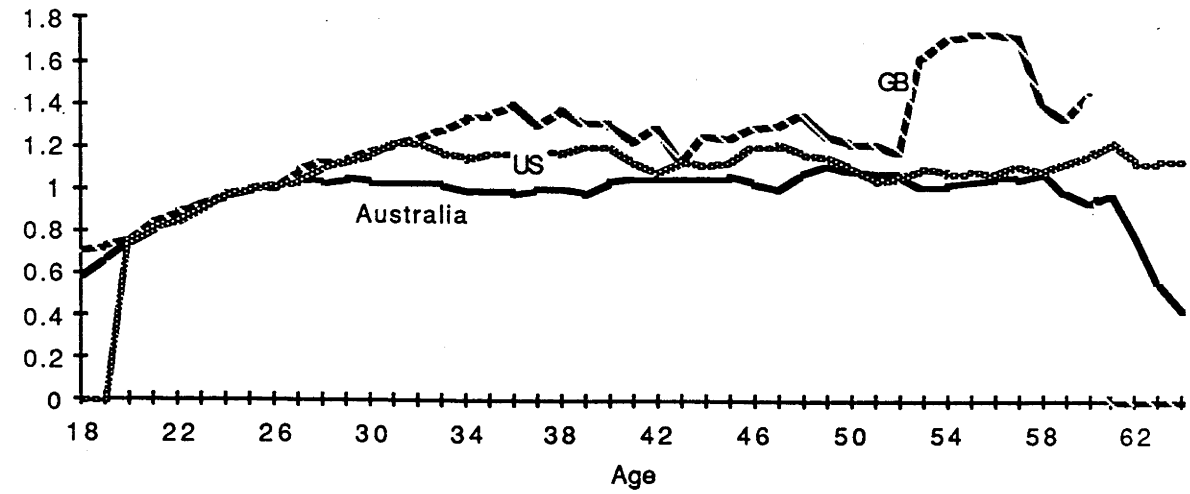


Figure 3.13: Average Weekly Earnings of Women with Post Secondary Qualifications, Australia, Great Britain and the United States, 1981.
Earnings of women with post secondary qualifications aged 25=1.

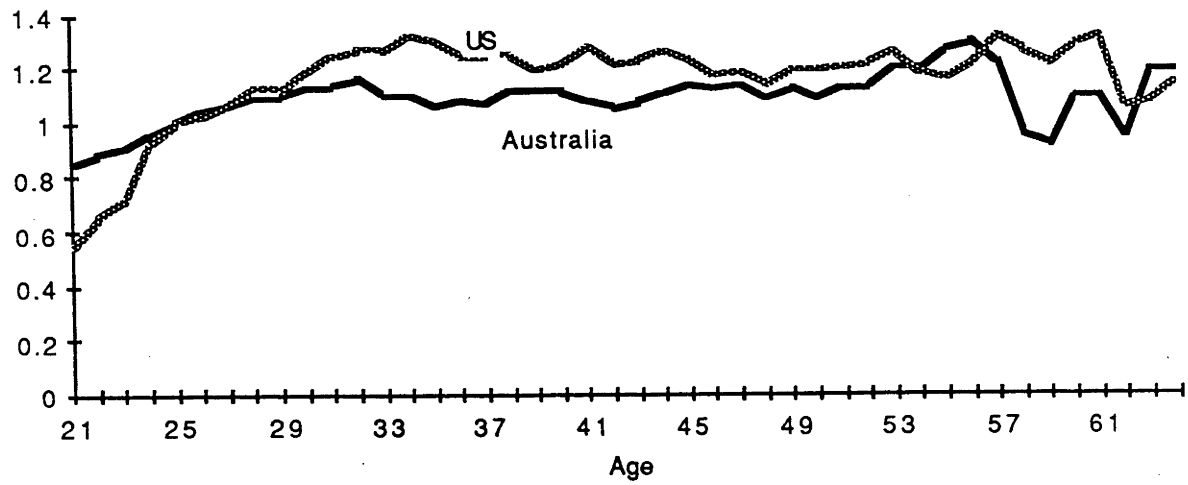


year old woman for the remainder of working life. The average weekly earnings of women at each age between 59-64 was almost 20 per cent above the average for the US sample of the unqualified as a whole. There is no immediately obvious explanation of this fact but perhaps it reflects differences in the retirement behaviour of the more and less economically successful among the unqualified. The conclusion for the unqualified is that there was greater overall variation in earnings by age in the US than in the other two countries for those over 25 but this conclusion did not hold for the under 25's.

A greater variability in earnings for high school graduates was also apparent in the US compared with Australia and Great Britain (see figure 3.12). The average earnings of Australian high school graduates doubled between age 16 and 25, after which earnings did not vary with age. Earnings of British high school graduates also rose substantially between the ages of 16 and 32, were flat into the late 40's and then rose to a higher plateau in their 50's. There were a very small number of women with high school qualifications in their 50's and perhaps not too much weight should be given to this latter finding. In the US high school graduates average earnings increased three times between the ages of 16 and 32 but after that did not change much with age.

In each country there were few women in their 50's with post secondary qualifications so the results presented in figure 3.13 for the older women in this group should be treated with caution due to the small sample sizes. The picture for Australian women in this education group aged between 18 and 50 was of small variation in earnings with age. Eighteen year olds earned about 60 per cent of the earnings of a 25 year old but there was little change in earnings after age 25. Earnings in the US continued to rise for longer than those in Australia, until age 30, but as in Australia, from that point, there was little variation in earnings. The British post secondary group showed the greatest variation in earnings with age. The average weekly earnings of British women with these qualifications were 60 per cent higher in their mid 30's than at age 18.

Figure 3.14: Average Weekly Earnings of Female University Graduates, Australia and the United States, 1981.
Earnings of university graduates aged 25=1.



The small sample size prevented us from plotting an age earnings profile for British graduates but figure 3.14 shows the relationship between age and earnings for graduates in Australia and the US, using as a benchmark the earnings of 25 year old graduates. The US profile shows greater variation in earnings with age than the Australian profile. For both countries the earnings of female graduates stopped growing with age in their early 30's. Once again the problems of small sample size make the average earnings of women over 55 rather variable.

2.3 Earnings by Industry

Average earnings by industry of employment for women working full-time are presented in Table 3.9. The figures show that as for men, there was a high correlation in average earnings for women across the three countries. The simple correlation coefficients for the samples as a whole were close to the results for men; 0.89 between Australia and Great Britain, 0.79 between Australia and the United States and 0.84 between Great Britain and the United States. Agriculture and distribution paid below the average for the sample as a whole and other services, energy and water paid above the average. Once again, the coefficient of variation of industry earnings was highest in the United States.

The strong positive correlation in industry earnings between the samples was not in evidence for 16-19 year olds. While the correlation of earnings was positive between Australia and Great Britain, ($r = 0.42$), it was negative between the United States and each of the other countries. The simple correlation coefficient was -0.62 between Australia and the United States and -0.16 between Great Britain and the United States. There were very small numbers of women working full-time in the United States in this age group (there were less than 100 observations) which perhaps explians this result.

As Tables 3.10-3.12 show, in common with the male sample, the distribution of women's employment by industry was not the same for each age group as for the sample as a whole. The women under 25 were particularly concentrated in distribution in all three countries. Australian women aged 16-19 were strongly represented in banking and business services but relatively under-represented in other services. In Great Britain and the United States, they were also under represented in other services but the percentage of this age group which was employed in banking and business services was only slightly larger than for the sample as a whole. Manufacturing was not an important area of employment for young women in Australia and the United States but it was much more important in Great Britain. The three manufacturing categories accounted for a greater percentage of the employment of older women in Australia and Great Britain than in the total employment of women in these two countries. This result only held for the 60-64 year olds in the United States.

3. Summary and Conclusion.

The purpose of this chapter was to describe the features of the samples of men and women working 35 or more hours a week in Australia, Great Britain and the United States which may be important in explaining the differences between the countries in the shapes of the age earnings profiles. We have considered the distribution of each sample according to marital status, residence, educational attainment, industry and occupation.

Table 3.9
Average Weekly Earnings of Women by Industry, Australia, Great Britain and the United States, 1981.

	Australia $A	Great Britain £ stg.	United States $US
All women-			
Agriculture	160	57	172
Energy and water	223	101	289
Manu. of metals, chemicals	217	85	304
Metal goods, engineering, vehicles	181	80	276
Other manufacturing	174	73	211
Construction	200	85	241
Distribution	176	65	201
Transport and communication	214	87	315
Banking and business services	200	81	258
Other services	235	90	266
Average of all industries	204.8	80.4	250.7
Coefficient of variation	12.4	15.7	18.4
Average Weekly Earnings of Women Aged 16-19 by Industry			
Agriculture	110	70	179
Energy and water	149	83	112
Manu. of metals, chemicals	147	68	-
Metal goods, engineering, vehicles	130	68	168
Other manufacturing	133	57	144
Construction	121	56	238
Distribution	115	50	149
Transport and communication	136	60	-
Banking and business services	130	60	161
Other services	135	50	114
Average of all industries	126.3	55.8	142.3
Coefficient of variation [a]	9.6	16.4	25.4

Source: as for Table 3.1.
Footnote (a) These calculations exclude the industries for which there were no observations in the sample.

Table 3.10
The Percentage of Each Age Group of Women by Industry, Australia, 1981.

	16-19	20-24	25-29	30-39	40-49	50-59	60-64	Total
Agriculture	1.0	0.9	1.0	1.2	1.4	0.4	5.5	1.1
Energy and water	1.4	0.6	1.1	0.7	0.2	1.0	1.4	0.8
Manu. of metals, chem	1.2	1.3	1.5	3.0	2.9	2.2	0.0	2.0
Metal goods, eng, veh	3.1	3.2	3.6	5.9	8.0	5.3	2.7	4.7
Other manu	9.7	8.3	8.0	13.5	17.4	16.5	5.5	11.6
Construction	1.2	1.0	1.2	1.9	1.9	1.2	2.7	1.4
Distribution	35.9	19.8	17.1	18.3	19.9	21.6	23.3	21.7
Trans and comm.	3.6	5.1	5.1	6.0	3.5	4.1	5.5	4.7
Banking and bus serv	21.8	21.9	16.3	10.4	6.2	6.9	8.2	14.9
Other services	21.1	37.9	45.2	39.0	38.7	40.7	45.2	37.2
Total	100	100	100	100	100	100	100	100
% of age group in total sample	14.6	25.6	14.7	19.5	15.5	8.84	1.3	100

Source: Australia 1981 Population Census.

Table 3.11
The Percentage of Each Age Group of Women by Industry, Great Britain, 1981.

	16-19	20-24	25-29	30-39	40-49	50-59	60-64	Total
Agriculture	0.6	1.1	0.4	0.5	0.0	0.6	0.0	0.6
Energy and water	1.4	2.4	1.9	1.4	2.3	2.0	6.7	2.0
Manu. of metals, chem	1.7	2.8	2.3	2.2	5.2	3.1	3.3	2.9
Metal goods, eng, veh	5.9	6.9	8.2	9.7	15.8	11.7	6.7	9.6
Other manu	17.7	13.3	12.0	18.1	17.1	16.8	13.3	15.8
Construction	2.0	0.8	4.1	1.1	2.3	1.1	0.0	1.7
Distribution	28.7	19.1	13.1	15.4	15.5	19.0	10.0	18.6
Trans and comm.	6.2	5.1	6.7	3.5	5.7	7.0	3.3	5.6
Banking and bus serv	15.7	18.0	15.4	12.2	4.7	4.5	10.0	12.0
Other services	20.2	30.4	36.0	36.0	31.5	34.4	46.7	31.4
Total	100	100	100	100	100	100	100	100
% of age group in total sample	15.5	23.2	11.6	16.1	16.8	15.6	1.3	100

Source: General Household Survey, 1981.

Table 3.12
The Percentage of Each Age Group of Women by Industry, United States, 1981.

	16-19	20-24	25-29	30-39	40-49	50-59	60-64	Total
Agriculture	1.2	0.7	1.2	0.4	0.0	0.0	0.4	0.5
Energy and water	1.2	1.5	0.9	0.7	0.5	0.5	0.8	0.8
Manu. of metals, chem	0.0	2.3	3.1	3.0	2.3	2.7	2.4	2.7
Metal goods, eng, veh	3.6	10.8	10.6	11.0	12.4	11.2	13.0	11.2
Other manu	6.0	10.7	13.8	12.8	14.7	15.4	20.3	13.8
Construction	1.2	1.3	0.7	1.1	0.9	1.6	0.4	1.1
Distribution	42.2	22.5	15.9	12.5	14.0	15.9	13.0	15.8
Trans and comm.	0.0	2.2	5.1	4.9	3.2	2.9	4.1	3.8
Banking and bus serv	15.7	14.9	13.7	13.2	10.9	9.3	7.7	12.2
Other services	28.9	33.0	35.0	40.4	41.1	40.4	37.8	38.3
Total	100	100	100	100	100	100	100	100
% of age group in total sample	1.6	13.0	17.2	27.1	19.0	17.5	4.7	100

Source: Current Population Survey, 1982.

We have also examined the relationship between earnings and education and earnings and industry and for men, the level of unionisation associated with each industry.

This description illustrates a number of similarities and differences between the countries. In each country, taking men and women separately, the more educated on average earned more than the less educated, the old more than the young and the age earnings profiles of the more educated continued to rise for longer than the less educated. It was broadly speaking the same industries which were high paying in each country for both men and women.

There was also a group of industries where a relatively large share of male employees were union members or covered by collective agreements in each country. This suggests that there are some common features of these industries such as the scale of production or the type of skills employed which make them more amenable to unionisation.

There were, however, some important differences between the countries. The US samples of both men and women were more highly educated than the samples of the other countries. The aggregate result for men of a steeper age earnings profile in the US than in the other countries cannot be explained solely by the mix of educational endowments. There was greater variation in earnings with age for American men for most education groups taken separately. The earnings for each education group in the US continued to grow with age for longer than in the other countries.

The evidence we have presented here also shows greater variation in average industry earnings for men in the US than in the other countries. It appears that industries which are high paying on average are also relatively high paying for young men. There was greater variation in average industry earnings for these young men in Great Britain and the US than in Australia.

The relationship between age and earnings was different for men than for women in each country. Womens' earnings varied less with age than did mens' particularly for women over thirty. In general, for each education category there was more variation in earnings with age for women in the US than in Australia or Great Britain. There was also more variation in earnings by industry of employment in the US than in the other countries.

The preceding chapter set out various theories which aim to explain why earnings should differ with age. Among the important potential explanators were educational attainment, industry of employment and the role of unionisation. This chapter has set out the facts on the relationship between these variables and earnings for our samples of men and women working full-time in the three countries. While there were many similarilties between the countries in terms of the effect of education and industry of employment on earnings, a general result was that earnings showed greater variation in the US than in the other countries. The remaining chapters look firstly at the determinants of relative earnings for men and then for women. Chapter 8 presents

results of a comparison of the relationship between age and earnings for men and women in each country.

Footnotes

1. We have outlined in the preceding chapter the major explanations offered for the positive relationship between age and earnings. While these in general do not consider age of itself to be important in explaining earnings, working experience or time spent with a particular employer are central to these theories. These factors are closely related to age.

2. See Bowman (1987) for a discussion of cohort, period and age effects on individuals.

3. The full definitions of the variables are presented in Appendix A.

4. The income data in the Australian Census is presented in categories while the data for the other countries is for actual earnings. The mid point of each category was chosen and an estimate made for the open-ended category. The 1981 Income and Housing Survey for Australia presents the actual data on income but categorises age. The age earnings profiles for full-time men derived from this sample showed a similar profile for men to the Census although the level of the profile was somewhat higher. As the general story from the data was similar for the two Australian data sets, it was decided to opt for the larger Census data set using actual age rather than age by category.

5. In all countries, there appeared to be a decline in average weekly earnings for men at the end of their working lives but in the US, the fall was smaller than in Australia and Great Britain. At the age of sixty four, the American average weekly earnings were twelve per cent below their peak but in Australia and Great Britain, they were sixteen and eighteen per cent respectively below the peak. It is important to remember that although cross section age earnings profiles typically show a decline in earnings at the end of working life, this need not imply that earnings are reduced with age for each particular cohort. Becker (1975) argued, using US data for three education groups

(college graduates, high school graduates and elementary school graduates), that there has been "no systematic tendency for time series profiles [of the earnings of a cohort] to decline even though cross section ones do" (p219). Hanoch and Honig (1986) in contrast, concluded that there was a decline in earnings among older men in their US sample which reflected a reduction in hours worked. There are several reasons why the aggregate cross section age earnings profile may show lower average earnings for older workers. As older workers are less well educated than younger ones, this can create the appearance of a declining age earnings profile in the cross section. The average earnings of full-time workers over sixty may also be effected by selective retirement if those with a greater earnings potential tend to retire earlier than those without. However, looking at an individual's earnings over time, economic growth may prevent a decline in their real value.

6. In another comparison of age earnings profiles between countries, Hashimoto and Raisain (1985) found that Japanese male workers had steeper earnings profiles than those of American male workers. They argued that the growth in earnings attributable to the period spent with one employer was greater in Japan than in the US.

7. A close correlation between earnings by industry in Australia and the United States was also found when a more disaggregated industry breakdown was used by Gregory and Daly (1990). This result held for both men and women.

8. See Metcalf (1990) for a discussion of some of the changes in British industrial relations in the 1980's.

9. The issue of selectivity bias in estimated earnings regressions for women is one which has received considerable attention in the literature. We discuss this question further in chapter 7 footnote 5.

10. The results for women aged 60 to 64 should be treated with particular caution. The number of older women in the samples was rather small, especially in Great Britain where the state pension became available to women at age 60 encouraging earlier retirement for women than for men. In the discussion about education groups which

follows, there were also some small numbers of observations in some of the cells, particularly for older women.

Chapter 4.
The Age Earnings Profiles of Men in Three Countries.

The following chapters contain empirical estimates of the age earnings profiles for men in the three countries, Australia, Great Britain and the United States. The aim is to consider the determinants of earnings by age and to try to estimate which part of the differences in the shape of the age earnings profiles between the countries can be accounted for by differences in endowments and which part by differences in the returns to these endowments. Further empirical estimates including cohort and industry variables are presented in the following chapters.

The structure of this chapter is as follows: section 1 outlines the basic model to be estimated and contains a discussion of the choice of variables included. Section 2 presents a comparison of results using two functional forms for the experience variable. Section 3 describes the method employed to decompose the differences between the countries in the observed relative earnings. Our results show that the quadratic form of experience, which is most commonly employed in earnings equations does not accurately capture the shape of the age earnings profile. Predicted earnings for the young are overestimated and for the old are underestimated. We present results using an alternative functional form which provides better predictions of earnings at the extreme ages. Our results show a much greater effect of labour market experience on earnings in the initial years of working life than the standard quadratic form.

We use our preferred functional form to decompose the differences between the countries in relative earnings by age into that part which can be attributed to endowments and that part which can be attributed to differences in the rewards for these endowments. Earnings varied with age much more in the US than in the other countries. At most ages, the relatively higher earnings of American men compared with each of the other countries can be attributed about equally to their higher level of human capital endowments and to

the greater rewards they receive for these endowments. Differences in educational endowments and the coefficients on the experience terms were the major sources of the difference. The results of the comparison between Australia and Great Britain show much smaller differences in the relationship between age and earnings.

The similarities between Australia and Great Britain are consistent with the particular institutional characteristics of each country being less important in explaining differences in the shape of the age earnings profile for men than explanations which could be applied equally well across the two countries. Specifically, the evidence does not suggest that the operation of a centralised wage fixing system in Australia has led to very different results with respect to age earnings profiles than those found in Great Britain. It is possible that institutional features which these two countries have in common and which are not found in the US, have been important in determining the shape of the age earnings profiles.

1. The Basic Model

The basic earnings equation to be estimated includes variables suggested by the human capital model. It can be thought of as an "hedonic price function which reflects the equilibrium of the supply and demand for workers at each level of schooling and experience" (Willis (1986) p529). The earnings function will be estimated in the semi-log form following Mincer (1974).

The basic equation to be estimated is the following :

Gross weekly earnings= f (education, potential experience, marital status, area) (1)

A detailed description of the variables is included in Appendix A. A preferred measure of earnings would be hourly earnings but the data on hours worked is presented in broad categories in the Australian Census making an accurate measure of hourly earnings difficult. By limiting the sample to full-time workers (those working more than 35 hours per week),we have reduced the possible variation in hours worked per week. We have made no adjustments for differences in the tax systems of the three countries.

Education and experience are included as central variables in the human capital model. As described in chapter 3, we have distinguished four education groups; those who have not completed high school ("the unqualified"), those who have completed high school but have no further educational qualification ("high"), those who have completed some post secondary schooling, or in Australia and Great Britain, a recognised apprenticeship ("post secondary"), and finally those who have completed a university degree either at the bachelor or higher degree level ("graduates"). Marital status and area have been included as control variables. These have been shown to be significant determinants of earnings in numerous studies of earnings.(1)

Experience is measured as potential experience (current age-age of completing full-time schooling). Interaction terms between education and experience are also added to allow the returns to experience to vary with education level. A number of studies, to be summarised below, have compared the returns to experience between education groups. The issues of interest in these comparisons is whether experience or on-the-job training acts as an alternative method of acquiring skill to formal schooling or whether this training is complementary with formal schooling. Higher investments in on-the-job training by the less well educated may enable their earnings to catch up with those of the more highly educated. Alternatively, formal education may make individuals more receptive to on-the-job training and increase the benefits they receive for a given amount of time spent training. This would result in a divergence in the experience earnings profiles for different levels of education.

2. Estimation of Earnings Equations for Men.

2.1 The Measure of Experience or Investment in On-the-job Training.

While human capital theory suggests that it is important to include a measure of post schooling investment in an earnings equation, the form of this investment function is less clear. In chapter 2 we outlined Mincer's derivation of a time equivalent measure of

investment in human capital. He also suggested two functional forms for the inclusion of this time equivalent measure of investment, namely experience, in the earnings equation. The first is a quadratic in experience.

$$\text{Ln } Y = \alpha + \beta S + \gamma E + \delta E^2 + \varepsilon Z \qquad (2)$$

Where Y is earnings, S is schooling, E is experience, Z is a vector of control characteristics.

In the second, experience is entered in exponential form (the Gompertz curve). This produces a relatively steep growth in earnings in the early part of working life and asymptotically tends to a zero growth rate.

$$\text{Ln earnings} = \alpha + \beta S + \gamma \exp^{-\delta * E} + \varepsilon Z \qquad (3)$$

Other researchers (see for example Miller and Volker (1987)) have found that this second functional form for experience fits the earnings profiles of younger workers more closely than the more common quadratic form. As we are particularly concerned to accurately predict earnings by age for the purposes of our international comparison, this section compares estimates of the basic model using two functional forms of experience; the quadratic and our preferred functional form, a combination of the quadratic and exponential terms. The details of the method of model selection are presented in Appendix D.

Other studies have considered the most appropriate functional form for an earnings equation. Heckman and Polacheck (1974) compared a range of functional forms for the earnings-schooling relationship. They considered various linear and log combinations of earnings, schooling and experience. Weeks worked was included in some regressions explaining annual earnings and experience was entered in the quadratic form in some equations. Their general conclusion was that the quadratic form for experience performed as well as the alternatives they tested. They did not consider any functional forms using the exponential form of experience nor the other alternatives presented in Appendix D.

A further study of the most appropriate functional form for experience is presented in Murphy and Welch (1990). They confine their comparisons to linear specifications of experience; the quadratic, cubic and quartic specifications. They estimate earnings functions using American data from the Current Population Surveys 1964-1987 for four education groups. They conclude that the quartic specification was the preferred one. We have also included this specification in our search for a preferred functional form and found that a functional form including a nonlinear term was superior. (See Appendix D for a justification of this statement). Our results as we shall see below, confirm the findings of Murphy and Welch that the quadratic form of experience does not adequately represent the "true" relationship between experience and earnings.

2.2. The Quadratic Form.

Table 4.1 presents the regression results for the basic model in each of the three countries using the quadratic form for experience. As this is the functional form most commonly adopted in the literature, we have used it as a benchmark with which to compare other functional forms. The results from these regressions show that all the human capital variables are important in determining earnings. All the coefficients estimated for each of the three countries apart from the interaction term between experience and graduates in Australia, were significant at the 5 per cent level.

The constant term measures the predicted earnings of an unqualified single man aged 16 with no labour market experience and of urban residence. In each country the following results hold. Men with higher levels of education earned more than the less qualified. Compared with the unqualified with no experience, that is the group left out of the regressions, graduates with no experience earned 69 per cent more in Australia, 56 per cent more in Great Britain and 75 per cent more in the US. Married men and men who were widowed, separated or divorced earned more than single men in each country. In Great Britain and the US, married men earned over 20 per cent

Table 4.1

Weekly Earnings of Full-time Men Aged 16-64 with Quadratic Experience, Australia, Great Britain, the United States, 1981.

Dependent Variable = ln Weekly Earnings

	Australia	Great Britain	United States
Intercept (a)	4.8359 (327.37**)	4.0908 (226.28**)	4.8434 (125.75**)
High	0.1347 (8.80**)	0.0766 (3.17**)	0.3390 (9.27**)
Post secondary	0.3667 (22.58**)	0.2838 (14.41**)	0.4668 (10.93**)
Graduate	0.6855 (32.77**)	0.5600 (15.48**)	0.7456 (18.76**)
Experience	0.0402 (31.17**)	0.0372 (23.46**)	0.0485 (18.15**)
Experience ^{2}	-0.0007 (-30.32**)	-0.0006 (-22.77**)	-0.0007 (-16.13**)
High*experience	0.0020 (2.91**)	0.0048 (4.66**)	-0.0042 (-3.25**)
Postsec*experience	-0.0064 (-9.77**)	-0.0033 (-4.52**)	-0.0046 (-2.63**)
Graduate*experience	-0.0018 (-1.80)	0.005 (2.43**)	-0.0072 (-4.36**)
Married	0.1600 (16.85**)	0.2222 (16.25**)	0.2339 (12.27**)
Widowed, separated, divorced	0.0995 (6.55**)	0.1356 (5.38**)	0.1303 (4.81**)
Rural	-0.1152 (-11.32**)	-0.0226 (-2.45**)	-0.1100 (-8.42**)
R^2	0.41	0.37	0.23
F	796.72**	297.67**	196.50**
Breusch-Pagan test for heteroskedasticity			
$NR^2 - \chi^2$	1.26	0.0	0.0
N	12,533	5,681	7,288
Mean of Dep. Var.	5.5126	4.7542	5.8853

't' statistics are in brackets. Significant test statistics at the 5 per cent level are indicated by a * and those significant at 1 per cent level by **.
(a) The constant term measurex ln earnings for a single unqualified man of urban residence with no labour market experience.

more than single men. The earnings advantage of married men over single men in Australia at 16 per cent was not as great. Rural residence was associated with lower earnings than urban residence in each country. In Australia and the US those living in rural areas earned about 11 per cent less than those in urban areas but in Great Britain, the rural disadvantage was smaller and only reduced earnings by about 2 per cent. This probably reflects differences in the geography of the countries and also the definitions of rural residence.

Table 4.2 illustrates the effect on earnings for each education group, of an additional year of experience at different levels of experience.The figures report the percentage addition to earnings with another year of experience. The functional form produced the effect that the addition of a year of experience raised earnings more at the beginning of working life than in later life. In fact after 30 years of experience, for nearly all education groups in each of the three countries, the addition of a year of experience reduced earnings by a small amount.(2) So, for example, if the experience of an unqualified person in Australia rose from one to two years, earnings would rise by 3.8 per cent. After 20 years of experience, the addition of an extra year's experience raised their earnings by 1.2 per cent but after 45 years of experience, another year in the labour force reduces earnings by 0.02 per cent. We have reported the effect of an additional year of experience for the post secondary and graduate groups at 40 rather than 45 years experience because 45 years experience would take most of these groups beyond the normal retirement age and outside the range of our sample. For Australia, an additional year of experience increased earnings more for the high school graduates than for the other groups.(3) The percentage increase in earnings at each level of experience was smallest for those with post secondary qualifications. This was also true for the post secondary group in Great Britain. Both the high school graduates and the university graduates in Great Britain had a greater return to experience than the unqualified.(4) In the US, the addition of a year of experience produced the

Table 4.2
Percentage Growth in Earnings with an Additional Year of Experience Based on Table 4.1 for each Education Group, Australia, Great Britain and the United States, 1981.

	Australia	Great Britain	United States
An additional year of experience starting from the following years of experience -			
Unqualified			
1	3.8	3.5	4.6
5	3.3	3.1	4.1
10	2.6	2.5	3.4
20	1.2	1.3	2.0
30	-0.003	0.001	0.006
45	-0.02	-0.02	-0.02
High school graduates			
1	4.2	4.0	4.2
5	3.5	3.5	3.7
10	2.8	2.9	3.0
20	1.4	1.7	1.6
30	-0.009	-0.005	0.002
45	-0.02	-0.01	-0.02
Post secondary qualifications			
1	3.2	3.2	4.2
5	2.6	2.7	3.6
10	1.9	2.1	2.9
20	1.0	1.0	1.5
30	0.09	-0.003	0.001
40	-0.02	-0.01	-0.01
Graduates			
1	3.6	4.0	3.9
5	3.1	3.6	3.4
10	2.4	3.0	2.7
20	1.0	1.8	1.3
30	-0.004	0.006	-0.001
40	-0.02	-0.006	-0.02

Source : Table 4.1.

largest percentage increase for the unqualified compared with all the other education groups. The university graduates had the smallest percentage increase in earnings for an additional year of experience.

Figures 4.1, 4.2 and 4.3 compare the logarithm of the geometric mean of predicted weekly earnings by age using the quadratic experience form with the logarithm of the geometric mean of actual earnings for each age in the three countries. (5) In each country the equation predicts least successfully for those in the 16-20 age group and for older men in their late 50's and early 60's. The quadratic function over predicted the earnings of young men in each country and tended to underpredict the earnings of older men. There were however, small differences between the predicted and actual values for older American men.(6) As we are focusing particularly here on the slopes of the age earnings profile and the differences in the slopes between the three countries, we have tried several functional forms with the aim of fitting the data more accurately.

We have estimated and compared a range of functional forms for experience. The details of these comparisons are presented in Appendix D. They include functions with higher order terms in experience, a spline function which allows the coefficients on the experience terms to differ for those with five or less years of experience compared with those with more experience, and a non linear function using the exponential form of experience presented in equation 3. The conclusion of these comparisons was that a functional form including both exponential and quadratic terms was most successful at capturing the relationship between experience and earnings. The relationship is not symmetrical. There is a sharp increase in earnings with additional experience in the early part of working life, followed by little change in earnings with experience and eventually there is some decline in earnings with experience. The exponential component of our functional form for experience enables us to better capture the initial substantial changes in earnings and the quadratic, the eventual slow decline.

2.3 Our Preferred Alternative Functional Form for Experience: the Combined Exponential and Quadratic Terms.

In this section we shall present results using our preferred functional form of experience. While many of the findings based on the equations using the quadratic form

Figure 4.1: Actual and Predicted Earnings using the Quadratic Form of Experience for Australian Men.

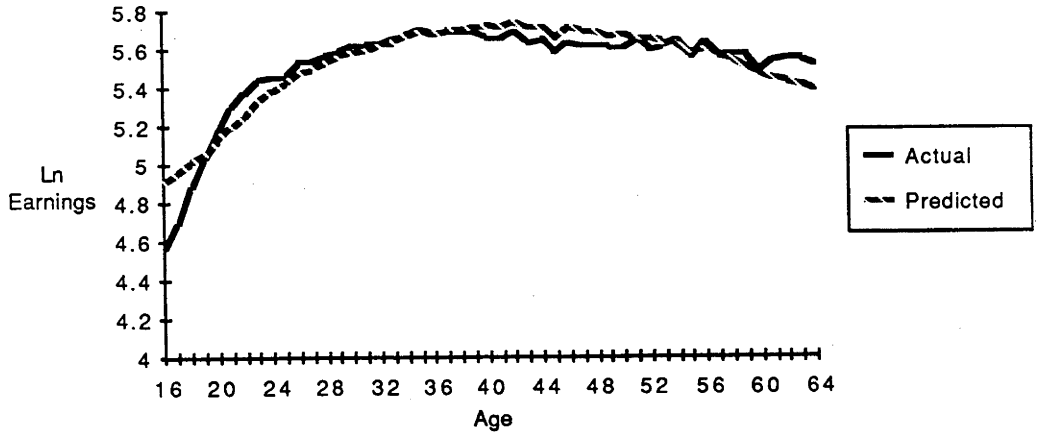


Figure 4.2: Actual and Predicted Earnings using the Quadratic Experience Term for British Men.

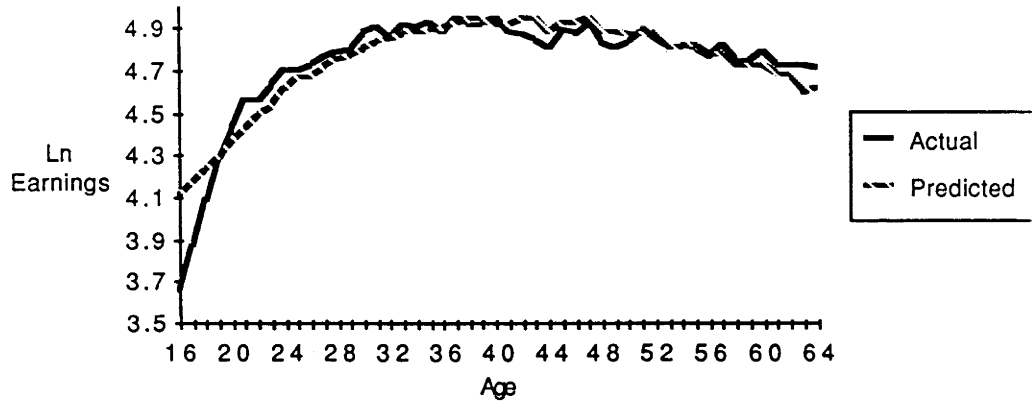
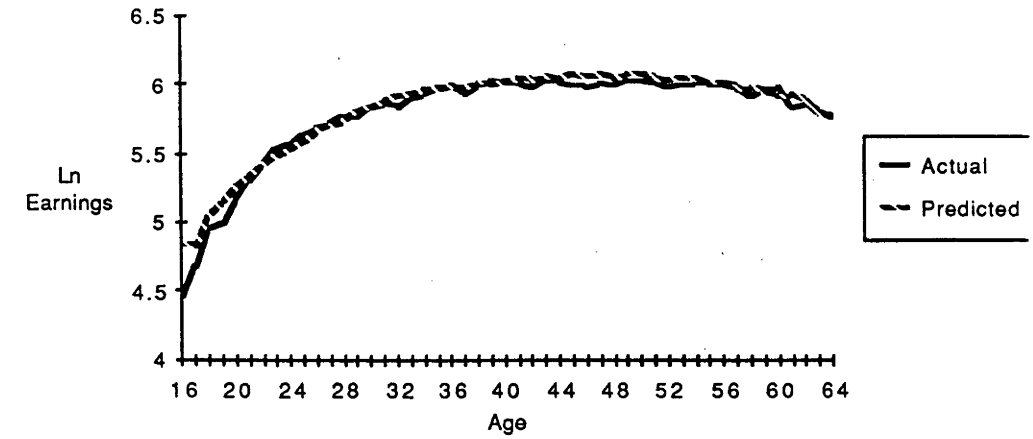


Figure 4.3: Actual and Predicted Earnings using the Quadratic Form of Experience for American Men



still hold, there are important differences in the estimated effect of experience on earnings. These results show that in the initial period of working life, experience is a more important source of earnings growth than the coefficients in the quadratic function would suggest.

In the results reported in Table 4.3 we have imposed a value on the coefficient δ from equation 3 derived from a simpler nonlinear regression.The results of the simpler equation are reported in more detail in Appendix D.(7) The R^2 rose in Australia and Great Britain compared with Table 4.1 but remained unchanged for the US. The general story of the earlier regressions holds; the more educated earned more than the less educated, married men earned more than unmarried men and urban residents earned more than rural residents. This was true in each of the three countries. There are however, some changes in the coefficient values.

The Australian regression reported in Table 4.3 column 1 shows an increase in the size of the intercept terms for each of the three education groups compared with the unqualified when compared with the results in Table 4.1. While there was little change in the coefficient on rural residence, the coefficients on marital status showed a smaller increment for married men compared with single men. We shall discuss the results for experience in greater detail below but for the post secondary and graduate groups, the education and experience interaction terms had the same sign as in Table 4.1 but for the high school group it had changed to a negative sign. All the education and experience interaction terms were statistically significant implying that the three more highly educated groups had different experience earnings profiles than the unqualified.

In comparison with the British results using the quadratic form of experience, the intercept term for high school graduates was lower in Table 4.3 but rose for the post secondary group and for university graduates. As for Australia, earnings differed less by marital status than in the earlier regressions but there was little change in the coefficient on rural residence. The experience interaction terms for the high school and post

secondary groups had the same signs as in Table 4.1, but for the graduate group, it had changed to a negative sign. There were statistically significant differences between the slopes of the experience earnings profiles for the high school and post secondary groups compared with the unqualified but there was no significant difference at the 5 per cent level between graduates and the unqualified.

The US equation reported in Table 4.3 did not explain more of the variance in earnings than the equation with quadratic experience.The initial earnings advantage for the high school and graduate groups was higher according to this equation than in Table 4.1 but lower for the post secondary group. However, in common with the other countries, the coefficients on the marital status variables were smaller for the US but did not change as much as the British coefficients. There was no change in the coefficient on rural residence and the coefficients on the education and experience interaction terms remained negative. The experience profile for the post secondary group was not statistically significantly different from that of the unqualified. High school and university graduates, however gained less from an additional year of experience than the other groups.

Figures 4.4-4.6 present a comparison of the predicted earnings from this model with the actual earnings by age for the whole sample in each country. The predictions fit the actual data more closely than the predictions from the quadratic equations. There was still however some overprediction for the young and underprediction for the old in Australia and Great Britain. The model over predicts for both the very young, those in their 40s and the old in the American sample.

Table 4.3
Weekly Earnings of Full-time Men aged 16-64 using our preferred Functional Form, Australia, Great Britain, the United States, 1981
Dependent Variable = ln Weekly Earnings

	Australia	Great Britain	United States
Intercept (a)	4.3917 (127.02**)	3.6574 (90.95**)	4.6538 (64.24**)
High	0.2468 (6.72**)	0.0304 (0.54)	0.3825 (4.96**)
Post secondary	0.6800 (15.83**)	0.3732 (6.09**)	0.4427 (5.12**)
Graduate	0.9899 (19.92**)	0.7554 (9.09**)	0.8365 (10.65**)
X	0.8683 (19.19**)	0.7538 (14.56**)	0.8791 (6.35**)
Experience	0.0115 (7.46**)	0.0165 (8.81**)	0.0093 (1.59)
Experience ^{2}	-0.0002 (-7.95**)	-0.0003 (-9.33**)	-0.0002 (-2.08*)
High*X	-0.0821 (-2.04**)	0.1623 (2.64**)	-0.1712 (-1.95)
Postsec*X	-0.4833 (-10.53**)	-0.1831 (-2.85**)	-0.0919 (-0.9)
Graduate*X	-0.3854 (-7.1**)	-0.1598 (-1.74)	-0.2953 (-3.19**)
Married	0.1231 (13.19**)	0.1776 (13.06**)	0.2130 (10.96**)
Widowed, separated, divorced	0.0597 (4.02**)	0.0925 (3.75**)	0.1098 (4.02**)
Rural	-0.1096 (11.04**)	-0.0212 (-2.35*)	-0.1100 (-8.43**)
R^2	0.44	0.40	0.23
F	825.38**	311.27**	182.92**
Breusch-Pagan test for heteroskedasticity			
$NR^2 - \chi^2$	1.25	5.68	0.0

Notes:
't 'statistics in brackets. Significant test statistics at the 5 per cent level are indicated by a * and those at the 1 per cent level by **.
X=1-e(-0.2643*experience) in the Australian regression, 1-e(-0.3713*experience) in the British regression, and 1-e(-0.1177*experience) in the US regression.
(a) The constant term measurex ln earnings for a single unqualified man of urban residence with no labour market experience.

Figure 4.4 Actual and Predicted Earnings for Australian men using Combined Exponential and Quadratic Forms of Experience.

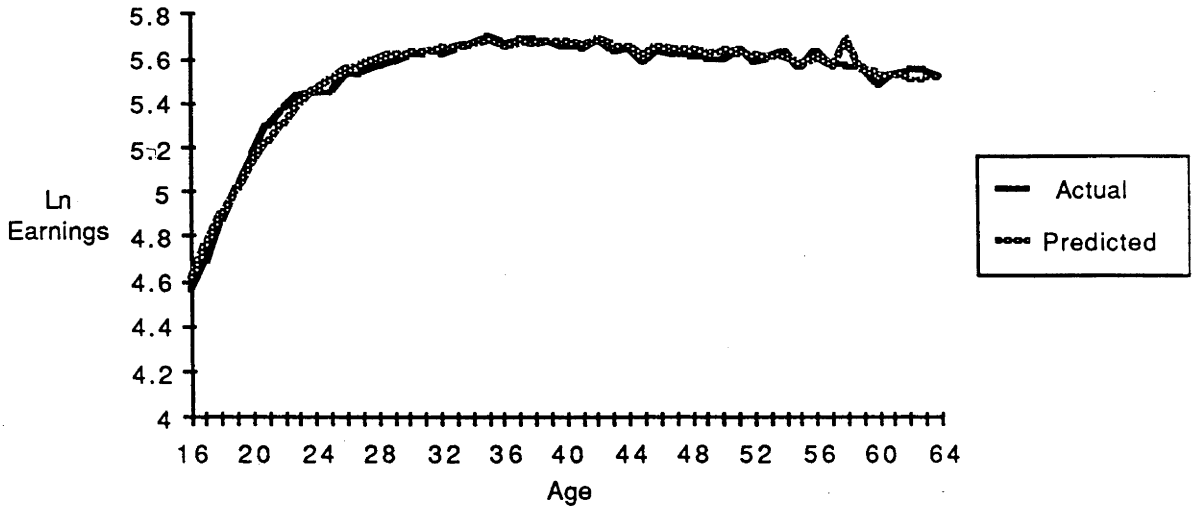


Figure 4.5: Actual and Predicted Earnings for British Men using the Combined Exponential and Quadratic Forms of Experience.

Figure 4.6: Actual and Predicted Earnings for American Men using the Combined Exponential and Quadratic Forms of Experience.

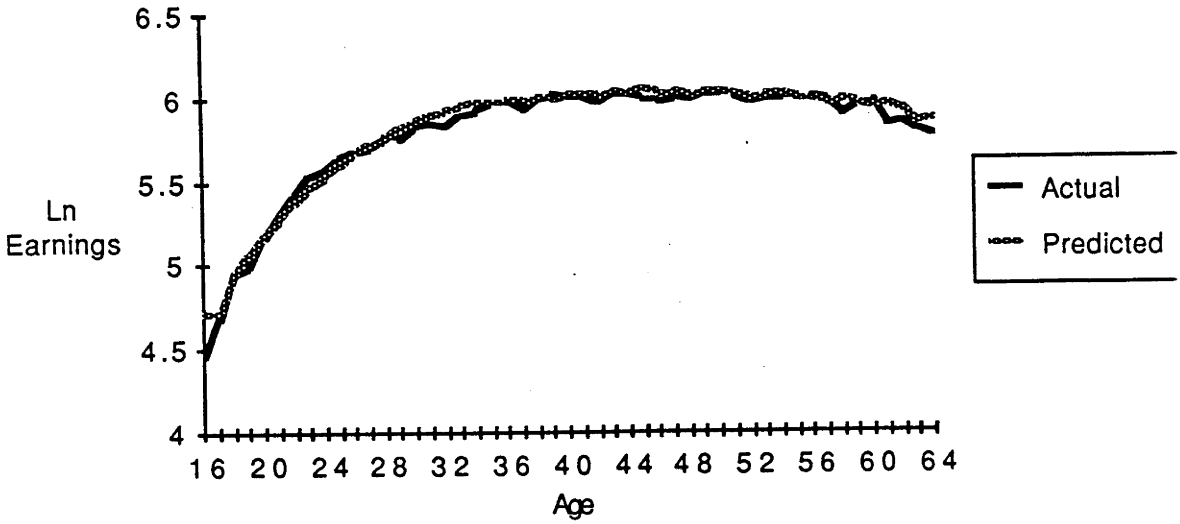


Table 4.4
Percentage Growth in Earnings with an Additional Year of Experience based on Table 4.3 for each Education Group, Australia, Great Britain and the United States, 1981.

	Australia	Great Britain	United States
An additional year of experience starting from the following years of experience-			
Unqualified			
1	16.6	17.7	9.6
5	6.3	5.0	6.1
10	2.2	1.6	3.5
20	0.5	0.4	1.0
30	-0.06	-0.02	-0.01
45	-0.07	-1.1	-0.8
High school graduates			
1	15.1	21.2	7.9
5	5.8	5.8	5.1
10	2.0	1.7	2.9
20	0.4	0.4	0.9
30	-0.06	-0.2	-0.06
45	-0.7	-1.1	-0.09
Post secondary qualifications			
1	8.0	13.8	8.6
5	3.3	4.1	5.6
10	1.4	1.5	3.2
20	0.4	0.4	0.9
30	-0.07	-0.2	-0.04
40	-0.5	-0.8	-0.6
Graduates			
1	9.7	14.3	6.6
5	3.9	4.2	4.3
10	1.5	1.5	2.5
20	0.5	0.4	0.7
30	-0.06	-0.2	-0.1
40	-0.5	-0.8	-0.6

Source :Table 4.3.

Table 4.4 presents the estimated percentage change in earnings with an additional year of experience for the four education groups in the three countries and is comparable with Table 4.2 for the quadratic form of experience. The figures in Table 4.4 show a much more dramatic effect of additional experience on earnings for those just entering the labour force than that found using the quadratic form of experience. Where an increase in

experience from 1 to 2 years raised earnings by about 3-4 per cent in Table 4.2, earnings grew between 6.6 and 21.2 per cent depending on education group and country for the same increase in experience using our preferred functional form. This more accurately reflects the impact of an additional year in the labour force on actual earnings for those entering the labour market.

This functional form also produced larger changes in earnings with experience at the end of working life than those reported in Table 4.2. The Australian regression results showed a reduction in earnings by about half a per cent per annum for each of the education groups at the end of working life. For Great Britain and the US it was larger, about one per cent and 0.75 per cent respectively.

There were also differences between the countries for those close to the peak of their earnings. Table 4.4 shows that for each of the education groups an additional year of experience after 20 years in the work force added more to earnings in the US than in the other countries. Earnings for each of the education groups apart from the university graduates rose by about twice as much in percentage terms in the US as in Australia and Great Britain.

The negative coefficient on the experience interaction term for graduates in each country produces the result that an additional year of experience at the beginning of working life adds less in percentage terms to graduate earnings than to the earnings of the unqualified This result may appear surprising and is perhaps best understood by considering the earnings profiles of university graduates and the unqualified in terms of both experience and age. As graduates enter the workforce some five or more years later than the unqualified, a comparison of the change in earnings at a given age involves very different levels of experience. So for example, in Australia, a 22 year old graduate who increased his experience by one year from one to two, added 9.7 per cent to his earnings but an unqualified man of the same age who increased his experience from five to six years raises his earnings by 6.3 per cent according to these estimates.

The different effect of experience on earnings across the education groups is of relevance to the discussion of whether on-the-job training should be thought of as an alternative method for raising the level of human capital to formal schooling or whether a certain amount of formal schooling is necessary before on-the-job training adds to an individual's earning capacity. (8) If it is an alternative to schooling, we would expect those with lower levels of formal education to gain more from additional experience and for there to be some convergence in experience earnings profiles. If, on the other hand, on-the-job training is complementary to formal education, we would expect a divergence in experience earnings profiles. Different conclusions on this question have emerged in earlier studies.

Mincer (1974) considered at some length, the differences between the earnings profiles of different education groups in age and experience space. He found, using data from the 1960 US Census, that the experience profiles of different education groups tended to converge with increasing experience but the age profiles diverged as age increased. McNabb and Richardson (1989) also note some convergence in the earnings experience profiles of Australian men with different levels of education. They concluded that

> " for Australia in the 50 year period prior to 1981, from which our data are drawn, on-the-job experience has predominantly been a substitute for, rather than a complement to, formal education as a path to the acquisition of human capital skills by men" (p65).

These results contrast with the results of Psacharopoulos and Layard (1989) for Britain. They found that the returns to experience increased with education level so that education and on-the-job training were complements rather than substitutes. Lillard and Tan's (1986) results also suggest a complementarity between formal schooling and on-the-job training in industries experiencing rapid technical change.

Figures D1-D12 in Appendix D present our results for predicted earnings for university graduates and the unqualified by both years of experience and age. These results for each of the three countries confirm the findings of Mincer (1974) and McNabb and Richardson (1989). The earnings profiles of the unqualified and university graduates converged in experience space but diverged in age space when we consider percentage changes. The human capital interpretation of these results is that for a given level of experience, the less educated invest more than the university educated in on-the-job training measured in terms of time. This is consistent with the proposition that to some extent formal schooling and on-the-job training are substitutes. In absolute money amounts the profiles diverged in both experience and age space reflecting the fact that graduates earn much more than the unqualified.

In the discussion so far, we have only considered changes in experience as a determinant of the shape of the age earnings profile. Other characteristics used in estimating these results are not fixed between ages and will vary in ways which may influence the shape of the age earnings profile. So, for example university graduates and married men earn more than unqualified and single men respectively. The lack of university graduates and married men among 16 year olds would, even without the effect of experience on earnings, result in lower earnings for 16 year olds than for other age groups possessing some of these characteristics. Figures 4.7-4.9 illustrate this point using as the benchmark the average characteristics of 25 year olds in each country. We have allowed earnings to vary with experience for this fixed set of characteristics (labelled "Predicted 25" in the figures). The average values of variables used in these figures and in the regressions are presented for selected ages in Appendix B. We have compared them with predicted earnings using the actual average characteristics of each age (labelled "Predicted" in the figures).(9)

The figures show that part of the sharp increase in earnings between 16 and 24 is due to changes in the characteristics of the sample other than a change in experience. For

Figure 4.7: Predicted Earnings Compared with Predicted Earnings using the Average Characteristic of Twenty-Five Year Olds, Australia, 1981.

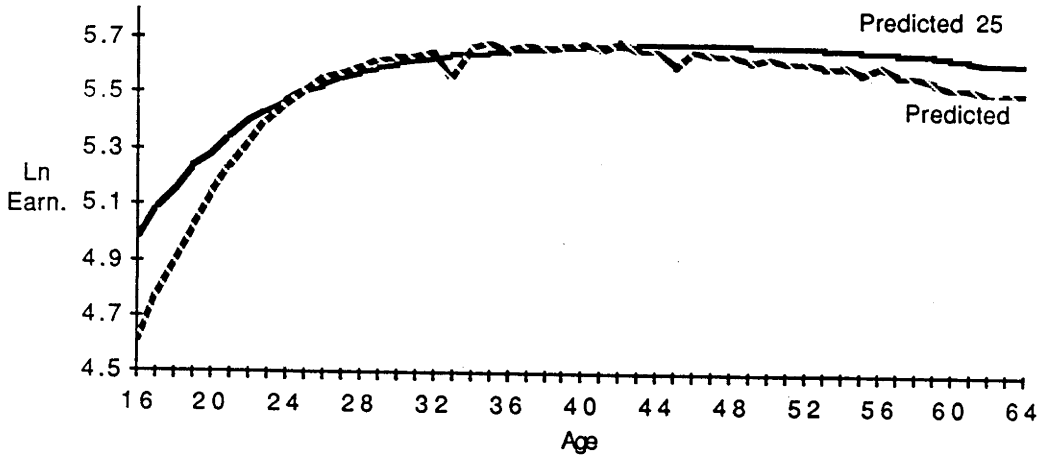


Figure 4.8: Predicted Earnings Compared with the Predicted Earnings using the Average Characteristics of Twenty-Five Year Olds, Great Britain, 1981.

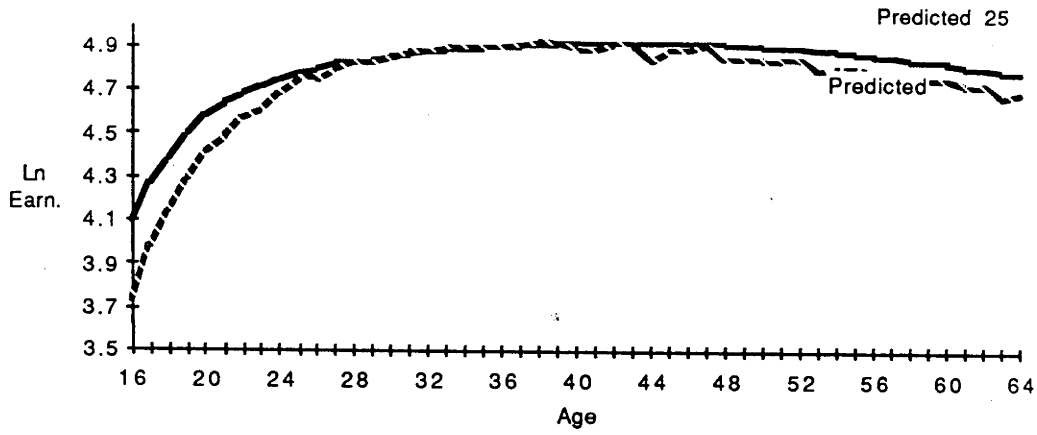
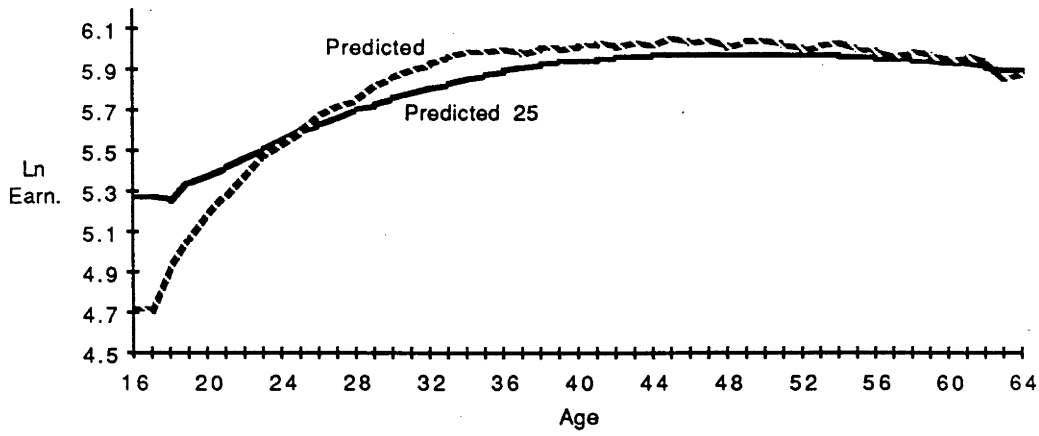


Figure 4.9: Predicted Earnings Compared with Predicted Earnings using the Average Characteristics of Twenty-Five Year Olds, United States, 1981.



each country, the age earnings profile would be flatter if the under 20's had the same endowments of characteristics, other than experience, as 25 year olds. The figures also show that part of the decline in earnings among the over 55 year olds can be accounted for by a reduction in favourable characteristics, and does not just occur because of the negative effect of experience at high values of experience. For Australia and Great Britain, earnings would show less of a decline for the over 55's using the fixed characteristics of 25 year olds than that observed when the actual characteristics of the group were used to predict earnings. In summary, for each country, part of the increase in earnings shown in the cross section over the early part of working life and part of the decline at the end of working life can be explained by changes in the human capital endowments of the samples at different ages. In the next section we shall see whether differences between the countries in the shape of the aggregate age earnings profile can be explained by differences in the relative endowments of human capital at particular ages.

3. The Decomposition of Relative Earnings

In chapter 1 we presented the evidence for a steeper aggregate age earnings profile for men in the US than in Australia and Great Britain. The purpose of this section is to consider how far we can go in explaining these differences using a simple human capital model. If the differences in the shape of the age earnings profiles can be attributed to differences in the amount of education and experience of men in each country, then this would give support to the human capital explanation of the steeper aggregate age earnings profile (see chapter 2, section 1). If, however, the rewards to these endowments differ markedly between the countries, this may reflect either (or both) differences in the supply and demand for human capital in the countries or the influence of institutional factors such as trade unions, on the rewards to endowments. We shall leave the discussion of industry effects on earnings to a later chapter.

We can think of any differences in the earnings of men by age in the three countries, using an adaption of Oaxaca's (1973) decomposition method, as being composed of two parts; the prediction error for each country (the first two terms on the right hand side of equation (4)), and that part which is measured in the regression equations (the final term in equation (4)).

$$y_{us}-y_a = (y_{us}-X_{us}\beta_{us}) - (y_a-X_a\beta_a) + (X_{us}B_{us}-X_a\beta_a) \quad (4)$$

$$\text{where } (X_{us}B_{us}-X_a\beta_a) = (X_{us}-X_a)\beta_a + X_{us}(\beta_{us}-\beta_a) \quad (5)$$

y is actual earnings, X is a vector of endowments, β the estimated coefficients. The subscripts a and us in this example are for Australia and the United States respectively.(10) This term can be further broken down into that part attributable to differences in endowments (the first term in equation (5)) and that part attributable to coefficients (the second term in equation (5)). This latter term will include any biases introduced by such things as the omission of relevant variables or measurement errors in the included variables as well as differences between the countries in the 'true' coefficient.

In this exercise we are merely considering the decomposition in an accounting sense. We do not wish to argue that if, for example, the Australian males suddenly possessed the educational levels of the US males, then the Australian coefficients would remain unchanged. The coefficients are obviously the outcome of particular supply and demand conditions and would change given non-marginal changes in endowments.

In order to compare across the three countries, it was decided that, rather than use the official exchange rates to convert $A into $US or £, we should set the logarithm of the actual earning of a 25 year old in each country equal to 100 and compare the earnings of all ages to this one. This has the further advantage of making it easier to see the relationship between age and earnings. We are interested here in explaining the slopes of age earnings profiles. By taking a benchmark age, we can easily compare earnings at other ages to this one and see whether there is a strong relationship between age and

earnings. Values of the indices of actual and predicted earnings close to 100 show that in the cross section, earnings do not vary much with age. Substantially larger or smaller values of the index show a greater range of earnings across age groups.

There are three pairwise comparisons between the countries which we wish to make; Australia/United States, Australia/Great Britain, and Great Britain/United States. We have presented the results here using Australian weights for the first two of these comparisons and US weights for the final one. The results of these decompositions are presented in figures 4.10-4.12 Results using alternative weights and more detailed results for selected ages can be found in Appendix D.

We shall begin by considering the comparison between Australia and the United States presented in figure 4.10. The heavy black line (XusBus-XaBa) shows the difference between the predicted earnings at each age for the two countries relative to the difference in predicted earnings at age 25. (11) Between the ages of 16 and 24, Australian men earned more relative to 25 year old men than was the case in the United States. The differences in the relative endowments of these young men (the line (Xus-Xa)Ba) was the major source of the difference in predicted relative earnings. The coefficient differences (the line Xus(Bus-Ba)) offset some of the negative effects of relatively low human capital endowments for the US men. The figure shows that American men over 40 earned much more relative to a 25 year old than Australian men in this age group. The gap in relative earnings for the 40-60 year olds of these two countries was between 30 and 40 per cent. Among men over 25, both the human capital endowments and coefficient differences were important in explaining the difference in relative earnings. US men had both higher levels of human capital endowments and were better rewarded for these. About half the difference in relative earnings at most ages over 25 could be explained by endowment differences and about half by coefficient differences.

Figure 4.10: The Decomposition of Relative Earnings of Men, Australia and the United States, 1981
Earnings of a 25 year old=1.

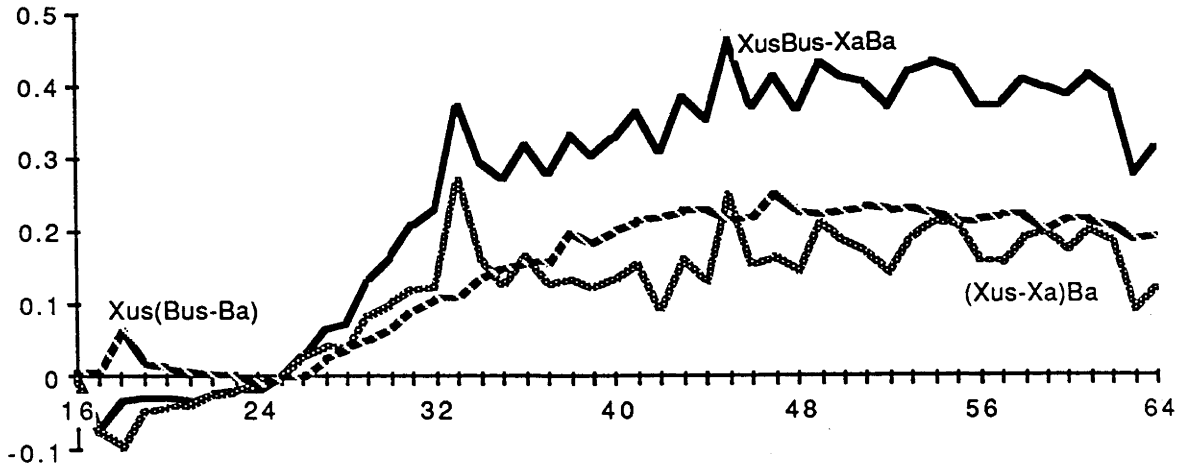


Figure 4.11: The Decomposition of Relative Earnings of Men, Australia and Great Britain, 1981.
Earnings of a 25 year old=1.

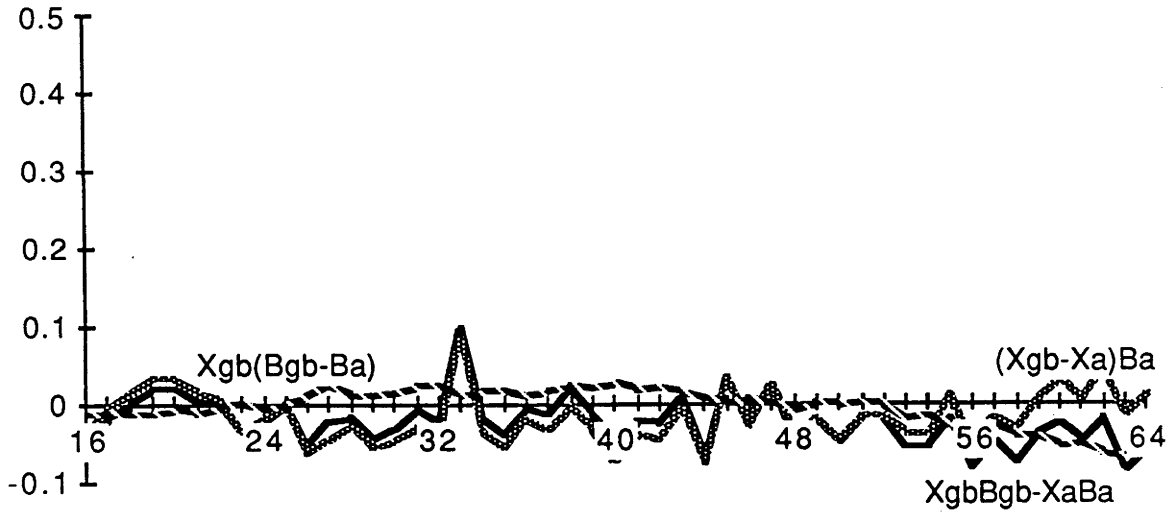
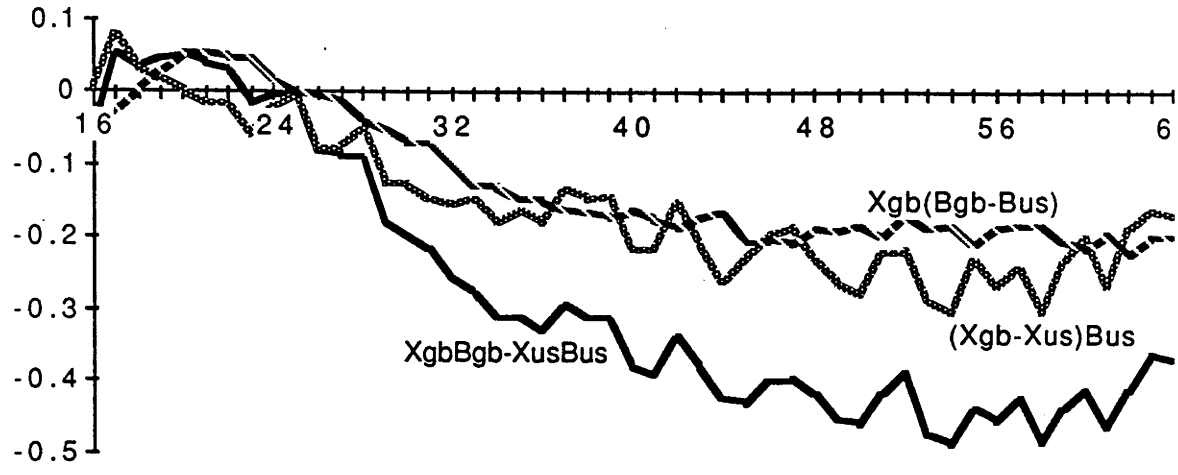


Figure 4.12: The Decomposition of Relative Earnings of Men, Great Britain and the United States, 1981.
Earnings of a 25 year old=1.



The results of the comparison between Australia and Great Britain presented in figure 4.11 are less clear cut. There was no pattern of large differences between the countries in the earnings of men at various ages relative to a 25 year old. Where at their peak, American predicted earnings were 40 per cent higher than Australian predicted earnings, relative to a 25 year old, the difference was always less than 10 per cent between the relative earnings in Great Britain and Australia. At most ages Australian men had higher stocks of human capital endowments than British men (see the negative values for (Xgb-Xa)Ba) but these were offset to some extent by the greater returns to a given stock of endowments in Britain compared to Australia (see the positive values of Xgb(Bgb-Ba)).

Like the comparison between Australia and the United States, the comparison of relative earnings by age for Great Britain and the United States shows large differences between the countries in the relationship between age and earnings. The earnings of men in their 50s relative to a 25 year old were approximately 50 per cent higher in the US than in Great Britain. About two-thirds of these differences were explained by the relatively large stock of human capital among older American men than among older British men. The higher returns to a given stock of human capital endowments in the US, shown in figure 4.12 (see the line Xgb(Bgb-Bus), contributed about a third of the difference between the countries in predicted earnings for men in their 50s.

These results raise the next obvious question, which are the important endowment and coefficient differences which generate the large differences in the relative earnings of men by age in Australia and Great Britain compared with the US ? Here we shall present some general conclusions of our further decomposition of the endowment and coefficient effects. The method adopted for this analysis and some illustrative calculations for particular ages are presented in Appendix D. The results of the comparison between the US and each of the other countries show that the large stock of educational endowments of American men over the age of 25 relative to the educational endowments of 25 year

olds and the larger returns to experience in the US were the major sources of the higher relative earnings of these men compared with Australia and Great Britain. As our discussion has already shown, the comparison between Australia and Great Britain produced less clear cut results. There were offsetting influences, the most important being the negative effect of lower educational endowments for British men over 25 relative to the educational endowments of 25 year olds, which was in part offset by the relatively larger returns to education in Great Britain than in Australia.

4. Summary and Conclusion.

In this chapter, we have presented a basic model for comparisons of male age earnings profiles between the three countries. We have compared several functional forms for experience. We concluded that one which included both an exponential and quadratic form of experience predicted most successfully the steep rise in earnings which took place between the ages of 16 and 25 and the decline in earnings for those over 55 in each of the three countries. Neither the quadratic nor the exponential form of experience when entered separately was particularly successful at predicting these two parts of the age earnings profile.

The earnings equations estimated here show that education and experience are important in determining earnings in each country, as many other equations using the human capital model have shown. We found that the returns to experience did differ significantly between education groups. These results for the three countries support the earlier findings of Mincer (1974) for the US and McNabb and Richardson (1989) for Australia by suggesting that on-the-job training may offer an alternative method by which those with low levels of formal schooling can supplement their human capital.

In addition to changes in earnings with changing experience, the shape of age earnings profiles can also be attributed to changes in other endowments with age. One of the reasons that the earnings of 16 year olds are low is that they do not have many

favourable characteristics such as high levels of education. We found that both the relatively young (under 20's) and the old (over 55) were poorly endowed with other favourable human capital characteristcs and if the only difference between men of different ages was their experience, the age earnings profiles would have been much flatter.

The results from our preferred functional form for experience have been used to decompose the gap between the countries in relative earnings into that part which can be explained by differences in endowments and coefficients and the residual error. The total gap in relative earnings was much larger between the US and the other two countries than between Australia and Great Britain. In each comparison including the US, the earnings of American men over 40 were estimated to be over 30 per cent higher relative to 25 year old men than the relative earnings of Australian and British men in their 40s. About half of this gap was attributed to endowment differences and about half to coefficient differences. In comparison to both Australian and British men, American men had particularly high levels of educational endowments and were particularly well rewarded for additional labour market experience.

In terms of our discussion of the theories used to explain the change in earnings with age, the results of this chapter offer support for human capital theories. The evidence suggests that education and experience are important in determining earnings. While the institutional characteristics may be important in determining the rate of accumulation of human capital, the evidence presented so far does not suggest that Australia's centralised system of wage fixation operated to produce very different results regarding the shape of the age earnings profile than those found in Great Britain. There may be common factors, for example the form which unionism takes in Australia and Great Britain, which may have been important in determining the similarities between the countries. We shall consider some other possible sources of differences between the

countries in the shape of the age earnings profile of men in the next two chapters; cohort and industry effects.

Footnotes

1. For a survey of American evidence and a discussion of the reasons for including marital status in earnings regressions see Hill (1979). Our results in the following chapters are typical of the findings discussed in this article, namely that while married men earned more than single men, there was no significant difference for women. Hill did not seek to distinguish between the possible sources of the difference in the earnings for men according to marital status. It may be that married men with greater financial responsibilities work harder than single men or that employers practice statistical discrimination in favour of married men.

2. A similar result was found by Murphy and Welch (1990) using US data.

3. These results can be contrasted to those reported for Australia using 1981/82 data, by McNabb and Richardson (1989). They compared the returns to experience for Australian men with nine different levels of schooling on the basis of annual income regressions for male employees aged 65 or under who worked at some time during the year. They found that the rate of return to experience increased as completed schooling increased from less than five years to 10-11 years but as schooling increased beyond this level, the returns on experience fell. Their regressions included only experience and experience ^{2} as explanators and their estimated returns to experience were higher than reported here.

4. This result can be compared with the conclusions of Psacharopoulos and Layard (1979). Based on their preferred functional form for the relationship between earnings, schooling and experience, they argued that the returns to experience rose with years of schooling. However, some of the other results they report show lower returns to experience with higher levels of education.

5. The series for actual earnings presented here differ from those in chapter 3 as a five year moving average has not been applied to the basic data.

6. Murphy and Welch (1990) also find that the quadratic is least successful at predicting earnings for young and old workers. While they showed the quadratic underpredicting earnings for those with 40 years experience, in our US sample, as noted in the text, the quadratic form of experience predicted the earnings of older workers fairly well.

7. The inclusion of generated regressors in subsequent equations is the subject of recent econometric work (see for example, McAleer and Smith (1990)). It has been shown in general that while the coefficient estimates in the presence of generated regressors in an OLS equation are unbiased, the standard errors are biased downward. While the properties of generated regressors in a non linear equation are yet to be described in the literature, the 't' statistics reported in the following tables should be treated with some caution as they are probably upwardly biased.

8. This issue is discussed in the Australian context by McNabb and Richardson (1989).

9. This is obviously a hypothetical exercise as it is only in exceptional circumstances that we would expect a 16 year old to complete a university degree.

10. Some criticisms of this decomposition method are presented by Cotton (1988) who considered the method in the context of measuring discrimination. He argued that the major flaw in the Oaxaca method is its inability to measure the wage structure that would prevail in the absence of discrimination because

> " not only is the group discriminated against undervalued, but the preferred group is over valued, and the undervaluation of the one subsidizes the overvaluation of the other. Thus, the white and black wage structure are both functions of discrimination and we would not expect either to prevail in the absence of discrimination." (p238).

For the purpose of our decomposition, this argument is not relevant. The coefficients on the earnings functions of each country can be assumed to be independent of each other and are unlikely to be effected by labour market conditions in the other countries. The

returns to graduates in the US, for example, are not higher because discrimination against Australian graduates holds down Australian earnings and raises those of US graduates.

11. The American equation over estimated the actual earnings of men in their 40s relative to the actual earnings of 25 year olds by about 10 per cent. The differences in actual earnings were therefore smaller than the comparison of predicted earnings suggests.

Chapter 5
Cohort Effects on Age Earnings Profiles of Men.

In the preceding chapters we have considered a number of important determinants of earnings and of the shape of the age earnings profile such as the level of education and potential working experience. In this chapter, we shall extend the basic model presented in chapter 4 by including another variable which has been shown in other studies to influence earnings, namely cohort size.

It is a prediction of the career phase model outlined in chapter 2 that a large cohort should depress the level of its own earnings, particularly in the early stage of the working life of its members. In a cross section, we would therefore expect to observe lower earnings for those who are members of a large cohort. (1) The different shapes of the age earnings profiles in each country may reflect differences in the absolute size and position in the life cycle of large cohorts.

Our ability to detect cohort effects in a cross section is limited by the nature of the data and the position of the large cohort in the cross section. So, for example, if the large cohort were aged 16-20 in a cross section, it would be difficult to separate the negative effects of large cohort size on earnings from the general effect that youth has in lowering earnings as we have no point of comparison. We do not have evidence of the shape of the age earnings profile with a young group of ordinary size. A further problem may arise from any misspecification of the functional form of experience. The cohort variable is likely to pick up any part of the relationship between age and earnings not explained by experience. Despite these estimation problems which suggest that the results should be treated with caution, it seemed worth considering whether cohort size was important in explaining earnings for our sample.

As we have discussed in chapter 2, there are two possible interpretations of cohort size which have been used in the literature. The first is a purely demographic definition

which considers the size of the birth cohort relative to the total size of the workforce. The second is based on educational groups and looks at the relationship between the relative size of an age group among the labour force participants with a particular qualification. We shall estimate earnings equations using both of these definitions.

The chapter is organised as follows. In the next section, we shall summarise the results of some existing studies for our three countries which use cohort size as an explanatory variable. In section 2, we present the empirical results of our estimation of the earnings regressions including the two definitions of cohort size. Section 3 presents a summary and conclusion.

Our regression results show that cohort size defined generally to include all those of a particular age did not have a statistically significant effect on earnings in Australia and Great Britain although the negative effect of this cohort variable on earnings was almost significant for the US. The results using the cohort variables which relate to educational groups showed a strong negative effect of the size of the graduate cohort on earnings in Australia and Great Britain. A statistical test supported the inclusion of the four educational cohort variables in the Australian and British earnings equations but not in the American one. These results in conjunction with the estimation problems associated with the identification of a cohort effect in the cross section, have led us to the following conclusion. The evidence presented here does not enable us to say with any confidence whether cohort size has been important in creating the differences between the countries in the shapes of the age earnings profiles. A comparison of the countries using data including both time series and cross section elements is needed.

1. Cohort Effects in Earlier Studies.

Most of the early studies of the effect of cohort size on earnings were done in the US and reflect an interest in the economic implications of the arrival of the post World War 2 baby boom on the labour market. These studies look at the economic position of

young workers overtime.(2) Among the American studies, two by Welch (1979)and Berger (1985) examine the effect of cohort size in an earnings function and additional studies by Freeman (1979) and Berger (1983) consider the problem in a production function framework (3). Other studies have considered the effects of large cohort size on the unemployment rate of an age group. (4)

1.1 American Studies of the Effect of Cohort Size on Earnings.

Welch (1979) estimated four separate earnings equations for the following educational groups: those with 8-11 years schooling; 12 years schooling; 13-15 years schooling; and 16 or more years schooling. The regressions were based on grouped data, taking as the dependent variable, the average earnings of individuals of a given age with a particular level of schooling. Equations were estimated using pooled cross section and time series data for the years 1967-75, for both annual and weekly earnings of male employees aged 14-65 who worked throughout the year. The explanatory variable of chief interest here, cohort size, was taken as a weighted average of the proportion of the workforce with the same age as the individual plus and minus two years. Cohort size may have an equal effect on the level of earnings at each age but it may also change the relationship between experience and earnings. In order to capture this effect an interaction term between cohort size and experience was also included for those in the early part of their working lives.(5) Almost all Welch's explanatory variables were significant, including cohort size. He concluded " there is fairly strong evidence that large cohorts do depress earnings and that most of the effect comes early in the career. The evidence also suggests that cohort size effects increase with the level of schooling". (p S95)

Berger (1985) further tested Welch's model by extending the estimation period to 1979 and replacing Welch's cohort and experience interaction term with a more general term (cohort*experience) that was not restricted to the first few years of working life. The inclusion of this variable enabled the author to see whether cohort size affected the

relationship between experience and earnings throughout working life. His results confirm Welch's finding of a cohort effect on earnings but contrary to Welch, Berger found that the depressing influence of membership to a large cohort was permanent. He concluded that " there will be no quick recovery of the earnings levels of workers in large entry cohorts as implied by Welch's study". (p 572).

The debate between Welch and Berger as to the persistence of cohort effects on earnings continues. Murphy, Plant and Welch (1988) update Welch's earlier study and present results of a simulation exercise which they argue, show that

> " although the depression of wages caused by large cohorts could be large during the initial stages of the large cohort's career, the wage differential diminished over the course of the career." (p 56).

Using a production function framework, both Freeman (1979) and Berger (1983) concluded that there was evidence of a cohort effect on earnings in the US. Freeman (1979) estimated demand for labour equations based on the constant elasticity of substitution production function and on the translogarithmic production function for the US over the period 1947-74. He concluded that " the increased number of young male workers was the major causal force underlying the increased earnings of older men relative to the earnings of younger men." (p 314-315). Berger's results added another contributing factor as an important cause of the observed reduction in the relative earnings of young men. He estimated a translogarithmic production function for nineteen states in the US over the period 1967-74 and concluded that the

> "rapid increase in the number of young male college graduates appears to have been the largest contributor to the decline in their earnings relative to lesser educated young males and older male college graduates. The increase in female labor participation appears to have contributed significantly to the decline in earnings of younger workers relative to older workers among those with less than a college degree." (p193).

1.2 British studies of the effect of cohort size on earnings.

There is also time series evidence of a cohort effect in Great Britain. Ermish (1988a) used annual data for men in manual occupations in production industries (that is not including service industries) to compare the relative earnings of those under 21 with the earnings of older men over the period 1952-1979. He considered a purely demographic definition of cohort size as the cohort variable was measured by the ratio of the number of young men aged 15-19 years to the total number of men of working age. Due to limitations in the data, he was not able to examine the effect of cohort size for different educational groups. He concluded that even for the group of less well-educated men in manual occupations, large cohorts were associated with lower initial relative earnings although the longer term implications for their earnings were not explored.

Wright (1989) utilised data sets which enabled him to more closely follow the Welch study of the effect of cohort size in the US for Britain. He pooled cross section and time series data from the General Household Survey 1973-82 and estimated earnings regressions for three educational groups; those with no qualifications, those with intermediate qualifications (such as 'O' levels and apprenticeships) and those with higher qualifications ('A' levels, nursing qualifications and university degrees). He used a demographic measure of cohort size which he argued was to be preferred to a measure of cohort size based on education groups because the amount of education held by members of a cohort was a function of its size (6). He found that weekly earnings of men aged 20-50 were not related to cohort size for those with no qualifications but were initially negatively related to cohort size for the intermediate and higher education groups. Earnings of large cohorts rose faster than the earnings of ordinary sized cohorts with these levels of education suggesting that the adverse effect of cohort size did not persist over the life cycle. These results for Great Britain therefore broadly confirm Welch's (1979) US findings that large cohort size had a negative effect on earnings which increased with education level but these effects diminished over time.

1.3 Some Australian results

There are no time series studies of the effect of cohort size on earnings for Australia. The ability to undertake such a study is limited by the fact that household survey data are not available on an annual basis during the 1970's. In the interests of completeness, we have estimated a regression using another data set than the 1981 Population Census. We shall report results of an estimated pooled cross section and time series regression based on data from the Labour Force Survey, a household survey covering the civilian population over 15 collected annually by the Australian Bureau of Statistics. The data are not as detailed as the American Current Population Survey and the British General Household Survey and are not released on a unit record basis. The results are therefore based on averages for particular age groups. The definitions of the variables are included in Appendix A.

The results using this alternative data set for the period 1977-1986 for men aged 20-59 working full-time are presented in Table 5.1. We have estimated one regression for the whole sample using as the dependent variable the ratio of average weekly earnings of the age group to the average weekly earnings of all males in the sample in the relevant year. There are a number of limitations to these data for our purposes. It has not been possible to estimate separate regressions for each education group so the results here constrain the effect of cohort size to be the same across all education groups. In addition, the data were not available for individual ages but rather for five age categories. (7). As the age categories were of unequal size, it was not possible to define cohort simply as the proportion of the sample in a particular age category. We have therefore defined it as

$$C_i = (N_i / Y)$$

where N_i is the number of men in the age category i and Y is the number of years covered by the age category.

Experience for the age category was estimated as the potential experience of the three education groups within the age category; university graduates, those with post

secondary qualifications and the remainder, weighted according to their proportions in the group. We have used an interaction term between experience and cohort to take account of the longer term effects of cohort size on the relationship between experience and earnings. We have weighted the calculations by the number of observations in each age category to correct for heteroskedasticity.

Our results show that all variables, apart from the proportion in the age category with post secondary qualifications and the two cohort variables, were significant at the five per cent level. Age groups with higher levels of experience and education earned relatively more and those with higher levels of unemployment earned relatively less. The coefficients on the cohort variables were however, not individually significant at the five per cent level and it was not possible to reject the null hypothesis that they were jointly equal to zero. Conclusions based on these results therefore should be treated with caution. They suggest that the initial effect of cohort size on earnings was positive and became negative as experience increased. For a given level of experience, larger cohorts earned relatively less than smaller cohorts. There was a remaining problem with the chosen functional form of the equation. It failed to pass the reset 3 test for functional form but attempts to alter the functional form and to retain plausible estimates of the coefficients were unsuccessful.These time series results do not find strong evidence of a cohort effect on earnings in Australia over the period 1977-1986. It is possible that the broad nature of the data and the time period for which the data are available prevented the identification of any cohort effects. The arrival of the post World War 2 baby boom on the labour market took place in the early rather than late 1970s, so this event was not within our sample period. It is perhaps not surprising to find that in the more regulated Australian labour market, the arrival of large cohorts did not produce great changes in the relative earnings of men of different ages but may have had important implications

Table 5.1
An Australian Earnings Function including Cohort Size, 1977-1986.

Dependent variable= Average weekly earnings of age category / Average weekly earnings of all males

Constant	78.781 (5.99**)
Experience	3.4714 (4.47**)
Experience ^{2}	-0.0593 (-5.99**)
Unemployment rate of age category	-0.747 (-5.11**)
Cohort	0.046 (0.44)
Experience * cohort	-0.0085 (-1.81)
Graduates as proportion of age category	1.045 (3.97**)
Post secondary as proportion of age category	-0.229 (-1.27)
SEE	1.59
R^2	0.98
F	234.16**
F test of joint significance of cohort and experience*cohort	2.51
Number of observations	50
Reset Test 2 predicted Y^2 (t value)	-0.5
Reset Test 3 F test of joint significance of Y^2 and Y^3	11.29**

Notes: t statistics are in brackets. Test statistics are marked * for those significant at the five per cent level and ** for those significant at the one per cent level.

for the unemployment rate. We have not tested this second proposition.(8)

In summary, there are a number of studies for Great Britain and the United States using pooled cross section and time series data which find a negative effect of large cohort size on earnings. We were unable to confirm this result for Australia.

2. The Effect of Cohort Size on Earnings- Cross Section Evidence.

The studies we have summarised above all use time series data to estimate cohort effects on earnings. In this section, we shall ask the following question; can cohort effects explain the shape of the age earnings profiles observed in the cross section of each of the three countries ?

As we have already discussed, our ability to detect cohort effects on earnings in the cross section is limited by our lack of a counterfactual hypothesis and also by the position of the large cohort in the cross section. In 1981, the largest cohorts in each of our samples had completed their initial years in the work force and this suggests the following test of the effect of cohort size on earnings. If large cohort size affects only the earnings of the large cohort and not the earnings of other age groups, then we should observe in the cross section a profile as depicted in stylised form in figure 5.1 by the heavy line. The reduction in earnings for the cohort group will be more pronounced if Berger's assumption of a persisting cohort effect is correct and smaller if Welch was correct in suggesting that large cohorts recover from the initial adverse effect on their earnings. If however, the large cohorts have become substitutes for all other workers regardless of age, and with a given demand for labour, the increased supply of workers has reduced the earnings of all workers, we will not observe a cohort effect on the earnings of the large cohort alone. The earnings profile in the worker phase of the career phase model will be flatter for all members of this group, not just for the large cohort. This is illustrated in figure 5.2. (9)

The proposition that cohort size effects earnings can be interpreted in several ways, as we have seen in earlier studies, and two of these will be considered here. It can be a purely demographic variable and measure the size of the birth cohort or it can be related to education group. The latter will be important if individuals with different levels of education are not close substitutes for each other. In this case an individual's earnings

Figure 5.1: The Effect of Cohort Size in a Cross Section.

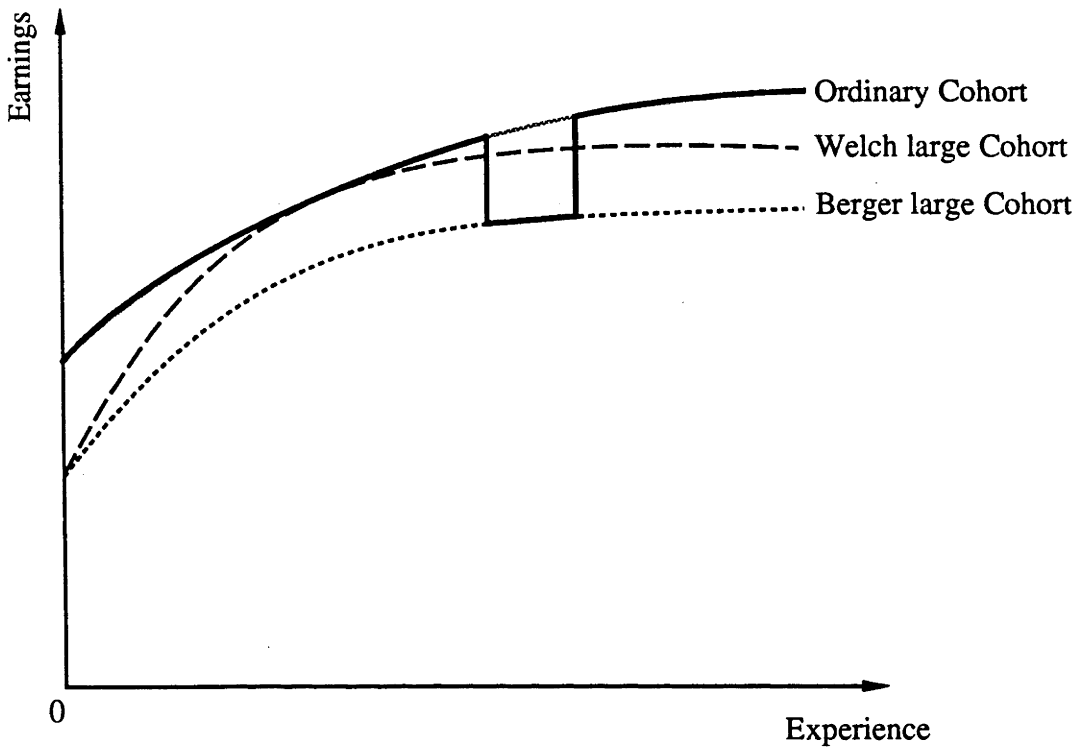
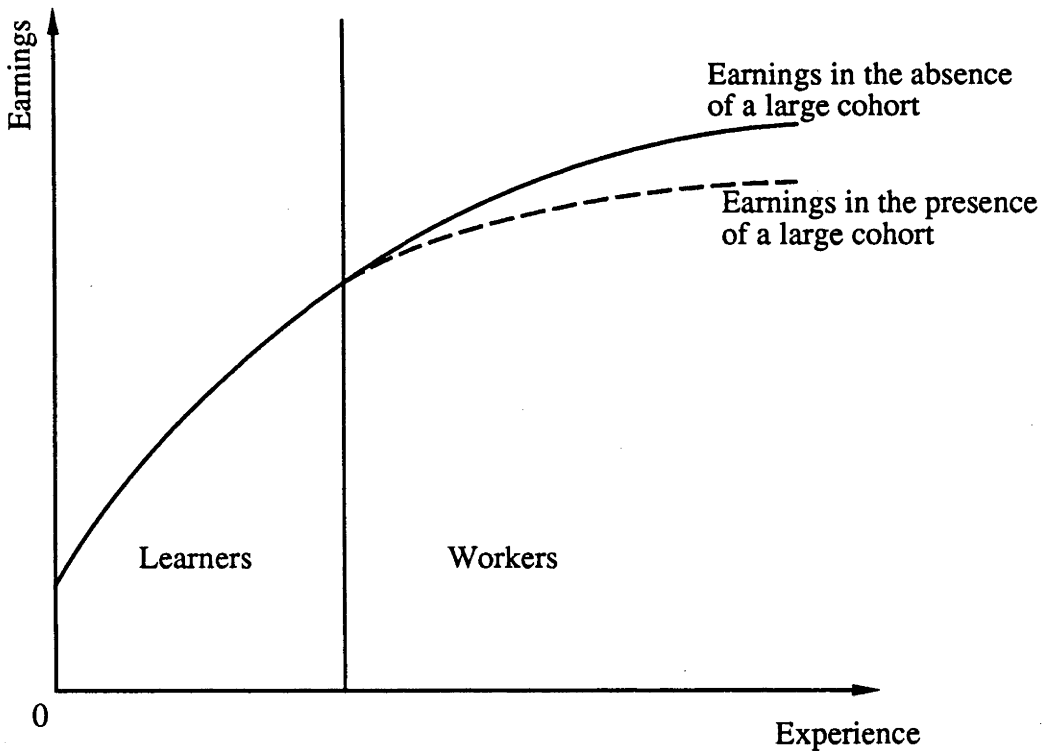


Figure 5.2: The Effect of a Large Cohort on the Earnings of "Workers"



will be related to the number of other men of his age with his level of education rather than the number of all men his age.

Ermish (1988a) and Wright (1989) in their two British studies opt for a demographic definition of cohort on the basis that this is clearly an exogenous variable in an earnings function. Current earnings will not influence the number who were born at least 16 years earlier. Educational cohorts are more likely to be influenced by the current level of earnings. Current earnings of particular education groups influence schooling decisions of those currently choosing between the labour market and various types of education.(10) It is less clear how the causal link may run in general. It would be necessary to argue that current earnings have influenced the educational decisions of members of the sample in the past. As we are interested in both hypotheses that the size of the birth cohort in the labour force and the size of the education cohort affect earnings, we shall report results using both definitions.

Cohort size has been measured as a five year moving average of those of a given age plus and minus two years

$$C_i = \frac{A_{i-2} + A_{i-1} + A_i + A_{i+1} + A_{i+2}}{5}$$

where A_i is the proportion of men in the labour force aged 16-64 who were of age i. Cohort size was also calculated in the same way for each of the four education groups. In this case, A_i was the proportion of men aged 16-64 with a given level of education of age i.

A description of the educational cohort variables is presented in Appendix E. Here we shall only consider the distribution by age of all men who were in the workforce aged 16-64 for each of the countries. The data are presented in Figure 5.3. The range of cohort size was largest in the US, from 0.05 per cent at age 16 to 3.1 per cent at ages 31 and 32, and smallest in Great Britain where the range was from 1.4 per cent at age 64 to 2.5 per cent at age 33. The Australian cohort sizes ranged from 0.65 per cent at age 64 to

2.9 per cent at age 32. In each country, the largest cohorts were under the age of 35. There was a particularly sharp concentration of men in the US aged between about 26 and 36. In Australia and Great Britain, young men between the ages of 18 and 22 constituted a much larger percentage of the workforce than this age group in the US. Where each cohort in this age range accounted for between 2.5 and 3 per cent of the workforce in Australia and over 2 per cent of the workforce in Great Britain, they accounted for between 0.5 per cent and 1.75 per cent of the male workforce in the US. In Great Britain, there was a relatively large proportion of the sample who were over 56 compared with the other countries.

Table 5.2 presents regression results using a broad definition of cohort size based on membership to the workforce. Most of the coefficients are similar to those already reported in earlier chapters so we shall concentrate on the results for cohort size. In Australia and Great Britain, the cohort variable was not significant at the five per cent level. It was not possible to pick up any effect of cohort size, defined in this general way to cover the effect of generation size, on earnings using cross section data.

Figure 5.3: Percentage of Each Sample of Men by Age, Australia, GB, US, 1981.

Table 5.2
Weekly Earnings of Full-time Men aged 16-64 including Cohort Size, Australia, Great Britain, the United States, 1981
Dependent Variable = ln Weekly Earnings

	Australia	Great Britain	United States
Intercept (a)	4.3529 (90.96**)	3.6098 (51.96**)	4.6263 (62.69**)
High	0.2351 (6.18**)	0.0296 (0.52)	0.4309 (5.32**)
Post secondary	0.6637 (14.7**)	0.3719 (6.07**)	0.5301 (5.44**)
Graduate	0.9680 (18.23**)	0.7519 (9.03**)	0.9693 (9.31**)
X	0.8308 (14.98**)	0.7432 (13.94**)	1.2764 (5.17**)
Experience	0.0124 (7.21**)	0.0168 (8.81**)	-0.0026 (-0.31)
Experience 2	-0.0002 (-7.65)	-0.0003 (-9.31**)	-0.0001 (-0.54)
High*X	-0.0676 (-1.60)	0.1631 (2.65**)	-0.2262 (-2.45**)
Postsec*X	-0.4628 (-9.42**)	-0.1816 (-2.83**)	-0.1931 (-1.69)
Graduate*X	-0.3558 (-5.94**)	-0.1549 (-1.68)	-.4563 (-3.67**)
Married	0.1221 (13.04**)	0.1770 (12.99**)	0.2138 (11.0**)
Widowed, separated, divorced	0.0585 (3.93**)	0.0920 (3.73**)	0.1105 (4.04**)
Rural	-0.1096 (-11.04**)	-0.0212 (-2.35**)	-0.1097 (-8.41**)
Cohort	2.2608 (1.17)	2.4320 (0.84)	-5.4984 (1.94)
R^2	0.44	0.40	0.23
F	762.02**	278.37**	169.20**

Notes:t statistics in brackets.Test statistics are marked * for those significant at the five per cent level and ** for those significant at the one per cent level.
X= 1- $e^{(-0.2643*\text{experience})}$ in the Australian regression, 1- $e^{(-0.3713*\text{experience})}$ in the British regression, and 1- $e^{(-0.1177*\text{experience})}$
(a) The constant term measures ln earnings for a single unqualified man of urban residence with no experience.

In the US equation, the coefficient on the cohort variable had the expected negative sign and was very close to significance at the five per cent level. According to this result, an increase in the cohort size from say 2 to 3 per cent reduced earnings by about 5.5 per cent (11). These results suggest that for Australia and Great Britain, large cohort size is not associated with lower earnings in the cross section. In the US, there is some evidence that large cohorts depress their own earnings relative to those of other ages.

Table 5.3 presents results using an alternative education-based measure of cohort size. Each educational cohort variable only takes a positive value for individuals with the same level of education. In both the Australian and British regressions, the cohort variables were jointly significant. In each case, three of the four cohort variables, for the unqualified, high school group and the university graduates had the predicted negative sign. For Australia, only the coefficient on the graduate cohort variable was individually significant and it had the largest negative coefficient. It was estimated that an increase in the size of the graduate cohort by one percentage point from say, 2 to 3 per cent, would reduce earnings by 0.5 per cent. This conforms with Welch's prediction that the negative effect of cohort size should be greatest for the more educated.

For Britain, there were statistically significant negative effects associated with large cohorts among the high school and university graduates. The equation predicts that an increase of one percentage point in the cohort size for university graduates would reduce earnings of graduates by 0.6 per cent and for the high school group, earnings would fall by 0.7 per cent. The effect of cohort size on the earnings of the post secondary group was estimated to be positive. It is difficult to interpret this result in the light of the theory underlying the effect of cohort size on earnings.

The US results also show a positive effect of cohort size on the earnings of the unqualified, the post secondary group and university graduates. Only the coefficient on the unqualified cohort size was significant at the five per cent level and the F test for the

Table 5.3
Weekly Earnings of Full-time Men aged 16-64 including Educational Cohort Size, Australia, Great Britain, the United States, 1981
Dependent Variable = ln Weekly Earnings

	Australia	Great Britain	United States
Intercept (a)	4.3788 (66.17**)	3.7329 (39.35**)	4.5601 (44.73**)
High	0.3224 (3.39**)	0.4038 (2.32*)	0.4826 (3.83**)
Post secondary	0.6583 (9.19**)	0.2022 (1.69)	0.4968 (3.83**)
Graduate	1.1322 (13.95**)	0.8754 (6.26**)	0.9221 (7.79**)
X	0.9347 (14.10**)	0.7485 (12.51**)	0.7758 (3.63**)
Experience	0.0087 (3.41**)	0.0157 (7.98**)	0.0094 (1.06)
Experience ^{2}	-0.0002 (-4.33**)	-0.0003 (-8.44**)	-0.0002 (-1.67)
High*X	-0.1513 (-2.42**)	-0.1367 (1.25)	-0.0479 (-0.48)
Postsec*X	-0.4918 (-10.65**)	-0.1719 (-2.68**)	0.0398 (0.35)
Graduate*X	-0.4025 (-7.22**)	-0.1785 (-1.90)	-0.1765 (-1.69)
Married	0.1247 (13.27**)	0.1741 (12.77**)	0.2133 (10.97**)
Widowed, separated, divorced	0.0604 (4.05**)	0.0890 (3.61**)	0.1094 (4.0**)
Rural	-0.1095 (-11.04**)	-0.0201 (-2.24*)	-0.1108 (-8.48**)
Cohorts			
Unqualified cohort	-0.6193 (-0.33)	-3.4018 (0.96)	9.1214 (2.58**)
High school cohort	-1.1550 (-1.43)	-7.2304 (-3.61**)	-0.6812 (-0.25)
Postsecondary cohort	0.5440 (0.52)	4.0909 (2.20*)	0.8273 (0.42)
Graduate cohort	-5.0205 (-4.84**)	-5.6695 (-3.03**)	0.0128 (0.01)
R^2	0.44	0.40	0.23
F	622.39**	236.84**	137.79**

	Australia	Great Britain	United States
F test for joint significance of cohort variables	7.94**	8.56**	2.06
F test for joint significance of education*experience variables	46.17**	2.94*	2.45
Breusch-Pagan test for heteroskedasticity			
$NR^2 - \chi^2$	1.25	7.95	0

Notes:
t statistics in brackets.Test statistics are marked * for those significant at the five per cent level and ** for those significant at the one per cent level.
X= $1-e^{(-0.2643*experience)}$ in the Australian regression, $1- e^{(-0.3713*experience)}$ in the British regression, and $1- e^{(-0.1177*experience)}$
(a) The constant term measures ln earnings for a single unqualified man of urban residence with no experience.

joint significance of the four cohort variables did not reject the null hypothesis that the coefficients on these variables were zero.

In summary, the results of this section suggest that in the US the size of the age group relative to the male workforce as a whole influenced earnings negatively. This did not hold for Australia and Great Britain but for these two countries, the size of the educational cohort influenced earnings. Most of the coefficients on these educational cohort variables had the expected negative signs so that large cohorts were associated with reduced earnings.

We are unsure, however that we are measuring a true cohort effect in these regressions. As we only have one cross section, and the cohort variables are measured as a smooth moving average, it is difficult to be sure that what we are picking up with these variables is a cohort effect rather than some other aspect of the relationship between earnings and experience. The size and sign of the cohort effect is very sensitive to the choice of functional form. In regressions using the quadratic experience form, cohort size, measured as a moving average of the proportion of the workforce of a given age,

was positive and significant for Australia, Great Britain and the United States. Using the four education cohort variables and a quadratic experience form, the signs on the coefficients also changed.(12)

3. Conclusions

Studies using time series data have found negative cohort effects on earnings in Great Britain and the US. The evidence we have from time series data for Australia do not show a statistically significant negative effect of large cohort size on earnings.

The aim of this chapter was to see whether these results from time series carried through to cross section data and to see whether cohort size can explain differences between the three countries in the shapes of the cross section age earnings profiles. There was some variation between the countries in the distribution of the total male workforce by age and in the distribution of the education cohorts by age so it is possible that differences in the relative size of cohorts may explain some part of the differences between countries in the shape of the age earnings profiles.

There are problems here related to our ability to identify a cohort effect in a cross section which make us reluctant to place too much emphasis on our results. We have estimated regressions including both a general measure of cohort and education cohort variables. Our regression results show some evidence of a negative effect on earnings of the relative size of an age group in the total male workforce in the US. There was no such effect in Australia and Great Britain. For these two countries, the size of the education cohort influenced earnings. Most of the coefficients on these variables had the negative sign predicted by the career phase model but it was only for Australia that the negative effect was largest for university graduates compared with the other education groups. Although the effect of cohort size on earnings is difficult to determine in the cross section, its inclusion does not alter our findings regarding the importance of human capital variables in explaining earnings in the three countries.

Footnotes

1. Murphy, Plant and Welch (1988), for example, present comparisons of experience earnings profiles for American high school graduates and college graduates in 1967 and 1977. The profiles for each group were steeper in the 1977 cross section and the authors explain this in terms of the relative size of young cohorts in these years. In 1977, the large numbers of young workers depressed their earnings relative to older workers and created the steeper cross section profile.

2. Easterlin (1987) takes a broader perspective on the effect of membership to a large cohort on a wide range of behaviours. According to Easterlin, large cohort size is the source of many of the problems in modern society. So, for example he argues "Crime, suicide, and political alienation are more prevalent among young adults from large generations than among those from small. So too are symptoms of psychological stress, such as nervousness and headaches." (p 97).

3. The importance of cohort size has been investigated in other countries. For a general survey of the issue in industrialised countries see Bloom, Freeman and Korenman (1988). For country specific examples see Dooley (1986) who examined the effect of changing cohort size on earnings using Canadian data; Ben-Porath (1988) for a study of the Israeli experience and Martin and Ogawa (1988) for a study of the Japanese experience. The question of the effect of cohort size on earnings has also been of considerable interest in developing countries where an emphasis on increasing the education of the population as a fundamental prerequisite to raising living standards has produced large cohorts of relatively well-educated youth. See for example, Bowman (1987) and Behman and Birdsall (1988).

4. For examples of British studies which examine the effect of large cohort size on the unemployment rate see Ermish (1988b), Hutchinson, Barr and Drobny (1984) and Lynch and Richardson (1982).

5. More formally, cohort size was defined as $c(x) = \Sigma\ \alpha_i\ n_{x+i}$ where n_x is the fraction of those in the group who are in their xth year of work experience. The α weights were

α = 0.33(0.33, 0.66, 1, 0.66, 0.33). Welch estimated annual and weekly earnings equations with the following explanatory variables; cohort size, an interaction term between cohort and an early career spline, experience, experience ^{2}, experience interacted with the early career spline, the unemployment rate, a trend term and two variables to take account of special problems with his data; the exclusion rate due to nonwork and the exclusion rate due to income imputation.

6. Cohort size was defined as the logarithm of a weighted moving average of age group i's relative share in the potential labour force (those aged 16-64).

$CS_{it} = \ln[\Sigma \alpha_k N_{i-k,t} / \Sigma N_{it}]$ where N_i denotes the number of individuals age i in year t, α_k are a set of five weights1/9, 2/9, 3/9, 2/9, 1/9.

See Connelly (1986) for a fuller discussion of the relationship between cohort size and educational attainment.

7. The age categories were 20-24, 25-34, 35-44, 45-54 and 55-59. The cohort variable therefore could only take on five values in each year.

8. As already noted there is British evidence of an effect of cohort size on the unemployment rate of an age group. Ermish (1988b) presents British evidence that large cohorts of young workers experienced higher levels of unemployment as well as changes in their relative earnings.

9. The distinction between learners and workers is presented in the discussion of the career phase model in chapter 2 section 1.5.

10. See Freeman (1976) for US evidence and Pissarides (1981) for British evidence on this point.

11. The cohort variables have been entered as proportions rather than percentages, hence the coefficient of five for the US.

12. For Australia, the four education cohort variables were jointly significant and the cohort variables for the high school and unqualified groups were individually significant with negative signs. For Great Britain, the four education cohort variables were also jointly significant. The high school and unqualified cohort variables had negative signs

and the post secondary and graduate cohort variables, positive signs. Welch predicted that the negative effect of large cohort size should be greater for the more educated and these results therefore do not fit easily with this prediction. The four education cohort variables in the US equation were jointly significant but all had positive signs.

Chapter 6
Industry Effects on the Age Earnings Profiles of Men.

It is a well documented fact that average earnings differ between industries. Industries such as oil refining and chemicals are high paying and others such as clothing and textiles are low paying. These differences persist both across time and between countries. (1) Even after controlling for such things as the education levels of the workforce, apparently similar individuals earn different amounts in different industries.

In this chapter we will consider the effects of industry on earnings. Human capital, shirking and institutional explanations of rising age earnings profiles suggest that industry mix may be important in explaining differences between the countries in the shape of the aggregate age earnings profile. The use of international data presented on a consistent basis, enables some testing of competing explanations of the industry effects.

The chapter is organised as follows. Section 1 presents a brief summary of earlier studies which have included industry variables and presents some of the rationalisations used for the inclusion of industry variables. In section 2 we present our results from further regression analysis to see if the addition of industry variables to the basic model outlined in chapter 4 adds to our ability to explain differences between the three countries in the shape of the age earnings profiles of men. In chapter 3, we presented evidence for the three countries that the distribution of each sample across industries was not the same for each age group. If industry is an important determinant of earnings and the three countries differ in the distribution of the sample by age and industry, then industry differences may be important in explaining differences in the shapes of the age earnings profiles of men. Section 3 reports a decomposition of the regression results into endowment and coefficient effects and considers whether the addition of industry variables adds to our ability to explain the differences in the shapes of the age earnings profiles. Section 4 presents results from splitting the sample in each country into the

more and less unionised industries and tests whether differences between the coefficients for these two groups are statistically significant. Section 5 contains a summary and conclusion.

The industry breakdown we have used here is a very broad one which may disguise considerable variation between the countries in the composition of these industry groups. Our results show that industry of employment is an important determinant of earnings but there was some variation between the countries as to the ranking of industry earnings. This suggests that there may be some general characteristics of industries which exist across all countries but there seem also to be country specific factors which create some variation in the ranking of industries by earnings.

It is a prediction of the human capital, shirking and labour turnover models that there should be a negative relationship between the industry intercept term and the growth of earnings with experience in an industry. Our results show this negative relationship for each country. These results are therefore consistent with interpretations of the industry coefficients in terms of either the human capital, shirking or labour turnover hypotheses.

The introduction of industry variables does not change the conclusions of chapter 4 that there were substantial differences between the US and the other two countries in the predicted earnings of older men relative to 25 year olds and a smaller difference between Australia and Great Britain. The introduction of industry and occupational variables, however somewhat changed the relative importance of the sources of these differences. In the comparison between Australia and the US using the basic equation of chapter 4, about 50 per cent of the difference came, in an accounting sense, from endowment differences and 50 per cent from coefficient differences. The addition of industry and coefficient variables changed this so about 25 per cent of the difference in relative earnings came from endowment differences and 75 per cent from coefficient differences.

The introduction of these additional variables did not however, greatly change the other pairwise comparisons between Australia and Great Britain and Great Britain and the US. Differences in coefficients and endowments of industry and occupation were not important in explaining the differences in relative earnings by age between the countries. Coefficient and endowment differences for the basic human capital variables used in the regressions reported in chapter 4 remained the major sources of differences between the three countries.

In section 5 we investigate another interpretation of the industry effects, that is that they are measuring the effect of the presence of trade unions on earnings. We split the sample into those industries with high and low levels of unionisation in each country and found that there were statistically significant differences in the coefficients between the groups. Our results show that in general, in each country, the more highly unionised industries have flatter earnings profiles than the less unionised industries. This finding is consistent with evidence from other studies which suggests that trade union members have flatter age earnings profiles than nonunion members

1. The Extension of the Model to Include Industry.

1.1 Industry Effects in Earlier Studies

Studies which include industry variables in earnings regressions usually find that they are statistically significant. However there is much less agreement about the underlying nature of the relationship between earnings and industry. Here we shall summarise some of the empirical results for each of the three countries. We have concentrated on studies which compare industry effects at different points in time.

1.1.1 US Studies

Studies using US data have found stability in the industry wage structure over most of this century (2) . However, as it is difficult to compare results across studies because of differences in such things as the level of aggregation of industries and the

choice of sample, we shall concentrate on the results presented by Krueger and Summers (1988) for the period 1974-1984. Krueger and Summers (1988) reported results on the effect of industry at the one, two and three digit level of industry aggregation, on non-agricultural hourly earnings for three years, 1974, 1979 and 1984. The study shows greater dispersion of earnings as the number of differentiated industries increases; that is moving from the one to three digit level.

At both the one and two digit levels of aggregation, Krueger and Summers (1988) found a close correlation between the estimated industry wage differentials in 1974 and 1984, after controlling for a range of factors including education, occupation, regional location, marital status, veteran status, race and union membership. At the one digit level, in both years, the construction, manufacturing, transport and public utilities, and mining industries consistently paid above the average and wholesale and retail trade and other services consistently below the average. In 1984, at the more detailed two digit level, tobacco, petroleum and the public utilities were the highest paying industries and private household and welfare services the lowest paying.

Krueger and Summers (1988) also attempted to allow for differences in fringe benefits between industries. They estimated an equation for 1984 using a measure of total compensation equal to the hourly wage for each worker multiplied by the ratio of total labour costs to wages in the appropriate industry. They found that non-wage compensation reinforced rather than reduced the industry wage differentials. When fringe benefits were taken into account, relatively well paid industries were shown to be even more lucrative and the relatively poorly paid industries even less lucrative.

1.1.2 British Studies

British evidence suggests a similar list of relatively well paid and poorly paid industries. Greenhalgh (1980) estimated hourly earnings equations for husbands for 1971 and 1975 which included education, experience, location, colour, health, occupation and industry. She found that the coal and oil, and finance industries were

relatively high paying industries in each year and agriculture and miscellaneous services were relatively low paying in each year.

Haskel and Martin (1990) present data for industry wages in 20 British industrial production orders for 1948 and 1970. They found a close similarity between the distribution of industry earnings in 1948 and 1970. Coal and petroleum, vehicles and metal manufacture were high paying industries in each year and clothing and textiles were low paying industries. They also estimated cross section earnings regressions for 1979, using as the dependent variable, the average wage of unskilled workers in manufacturing firms. Results were reported for unionised and nonunionised workers using a number of control variables such as net output per head, the extent of part-time work, the proportion of female employment in the firm, the extent of overtime and competition in the product market, and the financial performance of the firm. They concluded that productivity and product and labour market power were the major determinants of earnings and argued that the effect of industry on earnings was mainly related to the technology used by particular industries.

1.1.3 Australian Studies

There is no Australian study which directly compares industry wage effects over time. Hughes (1984) used 1963 earnings data for the average male production worker in 63 manufacturing industries. These data did not allow for any controls over such things as the variations in the average level of education across industries but the fact that the data were limited to production workers should in part act as a control. Hughes (1984) showed that production workers in mineral oils, papermaking, chemicals and iron and steel foundries were relatively well paid and in boxes and cases, brooms and brushes, and dyeworks and cleaning relatively poorly paid.

Chapman and Miller's (1983) study also used grouped data, this time from the 1976 Australian Census, which allowed for some control over the effects of education and experience on earnings. They found that for men, the mining and construction

industries had relatively high initial hourly income but the returns to experience were not greater in these industries than in other industries. Wholesale and retail trade and amusements and hotels had relatively low initial levels of hourly income but an additional year of experience added more to earnings than in most other industries.

Later Australian studies use individual data which allow for greater control over other determinants of earnings, for example education and experience. Chapman and Mulvey (1986) used 1982 data for hourly earnings of full-time men and after controlling for education, experience, marital status, place of birth, place of residence and occupation, found that earnings did differ significantly by industry. Those in mining, chemicals, electricity and construction earned relatively more for a given set of control characteristics and those in community services, entertainment, retailing and agriculture earned relatively less.

Borland and Suen (1989) show similar results for 1986. After controlling for education, experience, state of residence, occupation, country of birth, marital status and a dummy for participation in a superannuation scheme, they found that hourly wages were higher in mining, electricity, gas and water, communications and transport and lower in wholesale and retail trade and community services.(3)

1.1.4 Summary of earlier studies.

Earlier studies show that mining, public utilities (i.e. gas, electricity and water) and transport and communications are usually high paying industries while wholesale and retail trade, agriculture and general services (including such things as household services, restaurants and amusements) are usually low paying industries.

1.2 The Justification for the Inclusion of Industry Variables

In an earlier chapter we have outlined in greater detail, some of the theories used to explain why earnings rise with age. Here we shall summarise the possible interpretations of the industry variables in an earnings equation as suggested by theory. They may be

capturing the extent to which on-the-job training, the costs of shirking or labour turnover vary between industries. They may also reflect d immeasurable differences in labour quality, or the presence of compensating earnings differentials between industries. Industry effects may measure the extent of disequilibrium in the labour market. Alternatively they may measure the effect of unionisation on age earnings profiles.

Industry of employment may affect both the level of earnings for any given set of characteristics (the intercept term) and the change in earnings with age (the slope of the age earnings profile) brought about by a change in working experience. We shall therefore extend the basic model of chapter 4 to include industry intercept terms and an interaction term between industry and experience.

Our measure of experience and therefore industry experience, is a very crude one. The potential experience measure we have used does not allow us to distinguish between the experience gained in a particular industry and the experience gained elsewhere (including the experience gained from being unemployed). The industry age earnings profiles we have estimated assume that the cross section profile we observe are the profiles which would exist for individuals who stayed in the industry throughout their working life. This may not be true for a number of reasons.

There are general problems in using cross section results to derive conclusions about an individual's actual earnings over a lifetime. These have been discussed in chapter 3 but there is an additional complication in the context of industry experience. The current cross section will include people who have not been in the industry all their working lives. They may receive a different return to any experience in other industries and this will change the return to industry experience. So, for example, a man with 15 years experience in the construction industry may be observed in our sample with 16 years of potential experience and working in the transport and communications industry. He will be treated as having 16 years working experience in transport and communications when he has in fact had one. If experience in construction counts for

little in his new industry, then by attributing him with 16 years experience instead of one, we will underestimate the real return to his industry specific experience. Our conclusions would be greatly strengthened by the ability to distinguish between potential experience and actual experience within an industry or within a firm. This is not possible given our data sets. For the purposes of our comparison we need to assume that labour turnover between industries does not differ substantially between countries.(4)

1.2.1 What Are We Measuring with Industry Effects ?

Hypotheses i-iii -Industry effects measure the extent to which on-the-job training, the importance of monitoring workers or the cost of labour turnover vary between industries.

The inclusion of industry variables in an earnings equation can be justified from several theoretical viewpoints. Human capital theory, a shirking or monitoring model or a labour turnover model all predict an upward sloping age earnings profile. (5) These explanations may be the underlying source of the industry effect on earnings if on-the-job training or the costs of monitoring workers or of labour turnover are industry related. Each of these models predict that a low starting wage will be associated with a rapid growth in earnings with experience.

Hypothesis iv- Industry effects measure the differences in labour quality between industries.

One interpretation of the industry coefficients is that they are picking up differences between industries in the unmeasured quality of the workforce. Some of these differences between apparently similar individuals may arise from observable characteristics which happen not to be included in all our data sets, for example the major subject of a university degree. We have included all university graduates, regardless of major subject of study or length of course, in the group " university graduates". If, for example, most doctors worked in the "medical industry" and most general arts graduates worked in education, a regression including industry dummies for these two industries

would attribute all differences in the earnings of apparently similar individuals to the difference in their industry. The basic cause of the difference in their industry is in fact, the difference in their type of degree, unmeasured in all our data sets. Other differences in labour quality may arise because of differences between individuals in characteristics not easily measured such as their level of motivation and their native ability. Individuals with particular characteristics, unmeasured in our data sets, might be concentrated in certain industries where they are paid more than apparently similar individuals in other industries.

Krueger and Summers (1988) tested this hypothesis by tracking the earnings of men who changed industries over time and found that the earnings of these individuals varied according to their industry of employment. (6) We do not have comparable longitudinal data for the three countries to undertake such a test. If the industry variables are just picking up differences between industries in the types of education received by workers, we would expect the coefficients on the industry terms to become insignificant for the unqualified where education differences could be expected to be less important. If labour quality differences are systematically related to the technology of an industry, we would expect to observe a close correlation between countries in the ranking of industry coefficients.

Hypothesis v- Industry effects measure compensating differentials for working in certain industries.

Labour quality differences between industries may in part reflect compensating differentials in earnings arising from differences in working conditions across industries. The industry effect on earnings may just be a measure of the relative costs or benefits in terms of the conditions of employment, of working in a particular industry. Examples of these include security of employment and the health and safety aspects of the work. (7) If compensating differentials are important in explaining the earnings differential between

industries, we would once again, expect a close correlation between countries in the ranking of industry coefficients.

Hypothesis vi- Industry effects measure disequilibrium between supply and demand in the labour market.

Another possible explanation for the effect of industry variables on earnings is that they are a measure of the disequilibrium between supply and demand in the labour market. If this were so, it would be surprising to find a close correlation between countries in the ranking of industry earnings. A close correlation would suggest a common pattern of shortages of labour bidding up wages in one group of industries and surpluses of labour bidding down wages in other industries in Australia, Great Britain and the US at the same time.

Hypothesis vii- Industry effects measure the differing importance of trade unions between industries.

Empirical evidence for Australia and the US shows that union members tend to have flatter age earnings profiles than non-union members. As union members are concentrated in particular industries, these differences may be picked up by the industry variables and produce differences in age earnings profiles by industry. We propose testing for any statistically significant differences between the more and less unionised industries in the last section of this chapter.(8)

Hypothesis viii- Industry effects measure the influence of company or plant size on earnings.

Company and plant size have also been shown to affect wages. (9) Brown and Medoff (1989) suggested a number of reasons why employer size should affect earnings but concluded that none of them fully explain the extent of the earnings differential by size of employer. As Dickens and Katz (1987) noted

"The proportion of workers in an industry in large plants and the average establishment size have typically been found to be positively related to industry wage levels even in the presence of detailed control variables" (p 65)

If the industry effect on earnings is really measuring the effect of company or plant size on earnings then the correlation of industry effects across countries would depend on the correlation of plant size across countries. Our knowledge of these correlations is limited but available studies suggest a high positive correlation for the manufacturing sector.(10)

Hypothesis ix- Industry effects measure the influence of occupation on earnings.

One final possible explanation of the significance of industry in determining earnings is that the industry coefficients are in fact reflecting the occupational mix of an industry. Some industries have a larger proportion of say, managers and professional workers than other industries and it is possible that the industry coefficients are merely picking up these differences. If this were important, once occupation is taken into account, the effect of industry on earnings should be reduced. We shall test for this by including occupation in the regressions.

1.2.2 Summary of predictions.

We have outlined some alternative explanations of the importance of industry variables in explaining earnings and shall now summarise some of the predictions. All of the above hypotheses could be described as compensating differentials; some compensate for unmeasured differentials in the characteristics of the employees, and others for unmeasured differentials in the characteristics of the jobs.They each offer some predictions which we can test across the three countries.

The presence of low starting wages and a high growth in earnings for some industries would be consistent with either the human capital model, the shirking model or the labour turnover model. High starting earnings and a high growth of earnings with experience cannot easily be explained by these models. If the problems of shirking and

labour turnover vary in importance depending on the nature of the industry, we would expect to see the same industries having more steeply sloping age earnings profiles in each country. If the industry variables are picking up union effects, we would expect to see high intercepts and low growth in the more unionised industries. We shall examine this prediction further in section 4.

A close correlation between the countries in the ranking of industries by their industry intercept terms would be consistent with the labour quality, compensating differentials and/or company size explanations of industry differentials. It would not seem to support the hypothesis that industry effects measured disequilibrium in the labour market unless one wished to argue that the labour markets in these three countries faced the same problems of excess supply and demand in different industries at the same time. If the industry coefficients are just picking up differences between industries in unmeasured labour quality, such as the educational mix within education categories, regressions restricted to the unqualified should show no effect of industry on earnings.

These tests will not enable us to differentiate between the competing hypotheses concerning the underlying cause of the association between industry and earnings. Many of these theories produce the same predictions and it is difficult to distinguish between them for this reason.

3. Empirical Estimation of Industry Effects.

Table 6.1 presents the results from our estimation extended to include an industry intercept term, an interaction term between industry and experience and occupational dummies. (11) In comparison with Table 4.3 in chapter 4, the results for the basic model using the preferred functional form for experience, the inclusion of industry variables raised the explanatory power of the equation for each of the countries. The broad conclusions of the earlier results still hold.

The industry we chose to omit from these regressions was construction where average weekly earnings were roughly similar to the average for the whole sample in each country. The industry intercept dummies therefore measure the extent to which earnings of each industry differ from those in construction. Similarly, the coefficients on the industry by experience interaction terms measure the extent to which the returns to experience differ across industries.

The occupational category left out is other non-manual workers (such as clerks, and bookkeepers). As might be expected, managers and professional workers earned more than those in other non-manual occupations in each country and manual workers (skilled, semi-skilled and unskilled) and farm workers earned less.(12)

Industry of employment was a significant determinant of earnings. The F tests for the joint significance of the industry intercept terms and for the joint significance of the industry by experience interaction terms in each country rejected the null hypothesis of zero coefficients. In the Australian regression, agriculture; metal goods, engineering and vehicles; other manufacturing; distribution; and banking and business services all had significantly lower initial earnings than the construction industry. While banking and business services had an initially lower level of earnings than construction in Great Britain, employment in energy and water; transport and communications; and other services had a positive effect on earnings compared with construction. In the US, three industries, energy and water; manufacture of basic metals and chemicals; and metal goods, engineering and vehicles had intercept terms which were individually statistically significantly different from construction.

Banking and business services was the only Australian industry to have a statistically significant difference in its experience earnings profile compared with the construction industry. For Britain, additional experience added significantly more to earnings in the banking and business service industry and less in other services than in

Table 6.1

Weekly Earnings of Full-time Men aged 16-64 including Industry Variables, Australia, Great Britain, the United States, 1981.

Dependent Variable = ln Weekly Earnings

	Australia	Great Britain	United States
Intercept (a)	4.5986 (98.67**)	3.6948 (58.41**)	4.6983 (46.29**)
High	0.2335 (6.83**)	-0.0012 (-0.02)	0.3620 (4.86**)
Post secondary	0.6851 (17.1**)	0.2839 (4.8**)	0.3682 (4.38**)
Graduate	0.8057 (15.94**)	0.4657 (5.38**)	0.6901 (8.66**)
X	0.8703 (15.51**)	0.8310 (11.52**)	1.0111 (6.3**)
Experience	0.0071 (4.97**)	0.0118 (6.84**)	0.0076 (1.36)
Experience ^{2}	-0.0002 (-5.76**)	-0.0002 (-7.65**)	-0.0002 (-1.91)
High*X	- 0.1451 (-3.86**)	0.1014 (1.74)	-0.2088 (-2.45**)
Postsec*X	-0.5397 (-12.61**)	-0.1694 (-2.74**)	-0.1018 (-1.03)
Graduate*X	-0.4197 (-7.69**)	-0.0988 (-1.06)	-0.2457 (-2.63**)
Married	0.0908 (10.48**)	0.1334 (10.60**)	0.1775 (9.46**)
Widowed, separated, divorced	0.0489 (3.56**)	0.0578 (2.55**)	0.0979 (3.73**)
Rural	-0.0563 (-5.69**)	-0.0231 (-2.78**)	-0.0961 (-7.61**)
Industries			
Agriculture	-0.1386 (-1.96**)	0.2549 (1.74)	0.1445 (0.78)
Energy and water	0.0210 (0.31)	0.4345 (3.19**)	0.4647 (2.65**)
Manu. of metals, chemicals	0.0691 (1.24)	0.064 (0.47)	0.3353 (2.79**)
Metal goods, eng. and vehicles	-0.0997 (-2.18**)	0.0537 (0.72)	0.2638 (2.77**)

	Australia	Great Britain	United States
Other manufacturing	-0.1026 (-2.18**)	0.0279 (0.34)	0.0581 (0.59)
Distribution	-0.1028 (-2.50**)	-0.0915 (-1.26)	-0.0343 (-0.38)
Trans and Communications	0.0041 (0.07)	0.2660 (2.28**)	0.1625 (1.35)
Banking and bus services	-0.1838 (-3.56**)	-0.2034 (-2.06**)	0.1266 (1.20)
Other services	-0.0393 (-0.78)	0.2102 (2.39**)	-0.0523 (-0.55)
Industry*experience			
Agriculture*X	0.0204 (0.27)	-0.2818 (-1.93)	-0.7992 (-3.47**)
Energy and water* X	0.0914 (1.22)	-0.2341 (-1.64)	-0.3643 (-1.77)
Manu. of metals, chem*X	0.0054 (0.09)	-0.0224 (-0.16)	-0.1983 (-1.39)
Metal goods, eng. and veh*X	0.0467 (0.90)	-0.0387 (-0.48)	-0.2079 (-1.81)
Other manu*X	0.0793 (1.49)	-0.0132 (-0.15)	-0.1331 (-1.11)
Distribution*X	0.0134 (0.28)	-0.0734 (-0.93)	-0.1616 (-1.46)
Trans and Comm*X	0.0057 (0.09)	-0.1897 (-1.56)	-0.0231 (-0.16)
Banking and bus serv*X	0.1993 (3.43**)	0.2870 (2.71**)	-0.2778 (-2.15*)
Other services*X	0.0167 (0.3)	-0.1853 (-1.99*)	-0.1200 (-1.05**)
Occupations			
Managers	0.2579 (21.19**)	0.2444 (16.51**)	0.1406 (6.51**)
Professionals	0.0839 (7.14**)	0.2346 (10.65**)	0.0889 (4.18**)
Semi and Unskilled Workers	-0.1897 (-22.36**)	-0.1318 (-9.29**)	-0.1337 (-7.12**)
Skilled Workers	-0.1437 (-15.78**)	-0.0147 (-1.19)	-0.0332 (1.68)

	Australia	Great Britain	United States
Farm Workers	-0.2572 (-10.28**)	-0.2632 (-3.66**)	-0.1540 (2.91**)
R^2	0.52	0.49	0.30
F	393.09	157.85	87.94
Breusch-Pagan test for heteroskedasticity			
$NR^2 - \chi^2$	0.0	5.11	5.83
F test for joint significance of education*experience terms	70.76**	6.22**	3.06*
F test for joint significance of industry*experience terms	2.20**	3.29**	2.0*
F test for joint significance of industry terms	3.80**	4.87**	4.49**
F test for joint significance of occupation terms	336.66**	135.81**	36.95**
N	12,533	5,681	7,288
Mean of Dep. Var.	5.513	4.7542	5.8853

Notes:
t statistics in brackets. Significant test statistics at the 5 per cent level are indicated by a * and those significant at the 1 per cent level by **.

$X=(1- (e^{(-0.2643*experience)})$ in the Australian regression, $(1- e^{(-0.3713*experience)})$ in the British regression, and $(1- e^{(-0.1177*experience)})$ in the US regression.

(a) The intercept measures ln earnings for an unqualified, urban, never married, other nonmanual worker in the construction industry.

construction. Additional experience added significantly less to earnings in the American agriculture and banking and business service industries than it did in construction.

Table 6.2 shows the effect of an additional year of experience in construction and banking and business services for each of the countries as examples as of the industry experience effects. We shall begin by considering the results for construction. Additional experience initially had larger effects on earnings in the Australia and Great Britain than in the US but after 5 years in the workforce, further experience added more in percentage terms to earnings than in the other countries. The negative effect of idustry experience on earnings in all countries began between 25 and 30 years of experience. In banking and business services there was a very large initial increase in earnings especially in Great Britain, but after five years in the workforce, the addition to earnings with experience was lower in Great Britain than in Australia. Earnings grew more slowly in the US with experience in this industry than in the other countries but continued to grow for longer.

In the preceding section we outlined some tests of the underlying explanation for the effect of industry on earnings which made use of the international comparisons we have presented here. Firstly, we would expect according to various hypotheses, that low industry intercept terms be associated with a rapid growth in earnings with experience. Secondly, that there should be a positive correlation between the countries for the industry intercept terms. We shall now present our results for these tests.(13)

A simple human capital, shirking or labour turnover model predicts that a low starting wage will be associated with high growth in earnings with experience. In order to test for this association, we have plotted the relative intercept terms against the relative industry by experience terms in each country in figures 6.1, 6.2 and 6.3.(14) There is some evidence in these figures of a negative relationship between the industry intercept terms and industry by experience terms in each country. Those industries with low intercept terms tended to have relatively high industry by experience interaction terms.

Figure 6.1: Industry Intercept Terms and Industry by Experience Terms Relative to the Average, Australia, 1981.

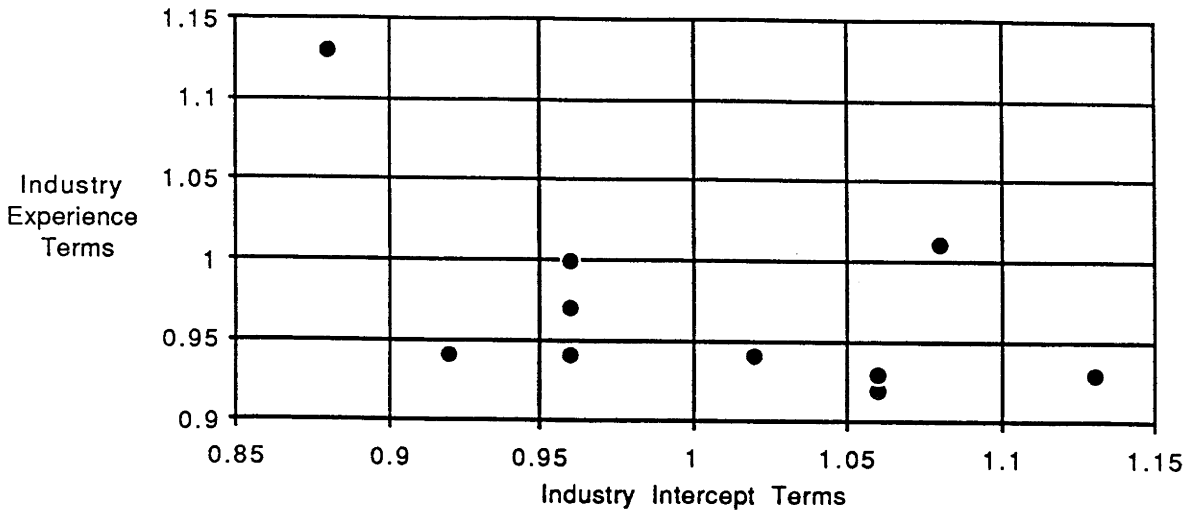


Figure 6.2: Industry Intercept Terms and Industry by Experience Terms Relative to the Average, Great Britain, 1981.

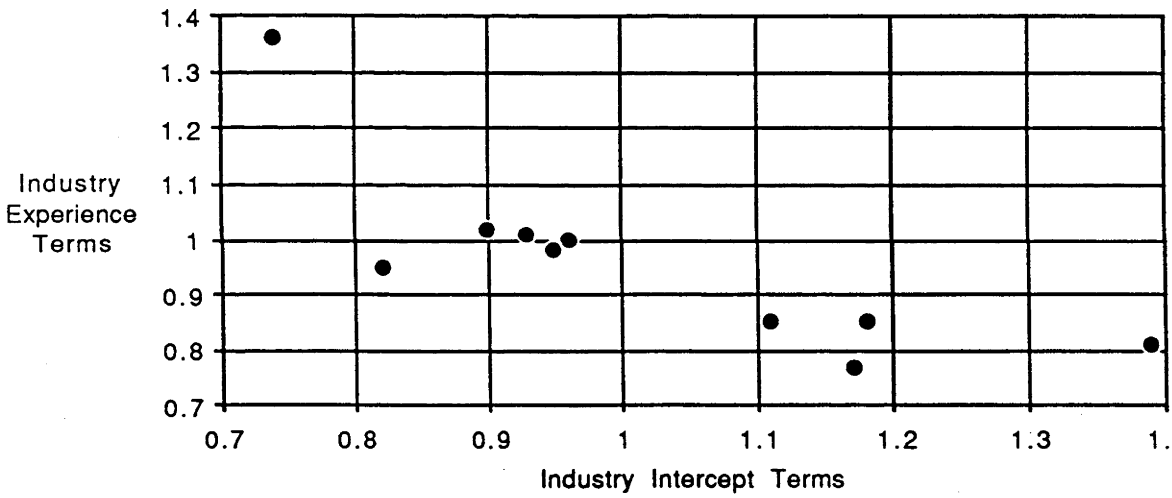


Figure 6.3: Industry Intercept Terms and Industry by Experience Terms Relative to the Average, United States, 1981.

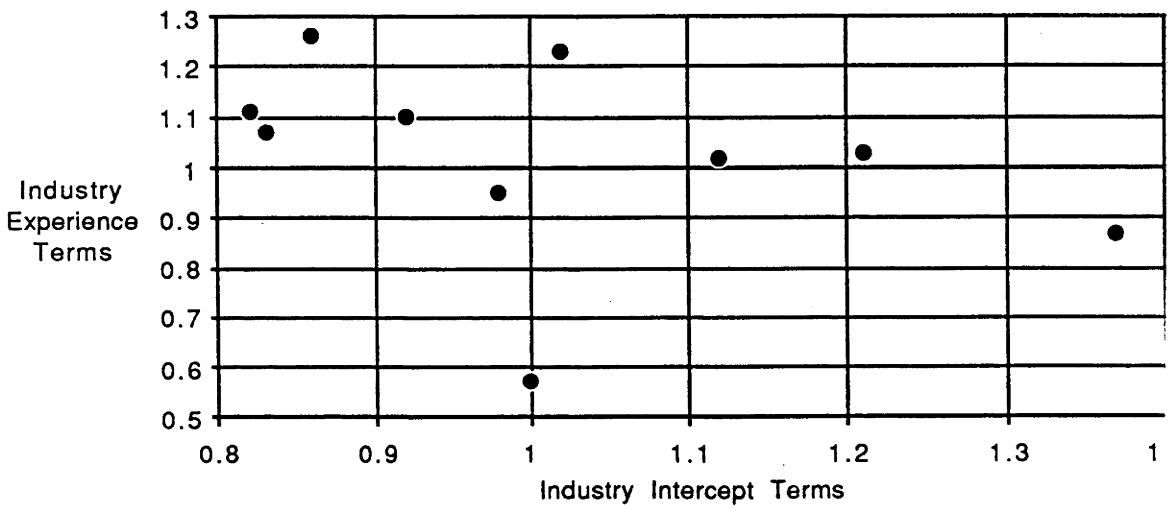


Table 6.2
Percentage Growth in Earnings with an Additional Year of Industry Experience for an Unqualified Man, Australia, Great Britain and the United States, 1981.

	Australia	Great Britain	United States
An additional year of experience starting from the following years of experience -			
Construction industry			
1	16.17	18.90	10.68
5	5.88	4.98	6.77
10	1.72	1.39	3.80
20	0.08	0.38	1.18
30	-0.50	-0.04	-0.13
45	-1.11	-0.60	-1.00
Banking and Business Services			
1	19.72	25.04	7.94
5	7.12	6.38	5.06
10	2.0	1.61	2.85
20	0.01	0.38	0.71
30	-0.50	-0.04	-0.22
45	-1.11	-0.64	-1.02

Source : Table 6.1.

This finding is consistent with either the human capital, shirking or labour turnover explanations of the industry effect on earnings. However, given the large standard errors on some of the coefficients, these results should be treated with caution.

If labour quality or compensating differentials were the underlying sources of the industry differentials, we would expect these factors to be important regardless of the experience level; that is we would expect to see a high positive correlation between countries in the industry intercept coefficients. This is the second hypothesis we wish to test. In chapter 3 evidence was presented of a fairly close correlation between the three countries of average earnings by industry and of the earnings of those just starting work. These correlations did not control for other factors such as the education and experience of the workforce in each industry. Regression analysis enables us to do this and to compare the industry effects once other factors have been controlled for. Table 6.3 presents the simple correlation coefficient, r, between the industry intercept terms relative

to the average in each country. It shows that there was some evidence of a positive correlation, so relatively high paying industries in one country tended to be high paying in another. There was, however, nothing like a perfect correlation. In terms of our initial hypothesis that if the underlying cause of industry differentials was compensating differentials, labour quality differences or company size differences, we would expect a close correlation in industry intercept terms between the countries, these results suggest the following tentative conclusion. While one or all of these factors may account for some part of the earnings differentials between industries, they do not appear to explain all of these differentials. Given these results, it seems unlikely that temporary shifts in the supply and demand for labour are the underlying explanation of the industry effect.

We have argued that one possible implication of the labour quality explanation of industry effects is that these effects should be less apparent for the unqualified than for the more qualified. We therefore ran two separate regressions for the unqualified and graduate groups. The F tests for the joint significance of the industry intercept terms and industry by experience interaction terms for the unqualified and graduate groups in each country are presented in Table 6.4. They show for the unqualified, that the level of earnings differed significantly between industries in Australia and Great Britain but not in the US. Among the graduates, the level of earnings differed significantly between industries in Australia and the US. There was, however, no evidence of significant differences in experience earnings profiles between industries for the unqualified in

Table 6.3
Simple Correlation Coefficients between Industry Intercept Terms in Australia, Great Britain and the United States, 1981.

	Australia	Great Britain	United States
Australia	1	0.45	0.42
Great Britain		1	0.54
US			1

Table 6.4
The Significance of Industry for the Unqualified and Graduate Groups, Australia, Great Britain and the United States, 1981

	Australia	Great Britain	United States
The Unqualified			
F test for joint significance of industry intercept terms	2.27*	3.12**	1.55
F test for joint significance of industry* experience terms	1.62	2.19*	1.52
Graduates			
F test for joint significance of industry intercept terms	3.77**	0.96	2.62**
F test for joint significance of industry* experience terms	1.97*	0.86	0.91

Notes: The regressions included experience (X, experience, experience ^{2}), marital status, location, industry and industry*X.

Australia and the US and for the graduates in Great Britain and the US. In summary, the results are difficult to generalise.

Summary

In conclusion, many earlier studies show that industry is an important determinant of earnings. Our results support this conclusion for three countries. Even after adding broad occupational categories to the regressions, industry remained important. It influenced both the starting wage of apparently similar individuals and also the rate at which earnings change with experience.

A number of theories have been put forward to explain the effect of industry on earnings. We have attempted here to show whether the results of our three country comparison support these explanations of the industry effect on age earnings profiles. There does seem to be a negative correlation between industry starting wages and the growth of earnings with experience. This is consistent with a human capital, shirking or labour turnover explanation of industry differentials. There was also a positive

correlation between the industry intercept terms across the countries. This is consistent with a labour quality, compensating differentials or employer size explanation of industry differentials. As already stated, we are unable to distinguish the source of these industry wage differentials. Whatever the underlying cause, it seems to persist across countries but there was also evidence of country specific effects of industry on earnings.

4. The Decomposition of Earnings

In chapter 4, we used the results from regression equations using the basic model to decompose the differences between the countries in the relative earnings of men of different ages. We broke down the gap between the relative earnings of men of a particular age into that part which could be explained by endowment differences, that part which could be explained by coefficient differences and the residual difference which was unexplained by the regressions. In this section, we consider whether the addition of industry and occupational variables changes our ability to explain differences between the countries in the average earnings at particular ages relative to the average earnings of 25 year olds. The results, based on the regressions reported in Table 6.1, are presented in figures 6.4, 6.5 and 6.6 and in Appendix F.

Predicted earnings varied much more by age in the US than in the other two countries.While older men in the US earned up to 50 per cent more than 25 year olds, the differences were much smaller for both Australia and Great Britain, reaching a maximum of about 20 per cent. As in the earlier decomposition, we shall make three pairwise comparisons of the decomposition in the relative earnings gap; Australia/United States, Australia/Great Britain, Great Britain/ United States.

Figure 6.4 presents the decomposition of the relative earnings gap between Australia and the US. The relative earnings of men under 25 compared with 25 year olds did not differ much between the countries. However, as age increased after 25, so did the gap in relative predicted earnings between the countries, at least into the mid 50s.

Figure 6.4: The Decomposition of Relative Earnings of Men, Australia and the United States, 1981.
Earnings of a 25 year old=1.

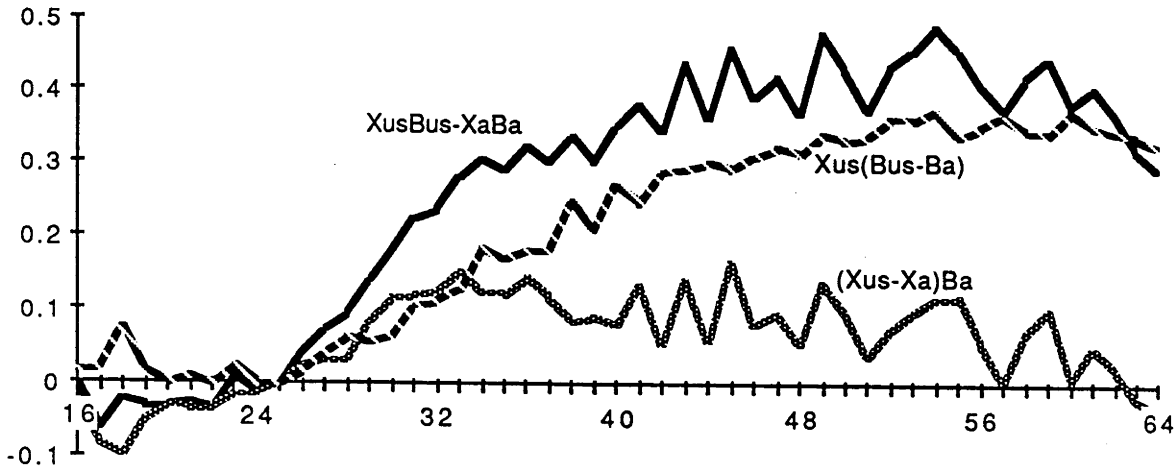


Figure 6.5: The Decomposition of Relative Earnings of Men, Australia and Great Britain, 1981.
Earnings of a 25 year old=1.

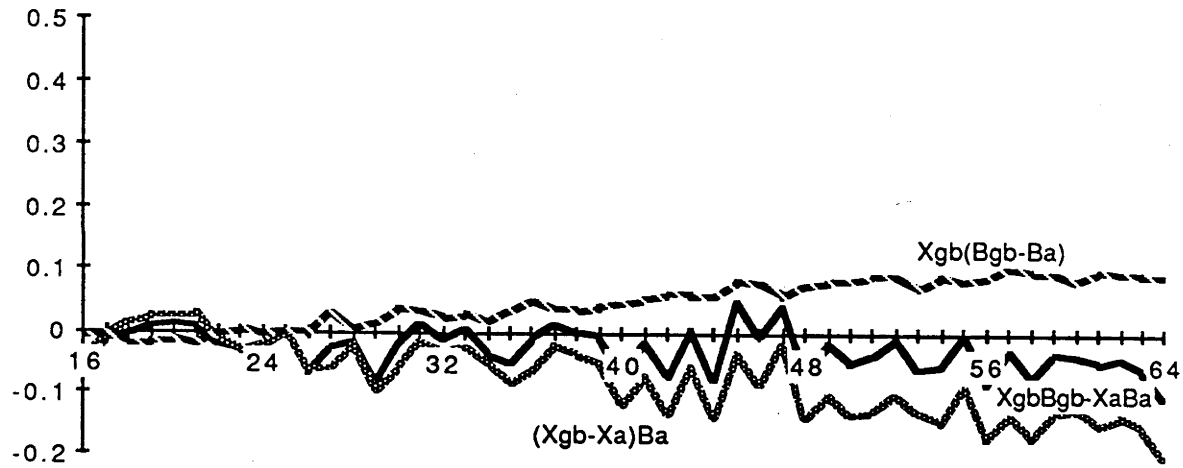
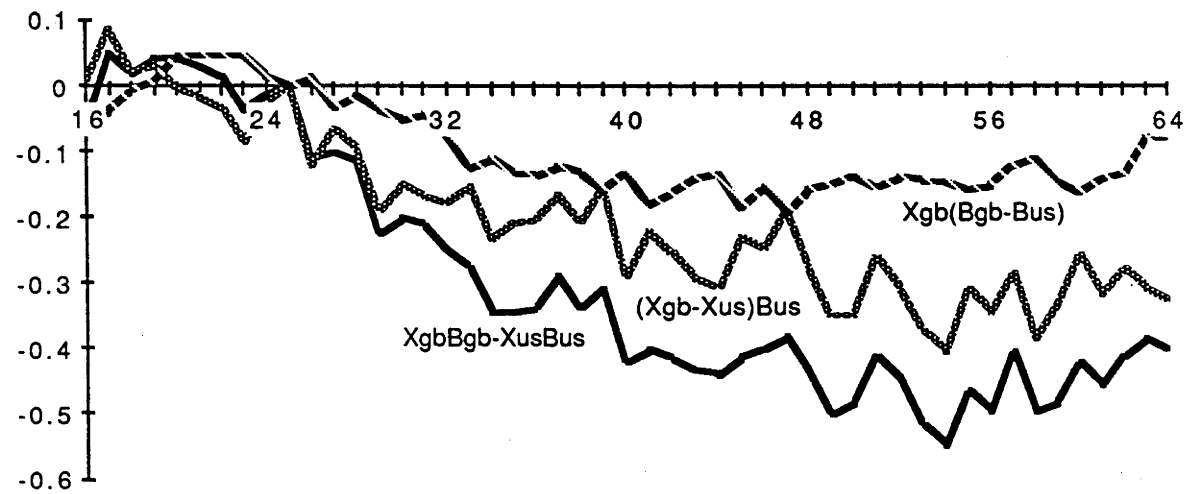


Figure 6.6: The Decomposition of Relative Earnings of Men, Great Britain and the United States, 1981.



American men over 40 earned between 30 and 40 per cent more than Australian men of these ages relative to a 25 year old. The inclusion of industry variables changed the relative importance of endowment and coefficient effects compared with the decomposition reported in chapter 4 using regression equations without industry variables. In the earlier comparison, about half of the higher relative earnings of American men was attributed to endowments and half to the greater rewards (that is the coefficients) for these endowments in the US. The results reported in figure 6.4 show that coefficient differences were the major source of the higher relative earnings in the US than in Australia. Differences in the rewards for a given set of human capital endowments accounted for about three quarters of the difference in relative predicted earnings, while endowment differences accounted for a quarter.(15)

Figure 6.5 presents the decomposition of the difference in relative earnings between Australia and Great Britain. The results are similar to those reported for the earlier decomposition in chapter 4. They show much smaller differences between the two countries than between either of these countries and the US. The maximum total difference in earnings at any age compared with 25 year olds was about 10 per cent. The rewards to a given set of human capital endowments (the coefficient effect) were higher in Great Britain than in Australia but this effect was offset by the smaller stock of human capital held by British men compared with Australian men at most ages.

Earnings varied with age much more in the US than in Great Britain. Predicted earnings were up to 50 per cent higher in the US relative to a 25 year old than in Great Britain. As in the earlier decomposition reported in chapter 4, the relatively larger stock of human capital endowments accounted for a significant part of the differences in relative earnings. At most ages endowment differences accounted for about half of the total gap between the relative earnings of men in the US and in Great Britain.

Summary

In summary, differences in industry endowments and rewards were not a major source of differences between the countries in the shapes of the age earnings profiles. The inclusion of industry and occupation in the regressions did not greatly change the results of our decompositions of the differences in the predicted earnings of men relative to the predicted earnings of 25 year olds for two of our comparisons; Australia/Great Britain and Great Britain/ the United States. However, the addition of industry and occupation changed the result about the relative importance of endowments and coefficients in explaining the differences between Australia and the US in relative earnings at particular ages. Coefficient differences were a more important source of differences between the countries than in the earlier decomposition using the basic model. At most ages it was not differences in the coefficients on the industry and occupation terms which were important in explaining the gap between the countries. Rather it was differences in the rewards to the basic human capital endowments which were the chief source of the differences, at least in an accounting sense. The largest changes in the coefficients between Table 4.3 (the basic model) and Table 6.1 (including industry) were on the education by experience terms.

5. The Effect of Trade Unions on Age Earnings Profiles

Evidence from other studies shows that members of trade unions tend to have flatter age earnings profiles than non members.(16) A number of theories such as the median voter and the exit voice models, have been used to explain this and they are outlined in Chapter 2. In this section we shall present the evidence of our test of the proposition that the industry differences may reflect the effect of trade union strength and that trade unions are associated with flatter age earnings profiles. We shall look at the results within each country to see whether more unionised industries tend to have flatter profiles.

Ideally we would like to have data on union membership for the individuals in our sample. These however, were not available. Instead we have used published data on the proportion of the men working in an industry who were union members to rank the industries according to the level of unionisation.(17) We have presented these data in chapter 3 and discussed the problems involved in comparing these figures between the countries. An additional complication arises here in that the classifications used for the union data do not fit easily into the industry classification used in this chapter. As we are only interested in broad distinctions between the highly unionised and the relatively ununionised industries, an exact match of the classifications is not necessary. In each country, the same industries fell into each category even though the levels of unionisation differed greatly between the countries. Table 6.5 presents our classification of industries according to the level of unionisation.(18)

In the regression results we have presented so far, we have constrained the effects of education, marital status, location and occupation to be the same across the whole sample. Our first question here is therefore to ask whether the coefficients on these variables in fact vary according to industry. We could test this for each industry taken separately, but for the purposes of our analysis we are interested in the specific question, do the coefficients differ for the highly unionised group compared with the rest and do they differ for the less unionised group compared with the rest. The results of these tests are presented in Table 6.6.

We have presented four test statistics for each country. The first two tests take the two and then three most unionised industries as the subsample and test the null hypothesis that their coefficients are significantly different from those in the rest of the sample. The third and fourth test statistic related to the two and three least unionised industries. The results show that in each case, the coefficients as a group were statistically significantly different from those estimated for the rest of the sample. It is

worthwhile investigating further whether the more unionised industries have different age earnings profiles from other industries.

We estimated equations for the three groups of industries defined in Table 6.5, high, medium and low, using the same explanatory variables as in Table 6.1 without the industry terms. The results are presented in Appendix F and in the appendix we also report the estimated percentage increase in earnings with an additional year of experience from these equations for each of the three groups of industries in each country. The general conclusion of these tables is that for all except the university graduates in the US, the percentage increase in earnings with an additional year of experience was at least as high in the industries where the level of unionisation was either medium or low as in the highly unionised industries and it was usually higher in the less unionised industries. Experience earnings profiles tended to be steeper in the less unionised industries than in the more unionised industries.

The results are consistent with the hypothesis that the effect of industry on earnings is at least partly a measure of the effect of trade unionism on earnings. A comparison of the predicted earnings of the unqualified and university graduates in more and less unionised industries does however add support to the union-based interpretation of this result. These are presented in figures 6.7, 6.8 and 6.9. In each country, the predicted earnings of the unqualified in the highly unionised group ("high"in the figures), lay above those in the less unionised industries ("low" in the figures). The smallest initial gap between the two industry groups was for the unqualified in Australia.

The results are less clear cut for university graduates. In Australia, the earnings profile of graduates in the highly unionised industries lay above that of the less unionised group. In Great Britain, although earnings started at a higher level for graduates in the

Table 6.5
Level of Unionisation by Industry, Australia, Great Britain and the United States

Level of Unionisation		
High	Medium	Low
Transport and Communications	Manufacture of basic metals and chemicals	Agriculture
Energy and water	Metal goods and engineering	Distribution
Other services	Other manufacturing	Banking and business services
	Construction	

Table 6.6
Testing for Structural Breaks for the Industries with High and Low Levels of Unionisation, Australia, Great Britain and the United States, 1981.

	Australia	Great Britain	United States
F test Ho: that the coefficients are the same for the subsample as for the rest of the sample			
Sub sample			
Relatively High Levels of Unionisation			
Transport + communications, energy and water.	9.30**	11.49**	7.66**
Transport + communications, energy and water and other services	9.19**	10.37**	7.36**
Relatively Low Levels of Unionisation			
Agriculture and distribution	16.54**	18.70**	10.99**
Agriculture, distribution and banking and business services	14.06**	11.35**	13.46**

Notes: The regression equation used Ln weekly earnings as the dependent variable and four education dummies,experience, experience ^{2},X, education*X, marital status, location and five occupational dummies (it was necessary to combine farm workers with semi and unskilled workers as farm workers are not found in all industries).

Figure 6.7: Predicted Earnings for Australian Men in Industries with High and Low Levels of Unionisation.

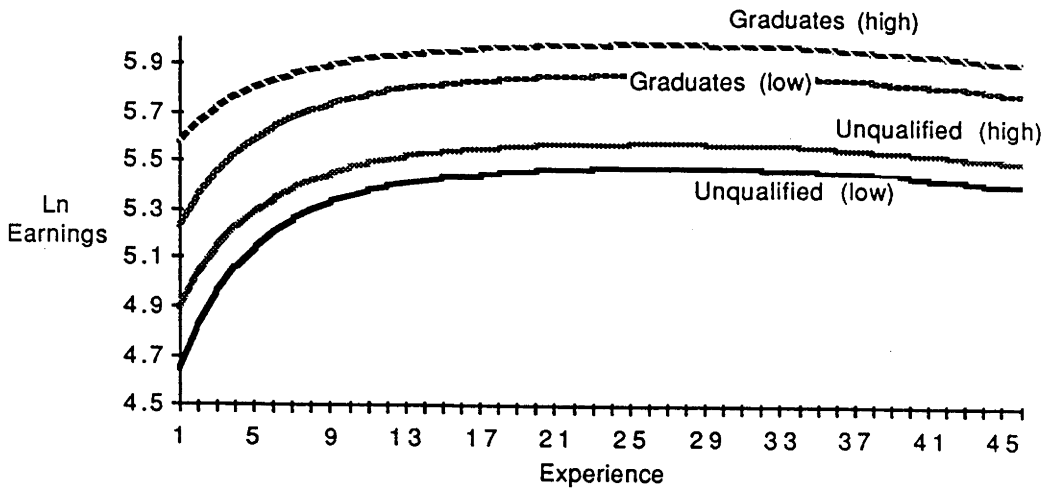


Figure 6.8: Predicted Earnings of British Men in Industries with High and Low Levels of Unionisation.

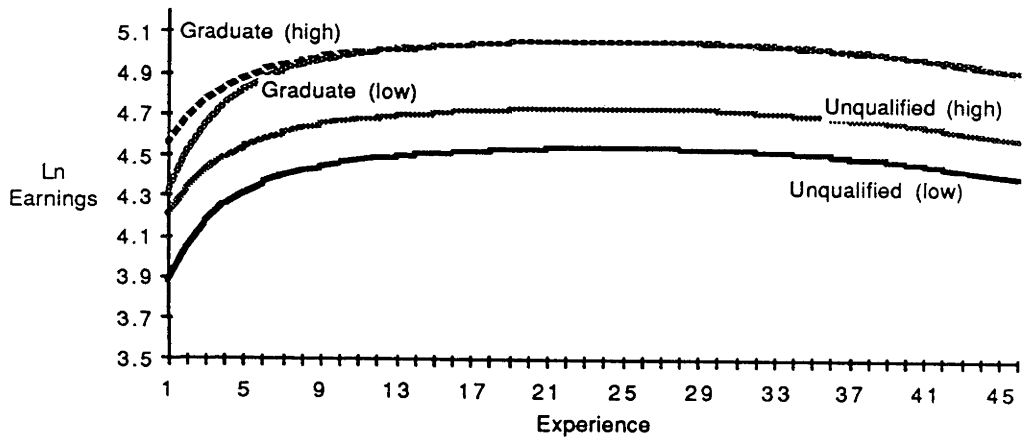
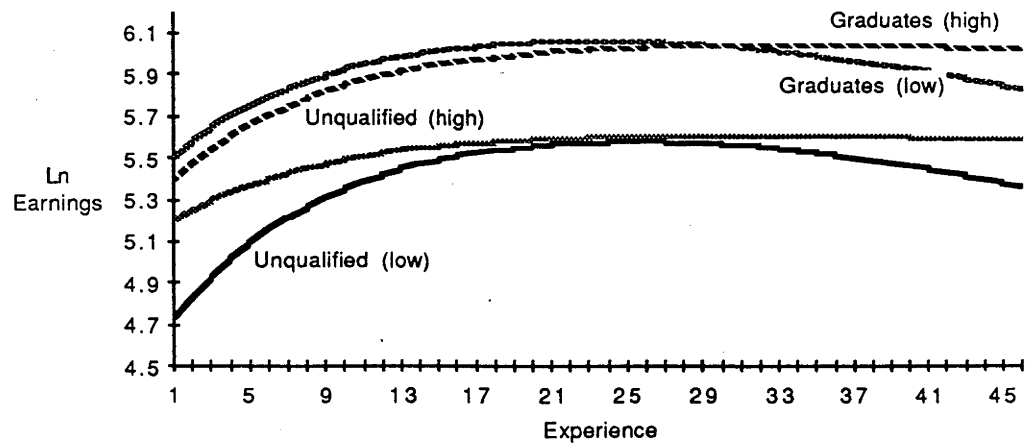


Figure 6.9: Predicted Earnings for American Men in Industries with High and Low Levels of Unionisation.



more unionised sector, this difference did not remain. After 10 years of labour market experience, the profiles were the same. In the US earnings of those graduates in the less unionised industries were above those in the highly unionised industries until about 30 years of labour market experience, after which the predicted earnings profile of graduates in the more unionised industries lay above that of the less unionised industries.

Summary

The results of this section are consistent with the hypothesis that trade unions cause the age earnings profile to be flatter. In the industries where the level of unionisation was relatively high in each country, there tended to be smaller increases in earnings with additional experience for most education groups.

A number of studies find that trade union members receive a premium over non union members who are similar in other respects. The predicted earnings for the unqualified in the more unionised industries lay above those of the unqualified in the less unionised industries for each sample. The difference in the level of these profiles was smallest for Australia, a result consistent with the hypothesis that a centralised wage setting system where most workers are covered by awards, should be expected to produce a smaller difference between the highly unionised and less unionised sectors than a more free market system. The fact that the differences were less pronounced for university graduates might be explained by the fact that white collar workers are less unionised than the rest of the workforce.(19) The results we have presented compare industries within countries where the level of unionisation differed markedly in the early 1980's. In Australia and Great Britain, a much larger part of the workforce was influenced by union activities than in the US. In Australia, 53 per cent of the male workforce were union members. In Great Britain about 70 per cent of the male workforce was covered by a collective agreement but in the US, union members only accounted for 28 per cent of the male workforce. It is perhaps for this reason that any

effects of trade unions on the industry wage structure appear less pervasive in the US than in Australia and Great Britain.

5. Conclusions

In this chapter we have confirmed results of many other studies that industry of employment is an important determinant of earnings. In each country there appeared to be a negative relationship between the industry intercept term and the growth of earnings with experience. The industry intercept terms were also positively correlated across the countries. These conclusions are consistent with a number of hypotheses concerning the underlying cause of the industry differences. Whatever it is, it appears to be operating in each of the three countries. Different institutional settings have produced broadly similar, but not identical, results in terms of the effect of industry on earnings.

While the results of the decomposition of the relative earnings gap between Australia and Great Britain and between Great Britain and the United States did not change substantially, the inclusion of industry and occupational variables somewhat changed the results of the Australia/ United States comparison. In comparing Australia and Great Britain, the positive effect of higher rewards for a given set of human capital endowments in Great Britain was offset by relatively lower stocks of human capital endowments at most ages compared with Australia. There is little evidence of systematic differences in the shapes of the age earnings profiles of Australia and Great Britain. The earnings of British men did not rise as much with age as for American men because of the relatively lower levels of human capital endowments among older Britaish men. The results presented here comparing Australia and the US show that coefficient differences were a more important source of differences in relative earnings by age between the two countries than the results of chapter 4 indicated. However, it was not differences in the rewards to industry and occupational endowments which were important in explaining, the gap in relative earnings but the rewards to the endowments included in the basic equation.

In the final section, we considered the hypothesis that the effect of industry on earnings is in part the effect of trade unionism on earnings. We tested for each country whether more unionised industries had different experience earnings profiles than the less unionised industries. In general, we found for most education groups, that the predicted age earnings profiles were flatter in the highly unionised compared with the less unionised industries. The industry variables in the regressions covering the whole sample may be picking up a union effect on earnings rather than the effect of investment in human capital or a steep profile to reduce shirking. Although the ranking of industries by level of unionisation was similar across the three countries, the actual levels of union influence in the labour market differed markedly. In the early 1980's unions were more important in Australia and Great Britain than in the US. Our results are consistent with trade unions effecting the industry wage structure more pervasively in Australia and Great Britain than in the US.

Footnotes

1. See Katz (1986) and Krueger and Summers (1987) for fuller discussions.
2. See Katz (1986), Krueger and Summers (1987) and (1988) for summaries of US evidence.
3. Participation in a superannuation scheme was included, the authors argued, as it may affect the age earnings profiles of otherwise identical individuals.
4. The limited evidence available suggests that job durations may be higher in the US than in Australia. The information relates to time with particular employers not with a particular industry. Individuals may change jobs more frequently in Australia but stay in the same industry.
5. These theories are presented in detail in chapter 2 so we have not repeated this earlier discussion here.

6. Murphy and Topel (1987) dispute this result. They used panel data to track the change in earnings of individuals who moved between industries. They concluded " A key finding is that actual wage changes in this population are only weakly related to the industry wage differences that are observed in the cross-section. The implication is that unobserved differences in individuals' earnings capacities account for a majority of observed cross-sectional wage differences." (p137)

7. For a fuller list of factors which may generate compensating differentials see chapter 2 footnote 1.

8. It has been argued in the US literature (see Krueger and Summers (1988) for a discussion) that the industry wage differential may be in response to the different costs associated with the threat of unionisation in different industries. Employers in different industries raise wages to varying degrees as a protection against unionisation depending on the costs they face. In the Australian and British contexts, with relatively high unionisation and coverage by collective agreements and awards in all industries, this seems an unlikely explanation of the industry differentials. We have therefore not considered this argument further.

9. See Krueger and Summers (1988) and Dickens and Katz (1987) for summaries of US evidence. Hatton and Chapman (1989) present Australian evidence.

10. Prais et al. (1981) compared plant sizes in 33 manufacturing subsectors in Great Britain, the US and West Germany. Bollard and Daly (1985) used this study to extend the comparison to Australia and New Zealand. The latter study distinguished 12 manufacturing industries and found a close correlation between the size of plants in Australia and the original three countries.

11. The results of the industry regressions omitting the occupational dummies are presented in Appendix F.

12. Only broad occupational groups were available for the British data, although more detailed information was available on occupation for Australia and the United States. The use of broad occupational categories may limit our ability to capture the full effect of

occupation on earnings because of the diversity of actual jobs included within a category; for example professional workers include doctors, nurses, accountants and lawyers. On the other hand, if the importance of occupation in determining earnings relates to the degree of substitutability between individuals in different occupations, these broad groups may at certain skill levels, more accurately cover individuals who are in fact close substitutes for each other than a finer classification. So for example, most workers classified as semi or unskilled may be close substitutes for each other across a range of detailed occupations such as labourers, textile workers, packers and storemen. Any effect of occupation on earnings may be related to being semi or unskilled, not to their detailed classification.

13. The data which have been used for these tests are presented in Appendix F. They are a reworking of the regression coefficients.

14. The calculation of a simple correlation coefficient between the two estimated values is not really appropriate because of the bias that will arise where the coefficients come from a shared regression (see Chapman and Tan (1980). However, the simple correlation coefficient between the two coefficients for each country were for Australia, r = -0.54, Great Britain, r = -0.81, the US, r = -0.36.

15. As with the American regression results reported in chapter 4, the equations including industry and occupation over-predicted the earnings of men in their 40s. There was a sizeable residual error for the American regression at these ages; for example see Table F6 in appendix F.

16. Hirsch and Addison (1986) summarised the US evidence as follows, " There is a fairly strong consensus that unions act to decrease the slope of the log earnings-experience profile. This conclusion is based primarily although not exclusively on cross-sectional evidence showing flatter and less concave earnings and wage profiles among union members, and a larger union-nonunion wage differential for younger workers."(p 170). US evidence also shows a positive relationship between unionisation and fringe benefits, especially those accruing to older workers, for example pensions. We do not

have the data available in this study to test whether unionisation is associated with flatter total compensation packages than non-union members receive.

17. If the effect of unions spreads beyond their members to all those who work or compete with union members, the use of industry data may better represent the area covered by unions than a straightforward count of union membership. In a centralised system of wage determination as found in Australia, the most important effect of unions may well be on the structure of the awards which apply to industries and/or occupations regardless of whether individuals belong to unions or not. Even in a more free market environment the effects of unionisation may go beyond union members. US evidence suggests that unions have a positive effect on the earnings of non-union members in the same industry, see Hirsch and Addison (1986).

18. One part of the classification which is not entirely satisfactory is the inclusion of "other services" in the highly unionised group. This industry covers public administration and community services which are highly unionised industries and personal services which is not (see Table 3.7 and 3.8 Chapter 3). The first two industries accounted for 92 per cent of employment in the US, 83 per cent in Australia and 75 per cent in Great Britain in "other services".

19. The difference between the aggregate level of unionisation and the level of unionisation among professional workers and managers and administrators was greater in the US than Australia. In the US, 14 per cent of these two occupational groups were union members but in Australia, 43 per cent of these groups were members of trade unions.

Chapter 7
The Age Earnings Profiles of Women in Australia, Great Britain and the United States.

The results of the preceding chapters show that at least for male age earnings profiles, the institutions of the Australian labour market have not led to very different results than those found in Great Britain. In both Great Britain and Australia, earnings varied less by age than in the US. We cannot however, say with confidence that the centralised system of wage determination in Australia had no effect on the shape of the age earnings profile. The results show that the rewards for any given set of endowments (both including and excluding industry and occupational endowments) were lower for Australian men at all ages than for either British or American men.

One area where it is argued that national labor market institutions have been important is in the determination of women's pay. A number of studies of the earnings of women relative to men stress the role of labour market institutions rather than the operation of supply and demand as the source of large changes in this pay relativity. (1) In each of the three countries, equal pay provisions in various forms were in place in 1981. The US was the first of these countries to enact equal pay provisions under the Equal Pay Act of 1963 and Title VII, the Equal Employment Opportunity (EEO) title of the Civil Rights Act of 1964. While the aggregate data show little change in the male-female earnings differential during the 1960s and 1970s, some have argued that there was an improvement in the earnings of women relative to men over this period which can be attributed in part to the legislation. (2) Gunderson (1989) summarised the results of these studies as at best showing modest success for the legislative changes in reducing the earnings differential.

In Great Britain, an Equal Pay Act was passed in 1970 and became effective in 1975. This was complemented by a Sex Discrimination Act, passed in 1975 and amended in 1986, which made it illegal to discriminate against a woman on the grounds

of her sex. Zabalza and Tzannatos (1985) argue that the effect of these legislative changes was to increase female pay relative to male pay by about 19 per cent.

There were also substantial changes in the male-female earnings differential in Australia over the period 1970-76 and there is strong evidence that the arbitration system was important in bringing about the 30 per cent increase in female relative pay which took place. In 1969, the federal arbitration tribunal ruled that sex was not to be used as a wage criterion in those jobs which were neither predominantly male or female. In 1972 this principle of equal pay for equal work was extended to cover equal pay for work of equal value. These two decisions and the associated decisions of the state arbitration tribunals have been attributed by Gregory et.al. (1989) as the source of the whole 30 per cent change in the male-female differential over this period.

The most generous assessment of the impact of institutions on female pay suggests that the institutions of Australia and Great Britain were more successful in raising the level of female earnings than were the institutions of the US. The different extent to which institutions succeeded in changing the earnings of women relative to men may have implications for our comparisons between the countries of the shapes of the age earnings profiles for women.

In the preceding chapters, we have investigated the relationship between age and earnings for men and have considered some of the possible sources of the differences in the shapes of the age earnings profiles between the three countries. In this and the following chapter, we shall examine the evidence on the shape of age earnings profiles for women in the three countries and compare them both with those of men in the same country and across the three countries. This chapter includes some empirical estimation of female age earnings profiles and considers some possible sources of differences in the shapes of the profiles between the countries. In the following chapter we shall consider some of the theoretical explanations for the differences between the age earnings profiles

of men and women and present some empirical estimates of the differences in the returns to experience for men and women.

The chapter is divided into four sections. In the next section we shall briefly consider the implications for age earnings profiles of institutionally determined changes in the male-female relativity. If female wage rates are set above the market clearing rate, we would expect to observe flatter age earnings profiles than in a free market. We have already presented the evidence in chapter 1 that women's age earnings profiles were in general flatter than men's. The profile for American women was steeper than for women in the other countries although the differences were not as dramatic as for men. Section 2 presents some empirical results for our comparison of female earnings between the three countries. Section 3 decomposes the differences between the countries into that part which is attributable to endowments and that part which is attributable to coefficients. A final section summarises and concludes the chapter.

Our regression results for the basic model show qualitatively similar results for the three countries of the effect of education, marital status and family variables, and location on women's full-time earnings. The results for experience do not show that the addition to earnings with experience was greater in the US than in Australia or Great Britain where the effect of institutional changes on the male-female earnings differential seems to have beeen greatest. If we accept the human capital hypothesis that the returns to experience reflect investment in on-the-job training, the evidence of these cross country comparisons does not suggest that the extent of on-the-job training undertaken by women varies greatly between the countries.

The differences in the shapes of the age earnings profiles between the countries were smaller for women than for men and the results of the decompositions are not so clear cut. In comparing relative earnings by age between Australia and each of the other countries, endowment differences were more important than coefficient differences. In

the comparison of relative earnings between Great Britain and the US, the greater rewards to a given set of endowments was important for those over 40.

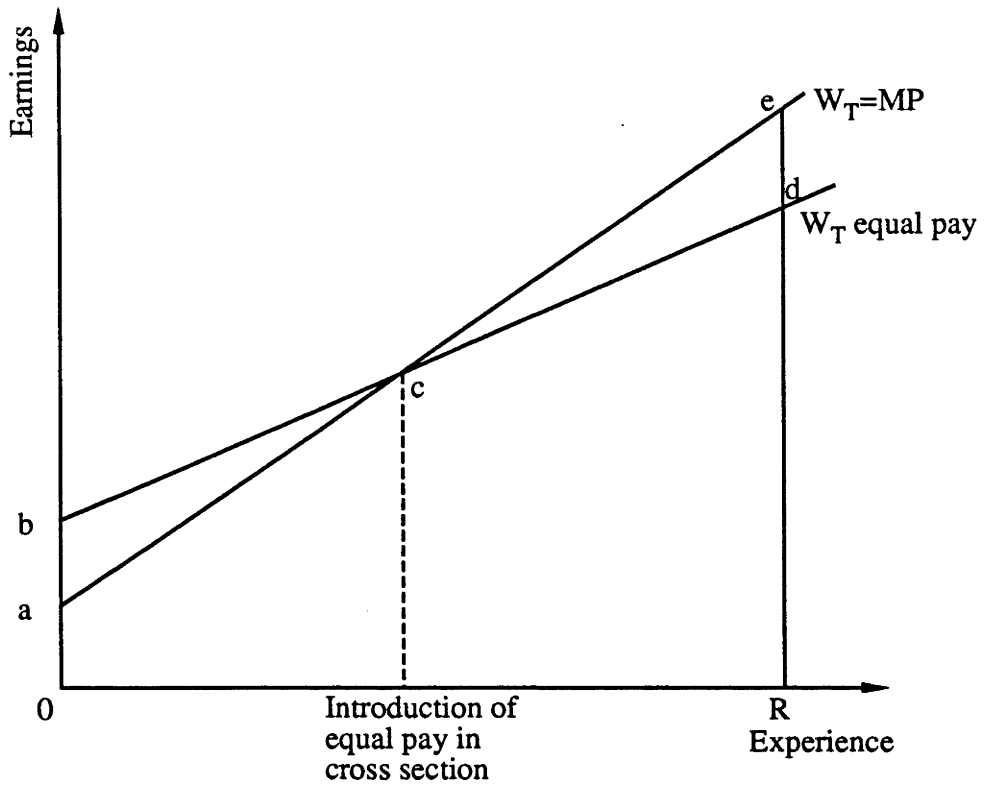
1. Some Possible Implications for Age Earnings Profiles of Equal Pay for Women.

In this section we shall consider the implications of the introduction of equal pay for women on the shape of age earnings profiles using some of the theoretical ideas presented in chapter 2.

The raising of female pay above the market clearing rate could be expected to have a similar effect on the age earnings profile of women as the introduction of a minimum wage analysed in section 4 chapter 2. Firstly, it raises the opportunity cost of continuing schooling but may also raise the benefits of completing a higher level of schooling so the effect of equal pay provisions on women's schooling decisions is ambiguous. However, the effect on investment in on-the-job training is likely tobe negative. We can illustrate this point with a simple diagram. Figure 7.1 uses the example of general training. In this example, women were paid their marginal product prior to the introduction of equal pay (W_T= MP). On entry to the workforce, with no experience, earnings were (oa) and increased with experience until retirement at R. If the introduction of equal pay prevented employers from paying below (oa) as a starting wage, less general training would be undertaken by women than before, producing a flatter experience earnings profile such as (bcd).

In the cross section we would observe both those whose investment decisions were unaffected by equal pay and who had undertaken some training prior to the introduction of equal pay and those who had entered the workforce after the introduction of equal pay. If equal pay were introduced say at point (c) in terms of experience measured in the cross section, we would have an experience earnings profile in the cross section which combined parts of the before and after profiles, (bce) in this example. It is

Figure 7.1: The Effect of Equal Pay Regulations on On-the-job Training for Women.



a prediction of this theory that we should observe a flatter age earnings profile where institutions were more effective at raising wages above the market clearing rate. In terms of our three country comparison, we would expect to observe flatter age earnings profiles in Australia and Great Britain than in the US. (3)

Alternative theories of the determination of women's pay emphasise the role of discrimination against women and might argue that the above analysis is irrelevant. Women, it would be argued, were never in the position of receiving much on-the-job training so the introduction of equal pay is unlikely to have the effects outlined above. These interpretations of the facts (to be considered in more detail in the next chapter) would suggest that equal pay provisions produce a parallel shift in the whole of the age earnings profile rather than a change in the slope of the age earnings profile.(4)

2. Estimation of Earnings Functions of Women in Three Countries.

2.1 The Basic Equation.

In this section we shall present the results of the estimation of earnings equations for full-time women in the three countries. (5) We shall use these equations to decompose the differences in the relative earnings of women by age into that part which is attributable to differences between the three countries in endowments and that part which is attributable to differences in coefficients. As already described, the aggregate earnings profile of full-time working women in the US continued to rise for longer than in the other two countries. This result is the same as the male result suggesting that the underlying factors affecting the male age earnings profile in the US also influenced the female full-time age earnings profile (6).

We have estimated earnings equations using the same preferred functional form of experience as for men, that is we have included experience in both quadratic and exponential terms. We have also adopted the same estimation procedure. Firstly we have estimated the δ coefficient in the variable X, equal to (1-exp(-δ*experience)), by non linear least squares and imposed this value in ordinary least squares regressions using a wider range of variables. The variables included are the same for women as for men and the full definitions are presented in Appendix A. There is one additional variable included here for women which was excluded from the male equations. We have included a dummy variable for the presence in the household of children under the age of eighteen. Earlier work has found that the presence of children had a significant and negative effect on female earnings but not on male earnings.(7)

The measure of experience we have used here is potential experience, that is age minus the age on leaving full-time schooling. This measure has a number of limitations which have been discussed in relation to men but it has particular limitations when used as a measure of women's actual experience in the workforce. Women typically do not maintain a continuous attachment to paid employment but have interruptions to

employment during periods of child raising. Their potential experience therefore overstates their actual working experience. As most men participate in paid employment, potential experience is a more accurate measure of their actual working experience than it is for women and a comparison of the returns to experience for men and women based on potential experience would be expected to overstate the differences. In the next chapter we shall suggest some methods by which we hope to make more accurate comparisons between men and women, but here, where we are comparing results only for women, we shall use the potential experience measure. It is necessary therefore, for us to assume that the relationship between actual and potential workforce experience for women is similar in the three countries.

Table 7.1 presents our results for the estimation of earnings equations using our basic model. The constant term measures the earnings of a single unqualified woman with no experience living in an urban location. There are some similarities with the results presented for a similar equation for men (see Table 4.3 chapter 4). The more educated women earned more than the less educated and those living in rural areas earned less than those in urban areas. The estimated coefficients show that female Australian university graduates with no experience earned more than double that of an unqualified woman while in the US and Great Britain the differential was respectively 90 and 73 per cent. Rural residence reduced weekly earnings by about 13 per cent in the US compared with 8 per cent in Australia and 4 per cent in Great Britain. As already discussed with respect to men, the smaller effect of rural residence in Great Britain than in the other countries may reflect differences in definitions and in the geography of the countries.

Marital status had different implications for female earnings than for male earnings. The positive and significant effect of marriage found in the male equations was not apparent for women. In none of the three countries did married women earn significantly more than single women. In Australia, widowed, separated and divorced women earned 4 per cent more than single women but in the other two countries this variable did not

have a significant effect on weekly earnings. The presence of children under the age of 18 lowered weekly earnings in each country, with the strongest negative effect being in Australia. So looking at the results of the regressions for the three countries for education, marital status and family variables and location, they are broadly similar in qualitative terms.

The experience variables also had qualitatively similar coefficients for Australia and the United States. Taking first the general quadratic and exponential experience terms, each of these had the same sign and were of roughly similar magnitudes. In combination they produced an experience profile that turned down after about 20 years of experience but then started to grow again, after 37 years of experience for the United States and after 45 years of experience for Australia. This latter result of an increase in the returns to experience at the very end of working life is difficult to explain in terms of human capital theory. For Great Britain the pattern on the signs of the individual coefficients on experience and the zero coefficient on the experience squared term produced a flat experience earnings profile after about twenty years of experience. There was no period of negative growth in earnings with additional experience as in the other two countries.

The initial returns to experience were in general higher for the unqualified group than for any other education group. This was not so for Great Britain where the point estimates on the coefficients for both the high school and post secondary groups suggested that the returns to experience were higher for these groups than for the unqualified. It would be unwise to make too much of these results however, as the F test for the joint significance of the education by experience coefficients was unable to reject the null hypothesis of no significant differences

Table 7.1
Weekly Earnings of Full-time Women aged 16-64 using Potential experience, Australia, Great Britain, the United States, 1981.
Dependent Variable = ln Weekly Earnings

	Australia	Great Britain	United States
Intercept (a)	4.3736 (132.73**)	3.7483 (87.94**)	4.5084 (46.53**)
High	0.2875 (8.37**)	0.0439 (0.88)	0.3334 (3.30**)
Post secondary	0.5148 (12.91**)	0.2952 (4.86**)	0.5434 (5.04**)
Graduate	1.0224 (25.19**)	0.7306 (6.71**)	0.9019 (8.59**)
X	1.248 (20.22**)	0.6083 (8.48**)	1.0298 (7.78**)
Experience	-0.0182 (-5.82**)	0.0002 (0.07)	-0.0141 (-3.02**)
Experience ^{2}	0.0002 (3.42**)	0.0 (-0.57)	0.0002 (2.08**)
High*X	-0.1613 (-3.85**)	0.1259 (2.15**)	-0.1447 (-1.32)
Postsec*X	-0.3186 (-6.59**)	0.0412 (0.56)	-0.2229 (-1.85)
Graduate*X	-0.5394 (-10.52**)	-0.1366 (-0.96)	-0.3517 (-2.99**)
Married	-0.0135 (-1.14)	0.0057 (0.32)	0.0274 (1.43)
Widowed, separated, divorced	0.0408 (2.44**)	0.0263 (0.94)	0.0184 (0.82)
Rural	-0.077 (-4.81**)	-0.0362 (-2.64**)	-0.1289 (-9.27**)
Child	-0.1293 (-10.74**)	-0.0922 (-4.67**)	-0.1153 (-7.62**)
R^2	0.39	0.28	0.19
F	275.28**	69.50**	92.36**
Breusch-Pagan test for heteroskedasticity			
$NR^2 - \chi^2$	6.11	12.87	0.53
F test for joint significance of education*experience terms	42.79**	2.34	3.96**

Notes: t statistics in brackets. Significant test statistics at the 5 per cent level are indicated by a * and those significant at the 1 per cent level by **.

Notes to Table 7.1 cont: X=(1- (e $^{(-0.1751*experience)}$)in the Australian regression,(1- e $^{(-0.2514*experience)}$ in the British regression, and (1- e $^{(-0.1676*experience)}$)in the US regression.

(a) The intercept term measures ln earnings for a single unqualified woman of urban residence with no labour market experience.

Table 7.2
Percentage Growth in Earnings for Full-time Women with an Additional Year of Potential Experience for each Education Group, Australia, Great Britain and the United States, 1981.

	Australia	Great Britain	United States
An additional year of experience starting from the following years of experience -			
Unqualified			
1	15.06	10.54	12.09
3	10.17	6.38	8.35
5	6.75	3.87	5.69
10	2.08	1.11	1.98
20	-0.40	0.11	-0.03
30	-0.50	0.02	0.41
45	0.01	0.02	0.41
High school graduates			
1	12.89	12.71	10.20
3	8.65	7.70	6.99
5	5.68	4.66	4.72
10	1.64	1.34	1.99
20	-0.48	0.13	-0.11
30	-0.51	0.30	-0.10
45	0.01	0.02	0.42
Post secondary qualifications			
1	10.77	11.25	9.18
3	7.15	6.81	6.26
5	4.62	4.13	4.19
10	1.19	1.19	1.72
20	-0.55	0.12	-0.15
30	-0.52	0.02	-0.11
40	-0.19	0.02	0.23
Graduates			
1	7.80	8.17	7.50
3	5.06	4.95	5.05
5	3.14	3.00	3.33
10	0.92	0.87	1.28
20	-0.65	0.09	-0.23
30	-0.54	0.03	-0.13
40	-0.19	0.03	0.22

Source : Table 7.1.

between the returns to experience for the four education groups in Great Britain. There were however, significant differences in the returns to experience in Australia and the United States.

The differences in the returns to experience for each of our four education groups are examined in greater detail in Table 7.2 which presents the predicted percentage growth in earnings for an additional year of schooling for each of the education groups in the three countries. The largest initial increases in earnings for unqualified women were for Australian women where a move from one to two years experience raised earnings by 15.06 per cent compared with 10.54 per cent in Great Britain and 12.09 per cent in the United States. The two experience earnings profiles for the unqualified in Australia and the United States crossed at twelve years experience after which the addition to earnings was greater in the United States than in Australia.

The initial effect of additional years of experience for high school graduates were similar in Australia and Great Britain, exceeding that of the United States. After nine years of experience the returns to additional experience were greater in the United States than Australia. A similar result held for the post secondary group. Over the range zero to 8 years of experience, an additional year of experience added more to earnings in Australia than in the United States but from that point it increased earnings in the United States by more than in Australia. The initial gains from experience for this education group were greater in Great Britain than in either Australia or the United States. However after ten years of experience, an extra year of experience added the same percentage to earnings in Great Britain as in Australia. While experience had a negative effect on the earnings of the Australian post secondary group after 15 years, it continued to have a small but positive effect on British earnings over the remaining period of working life.

The relatively high initial returns to experience in Great Britain were also apparent for graduates but the rate of growth decreased more sharply than in the other countries. The addition of a year's experience had a similar effect on the earnings of female

graduates in Australia and the United States but the general pattern of the earlier comparisons of education groups in these two countries held. Experience added more initially to earnings in Australia than in the United States but after four years of experience, further experience added more to earnings (or reduced earnings less) in the United States than in Australia.

Considering these results in the light of the hypothesis outlined in section 2 of this chapter that experience earnings profiles should be flatter in those countries where institutionally determined changes in women's pay were largest, we find that our results do not support this hypothesis. For the sample of women working full-time, they do not show a larger increase in earnings with potential experience in the US than in Australia or Great Britain.

2.2 The Equation including Industry and Occupation Variables

In chapter 6 we have outlined the arguments used to justify the inclusion of industry and occupation variables in earnings regressions and considered some of the interpretations which might be placed on the results. We shall now consider the effects of these variables on the earnings of full-time women. The results are presented in Table 7.3. In the presentation of our regression results for industry for men we chose to omit the construction industry in order to facilitate coefficient interpretation and for ease of comparison with these earlier results, we have also omitted construction here. The intercept term now relates to a single unqualified female to a single unqualified female with no experience living in an urban area and working in the construction industry in a non manual occupation.

The coefficients on the variables included in the earlier basic equation are on the whole similar to those reported in Table 7.1. The more educated earned more than the unqualified in each country, rural residence had a negative effect on earnings compared with urban residence and marital status did not of itself affect earnings. The presence of children in the household reduced the earnings of women in each country. There was

however a substantial change in the size and significance of the coefficient on the X variable in the American regression but it is important to remember that this coefficient on its own now relates to the effect of experience for unqualified women in the construction industry, compared with the earlier equation where the coefficient related to unqualified women in the whole sample. The result suggests that the increment in earnings with experience is lower in the American construction industry than in other American industries.

The occupation variables were similar in sign if not in magnitudes across the three countries. Managers and professionals earned more than those in other non manual occupations and skilled, semi-skilled, unskilled and farm workers earned less. Professional women in Australia added about half as much to their earnings as professional women in Great Britain and the United States, other things held constant. The negative effect on earnings of a blue collar skilled occupation relative to other non manual occupations was stronger in Australia than in either of the other countries. Farm workers were particularly lowly paid relative to other non manual occupations in Great Britain.

The industry intercept terms were mainly positive for Australia with only agriculture and distribution having lower intercept terms than construction. The F test for the joint significance of the industry intercept terms rejected the null hypothesis that they were all equal to zero. This conclusion also held for Great Britain and the United States (at the 5 per cent level). In the British equation all the individual coefficients were positive suggesting higher earnings for unqualified women, other things equal, outside the construction industry and in the American equation they were all negative, suggesting that workers were relatively well paid in construction.

Table 7.3

Weekly Earnings of Full-time Women aged 16-64 including Industry and Occupation Variables, Australia, Great Britain, the United States, 1981. The measure of experience is potential experience.

Dependent Variable = ln Weekly Earnings

	Australia	Great Britain	United States
Intercept [a]	4.3892 (45.81**)	3.6493 (20.54**)	5.1663 (20.62**)
High	0.2646 (8.06**)	0.0042 (0.09)	0.2704 (2.82**)
Post secondary	0.4616 (11.8**)	0.2518 (4.09**)	0.4217 (4.09**)
Graduate	0.8724 (20.71**)	0.5580 (5.09**)	0.6675 (6.47**)
X	1.2676 (10.08**)	0.8570 (4.03**)	0.3290 (1.11**)
Experience	-0.0173 (-5.81**)	-0.0031 (-0.90)	-0.0135 (-3.06**)
Experience ^{2}	0.0002 (3.81**)	0.0000 (0.23)	0.0002 (2.28**)
High*X	- 0.2014 (-5.02**)	0.0795 (1.37)	-0.1764 (-1.70)
Postsec*X	-0.3713 (-7.8**)	-0.0428 (-0.57)	-0.2558 (-2.22**)
Graduate*X	-0.5609 (-10.69**)	-0.1254 (-0.90)	-0.3459 (-2.99**)
Married	-0.0052 (-0.47)	-0.0029 (-0.17)	0.0185 (1.03)
Widowed, separated, divorced	0.0301 (1.91)	0.0212 (0.80)	0.0285 (1.35)
Child	-0.1041 (-9.11**)	-0.0771 (-4.11**)	-0.094 (-6.90**)
Rural	-0.0525 (-3.34**)	-0.0384 (-2.93**)	-0.1073 (-8.13**)
Industries			
Agriculture	-0.1560 (-1.06)	0.8468 (2.80**)	-0.6387 (1.92)
Energy and water	0.2545 (1.97*)	0.4589 (2.09**)	-0.1965 (-0.06)

	Australia	Great Britain	United States
Manu. of metals, chemicals	0.1091 (0.82)	0.3720 (1.69)	-0.3159 (-1.11)
Metal goods, eng. and vehicles	0.1151 (1.06)	0.3678 (1.88)	-0.3712 (-1.48)
Other manufacturing	0.1466 (1.50)	0.2574 (1.43)	-0.4584 (-1.82)
Distribution	-0.0423 (-0.46)	0.1088 (0.61)	-0.5439 (-2.24**)
Trans and Communications	0.1416 (1.37)	0.1354 (0.71)	-0.5598 (-2.03**)
Banking and bus services	0.0164 (3.56**)	0.1831 (2.06**)	-0.4173 (-1.69)
Other services	0.0972 (1.05)	0.1231 (0.70)	-0.5899 (-2.44**)
Industry*experience			
Agriculture*X	-0.0444 (-0.25)	-1.2183 (-3.25**)	0.3309 (0.78)
Energy and water* X	-0.1324 (-0.79)	-0.2617 (-1.02)	0.4922 (1.27)
Manu. of metals, chem*X	0.0091 (0.06)	-0.3896 (-1.54)	0.7374 (2.26**)
Metal goods, eng. and veh*X	-0.0924 (-0.71)	-0.3519 (-1.56)	0.7546 (2.62**)
Other manu*X	-0.1655 (-1.39)	-0.2907 (-1.39)	0.5980 (2.08**)
Distribution*X	-0.0008 (-0.01)	-0.3419 (-1.65)	0.4920 (1.76)
Trans and Comm*X	-0.0969 (0.09)	-0.0722 (-1.56)	0.9005 (0.16)
Banking and bus serv*X	0.0638 (0.55)	-0.2196 (-1.05)	0.5026 (1.77)
Other services*X	-0.0765 (-0.68)	-0.0964 (0.47)	0.6970 (2.52**)
Occupations			
Managers	0.2284 (6.47**)	0.1771 (6.22**)	0.2006 (7.34**)

	Australia	Great Britain	United States
Professionals	0.0910 (6.29**)	0.2454 (3.73**)	0.1895 (9.27**)
Semi and Unskilled Workers	-0.2019 (-15.88**)	-0.1259 (-6.93**)	-0.1992 (-11.89**)
Skilled Workers	-0.1994 (-10.08**)	-0.0798 (-2.70**)	-0.0549 (-1.46)
Farm Workers	-0.1172 (-3.33**)	-0.3826 (-2.89**)	-0.1108 (1.34)
R^2	0.46	0.37	0.29
F	132.37	36.41	58.38
Breusch-Pagan test for heteroskedasticity $NR^2 - \chi^2$	0.56	4.60	12.10
F test for joint significance of education*experience terms	42.42**	1.73	3.42*
F test for joint significance of industry*experience terms	2.54**	3.28**	2.32*
F test for joint significance of industry terms	5.04**	2.92**	2.08*
F test for joint significance of occupation terms	92.90**	23.79**	69.92**
N	5,554	2,299	5,261
Mean of Dep. Var.	5.2458	4.3173	5.4035

Notes:
t statistics in brackets. Significant test statistics at the 5 per cent level are indicated by a * and those significant at the 1 per cent level by **.

$X=(1- (e^{(-0.1751*experience)})$ in the Australian regression,$(1- e^{(-0.2514*experience)})$ in the British regression, and $(1- e^{(-0.1676*experience)})$ in the US regression.

(a) The intercept term measures ln earnings for a single unqualified woman of urban residence with no labour market experience.

In chapter 6 we included a discussion of some competing hypotheses which aimed to explain what the industry effect on earnings may be measuring. Among these hypotheses are the suggestion that industry effects arise because of differences on average, in the working conditions (compensating differentials), labour quality or the average company size of industries. We argued that a high correlation between the three countries in the ranking of industry coefficients would be consistent with some general underlying factors such as these explaining the rankings rather than country specific factors. We found that for men there was a positive but not particulary strong association between the relative size of industry coefficients across the three countries.

Table 7.4 presents the simple correlation coefficients, r, between the relative industry intercept terms for each pair of countries for women. (8) The correlation was once again positive, relatively high paying industries in one country tended also to be high paying in the other countries, but it was not as close as the male correlation. A tentative conclusion is that there were some underlying factors making for some commonality in the relative effect of industry on earnings between the three countries that other factors perhaps specific to each country, seemed to be more important in determining the relative industry effect on earnings.

Table 7.4
Simple Correlation Coefficients between Industry Intercept Terms for Women in Australia, Great Britain and the United States, 1981.

	Australia	Great Britain	United States
Australia	1	0.29	0.25
Great Britain		1	0.29
US			1

Source: Table 7.3

Industry of employment may be important in explaining the level of earnings of individual women but it may also be important in explaining the change in earnings with experience. Due to differences, for example, in the extent of on-the-job training between industries, each industry may exhibit a very different relationship between earnings and experience. In order to test for this we have included industry by experience terms in these regressions. In each country, the F test of the joint significance of the industry by experience terms was significant rejecting the null hypothesis that the returns to experience were the same across all industries. We shall now look at the results for each country in turn.

In the Australian equation, none of the individual coefficients were statistically significant. The returns to experience for British women appeared to be higher in construction than in any other industry (note the negative signs on all the industry by experience terms) but it was only in agriculture that the difference in the returns to experience was significant. In contrast in the United States, the returns to experience were lower in construction than in other industries (note the positive signs on all the industry by experience terms). In the manufacture of basic metals and chemicals; metal goods, engineering and vehicles; other manufactures and other services the coefficients on the industry by experience terms were all individually significant. There was no general pattern across the three countries of particular industries offering above or below average returns to industry experience (see Table G2 Appendix G).

In Table 7.5 we present the effect on earnings of additional experience in particular industries for an unqualified person. The effect of industry experience is constrained to be the same across all education groups so the change in earnings with experience, for example for a university graduate in a particular industry, is equal to the sum of the industry by experience term and the graduate by experience term. In Table 7.5 we have reported the change in earnings for additional experience in the construction industry (the industry dummy omitted from the regression) and for those industries where the

Table 7.5
Percentage Growth in Earnings with an Additional Year of Industry Experience for an Unqualified Woman, Australia, Great Britain and the United States, 1981.

	Australia	Great Britain	United States
An additional year of experience starting from the following years of experience -			
Construction industry			
1	15.42	14.51	3.0
5	6.98	5.11	1.06
10	2.23	1.24	0.02
20	-0.30	-0.19	-0.35
30	-0.41	-0.3	-0.09
45	0.09	-0.31	0.28

In other industries where industry*experience was statistically significant.

	Great Britain	United States			
	Agriculture	Metal Manu.	Metals, eng.	Other manu.	Other services
1	-6.56	12.62	12.85	10.81	12.1
5	-2.6	5.99	6.1	5.06	5.72
10	-0.96	2.14	2.2	1.75	2.03
20	-0.37	0.04	0.05	-0.02	0.03
30	-0.32	-0.02	-0.02	-0.03	-0.03
45	-0.31	0.29	0.20	0.28	0.29

Source : Table 7.3.

coefficient on the industry by experience term was significantly different from construction. Particularly in the Australian case, the large confidence intervals about the point estimates make the calculation of the effect of industry experience on earnings too imprecise to be of much value.

According to these regression results, industry experience appears to have a much larger effect on earnings in the construction industry in Australia and Great Britain than in the United States. An additional year of experience after a woman's first year in the industry raised earnings by about 15 per cent in Australia and Great Britain and by only 3

per cent in the United States. However the second part of the table suggests that the construction industry in the United States had a relatively flat experience earnings profile compared with other industries. The initial effect of additional experience on earnings in the four industries distinguished here was much larger and closer to the estimates for construction in Australia and Great Britain. In each of these industries as for construction in Australia and Great Britain, the experience earnings profiles flattened out between 10 and 20 years of experience and did not change much after that. The results presented for British agriculture show an immediate decline in earnings with additional experience. Even given the relatively high intercept term for agriculture in Britain (see Table 7.3) this does not make sense in terms of any theory, and probably reflects some peculiarities in the sample of workers in this industry.

We have not tested for the relationship between the industry intercept terms and the industry by experience terms as described in chapter 6 for men because of the large standard errors associated with the point estimates of the coefficients for women. A further important limitation for such an exercise is our use of potential experience as a measure of industry experience. The assumption that these two variables are the same is likely to be more doubtful for women who typically have a lower attachment to the workforce than for men.

Our results for the effect of industry experience could be summarised as follows. In common with our earlier results reported in Table 6.2, these industry results do not show greater increases in earnings with experience in the US than in Australia or Great Britain.

3. The Decomposition of Earnings

In the earlier chapters we have used regression results to decompose the differences between the countries in relative earnings by age for men. The gap between the relative earnings at a particular age in two countries can be broken into three

components; that part which is attributable to endowment differences, that part which is attributable to coefficient differences and the residual difference which was unexplained by the regressions. In this section we have used the same methodology to consider the sources of the differences in the relative earnings of women of different ages, once again taking the earnings of 25 year olds as the benchmark.

We shall consider decompositions using the basic equation presented in Table 7.1. Results based on the equation including industry and occupation presented in Table 7.3, can be found in Appendix G. The broad conclusions concerning the importance of endowment and coefficient differences between the countries in explaining the relative earnings gap hold for each set of equations. In general, in the comparisons between Australia and the United States and Australia and Great Britain, endowment differences were more important than coefficient differences in explaining the relative earnings at various ages. In contrast, the British/American comparison showed that a larger part of the differences in relative earnings between the countries could be explained by the different rewards for a given set of endowments as measured by the coefficients. While coefficient differences accounted for about half of the relative earnings gap between British and American women using the basic equation, when industry and occupation variables were included, coefficient differences became the major source of differences between the countries in relative earnings.

3.1. Decomposition Using the Basic Equation.

Figures 7.2-7.4 present the decomposition of the difference in relative actual earnings explained by the regression equations presented in Table 7.1 into that part attributable to the coefficients ($X_{us}(\beta_{us}-\beta_a)$) and that part attributable to the endowments ($(X_{us}-X_a)\beta_a$) . There are three pairwise comparisons between the countries which we wish to make; Australia/Great Britain, Australia/United States and Great Britain/United States. We have presented the results here using Australian weights for the first two of

Figure 7.2: The Decomposition of Relative Earnings of Women, Australia and the United States, 1981.
Earnings of a 25 Year Old=1.

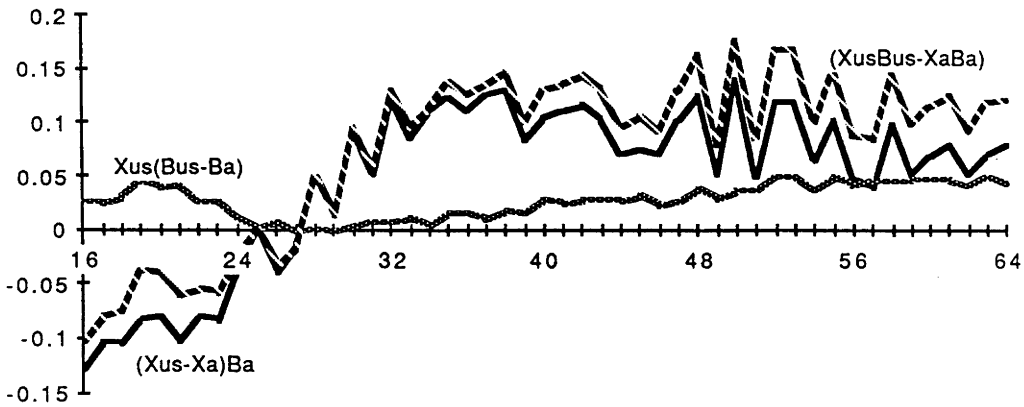


Figure 7.3: The Decomposition of Relative Earnings of Women, Australia and Great Britain, 1981.

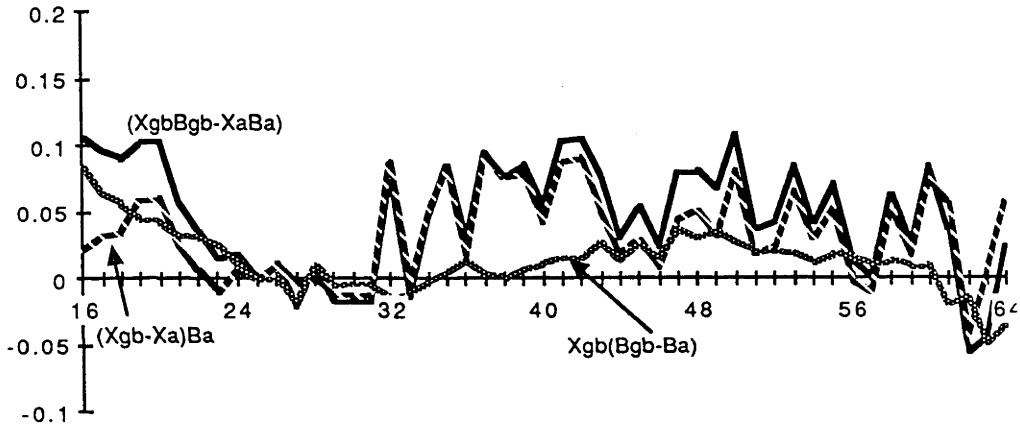
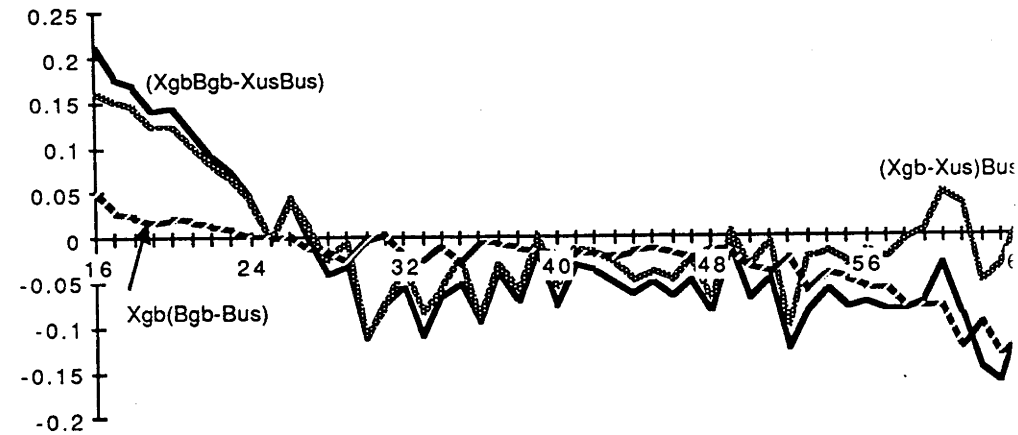


Figure 7.4: The Decomposition of Relative Earnings of Women, Great Britain and the United States, 1981.



these three comparisons and US weights for the final one. Additional figures and tables using alternative weights are presented in Appendix G and show a similar story.

We shall begin by considering the comparison between Australia and the United States. At the younger ages, until about 24, the endowments of Australian women relative to the endowments of 25 year old Australian women were greater than those of their American counterparts. After the age of 30 the US relative endowments of human capital exceeded those of Australian women. While most of the difference in the relative earnings of particular ages could be explained by endowment differences, coefficient differences played a more important role for those in their 50's and 60's than for the younger ages.

Differences in the rewards for a given set of endowments (the coefficient differences) explained more than half of the difference in relative earnings for 16 year olds in Australia and Great Britain. Coefficients continued to play an important role in explaining the gap into the mid 20's. However for women in their 30's and 40's, relative endowment differences were the major source of the relatively higher earnings in Great Britain than in Australia.

Relative endowment differences were also important in explaining the gap between the relative earnings of women in Great Britain and the United States. Among the under 25's, the relative endowments of British women exceeded those of their American counterparts but for those women over 25, the human capital endowments of American women exceeded those of British women. Coefficient differences also contributed to the relative earnings gap for women between the ages of 30 and 55. The same group of characteristics were more highly rewarded in the United States than in Great Britain and the differences accounted for about half of the total relative earnings gap.

This discussion raises the obvious next question, which endowments and coefficients are most important in producing the differences between the countries in

earnings at particular ages compared with the earnings of a 25 year old ? We shall once again consider this question as three pairwise comparisons between the countries. The calculations upon which our conclusion is based are presented in appendix G, Table G9 The differences in the major human capital endowments and coefficients, education and experience, were more important in explaining relative earnings by age than differences in marital status and location between the countries. A decomposition of the relative earnings gap using the equations including industry and occupation showed that the coefficients on the industry terms were important in accounting for the differences between the US and each of the other countries (see appendix G Table G10).

4. Summary and Conclusion

Earnings for full-time women did not vary as much with age as for men in each of the three countries. However, there were some differences between the countries in the relationship between earnings and age. As with men, there was more variation in earnings with age in the United States than in the other two countries. In general for each of the four education groups we have distinguished, there was also greater variation in earnings with age in the United States than in the other two countries.

The regressions show qualitatively similar effects for women in each country of education, experience, marital and family status, location and occupation. The initial effects of experience on earnings were in general higher for the unqualified group than for the other education groups. Industry of employment affected earnings but there was not a close correlation between the countries in the effect of industry on earnings. The influence of industry on earnings, at least when this broad industry classification is used, appeared to be weaker for women than for men.

Evidence suggests that institutions have played an important role in setting female pay, particularly in Australia and Great Britain. It is a prediction of human capital theory and any other theories used to explain an upward sloping age earnings profile, that

setting a wage above the market clearing rate should result in flatter age earnings profiles than would be observed in a free market. If the institutionally generated changes in women's pay resulted in pay levels above the market clearing rate, we would expect to observe flatter age earnings profiles. As the institutions on Australia and Great Britain appear to have had a greater effect on women's pay than those in the US, we would expect flatter profiles in Australia and Great Britian than in the US. Our results do not show larger increases in earnings with experience in the US than in Australia and Great Britain. Either the rates set by the institutions were not above the market clearing rates or for reasons to be discussed in the next chapter, women's earnings do not vary much with experience and the change in female pay affected the level not the slope of the age earnings profile.

As for men, we used these equations to find the source of differences in the shape of the age earnings profile between the countries. We considered three pairwise decompositions of the earnings differential at each age relative to 25 year olds; Australia/United States, Australia/Great Britain, and Great Britain/United States. We presented results using both the basic equation and additional results from the equation including industry and occupation in Appendix G. Some general conclusions came out of these comparisons. Firstly the differences between the countries in relative earnings by age were smaller for women than for men. In comparing relative earnings by age between Australia and each of the other countries, endowment differences were more important than coefficient differences. Differences in the contribution of education and experience were particulary important in these comparisons. Coefficient differences played a more important role in the comparison between Great Britain and the United States, especially among older women. Education and experience differences were the major source of relatively higher earnings for women over 25 in the United States compared with Great Britain.

Footnotes

1. Studies by Gregory, Daly and Ho (1986), Gregory , Anstie, Daly and Ho (1989) and Zabalza and Tzannatos (1985) emphasise the role of institutions in raising the relative pay of women in Australia and Great Britain during the early 1970s. Killingsworth (1990) disputes this finding for Australia. Beller (1979) argues that legislative changes in the US contributed to a reduction in the male-female earnings differential in the period 1967-74 of about 7 percentage points.

2. While there was little change in the aggregate female/male earnings ratio in the 1960s and 1970s, the ratio rose over the 1980s. Smith and Ward (1985) argue that the change is due to an increased commitment of women to the labour market.

3. The US labour market cannot really be regarded as a free market. There are of course, numerous regulations relating to the employment of labour. In this context the existence fo a minimum wage in the US may be important. The minimum wage in the US, as we have already described in chapter 1, is set at a nominal level by Congress at irregular intervals. There is no junior rate. Although the minimum wage has been relatively low, it is possible that it was binding for young women and set above the market clearing rate. If this were true, the existence of minimum wages, according to the human capital model, would reduce the amount of training undertaken by young women, for the reasons presented in chapter 2 section 5. The age earnings profile for women in the US would therefore be flatter than that found in a free market with no wage regulation.

4. There may of course be other implications arising from the introduction of equal pay for the shape of the age earnings profile. The Australian experience of increasing female pay across all occupations is criticised as it is argued that the relatively high pay in traditionally female occupations with few career prospects discourages women from moving into male dominated occupations with better career prospects. If this factor were important, then we would expect to see flatter age earnings profiles in Australia than in the US if we traced individuals over time. As Australian women languished in

traditionally female occupations, American women should be moving into occupations with greater opportunities for advancement.

5. The issue of selectivity bias in the estimation of earnings regressions for women is one that has received considerable attention following the work of Heckman (1979). The method however has recently come under criticism. (see for example Miller and Volker (1987) and Hirsch and Addison (1986)). The results are very sensitive to the choice of variables used to construct the inverse of the Mills ratio and to the assumption of normality for the errors. In our estimates of women's earnings functions in chapters 7 and 8, we have therefore omitted the Heckman correction.

6. The story for part-time women of course, may differ but we have not considered it here. Evidence from Great Britain suggests that women working part-time receive less for a given set of human capital endowments than full-time workers (see Ermish and Wright (1988)). The returns to work place experience may also differ between the groups.

7. See for example Oaxaca (1973), Joshi and Newell (1987a), Gregory, Anstie, Daly and Ho (1989) and Gregory and Daly (1990).

8. The data on which these calculations are based is presented in Appendix G.

Ch 8.
The Age Earnings Profiles of Men and Women in Three Countries

In the preceding chapter, we compared between the three countries, the earnings of women of different ages relative to the earnings of a 25 year old woman. The differences between the countries in the shape of the age earnings profiles of women were much smaller than the differences for men.

In this chapter we shall also compare the relative earnings of women in the three countries but this time with the relative earnings of men in the same country. We begin by setting out the facts for the three countries in section 1. Section 2 briefly presents an outline of competing explanations as to why women at all ages have lower average earnings than men. Section 3 considers some possible sources of the differences in the shape of the age earnings profiles for men and women; differences in the returns to experience and in the level of human capital endowments at different ages. We present some empirical estimates of the differences in the returns to experience for men and women using two sets of equations, one for single women and one using an adjusted measure of experience for all women. Section 4 summarises the chapter and presents some conclusions.

Our data sets do not provide us with good measures of the actual experience of women in the workforce. We have therefore tried to deal with these shortfalls by estimating two sets of regressions for women; firstly relating only to single women and secondly with an adjusted measure of experience. Our results show that for Australia and Great Britain, there do not appear to be large differences in the returns to experience for single women and men which would explain the differences in the shapes of the age earnings profiles. Single women, however in general had lower levels of human capital endowments at most ages, particularly in the 30 to 40 age range. Differences in the returns to experience for men and single women were more important in the US.

Our results using the adjusted measure of experience show that in each country, although women began by gaining more from experience than men, this did not continue throughout working life. Although there were no big endowment differences between young men and women when weighted by the coefficients from an earnings regression for men, this was not so among middle aged men and women. The differences contributed to the flatter age earnings profiles of women.

1. The Age Earnings Profiles of Men and Women.

In all three countries, as shown in figures 8.1, 8.2 and 8.3, full-time earnings of women varied less with age than for men. A similar pattern was found for each of the four education groups in each country.(1) The earnings profiles of single women, the group of women expected to behave most like men in terms of their attachment to the labour force, lay between the aggregate profiles for men and women. Although the earnings profiles of single women showed greater variation with age than the aggregate profile for women in each country, the growth in earnings with age was smaller for these women than for men.

2. Why Do the Age Earnings Profiles of Women Differ from those of Men ?

The purpose of this section is to consider whether there are any additional factors which may explain differences in the shape of the age earnings profiles of men and women apart from those general explanations already discussed in chapter 2. There are a number of theories which offer an explanation as to why at each age women earn less than men. We shall consider five of them in turn; the role of human capital and the division of labour within the family, a taste for discrimination against women, statistical discrimination, occupational segregation and the role of family migration and monopsony in the labour market. We do not propose presenting a detailed exposition of each of these approaches but rather we shall outline the broad ideas and shall emphasise

Figure 8.1: Actual Average Full-time Weekly Earnings of Men, All Women and Single Women, Australia, 1981.

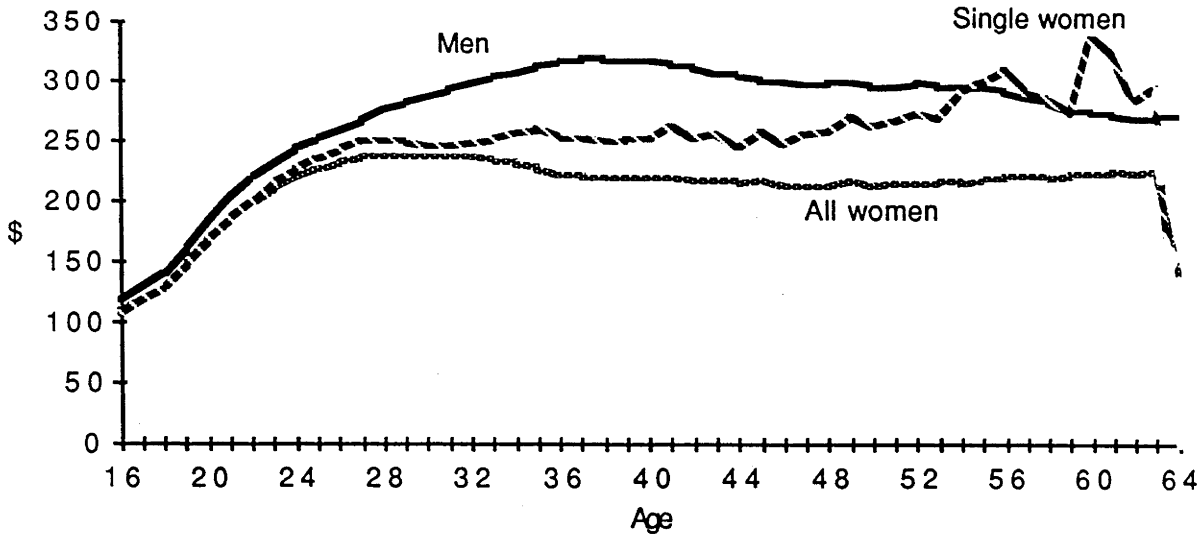


Figure 8.2: Actual Average Full-time Weekly Earnings of Men, All Women and Single Women, Great Britain, 1981.

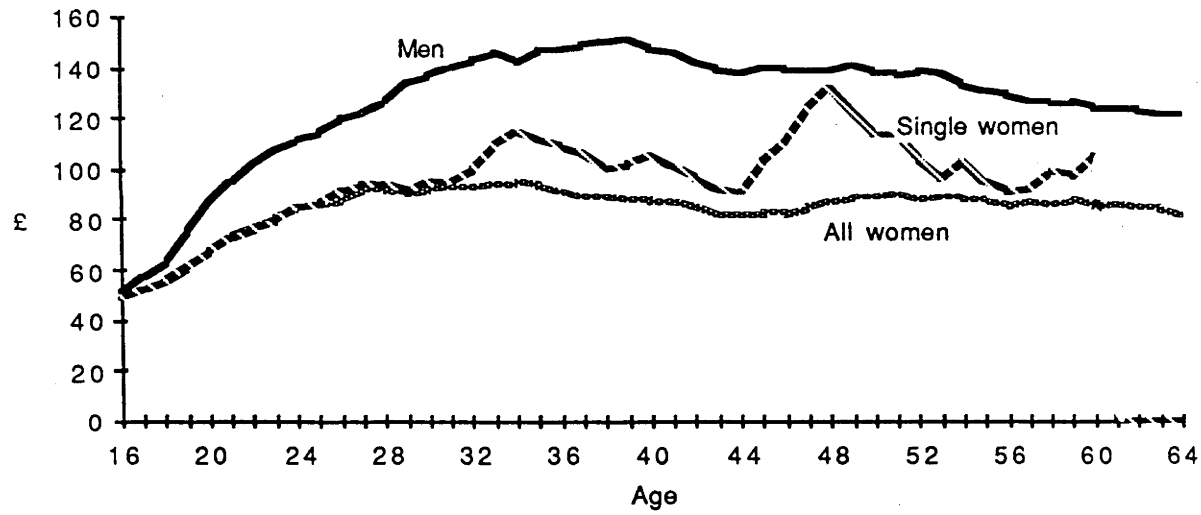
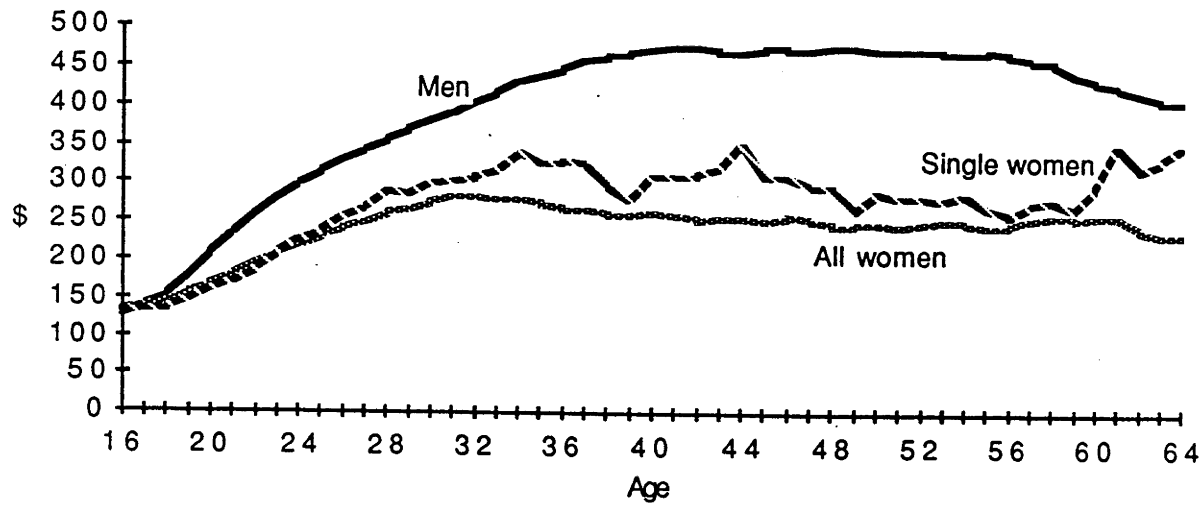


Figure 8.3: Actual Average Full-time Weekly Earnings of Men, All Women and Single Women, United States, 1981.



the aspects which may explain why the gap between the earnings of men and women should increase with age.

2.1. Human Capital and the Division of Labour within the Family

In chapter 2 we outlined the human capital model as one of the major theories explaining why earnings increase with age for all groups. As people invest in their productive capacities during schooling and the early part of working life, so they reap the benefits of this investment in terms of higher earnings later in life. The human capital approach has been linked with the typical division of labour observed in the family to explain why women earn less than men in a model originally developed by Mincer and Polachek (1974).

The family can be thought of as a trading group where each member gains from the specialisation of labour within the group in particular activities. In the traditional family, the male specialises in market work and the female specialises in non-market work. This has implications for the extent and type of investment in human capital which the woman undertakes. Mincer and Polachek (1974) present three implications of this division of labour.

Firstly if women expect to spend relatively short periods in paid employment, the incentives to invest in human capital skills which are rewarded in the market place is reduced. This is illustrated in figure 8.4 which presents the alternative earnings profiles for a woman deciding at the end of full-time schooling whether to undertake some general training or to opt for a job which offers no training. The experience earnings profile for the job without training is represented by the line Wo and the training alternative by WT. If the woman were planning to continue in paid employment until retirement at point R, for a given discount rate, she would be indifferent between the two experience earnings profiles. However if she is planning to leave market work at experience level A (in fact at any point before R), she will choose the job without

Figure 8.4: The Training Decision for Women

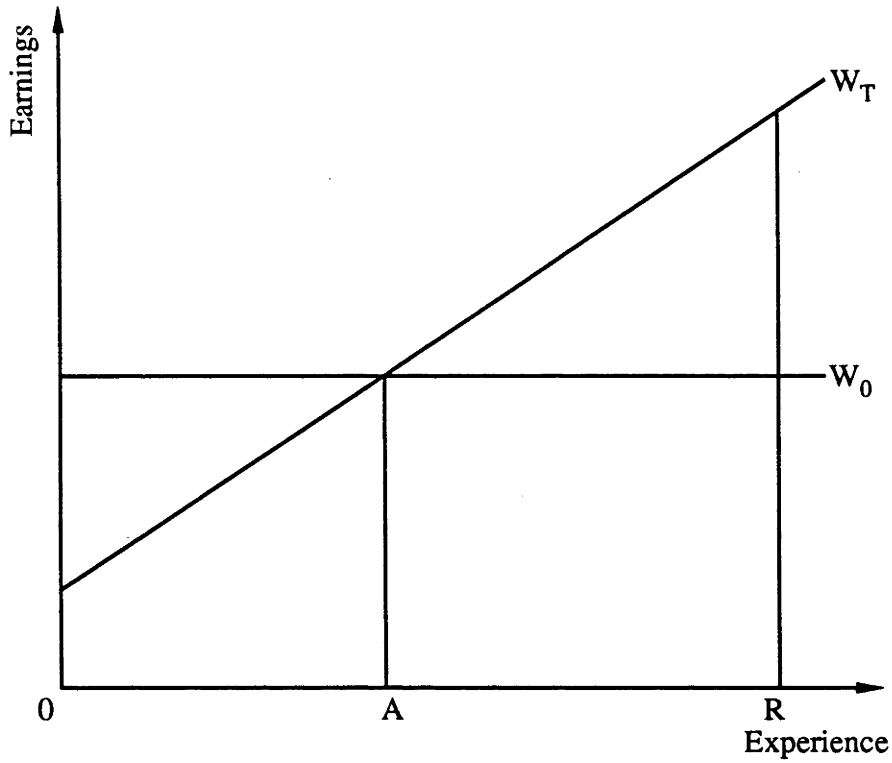
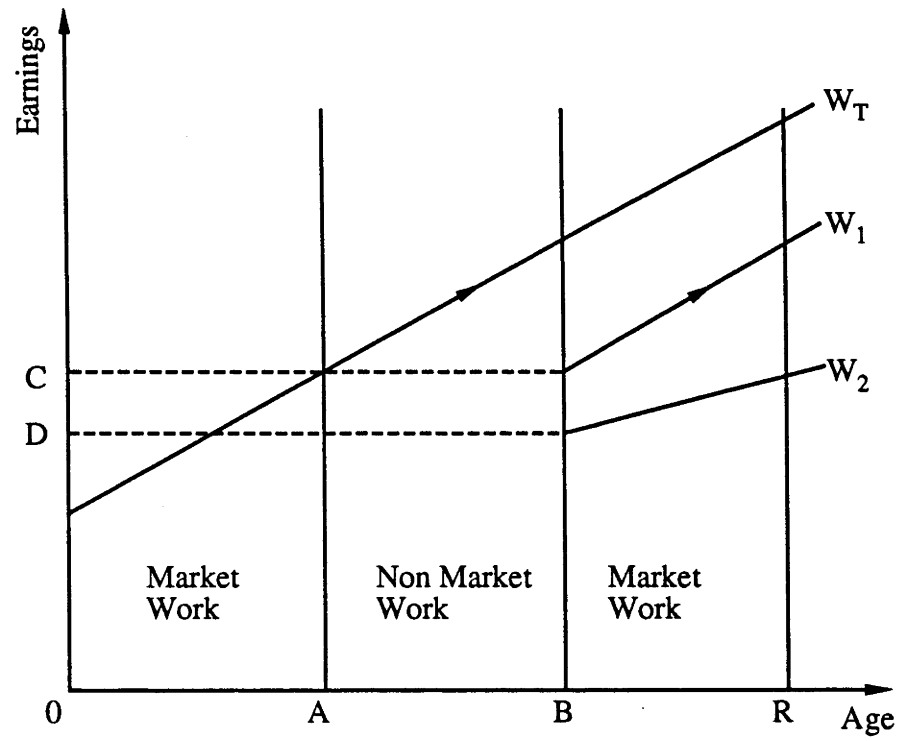


Figure 8.5: The Effect of Intermittent Labour Supply on Earnings.



training. Mincer and Polachek summarised this point "the shorter the expected and actual duration of work experience, the weaker the incentives to augment job skills over the life cycle." (pS80) (2)

Women with children typically take a break from market employment while the children are young. This produces a depreciation in any human capital skills acquired before the birth of the children and changes the conclusions of the initial optimisation decision concerning the extent of investment in human capital. This effect is illustrated in figure 8.5. We assume for simplicity, three stages of the life cycle; an initial period of market work followed by periods of non-market work and market work. W_T represents the wage with training for someone who does not interrupt their career in the market. If a women takes the time AB out of the workforce, she cannot expect to return to employment at the same level of earnings, C, she had before her break in employment. Nor can she expect to experience the same growth in her earnings on her return to market work as she could have experienced over the period AB but delayed to the period BR, represented here by the wage profile W1. Rather she will return at a lower level of earnings reflecting the depreciation of her market skills during her absence from the market, at earnings D, and will experience a slower growth in her earnings over the period BR.

A final implication of the effect of the division of labour in the family on human capital formation concerns the level of investment by women during any particular period of market work. The longer the participation in the current spell of market work is expected to be, the larger the likely investments in human capital. Mincer and Polachek expected women who never marry to behave more like men than women who were married or who had children.

> "To the extent, however, that the expectation of marriage and of childbearing are stronger at younger ages and diminish with age, investment of never-married women is likely to be initially lower than that of men. At the same time, given

lesser expectations of marriage on the part of the never-married, their initial on-the-job investments exceed those of the women who eventually marry." (p S86).

So within the human capital framework it is possible to present a straight forward explanation of the flatter age earnings profiles of women compared with men. Women who do not invest in human capital can be expected to have relatively high starting wages and little change in earnings with experience. The differences between men and women arise from optimising behaviour within the family although human capital theory by itself offers no explanation as to why the woman should specialise in non-market work and the man in market work. The domestic division of labour in traditional families discourages investment by women in human capital but this may be further reinforced by the operations of the labour market. Even with the same observable human capital, women may earn less than men. If men can earn more than women in the market place with the same set of human capital attributes, an optimising family will send the man into the market place while the woman concentrates on non-market work. The following discussion will examine some of the reasons why women may earn less in the market place than men for a given set of human capital attributes.

2.2 A Taste for Discrimination.

Discrimination is a very broad term covering a multitude of social situations and conventions but economists have typically confined their attention to discrimination which takes place within the market place. Social conditioning, expectations of future labour market attachments, differences in the type and quality of schooling are all examples of factors which may create differences in the position of men and women about to look for paid employment. While not denying the importance of such factors, economic analysis of discrimination has concentrated on explaining the existance of discrimination within the labour market or why apparently similar individuals should receive different rewards for the same attributes depending on their sex.

Becker (1957) offered one of the first economic interpretations of discrimination with respect to racial discrimination but the analysis he developed has been used to explain discrimination against women.(3) He defined discrimination in terms of a monetary measure;

> "If an individual has a "taste for discrimination", he must act as if he were willing to pay something either directly or in the form of reduced income, to be associated with some persons instead of others. When actual discrimination occurs, he must, in fact, either pay or forfeit income for the privilege." (p 6).

Employers, employees, consumers and government may each exhibit a taste for discrimination. (4)

Following Arrow's (1973b) analysis, we shall begin with the simple case of a perfectly competitive labour market with male (M) and female (F) workers and a representative firm who wishes to discriminate against women, that is "personal characteristics of the workers unrelated to productivity are also valued on the market" (p 3). The firm aims to maximise a utility function which includes both profits (Π) and the numbers of M and F employees.

$$U = u(\Pi, M, F) \qquad (1)$$

In the short run with fixed capital

$$\Pi = f(W+M) - w_W W - w_m M \qquad (2)$$

where f(W+M) is output, and w_W and w_m are the wage rates of women and men respectively. As each type of labour is by assumption a perfect substitute for the other, in the absence of discrimination we would expect their wages to be equated with their identical marginal products. However in the case of discrimination against women, the price to the employer of a woman is not just her wage but the additional "cost" to the employer of having a female employee. Becker called this the "discrimination coefficient", d, which is the negative of the marginal rate of substitution of profits for

female labour. The employer therefore equates marginal product with the total cost of employing a female

$$MP_W = w_W + d_W \qquad (3)$$

If the marginal utility of W is negative then d_W is positive. For men d_m is either zero (if there is no positive discrimination) or negative.

$$MP_m = w_m + d_m \qquad (4)$$

In equilibrium $MP_W = MP_m = MP_l$ so

$$w_m - w_W = d_W - d_m > 0 \qquad (5)$$

and the male wage rate exceeds the female wage rate. Women are paid less than their marginal product. This model implies that in the long run in a competitive market with differences between firms in the size of their discrimination coefficients, only the least discriminatory will survive as the firms which discriminate effectively place a tax on their profits which reduces their ability to expand. In a less competitive industry where supernormal profits exist, discrimination may persist for longer.

A similar analysis can be made in the case of employee discrimination against women. If male employees are willing to trade off higher wages for reduced contact with women in the workplace, the employer can minimise his costs by reducing the number of women working in the firm. A predicted outcome from this form of discrimination is segregation of employment by sex. The idea of a taste for discrimination can also be applied to the actions of consumers and government but it will not be considered here as it does not directly relate to the question of why age earnings profiles of women are flatter than those of men.(5)

This theory of discrimination explains why wage levels may differ between males and females but additional factors are needed to explain the flatter age earnings profiles

of women compared with men. The discrimination coefficient of employers or employees may differ between different levels of skill, for example, which may have the effect of restricting female access to particular jobs where there are higher levels of on-the-job training. Men may discriminate more against the woman who wants to be a trainee manager than the woman who wants to be the tea lady. In this example it would be the combination of both discrimination and the lack of opportunity for human capital investment which produced a flatter age earnings profile for women than for men. Differences in the opportunities for human capital investment need not be the only source of differences in the shape of the age earnings profile. Higher wages may be associated with particular jobs for institutional reasons not associated with the human capital of the people in the jobs and discrimination may deny women access to these positions.

2.3 Statistical Discrimination

In contrast to the "tastes" theory of discrimination, the statistical theory does not require a preference or aversion on the part of employers for some particular groups over others to generate different earnings for people with the same potential productivity (see Phelps (1972) and Aigner and Cain (1977) for a fuller discussion of the theory). The employer is assumed to be acting in a rational way to maximise profits. It is argued that there are substantial costs in acquiring information about potential employees and the knowledge that certain desirable characteristics (such as lower labour turnover) are associated with particular groups, encourages employers to apply statistical generalisations in their hiring practices. If women are perceived to be "bad employees" for some reason they will only be employed at lower wages than men. (6)

This model does not explain the development of the employer's perceptions. Although the employer may discriminate against individual females on the basis of his perception of the desirability of all females as employees, statistical discrimination against the whole group is unlikely to persist over time unless it is correct. The use by employers of hiring rules based on the average behaviour of particular groups of

potential employees cannot be regarded as discrimination against the whole group. Discrimination only exists if these rules are based on prejudice not on fact. Any misguided perceptions not based in fact could be expected to disappear in time. If women were incorrectly seen to have certain undesirable charateristics as employees, any employer willing to employ the cheaper female labour which did not on average hold the assumed undesirable characteristics would gain the benefit of higher profits. However in times such as the 1970's and 1980's of great changes in the labour market activity of women, there may well be a problem if employers are slow to adjust their perceptions of the benefits of employing a new generation of women with higher levels of commitment to the workforce than older women.

Statistical discrimination by itself may explain why women are not promoted to particular positions where the characteristics which are felt to make women "bad employees" are of greater significance. Restricted opportunities may be the source of flatter age earnings profiles for women. Another interpretation is that it is the combination of statistical discrimination and the associated lack of human capital investment which produces the flatter age earnings profiles of women compared with men.

2.4 Occupational Segregation

Occupational segregation or crowding is perhaps best thought of as a symptom of one of the underlying causes of lower female earnings compared with men rather than an independent cause. (7) In each of the three countries, women are concentrated in particular occupations and the change in the distribution of women across occupations over time has been small.(8) This is in contrast to much larger changes in the occupational segregation by race in the United States over the period 1960-80 (see Fuchs (1988)). There are two possible interpretations of the facts of occupational segregation by sex. Firstly that it arises because of the free choice of women, or perhaps their social

conditioning prior to labour market entry, and secondly that it arises because of the deliberate discriminatory actions of men. We shall consider each of these in turn.

Polachek (1979) and (1981) present a model where individuals maximise their expected lifetime earnings subject to the effect of occupation on human capital accumulation. He argues that intermittent labour supply will effect the choice of occupation as different occupations have different rates of skill loss associated with absence from the labour market. Women expecting to have an intermittent attachment to the labour force will opt for those occupations with low degrees of depreciation of skills outside paid employment. Occupational segregation according to this approach is therefore the outcome of the rational optimising behaviour of women.

An alternative interpretation of the facts emphasises the role of men in keeping women out of particular occupations and restricting their employment to less attractive occupations.(9) Apps (1981) presents a summary of this approach. The occupational mobility of women may be restricted by "professional associations, by management policy, by trade unions, by social attitudes and/or government policy." (p 5). Given these restrictions from outside the model, profit maximising employers will pay people according to their marginal product but the value of the marginal product in the crowded female-dominated sector will be lower than in the male dominated sector. Differences in earnings between the sectors will be reinforced as those crowded in the low wage sector have less incentive to invest in human capital.

So occupational segregation can be interpreted as a rational response of utility maximising individuals or as a reflection of the restrictions imposed on female employment opportunities by men. (10) Either way, it is the differences in the career opportunities and the extent of on-the-job training between the male and female occupations which is important in explaining the differences in the shape of the age earnings profiles between men and women according to those who emphasise the role of occupational segregation.(11)

2.5 The Role of Monopsony and Migration.

The final explanation of lower female earnings compared with those of men relates once again to the division of labour within the family and its implications for the position of women in the labour market. It is argued that married women are limited in their choice of employer by their husband's job and their family responsibilities.

We shall firstly consider the role of family migration. A husband and wife looking for work, aim to maximise their joint family income which usually requires some compromise on geographical location. If the male works longer hours and has more human capital, then a greater burden of compromise will fall on the woman and result in the woman earning less than her maximum potential (see Franks (1978) for a more detailed presentation of this model).

The monopsony power of some employers may also contribute to the lower earnings of some women. If family responsibilities and job opportunities of men restrict the job opportunities of women to a small local market (for example in a company town), local employers are put in the position of monopsonists who are able to set the wage below the level of marginal revenue product. While these factors may explain the lower earnings of some women, it is unlikely to provide a satisfactory explanation of the relatively lower earnings of all women, including those who do not move.(12)

2.6 The Relationship between Generally Applicable Theories of the Shape of Age Earnings Profiles and Women's Profiles.

In the preceding section we have considered some of the theories which have been used to explain why women earn less than men. The two major approaches are "self discrimination" arising from the role of women in the family and discrimination by men against women in the labour market.(13) Both these theories can explain the flatter age earnings profiles of women compared with men.

Some of the more general explanations of why earnings profiles slope upwards may apply differentially to men and women. The role of human capital has been emphasised here but alternative explanations are possible. For example, an explanation of upward sloping earnings profiles unrelated to human capital is offered by Lazear's shirking model. Family responsibilities and the prospect of intermittent labour supply would discourage a woman from taking any job where the rewards accumulated toward the end of working life or were based on tenure with one employer. The observation that women have flatter age earnings profiles is compatible with any explanation of an upward sloping age earnings profile, given the intermittent nature of most women's attachment to the labour force.

The differences between the male and female slopes of age earnings profiles are not compatible with all theories outlined in chapter 2. For example, the "exit voice" theory of trade unions has been used to explain the evidence for men that union members have flatter age earnings profiles than non-union members. Women however, are less unionised than men in each of these countries and contrary to the predictions of this model have flatter age earnings profiles.

As we have seen in chapter 7, the operation of labour market institutions in each of these countries may result in differences in the shape of the age earnings profiles of women. We have argued that the institutional changes in female pay introduced in Australia and Great Britain had a larger impact on the male-female relativity than the institutional changes of the US. The ratio of average weekly earnings of women working full-time compared with men rose in the early 1970s by about 30 per cent in Australia, by 19 per cent in Great Britain and remained virtually unchanged in the US. (14) In 1981, the ratio of female to male full-time weekly earnings was 77 per cent in Australia, and 64 per cent in Great Britain and the US. If the major effect of these changes in the relativities between men and women was to reduce the extent of on-the-job training for women, we would expect to observe higher starting wages for women

than for men and low growth in earnings with experience in Australia and Great Britain. If however training had never been important for women in any of these countries, there may be no differences between them in the relationship between the returns to experience for men and women.

The discrimination and human capital explanations of flatter age earnings profiles for women compared with men are not mutually exclusive. However, while the human capital explanation would suggest that the relatively flat age earnings profiles of women should be associated with high initial earnings, as no sacrifice of income has been made in the interests of investment in human capital, an interpretation which emphasises discrimination would predict low initial earnings for women as well as relatively flat age earnings profiles.

3. Empirical Estimation of Age Earnings Profiles for Women

The purpose of this section is to see whether the flatter age earnings profiles of women compared with men can be attributed to the lower returns to experience for women or whether human capital endowment differences between the sexes are important. The flatter cross section age earnings profiles of women may arise because older women are less well endowed with human capital than younger women compared with the difference between older and younger men. An extreme example would be the case where all young women were university graduates and all old women were unqualified. The cross section would show declining average earnings with age. In contrast, the male education mix may be more similar across ages reducing the size of this effect. The use of regression techniques enables us to consider these questions by holding other things equal.

Both the endowment and experience explanations would be compatible with "self discrimination" or male discrimination being responsible for the shape of the age earnings profiles of women compared with men. Women may decide not to undertake

university education or to invest in on-the-job training because they independently choose not to or because they perceive that discrimination against them in the market place makes these investments less profitable than for men. However if lower returns to experience for women are associated with a higher intercept term this would add support to the human capital interpretation of the differences.

In the preceding chapter we have outlined some of the additional limitations of a measure of experience based on potential experience in relation to women. Given the intermittent attachment of women to the labour force, potential experience overstates actual experience. Our preferred measure of experience would of course be the actual time that each individual spent in the labour force, derived either from longitudinal data or surveys of retrospective labour force attachment. Studies such as those by Mincer and Polachek (1974) for the US and Joshi and Newell (1987a), Dolton and Makepeace (1986 and 1987) and Sprague (1988) for Britain and Rummery (1989) for Australia have benefited from such surveys covering past labour force experience. While the data sets we have used for this study have the advantage of comparability across the three countries, they have the disadvantage of no measure of actual experience.

In this section we report results which attempt to limit the effect of this deficiency. Our first set of results relate to single women where the differences between potential and actual experience are expected to be less marked than for women as a whole. We also expect the "self discrimination" explanation of female/male earnings differentials to be less important for this group. Our second set of results covers all women and uses a corrected measure of experience based on the participation rates of various cohorts over time. The method used to calculate this measure shall be described below.

A comparison of these two sets of results may offer some evidence of the importance of "self discrimination" in explaining the flatter age earnings profiles of women compared with men. If women in aggregate gained less from experience and were less well endowed with human capital than single women, it suggests that there

were factors other than sex per se which flattened the age earnings profiles of women. If sexual discrimination alone was the source of all differences between the earnings of men and women, we would not expect to see differences in the results between groups of women. Similarly, if all the differences in male-female earnings were due to the family responsibilities of women, we would expect to see smaller differences between men and single women who do not have family responsibilities than between men and all women. (15)

3.1 Comparing the Returns to Experience for Men and Women.

Our results to be reported below show mixed findings for the effect of increases in experience on female earnings compared with men in the same country. The answer to the question, who gains more from additional experience, men or women, depends on choice of country, the level of experience to be used as a base and whether we are considering all women or single women alone. Many earlier studies compare the returns to experience between men and women and we shall now summarise some of the findings for each of the three countries. These studies also show a variety of answers to the question of whether men or women gain more from labour market experience. One study by Gregory, Daly, Ho and Anstie (1989) which covers the same three countries using a slightly different sample group for 1981 found a lower return to potential experience for women compared with men in each country.

3.1.1 American studies

An early example of an American comparison of the determinants of earnings for men and women was the study by Blinder (1973) using data from the Michigan Survey Research Centre's Panel Study of Income Dynamics for 1967. These regressions included location, health, conditions in the local labour market, education, occupation, union membership, vocational training, verteran status, job tenure and geographical mobility. He used age as a measure of labour market experience and found that differences in the rewards for age were the major source of differences in the earnings of

women relative to men. Male earnings increased much more with age than female earnings.

Mincer and Polachek (1974) had a better measure of actual labour market experience than age but produced qualitatively similar results to Blinder for the US. They used 1966 data for women aged 30 to 44 which included information on work histories and matched data for the same year for men. Their regressions controlled for education, location, health and number of children in addition to experience. They concluded that the major cause of differences in earnings between men and women was differences in experience (both coefficient and endowment differences) which accounted for "about 70 per cent of the observed difference in wage rates between married men and married women and a half of the difference between married men and single women." (p 103).

3.1.2 British Studies

Greenhalgh (1980) estimated earnings regressions for single and married men and women in Great Britain with data from 1971 and 1975. She used a measure of potential experience and included education, location, occupation, industry, health, colour and age of children in the regressions. Her results show for 1971 that the returns to experience for wives were less than for husbands but in the comparison of single men and single women, women gained more from experience. The results for 1975 were somewhat different and show that the returns to experience were higher for both married and single men than for the equivalent female group. The differences between married men and women were however small.

Joshi and Newall (1987a) used longitudinal data for British men and women born in 1946 and aged 26 in 1972 and 32 in 1977 to estimate their earnings regressions. The regressions included such variables as education, current and first occupation, location, and ability and ambition as measured in the National Survey of Health and Development at age 15. Their results for 1972 show a slightly lower return to the time spent working

between the ages of 18 and 26 for men than women. In 1977 however, the returns to work experience between the ages of 26 and 32 were lower for these women than for men.

3.1.3 Australian Studies.

There are two studies we shall consider for Australia. Chapman and Mulvey (1986) used data for 1982 to estimate earnings regressions for men and women including variables such as education, industry, marital status, country of birth, place of residence and occupation. Experience entered the regressions in two forms, potential experience as we have defined it and years of experience with the current employer. Their point estimates suggest that the percentage increase in the wage arising from additional experience from either of these two sources was higher for women than for men.

Rummery (1989) compared the returns to experience for Australian men and women using measures of both actual and potential experience taken from the 1984 National Social Science Survey. She included education, location and marital status in regressions using both measures of experience. The returns to potential experience were slightly higher for men than women but the point estimates suggest that the returns to experience were identical for men and women when experience was measured by actual time in the workforce.

In conclusion, these studies for three different countries using different data sets and measures of experience show a variety of conclusions on the relative effects of experience on the earnings of men and women. While the US results presented here support the conclusion that the returns to experience are lower for women than for men, both the Australian and British studies produce mixed results.

3.2 The Earnings Regressions for Single Women.

The evidence for the three countries shows that age earnings profiles for single women working full-time lay somewhere between the profiles of men and all women. This observation is consistent with the hypothesis that family commitments reduce female investment in human capital and that women without families can be expected to have earnings profiles which look more like those of men. It is also consistent with the hypothesis that women have flatter age earnings profiles because of discrimination. Even this group of women who might be expected to behave most like men in terms of commitment to the workforce do not earn as much as men at any age. In this section we shall compare regression results for single women in the three countries with earlier regression results for all men. We shall also look in more detail at the addition to earnings with increased potential experience for men and single women.

The average characteristics of single women, presented in Table 8.1 show differences between these women and the male sample used in the earlier regressions (see Table 3.1 chapter 3). In each country they had more education on average than the male sample but their average potential experience levels were less than half that of the male sample.

The regression results for single women are presented in Table 8.2. We have constrained the effect of experience on earnings to be the same across all education groups because of the small sample size for single women and their concentration among the younger age groups. The results follow the pattern of other regressions presented in earlier chapters. More educated single women earned more than the less educated and rural residence had a negative effect on earnings. The results can be directly compared with the male results presented in Table D5 appendix D. The comparison shows that for each education group the addition to earnings was higher for single women than for men. So for example, while male graduates according to these results earned about 60

per cent more than unqualified men in each of the countries, single female graduates earned about 74 per cent more than unqualified single women in each country.

Table 8.3 compares the addition to earnings at various levels of experience for men and single women in each of the countries as predicted by the regression equations found in Table 8.2 and in Table D5 appendix D. In the first few years experience added more to earnings for Australian men than for single women. However, in the remaining years of working life there was not much difference between the two groups in the effect of potential experience on earnings (see columns (1) and (2), Table 8.3). The British results suggest a much larger initial increase in earnings with experience for men than single women but after five years in the labour force, the differences were not very great (see columns (3) and (4), Table 8.3). The American results contrast with those of the other two countries as at the point of labour market entry, single women gained more from experience than men although this advantage had disappeared after five years of potential work experience.(see columns (5) and (6) Table 8.3) These results suggest, therefore, that apart from some differences during the initial part of working life, differences in the shape of the age earnings profiles of men and single women cannot be attributed chiefly to differences in the growth in earnings with experience for Australia and Great Britain. American men, however, gained substantially more for an additional year of experience over the range five to 20 years experience than American single women did over that range.

As we have discussed in earlier chapters, human capital theory predicts that investment in on-the-job training will lead to an inverse relationship between the size of the intercept term and the growth of earnings with experience. The flatter age earnings profiles of women relative to men combined with a higher intercept term would be consistent with a human capital interpretation of the facts. Women opt for jobs which do not offer much training and the chance of higher earnings in the future. A lower intercept value and a lower growth in earnings with experience for women relative to men, would

be consistent with discrimination against women being an important source of the difference in the shapes of the age earnings profiles. We have therefore tested to see whether the differences between men and single women are statistically significant. The results of the pooled regressions are reported in appendix H. (16) They do not show a statistically significant negative intercept term for women in Great Britain but for Australia the coefficient was almost significant at the 5 per cent level and was clearly significant for the US. The experience variables for females were jointly significant. We conclude that the relationship between experience and earnings was significantly different between the sexes.

We have not presented the results of a decompositon of the differences in earnings between men and single women but have undertaken the more limited exercise and considering the question, how would the age earnings profiles of men and single women compare if they were both paid according to the same coefficients. This can be thought of as measuring the difference in endowments between the two groups. Figure 8.6 presents the gap between predicted earnings of men and single women using the male pay structure.Where the predicted earnings of men and single women were the same, the difference shown in figure 8.6 equals one. Values greater than one show that at a particular age the single women were better endowed with human capital than men and a value below one shows the opposite. The results suggest that we would expect the earnings gap between men and single women to widen with age into their 40s because of differences in the endowments of the two groups but to decline toward the end of working life.

This results of this section can be summarised as follows. While the evidence on differences between men and single women in the rewards from on-the-job training as measured by the experience coefficients, does not suggest that this is an important determinant of the differences in the shapes of the age earnings profiles, differences in

Table 8.1
The Characteristics of Single Women , Australia, Great Britain and the United States, 1981

	Australia	Great Britain	United States
% of the sample with the following education			
Unqualified	21.48	33.76	11.04
High school	49.45	45.26	42.14
Post secondary	16.50	17.89	19.53
Graduate	12.57	3.09	27.28
Rural	7.20	34.40	24.73
Experience (years)	6.49	7.77	10.76

Table 8.2
Weekly Earnings of Full-time Single Women aged 16-64, Australia, Great Britain, the United States, 1981. The measure of experience is potential experience.
Dependent Variable = ln Weekly Earnings

	Australia	Great Britain	United States
Intercept (a)	4.5219 (237.99**)	3.7298 (97.90**)	4.4824 (52.30**)
High	0.1867 (12.45**)	0.1348 (5.81**)	0.3252 (5.77**)
Post secondary	0.3277 (17.52**)	0.3000 (10.14**)	0.4325 (6.88**)
Graduate	0.7367 (36.11**)	0.7326 (12.19**)	0.7532 (12.57**)
X (b)	1.3301 (2.97**)	0.7785 (1.82)	0.6089 (2.68**)
δ	0.1329 (4.34**)	0.1764 (2.02**)	0.2721 (1.91)
Experience	-0.0369 (1.42)	-0.0059 (0.21)	0.0035 (0.18)
Experience ^{2}	0.0006 (1.5)	0.0001 (0.02)	0.0000 (0.01)
Rural	-0.0934 (4.25**)	-0.0435 (-2.04**)	-0.1134 (-2.98**)
R^2	0.54	0.38	0.26
N	2,346	939	942

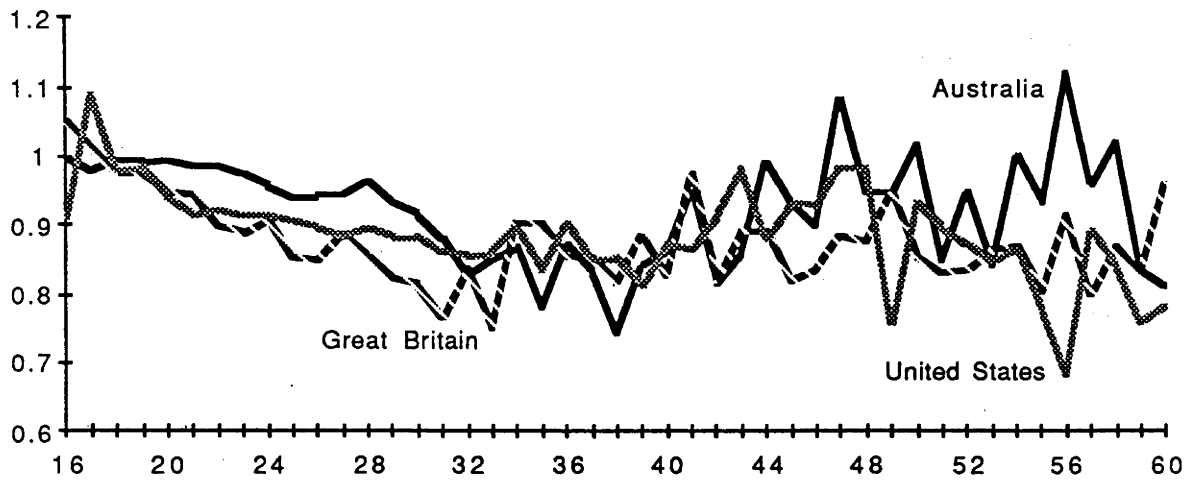
Notes:
t statistics in brackets. Significant test statistics at the 5 per cent level are indicated by a * and those significant at the 1 per cent level by **.
(a) The intercept measures ln earnings for an unqualified singel woman of urban residence and no working experience. (b) $X = 1\text{-}e^{(-\delta*\text{experience})}$

Table 8.3
Percentage Growth in Earnings with an Additional Year of Experience for Men and Single Women, Australia, Great Britain and the United States, 1981.

	Australia		Great Britain		United States	
	Single Women (1)	Men (2)	Single Women (3)	Men (4)	Single Women (5)	Men (6)
An additional year of experience starting from the following years of experience -						
1	10.99	13.36	10.00	17.61	11.40	7.68
3	7.89	8.18	6.90	9.05	6.76	6.16
5	5.49	5.09	4.74	4.90	4.07	4.95
10	1.95	1.73	1.78	1.52	1.31	2.84
20	-0.07	0.26	0.19	0.36	0.41	0.79
30	0.28	-0.21	0.08	-0.25	0.36	-0.12
45	1.82	-0.82	0.33	-1.15	0.35	-0.90

Source Table 8.2 and Table D5 Appendix D.

Figure 8.6: Proportionate Difference in Predicted Earnings for Men and Single Women using Male Coefficients, Australia, Great Britain and the United States, 1981.



other human capital endowments, for example education, contributed to the flatter age earnings profiles of single women compared with single men.

3.3. The Earnings of Women Using an Adjusted Experience Measure.

We have already explained the problems associated with the use of potential experience as a measure of labour market experience for women. In this section we shall present some results for women which use an adjusted measure of experience. We follow the method outlined by Chapman and Miller (1983) and Chapman and Mulvey (1986) of estimating the average experience of a cohort by tracing the participation rates of the cohort over time using the Census of each country. Census data for various years show the participation rate of age group i, (Pi). By extrapolating between the Census years we can estimate the accumulated average experience of a cohort of age i in 1981 as

$$AE_i = P_{i,\ 1981} + P_{i-1,(1980)} + P_{i-2,(1979)} + \ldots\ldots + P_{i-n,(1981-n)} \qquad (6)$$

where n is the number of years they have been in the labour force in 1981. There are shortcomings of this measure but we consider such an adjustment enables us to make some allowance for the differences in labour force attachment between men and women.

In order to apply this measure to the individual data, it has been necessary to assume that individuals in a given age group had the average working experience of that age group at each stage of their lives. We will therefore underestimate the actual experience of those who have worked continuously until 1981 and over estimate the experience of those who have just entered the workforce in time to be included in our sample but had previously had prolonged spells of non-market work. This measure will make no allowance for any depreciation in human capital which may take place during a complete break from market work. Our estimates of the effect of experience on earnings will be biased downward because of measurement errors.

There are two further limitations of the Census data and our measure of experience, which we would like to consider here. Firstly, the broad average conceals differences in the participation rates of different groups. For example, evidence from the 1981 cross section shows that participation rates vary by marital status (single women work more than married women but not as much as men) and education group (women with higher levels of education tend to spend more time in the labour force than others). Unfortunately the available Census data did not allow us to take these factors into consideration.

A further limitation of the data was the inability to separate part time and full time workers by age category. It has therefore been necessary to assume that the experience gained as a part time worker was equivalent to that gained as a full time worker and there is some evidence that this is not the case at least in Britain (see Ermish and Wright (1988)). Our assumption will overstate the extent of labour market experience of women as there were a substantial proportion who only worked part time. (17)

Our regression results using the adjusted experience measure for women are presented in Table 8.5. The variables used are the same as those included in the equations for single women but have in addition marital status and family variables. We have not included the education by experience interaction terms. The results are qualitatively similar to the earlier results for all women using potential experience (see chapter 7 Table 7.1) and for single women. The more educated earned more than the less educated. Rural residence and the presence of children in the household reduced earnings and marital status of itself was generally not an important determinant of earnings.

In comparison with the earlier results using the measure of potential experience, these results show smaller returns to education and larger returns to experience for women. The coefficients on the other variables did not alter substantially. The returns to education were also smaller than those estimated for men in an equation using the same

variables (see Table D5 appendix D). Table 8.6 shows the effect of additional experience on the earnings of women compared with men in the three countries. The results show that women in all three countries gained more initially than men from added experience. However, for Australia in particular this advantage was short lived. After five years of labour market experience men added more to their earnings with additional experience than women at least until the end of working life. After ten years experience, additional experience also contributed less to women's earnings in Britain than to male earnings. The predicted increases of six and 14 per cent in female earnings after 30 and 45 years of experience are implausibly high and suggest that the functional form of experience was not appropriate at these higher levels of experience. American women gained more from experience than men in the early part of working life but after ten years of experience this result was reversed.

Table H2 appendix H presents results from pooled regressions including both men and women using the adjusted experience measure. A statistically significant negative coefficient was found on the female variable for Great Britain and the US but not for Australia. The females variables were taken together, highly significant supporting the hypothesis that there was a different relationship between the dependent and independent variables for women than for men.(18)

We have once again adopted the approach of comparing predicted earnings for men and women using the male coefficients rather than undertake a full decomposition of the earnings differences into the parts attributable to coefficients and endowments. The differences between the predicted earnings at each age are presented in figure 8.7. The figure can be read in the same way as figure 8.6 comparing men and single women. Points in the figure below one show that women were less well endowed with human capital than men at that age and points above one show that women were better endowed

Table 8.5

Weekly Earnings of Full-time Women aged 16-64, Australia, Great Britain, the United States, 1981. The measure of experience is adjusted experience.

Dependent Variable = ln Weekly Earnings

	Australia	Great Britain	United States
Intercept (a)	4.5636 (183.28**)	3.2388 (23.81**)	4.5372 (64.29**)
High	0.1159 (10.73**)	0.1410 (9.22**)	0.1884 (10.08**)
Post secondary	0.1924 (14.69**)	0.2737 (13.55**)	0.3078 (13.33**)
Graduate	0.4751 (32.77**)	0.4922 (11.24)	0.5315 (23.36**)
X (b)	0.8767 (2.08**)	1.7406 (4.08**)	1.6267 (2.46**)
δ	0.3418 (2.54**)	0.3031 (2.98**)	0.1371 (1.99*)
Experience	-0.0115 (-0.19)	-0.0795 (1.39)	-0.0537 (-0.88)
Experience ^{2}	0.0002 (0.09)	0.0024 (1.50)	0.0005 (0.31)
Married	0.0041 (0.34)	-0.0083 (0.47)	0.0295 (1.55)
Widowed, separated, divorced	0.0622 (3.70**)	0.0112 (0.40)	0.0249 (1.12)
Rural	-0.0709 (-4.35**)	-0.0415 (-3.01**)	-0.1317 (-9.46**)
Child	-0.1144 (-9.38**)	-0.0840 (100.0**)	-0.0984 (-6.62**)
R^2	0.38	0.27	0.18
N	5,554	2,299	5,261
Mean of Dep. Var.	5.2458	4.3173	5.4035

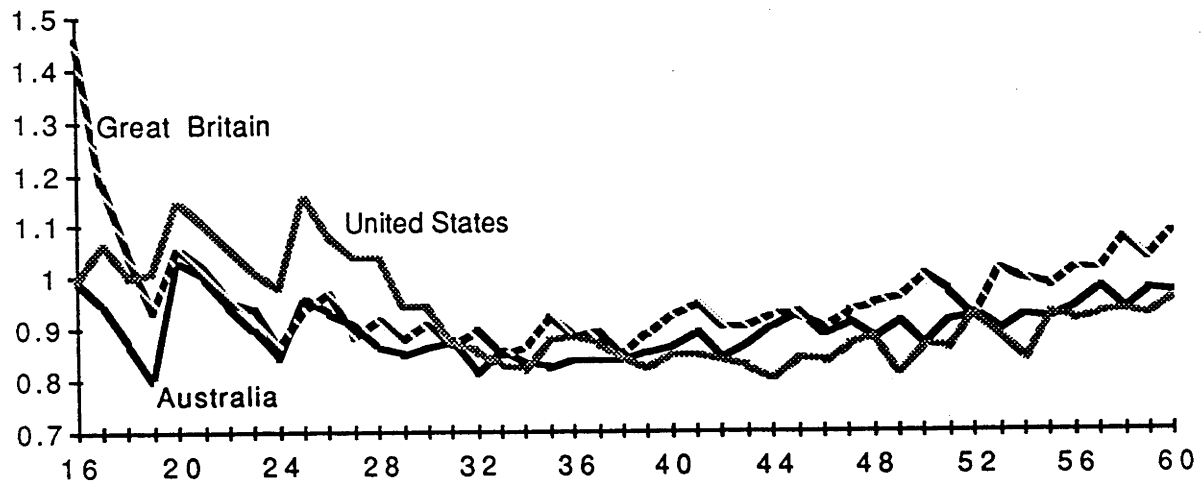
Notes:
t statistics in brackets. Significant test statistics at the 5 per cent level are indicated by a * and those significant at the 1 per cent level by **.
(a) the intercept measures ln earnings for a single unqualified woman of urban residence with no experience. (b) $X = (1-e^{(-\delta * \text{experience})})$

Table 8.6
Percentage Growth in Earnings with an Additional Year of Experience for Men and Women, Australia, Great Britain and the United States, 1981.

	Australia		Great Britain		United States	
	Women (1)	Men (2)	Women (3)	Men (4)	Women (5)	Men (6)
An additional year of experience starting from the following years of experience -						
1	16.94	13.36	26.38	17.61	12.95	7.68
3	8.09	8.18	12.06	9.05	8.80	6.16
5	3.66	5.09	4.69	4.90	5.68	4.95
10	0.10	1.73	-0.71	1.52	0.97	2.84
20	-0.30	0.26	0.02	0.36	-1.98	0.79
30	0.07	-0.21	6.70	-0.25	-1.98	-0.12
45	0.67	-0.82	13.89	-1.15	-0.78	-0.90

Source Table 8.5

Figure 8.7: Proportionate Difference in Predicted Earnings for Men and Women using Male Coefficients, Australia, Great Britain and the United States, 1981.



with human capital at these ages. A general pattern appears to exist across the three countries. Initially there were not big differences in the endowments of men and women but the relative endowments of women in their 30s compared with men were particularly low. The endowments of older women increased relative to men of the same age.

Our conclusions to this section are of course tentative because of the limitations associated with our measure of experience for women. However, our results show men in each country gained more from additional experience than women over longer periods during the middle of working life but on entry to the labour market, women increased their earnings more with experience than men. Differences in the addition to earnings with experience appear to contribute, at least in part, to the flatter age earnings profiles of women. Endowment differences between the sexes, using male coefficients as weights, would also tend to produce flatter age earnings profiles for women than men in a cross section. The results suggest that both endowment differences and differences in the returns to experience contribute to flatter age earnings profiles of women.

4. Conclusion and Summary.

In this chapter we have presented evidence of a similarity across the three countries in the relationship between age and earnings for women when compared with men in their same country. In each country women at each age earned less on average than men. The difference began by being quite small but in their early 30's the gap between their average earnings grew and it was not until the end of working life that it became smaller.

There are several theories which attempt to explain these facts. The first links the human capital explanation of rising age earnings profiles to the division of labour within the traditional family. As women have traditionally specialised in non-market work, there are few incentives for them to invest in skills which would make them more productive in the market place. As this specialisation is assumed to be the rational response of a woman making her own choices about time allocation, some have called it "self

discrimination". Other writers however, have suggested that men actively oppose the entry of women into paid employment, and the earnings differential reflects the extent of their discrimination.

We have presented evidence that suggests that it is not just the lower returns to experience that produced a flatter age earnings profile for women but also the greater difference between the endowments of older and younger women than between the endowments of older and younger men. As a much smaller proportion of older women participate in full-time work than for men, these endowment differences may reflect on the type of women who choose to work full-time compared with the rest.

Our results show that single women, who might be expected to behave like men in terms of their attachment to the workforce, at each age do not have earnings which are equivalent to those of men of their age. This appears to reflect differences in endowments between men and single women and at least in the United States, differences in the returns to experience. Taking our adjusted measure of experience, it appears that endowment differences also contribute to the different shapes of the male and aggregate female age earnings profiles. While women gained more than men from additional experience at the very beginning of working life, they gained less with experience over the middle period of working life.

It is probably a mixture of both "self discrimination" and discrimination by men which produces the flatter age earnings profiles of women compared with men. It is perhaps worth emphasising however, that although there were differences between the countries, there were also very strong similarities and whatever the underlying causes of the differences between men and women in the shape of age earnings profiles, they seem to operate across these three countries and not to be country specific.

Footnotes

1. This result also held in 1976 for Australia. Miller (1982) presents evidence from the Australian Population Census, 1976 of flatter age earnings profiles for women than men in each of three education groups; those with a bachelor's degree, those who had left school aged 18 and those who left school aged 15.

2. The predictions of the Mincer and Polachek model are very similar to those of the Salop and Salop (1976) labour turnover model discussed in chapter 2. Men acn be thought of as "stayers" and women as "quitters".

3. A number of writers have questioned the applicability of a theory of discrimination based on race to sexual discrimination. Sloane (1985) discusses these points in more detail. He summarised the arguments of a number of writers in the following points(see pp 81-82). Firstly, it is doubtful whether physical distance or social distance models are applicable to sexual discrimination. Secondly the role of family status and responsibilities are likely to be important in explaining differences in earnings between the sexes but not between races. A third argument against the applicability of discrimination models based on race to sex is the observation that genetic differences are smaller between races than between sexes. Studies show differences in achievement motivation between the sexes but not between races. Finally, the evidence on differences in earnings by occupation suggests different underlying causes of the lower earnings of women and blacks compared with men in the United States.

4. There are numerous empirical studies of the extent of sexual discrimination in each of these three countries. A general survey of the issues and results is presented in Gunderson (1989). Discrimination is usually measured following the method developed by Oaxaca (1973) and Blinder (1973) as the unexplained residual in an earnings regression. The results are sensitive to the number of control variables included in the regression and several writers have been critical of this methodology (see for example, Sloane (1985) for a summary of the arguments and Cotton (1988) and Fuchs (1988)).

For examples of results using these techniques for the US see Blinder (1973), Oaxaca (1973), Corcoran and Duncan (1979), Daymont and Andrisani (1984) and Blau and Ferber (1987). British examples include Greenhalgh (1980), Zabalza and Tzannatos (1985) and Joshi and Newell (1987). Chapman and Mulvey (1986) use this methodology to estimate the extent of discrimination against Australian women. The technique has also been used to examine the extent to which male-female earnings differentials between countries can be explained by endowment differences or differences in the rewards for these endowments. (See Gregory, Anstie, Daly and Ho(1989), Gregory and Ho (1985) and Gregory, Daly and Ho (1986)).

An alternative experimental approach to the measure of discrimination against women was adopted by Riach and Rich (1987). They applied, using fictitious individuals, to job advertisements in an Australian newspaper. They compared the acceptance rate for job interviews requiring an initial written application for men and women created by the researchers to be identical in major characteristics. They concluded that women faced discrimination in their sample of firms.

5. In the 1980's governments could perhaps be best thought of as discriminating in favour of women rather than against women. Each of these three countries now has laws which aim to promote the economic position of women. See Gunderson (1989) for a summary of US studies of the effect of affirmative action.

6. There is evidence that women do have higher quit rates than men. Examples of studies showing this result include Barnes and Jones (1974) and Viscusi (1980) for the US and Lewis (1979) and Chapman and Prior (1986) for Australia. However, Lewis (1979) found in his sample of Australian manufacturing firms that employers tended to overestimate the quit rates of their female employees relative to their male employees.

7. The origins of this model are generally attributed to Edgeworth (1922) who argued that the "pressure of male trade unions appears responsible for that crowding of women into comparatively few occupations, which is universally recognised as a main factor in the depression of their wages."

8. There are numerous studies of occupational segregation by sex and its effect on earnings for each of these countries. Examples for Australia include Moir and Selby Smith (1979), Lewis (1982), Karmel and MacLachlin (1988) and Mumford (1989). For Great Britain, Hakim (1979), Pike (1982), Greenhalgh and Stewart (1985) and Miller (1987) consider occupational segregation by sex. Results and a discussion of the issues for the US can be found in Bergmann (1972), LLoyd and Niemi (1979), Beller (1985), Goldin (1986), Blau and Ferber (1986) and Fuchs (1988).

9. There are plenty of example of restrictions placed on the types of employment women were allowed to accept during this century. Phelps Brown (1977) argued on the basis of British evidence that "there is much evidence for the obstacles and inhibitions that obstruct the entry of women into employment they are well capable of following. Particularly among manual workers, women are debarred from work which they could do perfectly well by the deliberate opposition of the men, often with the agreement of employers, or by the tacit acceptance of customary lines of demarcation between what is and what is not 'women's work'."(p 150) O'Donnel and Hall (1988) present Australian evidence. For example women were prevented from working in employment defined as dangerous. "Such work included work on metal-working machinery, forging machines, mechanically operated cutting and welding machines, wood-working machines, and machines used in making aerated waters, aluminium ware, asbestos, boots and shoes, brick tiles, pottery, bread and biscuits, foodstuffs, printing, rubber and soap." (p 7). There were also restrictions on the hours women were permitted to work. The importance of these restrictions for the employment prospects of women however, is difficult to measure.

10. England (1982) presents a test of the hypothesis that occupational segregation arises from the optimising behaviour of women who typically have an intermittent attachment to the labour force. On the basis of regression results using panel data for the US, she concludes that the earnings of women in predominantly female occupations do not show lower rates of either depreciation or appreciation than do the earnings of women in

occupations containing more males. She also produces evidence that women who have spent more time out of the labour force are no more likely to be in predominantly female occupations than women who have been employed continuously. Beller (1982) also argues that discrimination rather than self selection is an important source of occupational discrimination in the US.

11. Several American studies do not support the conclusion that occupational segregation was important in explaining the flatter age earnings profiles of women. King (1977) used 1970 US Census data to compare the earnings of never married women employed as professionals and a similar group of men. He concluded that the flatter experience earnings profiles of women were only to a minor extent attributable to the pattern of their employment among the professions. Of more importance was the variation between men and women in experience earnings profiles within each profession. Several other studies summarised by Sloane (1985) also show that earnings inequality within occupations is more important in explaining the differences in earnings between the sexes than their distribution across occupations.

12. American evidence suggests that wives who move do suffer differentially more unemployment and/or decreases in income (see Lloyd and Niemi (1979) p 146).

13. "Self discrimination" is a term used by some writers but perhaps a better term would include the importance of social conditioning in determining women's behaviour.

14. See Gregory, Anstie, Daly and Ho (1989) for data on the changes in relative female earnings over the period 1966-1986.

15. Single women may not be at all like men. It depends whether single women are typically career orientated people committed to a life in the work force or women anticipating the arrival of "Prince Charming" and therefore without a long term commitment to paid employment. A further reason why they may differ from men in their attitudes to work relates to other forms of family responsibilities than marriage and children. We have no data on the extent to which these women may be responsible for

other family members such as aged parents. These types of responsibilities therefore are not considered here.

16. In the regression equations which pool both the male and single female samples, we have constrained the coefficient δ on the nonlinear experience term to be equal for men and women.

17. Other estimation techniques have been applied to the problem of adjusting potential experience to more closely resemble women's attachment to the workforce. See Zabalza and Arrufat (1985).

18. In the regression equations which pool both the male and female samples, we have constrained the coefficient δ on the nonlinear experience term to be equal for men and women.

Chapter 9
Conclusions

This thesis has investigated the relationship between age and earnings for men and women in three countries; Australia, Great Britain and the United States. As we have seen, there was much more variation in earnings with age in the US than in the other countries, particularly for men. In Australia men of 45 earned 13 per cent more than 25 year olds. The corresponding figure was 21 per cent in Great Britain and 42 per cent in the US. Within each country, there was much more variation in earnings with age for men than for women. At their peak in their early 30s, American women's earnings were about 20 per cent above the earnings of a 25 year old woman while British women earned about 8 per cent more and Australian women about the same as a 25 year old. The gap between male and female earnings grew with age and this was particularly pronounced for Australia.

A number of theories have been put forward to explain why earnings should vary with age. The best established of these is the human capital model. It is also the one which goes furthest by itself in explaining why older people earn more than younger people, why the more educated earn more than the less educated and why the earnings of the more educated tend to peak later than those of the less educated. There are other theories which explain upward sloping age earnings profiles in terms of the high costs of monitoring workers and the need to reduce shirking on the job or the high cost of labour turnover. These can explain some aspects of the relationship between age and earnings but are less successful at explaining the relationship between education, age and earnings.

The presence of trade unions and the activities of labour market institutions may also have implications for the shape of the age earnings profile. Trade unions have been shown to be associated with flatter age earnings profiles and this is consistent with a number of hypotheses such as the median voter model and the

exit-voice model. The introduction of labour market regulations in various forms can also be expected to alter the shape of the age earnings profile. Human capital theory predicts that where minimum wage regulations, or equal pay regulations in the case of women, set the wage above the market clearing rate, we would expect the age earnings profile to be flatter than in a perfectly competitive market.

We have considered the factors which these theories suggest may be important in explaining the shape of the age earnings profile; sex, experience in the workforce, education, industry of employment, the level of unionisation in an industry and cohort size, in the earnings regressions reported in chapters 4-8. We have also seen to what extent our evidence supports the hypothesis that country specific factors are important in explaining differences in the shapes of the age earnings profiles. Our results show that within each country for both men and women, education, experience and industry of employment are important determinants of earnings. The results for the effect of cohort size on the earnings of men were less conclusive. The decompositions of the differences in relative earnings by age between the countries showed that differences in the level of endowments of the basic human capital variables, education and experience, and the rewards to these endowments were the major sources of differences between the countries in the shapes of the age earnings profiles for both men and women.

The results in chapters 4-6 relate to men. In chapter 4 we presented results using a simple human capital earnings function including education, experience, marital status and location variables. In each of the three countries these variables were significant determinants of male earnings. We began by using the quadratic form of experience which is usually used in the literature. We showed that this functional form did not fit the data very well at either end of the age range 16-64. Earnings typically grow very fast in the first few years in the labour market, level off, and eventually fall slightly. The quadratic form of experience does not track

the asymmetries in the relationship between age and earnings very successfully. We compared a number of functional forms for experience and found the one which best fits the data included both exponential and quadratic terms for experience. Our preferred functional form tracked the large increases in earnings with experience during the initial few years in the workforce more successfully than the quadratic function.

We used this preferred functional form to decompose the differences between the countries in earnings by age relative to the earnings of 25 year old men, into that part which can be attributed to endowments and that part which can be attributed to coefficients. While the predicted age earnings profiles in Australia and Great Britain looked very similar, they differed substantially from that in the US. About half the difference between the US and each of the other two countries could be explained by the larger stock of human capital endowments in the US and about half by the larger rewards for these endowments. Of particular importance in explaining the differences were the larger amounts of educational endowments and the rewards to experience in the US. The differences in educational endowments reflect the fact that the growth in education has been a more recent phenomenon in Australia and Great Britain than in the US.

In chapter 5 we added cohort variables to the basic equation of chapter 4. There are problems in identifying the cohort effect in the cross section. Where the cohort variables were statistically significant, they had the expected sign. We also found that the inclusion of either a general cohort variable covering all those of a particular age, or educational cohort variables which related only to those with a given level of education, did not alter the result of the significance of the standard human capital variables.

Chapter 6 presents the results from the inclusion of industry variables in the basic male regressions of chapter 4. There are a number of hypotheses concerning

the interpretation of the industry coefficients and it is very difficult to distinguish between them. We found, as many earlier studies have found, that industry of employment is an important explanator of earnings for men. We also found some evidence of low industry intercept values being associated with faster growth in earnings with industry experience. This is consistent with the hypothesis that industry effects on earnings of new entrants compensate at least in part, for industry specific differences in the rates of growth of earnings.

We found evidence of a positive correlation between the countries in the industry intercept terms suggesting there were some common factors operating between the countries in determining the relative size of the industry effect. However, the correlation was not particularly large, suggesting that there were also some country specific effects of industry on earnings.

The inclusion of industry variables did not change the result that differences between the countries in the stocks and rewards to the basic human capital variables, education and experience, were most important in explaining the differences in relative earnings by age. The relationship between age and earnings was similar in Australia and Great Britain so there were not big differences to explain. About half of the differences in predicted relative earnings by age between Great Britain and the US were explained by endowment differences and about half by coefficient differences as in the decomposition which excluded industry variables.

However with the inclusion of industry variables in the comparison between Australia and the US, the greater rewards to a given set of endowments in the US explained about three-quarters of the earnings differences at most ages and endowment differences, the remaining quarter. This result suggests a more important role for coefficients than the earlier decomposition which did not include industry. The most important sources of the differences remained in education and

experience endowments and coefficients. Differences between the countries in the endowments of industry and the rewards to these endowments were in general not important in explaining the differences in the shapes of the age earnings profiles.

A final section of chapter 6 considered the question of whether the industry variables may be picking up the effect of trade union activity on the shape of the age earnings profile. We did not have data on individual union membership so we grouped the industries according to the level of unionisation. Three groups were distinguished for each country; the highly unionised industries, those with low levels of unionisation and those in the middle. Although the absolute levels of unionisation varied greatly between the countries, the ranking of industries by level of unionisation was the same across the three countries. We found that the industries with relatively higher levels of unionisation had flatter age earnings profiles and higher earnings for new entrants than the industries with low levels of unionisation for most education groups in each of the countries. These results are consistent with the hypothesis that industry effects are in part measuring the effect of trade unionism on the shape of the age earnings profile.

Chapter 7 presented a comparison of the age earnings profiles of women in the three countries. The earnings of women working full-time in these cross sections did not vary so much with age as the earnings of men. Nor were the differences between the countries so pronounced. As for the male sample, we found that the standard human capital variables were significant determinants of female earnings in each country. One notable difference between the sexes was in the effect of marriage on earnings. While marriage was associated with higher earnings for men, there was no evidence of this effect for women. Our results of the decomposition of relative earnings by age for women showed that older Australian women were relatively less well endowed with human capital compared with 25 year old women than their British and American counterparts and this was

important in explaining the differences between the countries in the shapes of the age earnings profiles. Coefficient differences were more important in explaining the small differences between the relative earnings of British and American women over 25. For the under 25s, endowment differences were important.

In chapter 8 we compared the relationship between age and earnings for men and women in the same country. As we have shown, the relationship is quite different, with women's earnings varying much less with age than men's. One theory attributes this fact to women's role in the traditional family and the associated intermittent attachment to the labour force, another theory attributes it to discrimination by men against women. Our results do not enable us to clearly discriminate between these explanations. We estimated two sets of regressions to compare the returns to experience between women and men. The first relates to single women as they are the group of women expected to behave most like men in terms of their attachment to the labour market. The results of these regressions do not show large differences between the returns to experience for men and single women. The second set used an adjusted measure of experience to take some account of the difference between actual labour market experience and potential labour market experience. Results using our adjusted experience measure show that the returns to experience were initially higher for women in all three countries than for men but after five to ten years this initial advantage disappeared.

The difference in the shapes of the age earnings profiles for men and women may be reduced with changes in the labour force participation rate of women. In the cross section, older women working full-time were much less well endowed with human capital compared with young women than older men were relative to younger men. This source of differences between the sexes should change with the increased commitment of women to the labour force and the associated rise in

the incentives for women to invest more in skills which will raise their earnings power in the market place.

The results of this thesis show that there were many strong similarities between the countries. For example, the coefficients on the education variables were very similar between the countries, the association of relatively high levels of unionisation with flatter age earnings profiles was apparent in each country and the relationship between the age earnings profiles of men and women in the three countries was qualitatively the same. There were however some important differences between the countries. Earnings varied much more with age in the US than in either of the other countries and the effects of age on earnings differences between men and women were especially marked in Australia. It is however, difficult to claim that equal pay for women of itself caused the larger differences between the male and female profiles in Australia than in the other countries. There was also a substantial increase in relative female pay in Great Britain yet the relationship between the age earnings profiles of the sexes there looked more like that of the US than Australia.

Our study suggests that the Australian system of centralised wage fixing has not produced very different results with respect to age earnings profiles for men and women taken separately than those found in Great Britain. However the relationship between the profiles for men and women in each of these countries was quite different. We cannot conclude that the arbitration system has no effect on the distribution of earnings.

This thesis has touched on a wide range of issues relating to earnings. A next step should be more explicit testing of some of the hypotheses raised. A comparison between countries enables a greater understanding of both the common themes underlying the determination of earnings and the factors which may lead to substantial differences between countries.

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Appendix A

Definitions of Variables used in the Regression Equations.

Australia

Education Variables

Unqualified - Age on leaving school was less than or equal to 15; no further qualifications.

High school - Age on leaving school was greater or equal to 16, but the person had no post secondary qualifications.

Post secondary - Trade certificate or other post secondary certificate.

University degree - completion of a bachelor's or post graduate degree.

Experience

Age minus years of schooling minus six.

Children

A Dummy variable taking the value of 1 if children under the age of 18 were present in the household and were the responsibility of the head of the household or spouse.

Area

Rural - Those living in a community of less than 1,000 people.

Urban - Those living in a community of more than 1,000 people.

Marital Status

Spouse present - Currently married and living with spouse.

Other marital status - Widowed, separated and divorced individuals.

Single - Never married.

Great Britain

Education Variables

Unqualified - Those with no qualifications or with ungraded or grades 2 to 5 of a Certificate of Secondary Education

High school - The person had one of the following: a Certificate ofSecondary Education grade 1, school certificate, one or more GCE "O" level or the Scottish equivalent, or clerical and commercial qualifications.

Post secondary - Trade apprenticeship, GCE "A" levels, or other post secondary certificate.

University degree - completion of a bachelor's or higher degree.

Experience

Age minus age on leaving full-time education.

Children

A Dummy variable taking the value of 1 if children under the age of 16 were present in the household and were the responsibility of the head of the household or spouse.

Area

Rural - Those living in rural local authority areas.

Urban - Those living in urban local authority areas or the conurbations

Marital Status

Spouse present - Currently married and living with spouse.

Other marital status - Widowed, separated and divorced individuals.

Single - Never married.

United States

Education Variables

Unqualified - Completed less than 4 years of high school.

High school - Completed 4 years of high school.

Post secondary - Completed 1 to 3 years of college.

University degree - completed 4 or more years of college.

Experience

Age minus years of schooling minus six.

Children

A Dummy variable taking the value of 1 if children under the age of 18 were present in the household and were the responsibility of the head of the household or spouse.

Area

Rural - Those living in a community of less than 1 million people.

Urban - Those living in central cities or other communities of more than 1 million people.

Marital Status

Spouse present - Currently married and living with spouse.

Other marital status - Widowed, separated and divorced individuals.

Single - Never married.

Industry Variables

1. Agriculture

2. Energy and water

3. Extraction of minerals, manufacture of basic metals, mineral products and chemicals.

4. Metal goods, engineering and vehicles.

5. Other manufacturing (including.food, drink, tobacco, textiles, clothing and footwear, paper and printing,rubber and leather).

6. Construction.

7. Distribution, hotels and catering and repairs.

8. Transport and communications.

9. Banking, finance, insurance, business services and leasing.

10. Other services (including public administration, health, education, entertainment and personal services).

Occupations

1. Managers.

2. Professional workers.

3. Other non manual workers (including bookkeepers, secretaries, office machine operators, receptionists and sales workers).

4. Skilled and skilled supervisors (including foreman and women, metal workers, plumbers and electricians).

5. Unskilled and semi-skilled (including storemen and labourers

6. Farm workers.

Data used in the Australian Regression reported in Table 5.1 chapter 5.

Earnings

Average weekly earnings of age category/ average weekly earnings of all males was taken from ABS Weekly Earnings of Employees (Distribution) Australia Cat 6310.0

Experience-

The midpoint of age category- age left school weighted according to the proportion of the age group who were university graduates, had post secondary qualifications and the remainder.

Unemployment rate of age category and the cohort variable

These were taken from ABS The Labour Force, Australia cat 6204.0. Cohort size was taken as the number in the age category / number of years covered by the age category.

Education

The proportion of the age group who were graduates and had a post secondary qualification were taken from ABS Labour Force Status and Educational Attainment, Australia cat 6235.0. These data were available for the period 1980-86 so we have extrapolated backwards for the earlier years. Table 27 from the 1976 Australian Population Census, "Population aged 15 years and over, age by qualifications obtained by labour force status by sex, Australia" was used to establish a 1976 base.

Appendix B

Average Values of Variables by Age for Men, Australia, Great Britain and the United States, 1981.

	Australia	Great Britain	United States
Age 18			
Unqualified	0.2465	0.3622	0.4783
High School	0.6912	0.4094	0.5217
Post Secondary	0.0623	0.2283	0
Graduates	0	0	0
Experience (years)	1.8159	1.8268	0.9565
Married	0.0057	0	0.1304
Widowed, separated, divorced	0	0	0
Rural	0.1190	0.4094	0.3913
Industry			
Agriculture	0.0652	0.0315	0.0435
Energy and Water	0.0368	0.0157	0.0870
Manu. of Metals, chemicals	0.0595	0.0315	0
Metal goods, engineering, vehicles	0.1501	0.1575	0.0435
Other manufacturing	0.1331	0.1417	0.2174
Construction	0.0850	0.1732	0.0435
Distribution	0.2720	0.2756	0.3043
Transport and Communications	0.0595	0.0472	0
Banking and Business Services	0.0850	0.0472	0.1304
Other services	0.0481	0.0787	0.1304
Occupation			
Managers	0.0028	0.0236	0
Professional Workers	0.0170	0.0079	0
Other non manual workers	0.2096	0.1732	0.1739
Semi and unskilled workers	0.2408	0.2283	0.4783
Skilled workers	0.4476	0.5433	0.1739
Farm workers	0.0822	0.0236	0.1739

	Australia	Great Britain	United States
Age 25			
Unqualified	0.1850	0.2993	0.1764
High School	0.3353	0.1497	0.4279
Post Secondary	0.3584	0.4286	0.2093
Graduates	0.1214	0.1224	0.1860
Experience (years)	7.5260	8.0816	6.2465
Married	0.5549	0.6327	0.6233
Widowed, separated, divorced	0.0462	0.0204	0.0326
Rural	0.0896	0.2993	0.2884
Industry			
Agriculture	0.0260	0.0136	0.0186
Energy and Water	0.0318	0.0680	0.0093
Manu. of Metals, chemicals	0.0809	0.0544	0.0558
Metal goods, engineering, vehicles	0.0896	0.2041	0.1302
Other manufacturing	0.1214	0.0680	0.1488
Construction	0.0867	0.1156	0.0930
Distribution	0.1532	0.1361	0.2512
Transport and Communications	0.1214	0.0816	0.0651
Banking and Business Services	0.0983	0.0748	0.0884
Other services	0.1908	0.1837	0.1395
Occupation			
Managers	0.0145	0.0680	0.0279
Professional Workers	0.1387	0.0748	0.1395
Other non manual workers	0.2139	0.2789	0.2093
Semi and unskilled workers	0.2775	0.1769	0.3163
Skilled workers	0.3208	0.3810	0.2698
Farm workers	0.0347	0.0204	0.0372

	Australia	Great Britain	United States
Age 35			
Unqualified	0.2778	0.3529	0.0988
High School	0.1975	0.2206	0.3755
Post Secondary	0.3549	0.3824	0.2016
Graduates	0.1698	0.0441	0.3241
Experience (years)	17.6296	18.5662	15.3597
Married	0.8457	0.9044	0.8142
Widowed, separated, divorced	0.0895	0.0294	0.0909
Rural	0.0957	0.3162	0.3360
Industry			
Agriculture	0.0247	0.0074	0.0079
Energy and Water	0.0278	0.0441	0.0356
Manu. of Metals, chemicals	0.1049	0.0809	0.0751
Metal goods, engineering, vehicles	0.1080	0.1691	0.1700
Other manufacturing	0.0802	0.1397	0.0988
Construction	0.0463	0.1103	0.0791
Distribution	0.1914	0.1250	0.1739
Transport and Communications	0.0864	0.1029	0.0751
Banking and Business Services	0.0802	0.0735	0.0909
Other services	0.2500	0.1471	0.1937
Occupation			
Managers	0.1142	0.1838	0.1858
Professional Workers	0.1728	0.0441	0.1739
Other non manual workers	0.2593	0.2059	0.1818
Semi and unskilled workers	0.1944	0.1103	0.2095
Skilled workers	0.2346	0.4485	0.2372
Farm workers	0.0247	0.0074	0.0119

	Australia	Great Britain	United States
Age 45			
Unqualified	0.5146	0.4727	0.2303
High School	0.1602	0.1182	0.3553
Post Secondary	0.2718	0.3818	0.1053
Graduates	0.0534	0.0273	0.3092
Experience (years)	28.9806	29.1091	25.8750
Married	0.8252	0.8545	0.8355
Widowed, separated, divorced	0.1019	0.0818	0.1447
Rural	0.1019	0.3000	0.2632
Industry			
Agriculture	0.0243	0.0273	0
Energy and Water	0.0485	0.1091	0.0132
Manu. of Metals, chemicals	0.0825	0.0727	0.0658
Metal goods, engineering, vehicles	0.1117	0.2091	0.1974
Other manufacturing	0.0971	0.0909	0.1316
Construction	0.0728	0.1364	0.0263
Distribution	0.1505	0.0455	0.1053
Transport and Communications	0.1942	0.1364	0.0592
Banking and Business Services	0.0534	0.0364	0.0658
Other services	0.1650	0.1364	0.3355
Occupation			
Managers	0.1117	0.1727	0.0855
Professional Workers	0.0971	0.0455	0.2632
Other non manual workers	0.1796	0.1273	0.1776
Semi and unskilled workers	0.3592	0.1273	0.2566
Skilled workers	0.2379	0.5000	0.1974
Farm workers	0.0146	0.0273	0.0197

	Australia	Great Britain	United States
Age 55			
Unqualified	0.5180	0.5529	0.3419
High School	0.1396	0.0706	0.2903
Post Secondary	0.2793	0.3529	0.1226
Graduates	0.0631	0.0235	0.2452
Experience (years)	39.0811	40.2353	36.8839
Married	0.8604	0.8471	0.8387
Widowed, separated, divorced	0.1081	0.0824	0.0968
Rural	0.0991	0.3765	0.2581
Industry			
Agriculture	0.0270	0.0353	0.0065
Energy and Water	0.0495	0.0235	0.0581
Manu. of Metals, chemicals	0.1081	0.0588	0.1032
Metal goods, engineering, vehicles	0.1712	0.2471	0.1419
Other manufacturing	0.1081	0.0824	0.1226
Construction	0.0586	0.1294	0.0774
Distribution	0.1171	0.1176	0.1290
Transport and Communications	0.1216	0.1412	0.0710
Banking and Business Services	0.0676	0.0353	0.0645
Other services	0.1712	0.1294	0.2258
Occupation			
Managers	0.0991	0.2118	0.1677
Professional Workers	0.0946	0.0471	0.1613
Other non manual workers	0.1667	0.1529	0.1677
Semi and unskilled workers	0.3514	0.1294	0.2903
Skilled workers	0.2477	0.4235	0.2000
Farm workers	0.0405	0.0353	0.0129

	Australia	Great Britain	United States
Age 64			
Unqualified	0.5345	0.6415	0.4355
High School	0.1207	0.1132	0.3387
Post Secondary	0.2586	0.2075	0.1129
Graduates	0.0862	0.0377	0.1129
Experience (years)	47.9828	49.0	46.8387
Married	0.8103	0.8679	0.8871
Widowed, separated, divorced	0.0862	0.0566	0.0806
Rural	0.0517	0.3585	0.3548
Industry			
Agriculture	0.0172	0.0377	0
Energy and Water	0.0345	0.0189	0.0323
Manu. of Metals, chemicals	0.1034	0.0189	0.0484
Metal goods, engineering, vehicles	0.1724	0.2264	0.1935
Other manufacturing	0.0517	0.1509	0.2097
Construction	0.0690	0	0.0484
Distribution	0.1552	0.1509	0.1774
Transport and Communications	0.1379	0.0755	0.0484
Banking and Business Services	0.0517	0.0943	0.1129
Other services	0.2069	0.2264	0.1290
Occupation			
Managers	0.1034	0.0943	0.1613
Professional Workers	0.1207	0.0377	0.0968
Other non manual workers	0.2069	0.1698	0.1774
Semi and unskilled workers	0.2586	0.3019	0.3710
Skilled workers	0.2759	0.3774	0.1935
Farm workers	0.0345	0.0189	0

Appendix C

Average Values of Variables by Age for Women, Australia, Great Britain and the United States, 1981.

	Australia	Great Britain	United States
Age 18			
Unqualified	0.1810	0.3628	0.5714
High School	0.7241	0.5310	0.4286
Post Secondary	0.0948	0.1062	0
Graduates	0	0	0
Experience (years)	1.6422	1.7257	1.3333
Married	0.0344	0.0442	0.0952
Widowed, separated, divorced	0	0	0.0476
Child	0.0216	0	0.4286
Rural	0.0776	0.3717	0.3333
Industry			
Agriculture	0	0	0
Energy and Water	0.0129	0.0177	0
Manu. of Metals, chemicals	0.0129	0.0177	0
Metal goods, engineering, vehicles	0.0345	0.0796	0
Other manufacturing	0.0690	0.1327	0.0476
Construction	0.0172	0.0088	0.0476
Distribution	0.3750	0.3186	0.5238
Transport and Communications	0.0259	0.0265	0
Banking and Business Services	0.2457	0.1416	0.0952
Other services	0.2069	0.2566	0.2857
Occupation			
Managers	0.0000	0	0
Professional Workers	0.0560	0	0
Other non manual workers	0.7672	0.6903	0.4286
Semi and unskilled workers	0.1164	0.2832	0.5714
Skilled workers	0.0517	0.0177	0
Farm workers	0.0086	0.0088	0

	Australia	Great Britain	United States
Age 25			
Unqualified	0.2250	0.2973	0.0994
High School	0.3750	0.4730	0.3684
Post Secondary	0.1750	0.1622	0.2339
Graduates	0.2250	0.0676	0.2982
Experience (years)	7.4570	7.8514	5.5439
Married	0.5000	0.5946	0.5322
Widowed, separated, divorced	0.0850	0.0405	0.1228
Child	0.1400	0.1216	0.2749
Rural	0.0750	0.3649	0.3392
Industry			
Agriculture	0.0050	0	0.0117
Energy and Water	0.0100	0.0135	0.0058
Manu. of Metals, chemicals	0.0150	0.0135	0.0409
Metal goods, engineering, vehicles	0.0500	0.1081	0.1170
Other manufacturing	0.0450	0.1216	0.1637
Construction	0.0250	0.0405	0.0058
Distribution	0.1700	0.1622	0.1462
Transport and Communications	0.0450	0.0811	0.0409
Banking and Business Services	0.1950	0.1216	0.1287
Other services	0.4400	0.3378	0.3392
Occupation			
Managers	0.0150	0.0541	0.0585
Professional Workers	0.3000	0.0135	0.2105
Other non manual workers	0.5600	0.7297	0.4503
Semi and unskilled workers	0.0800	0.1351	0.2339
Skilled workers	0.0350	0.0676	0.0351
Farm workers	0.0100	0	0.0117

	Australia	Great Britain	United States
Age 35			
Unqualified	0.4333	0.3750	0.0962
High School	0.2889	0.3750	0.4680
Post Secondary	0.1556	0.2188	0.2244
Graduates	0.1222	0.0313	0.2115
Experience (years)	18.5556	18.1563	15.8462
Married	0.6778	0.8125	0.5769
Widowed, separated, divorced	0.1667	0.0313	0.3013
Child	0.6667	0.5000	0.7308
Rural	0.0667	0.2813	0.2756
Industry			
Agriculture	0.0111	0	0
Energy and Water	0	0	0
Manu. of Metals, chemicals	0.0333	0	0.0128
Metal goods, engineering, vehicles	0.0889	0.0313	0.1218
Other manufacturing	0.1556	0.2813	0.1026
Construction	0	0	0.0192
Distribution	0.1778	0.0938	0.1026
Transport and Communications	0.0778	0.0938	0.0321
Banking and Business Services	0.1222	0.0625	0.1603
Other services	0.3333	0.4375	0.4487
Occupation			
Managers	0.0333	0.0313	0.0641
Professional Workers	0.1889	0	0.2821
Other non manual workers	0.4556	0.6250	0.3462
Semi and unskilled workers	0.2111	0.2813	0.2821
Skilled workers	0.1000	0.0625	0.0256
Farm workers	0.0111	0	0

	Australia	Great Britain	United States
Age 45			
Unqualified	0.4828	0.6042	0.2130
High School	0.2874	0.2500	0.5648
Post Secondary	0.0920	0.1250	0.0833
Graduates	0.1379	0.0208	0.1389
Experience (years)	28.6092	29.4167	26.7963
Married	0.7471	0.7083	0.6852
Widowed, separated, divorced	0.1494	0.1458	0.2500
Child	0.4600	0.3958	0.4907
Rural	0.0575	0.3750	0.2500
Industry			
Agriculture	0.0230	0	0
Energy and Water	0	0	0
Manu. of Metals, chemicals	0.0345	0.0417	0.0370
Metal goods, engineering, vehicles	0.0575	0.1875	0.1296
Other manufacturing	0.2184	0.0833	0.1481
Construction	0	0.0417	0
Distribution	0.2184	0.1458	0.1481
Transport and Communications	0.0345	0.0833	0.0278
Banking and Business Services	0.0575	0.1042	0.0926
Other services	0.3563	0.3125	0.4167
Occupation			
Managers	0.0115	0.0625	0.0093
Professional Workers	0.1954	0	0.1667
Other non manual workers	0.3563	0.5417	0.4167
Semi and unskilled workers	0.2989	0.2708	0.3611
Skilled workers	0.1149	0.1042	0.0370
Farm workers	0.0230	0.0208	0.0093

	Australia	Great Britain	United States
Age 55			
Unqualified	0.5417	0.6176	0.2405
High School	0.2500	0.3235	0.4810
Post Secondary	0.1458	0.0588	0.1519
Graduates	0.0625	0	0.1266
Experience (years)	39.0625	39.8824	36.9494
Married	0.6875	0.6176	0.7089
Widowed, separated, divorced	0.1875	0.1176	0.2278
Child	0.1875	0.0294	0.0759
Rural	0.0833	0.4118	0.3544
Industry			
Agriculture	0	0	0
Energy and Water	0	0	0.0127
Manu. of Metals, chemicals	0.0417	0.0882	0.0380
Metal goods, engineering, vehicles	0.0625	0.0588	0.0759
Other manufacturing	0.1250	0.0882	0.1519
Construction	0.0208	0.0294	0.0506
Distribution	0.1042	0.1176	0.1646
Transport and Communications	0	0.1471	0.0253
Banking and Business Services	0.1875	0.0588	0.0886
Other services	0.4583	0.4118	0.3924
Occupation			
Managers	0	0.0588	0.0759
Professional Workers	0.1667	0	0.1646
Other non manual workers	0.4792	0.6471	0.4304
Semi and unskilled workers	0.2083	0.2059	0.3165
Skilled workers	0.1250	0.0882	0.0127
Farm workers	0.0208	0	0

	Australia	Great Britain	United States
Age 64			
Unqualified	0.6000	0.8333	0.3333
High School	0.4000	0.1667	0.5238
Post Secondary	0	0	0.0952
Graduates	0	0	0.0476
Experience (years)	49.2000	49.5000	46.9524
Married	0.8000	0.5000	0.5238
Widowed, separated, divorced	0.2000	0.5000	0.3810
Child	0	0	0
Rural	0	0.3333	0.3333
Industry			
Agriculture	0	0	0
Energy and Water	0	0	0
Manu. of Metals, chemicals	0	0	0
Metal goods, engineering, vehicles	0	0	0.2381
Other manufacturing	0	0.1667	0.1905
Construction	0	0	0.0476
Distribution	0.4000	0.1667	0.0952
Transport and Communications	0	0	0
Banking and Business Services	0	0	0.1429
Other services	0.6000	0.6667	0.2857
Occupation			
Managers	0	0	0.0952
Professional Workers	0	0	0.0476
Other non manual workers	0.6000	0.5000	0.3333
Semi and unskilled workers	0.4000	0.5000	0.4286
Skilled workers	0	0	0.0952
Farm workers	0	0	0

Appendix D

Appendix to Chapter 4: The Estimation of Earnings Regressions for Men.

This appendix contains three sections relating to the results presented in chapter 4. The first section presents a comparison of results using a range of functional forms for experience referred to in section 3 of chapter 4. The second section compares predicted earnings for the unqualified and graduate groups in both age and experience space referred to in section 3 of chapter 4. The third section examines further, the decompositions of relative earnings used in section 4 of chapter 4.

1. A Comparison of Functional Forms of Experience.

This section presents a comparison of the various functional forms of experience considered to see which one best described the data. A summary of the models used can be found in Table D1. Model B adds experience ^{3} and experience ^{4} to the quadratic form. Model C uses the exponential form of experience presented in equation (3) of chapter 4. Model D encompasses both the quadratic and exponential forms of experience and experience ^{3} and experience ^{4} are added to this in model E. Model F is a spline function which allows the coefficients on the experience terms to differ for those with five or less years of experience compared with those with more experience. It is not proposed to present the results of all these regressions in detail but rather to outline the process of selection of our preferred functional form for experience.

The results for the quadratic form of experience are presented in Tables 1 and 2 of chapter 4. A first addition to the quadratic form of experience to be considered here is the inclusion of higher polynomial terms in experience. We have added experience ^{3} and experience ^{4} and a comparison of these two functional forms (model A and model B) is presented in Table D2. The addition of these two terms adds to the explanatory power of the equations; the $\overline{R}^2$ rose for each country.The F test for the joint significance of the

coefficients on experience ^{3} and experience ^{4} is highly significant for each country rejecting the null hypothesis that these coefficients are in fact zero. We can conclude that Model B is superior to Model A. (1)

Another possible functional form for experience is the exponential form used by Mincer (1974) and included here as model C. In Mincer's original work, he searched for the coefficient on the exponential experience term (δ in equation 3 in chapter 4) over the range 0.5 to 0.30 at 0.05 intervals and found that "The highest R^2 and most plausible coefficient values were found in the 0.10-0.15 range." Mincer (1974, p 93). He then imposed the coefficient of 0.15 in his reported regressions. Here we have estimated this coefficient using non linear least squares but omitting the interaction terms between education and experience. We have used a simpler equation because of computational problems which arose when the education and experience interaction terms were introduced into the non linear equation.

A comparison of three models which include the exponential form of experience is presented in Table D3. We shall begin by comparing model C (the exponential form of experience on its own) with model A (the quadratic form of experience). A comparison of R^2 for models A and C (see Tables D2 and D3) shows that model C fits the data better than model A. Model C also predicts the sharp rise in earnings for young workers more successfully than the quadratic form of experience. It does not however, capture the actual decline in weekly earnings at the end of working life. The functional form cannot allow for this decline as it tends asymptotically to a ceiling of one.

Model D is an attempt to allow for the rapid rise in earnings in the initial years of working life and the decline in earnings among older men. It encompasses both Mincer's specifications of experience as extreme cases. The $\bar{R}^2$ was at least as high in each country for Model D compared with models A , B and C. A more important test of model D compared with model A

Table D1
Functional Forms of Potential Experience.

Model A	Experience, Experience ^{2}, high*experience, post secondary * experience, graduate*experience.
Model B	Experience, Experience ^{2}, Experience ^{3}, Experience ^{4}, high*experience, post secondary*experience,graduate*experience.
Model C	X, high*X, post secondary*X, graduate*X.
Model D	X, Experience, Experience ^{2}, high*X, post secondary*X, graduate*X.
Model E	X, Experience, Experience ^{2}, Experience ^{3}, Experience ^{4}, high*X, post secondary*X, graduate*X.
Model F	Spline The following experience terms were used- Experience1, Experience1 ^{2}, high*experience1, post secondary* experience1, graduate*experience1, Experience2, Experience2 ^{2}, high*experience2, post secondary* experience2, graduate*experience2.

Notes The definitions of the experience terms are as follows
Experience = current age -age on leaving full-time education.

X= (1-e $^{(-\beta*\text{experience})}$

Experience1=Experience for those with five or less years experience

Experience 2 = Experience for those with more than five years experience minus 5.

Table D2
A Comparison of Models A and B, Australia, Great Britain and the United States, 1981.

	Australia	Great Britain	United States
Model A R^2	0.410	0.365	0.228
Model B R^2	0.431	0.391	0.230
F test of joint significance of Experience ^{3}, Experience ^{4} Ho: Experience^3= Experience^4=0	233.14 **	124.07 **	13.01 **

Table D3
A Comparison of Models C, D and E

	Australia	Great Britain	United States
Model C			
$\bar{R}^2$	0.435	0.389	0.230
Model D			
$\bar{R}^2$	0.441	0.396	0.231
F test of joint significance of Experience, Experience ^{2}			
Ho : Experience=Experience ^{2}= 0.	32.61 **	44.48 **	6.30 **
Model E			
$\bar{R}^2$	0.441	0.397	0.230
F test of joint significance of polynomial terms in experience			
Ho: Experience ^{3}=Experience ^{4} = 0	0.39	0.87	0.16

Table D4
A Comparison of Models D and F

	Australia	Great Britain	United States
Model F			
$\bar{R}^2$	0.404	0.360	0.224
'J' test			
t statistic on predicted Y from model F in model D equation	4.97 **	4.63**	0.45
t statistic on predicted Y from model D in model F equation	29.52 **	19.24**	8.26**

is the 't' statistic on X which was highly significant in each country. The F test of the joint significance of experience and experience ^{2} in model D was also highly significant, rejecting the null hypothesis that the coefficients on these two terms were zero. This suggests that all three experience terms, X, experience and experience ^{2} should be included in a preferred model. In order to compare models B and D, experience ^{3} and experience ^{4} were added to model D (this is reported as model E). The F test for the joint significance of their two coefficients was accepted implying a zero coefficient on these terms. In model E, for each country, the absolute 't' statistic on X, the exponential term for experience, remained significant. Model D therefore appears to be the preferred model of those discussed so far.

Two spline functions were estimated; one that broke the sample at ten years experience and a second that broke the sample at five years of experience. The latter had a higher R^2 in each of the countries and we have therefore used the spline function which breaks the sample at 5 years experience for comparative purposes. (2) Table D4 compares model D with model F, the spline function. The $\bar{R}^2$ for model F was smaller than for model D (see Table D3) though this difference was small for the US.

Table D4 also reports the results of a 'J' test comparison of non-nested alternatives (see McAleer and Deistler (1986)). In this test the predicted values (Y) from one equation are added to the alternative model. A significant coefficient on the predicted value suggests that the initial model is preferred. There are a number of problems with this test and our results illustrate them. The results of this test are not necessarily consistent, so in this case the predicted Y values are significant for each of the alternatives for Australia and Great Britain. This test is unable to distinguish between these alternatives. However, for the US, model D was preferred.

A comparison of the earnings predicted at each age by models D and F shows that model D predicts actual earnings more closely than model F for the young (under 20 years

of age). For the old (after age 58), model D predicts the actuals more closely for Australia and Great Britain but for the US, the spline predicts more successfully.

There are of course, numerous other tests available for model selection (3) but as there appears to be little agreement among econometricians as to the usefulness and properties of these tests, it was decided not to devote more effort to model selection. On the statistical evidence presented there are not large differences between models D and F. The differences which do exist favour model D over model F and it was therefore decided to use this functional form of experience in the main analysis.

It was necessary for computational reasons,to estimate the δ coefficient of equation 3 in chapter 4 in an equation omitting the education and experience interaction terms. The results of this estimation are presented in Table D5. We have entered the exponential experience term as "X" (= $1-(e^{-\delta*\text{experience}})$) rather than as "$e^{-\delta*\text{experience}}$" to facilitate the interpretation of the coefficients, so a positive coefficient on X shows that earnings go up with experience. It is not proposed to discuss these results in any detail but to focus on the estimates of δ. The coefficient, δ, on experience for the US was 0.1177, within Mincer's preferred range. The estimated coefficient for Australia and Great Britain implied, ceteris paribus that earnings peaked earlier in these countries than in the US. Not all the experience terms were significant at the 5 per cent level. In the US equation in particular, none were. The F test for the joint significance of these experience terms however, rejected the null hypothesis that the coefficients were zero for each country. The results of the regression equation including the education by experience interaction terms are discussed in chapter 4.

Table D5

Weekly Earnings of Full-time Men aged 16-64, Australia, Great Britain, the United States, 1981

Dependent Variable = ln Weekly Earnings

	Australia	Great Britain	United States
Intercept	4.5636 (24.54**)	3.6657 (106.25**)	4.8082 (102.96**)
High	0.1527 (18.40**)	0.1680 (12.35**)	0.2343 (13.78**)
Post secondary	0.2368 (29.6**)	0.2006 (20.06**)	0.3561 (17.04**)
Graduate	0.6413 (58.83**)	0.6153 (29.16**)	0.5980 (31.15**)
Married	0.1291 (13.45**)	0.1779 (12.8**)	0.2189 (11.28**)
Widowed, separated, divorced	0.0663 (4.39**)	0.0928 (3.73**)	0.1166 (4.27**)
Rural	-0.1102 (-11.02**)	-0.0216 (-2.40*)	-0.1107 (-8.45**)
X	0.6962 (18.27**)	0.7535 (17.77**)	0.6951 (1.67)
δ	0.2643 (11.49**)	0.3713 (8.88**)	0.1177 (1.88)
Experience	0.0100 (0.55)	0.0158 (0.47)	0.0088 (0.14)
Experience ^{2}	-0.0002 (-5.00**)	-0.0003 (-6.00**)	-0.0002 (-0.67)
R^2	0.43	0.39	0.23
F test of joint significance Ho: Experience=0, Experience ^{2}=0.	25.06**	41.93 **	4.36 **
F test of joint significance Ho: X=0, Experience=0, Experience ^{2}=0,	690.11**	351.31 **	218.17 **
N	12,533	5,681	7,288

't 'statistics in brackets. Significant test statistics at the 5 per cent level are indicated by a * and those at the 1 per cent level by **.

$X = (1-e^{-\delta * experience})$

2. A Comparison of the Predicted Relationship between Age and Earnings and Experience and Earnings for the Unqualified and Graduate Groups.

In this section we present the predicted age earnings and experience earnings profiles for the unqualified and university graduate groups for each country. We have presented the results in both experience and age space; firstly the relationship between experience and earnings in percentage and absolute terms and secondly the relationship between age and earnings in percentage and absolute terms.

Taking firstly the percentage changes in the predicted experience earnings profile for each country (figures D1, D5, and D9), the profile of the unqualified was steeper for the initial ten years. The profiles for the graduates and the unqualified then continued to converge but at a slow rate. In absolute terms, the graduate profile was steeper than the unqualified in experience space with the monetary difference between the earnings of the two groups growing with experience (see figures D2, D6, and D10).

Figures D3, D7, and D11 present the predicted earnings for the graduates and the unqualified by age in percentage terms and figures D4, D8, and D12 present the same data in term of money amounts. If we compare the two profiles in figures D3, D7, and D11 between ages 21 and 36, the graduate profile was steeper than that of the unqualified in percentage terms. The profiles continued to diverge as age increased. In absolute money amounts this divergence was even more pronounced (see figures D4, D8, and D12).

3. The Decomposition of Relative Earnings for Men using The Basic Equation.

This appendix presents further results for the decomposition of relative earnings by age for the three countries. Figures D13, D14 and D15 present the results of the comparisons between Australia and the US, Australia and Great Britain and Great Britain and the US using the alternative country weights from those reported in chapter 4. Tables D6, D7

Figure D1: Predicted Earnings for Graduates and the Unqualified by Experience, Australia, 1981.

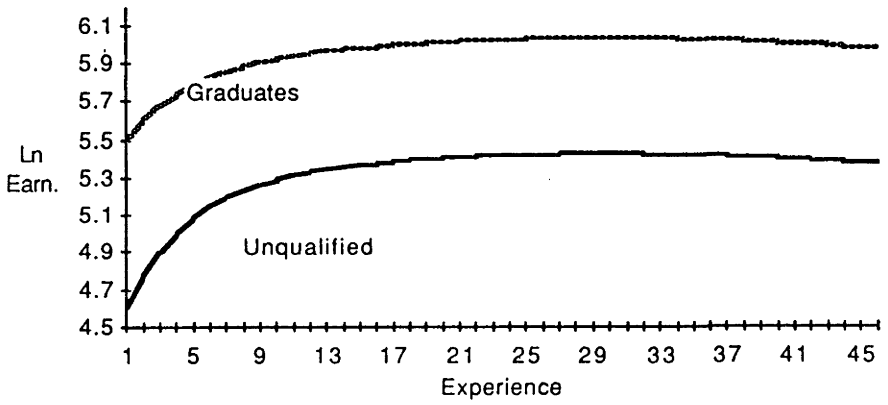


Figure D2: Predicted $ Earnings for Graduates and the Unqualified, Australia, 1981.

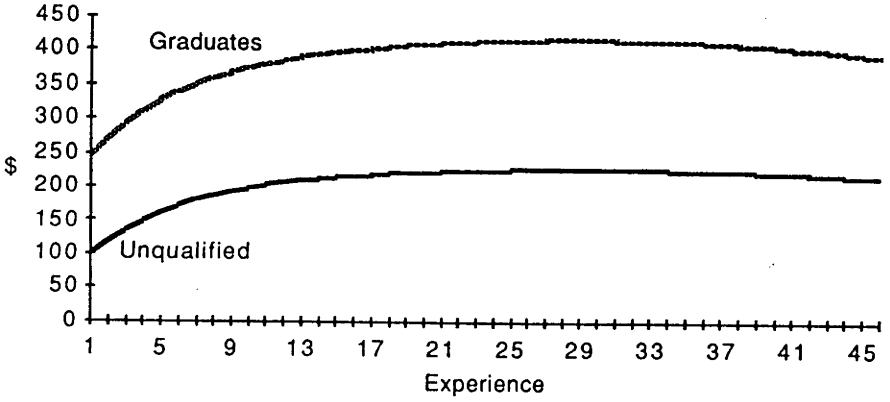


Figure D3: Predicted Earnings for Graduates and the Unqualified by Age, Australia, 1981.

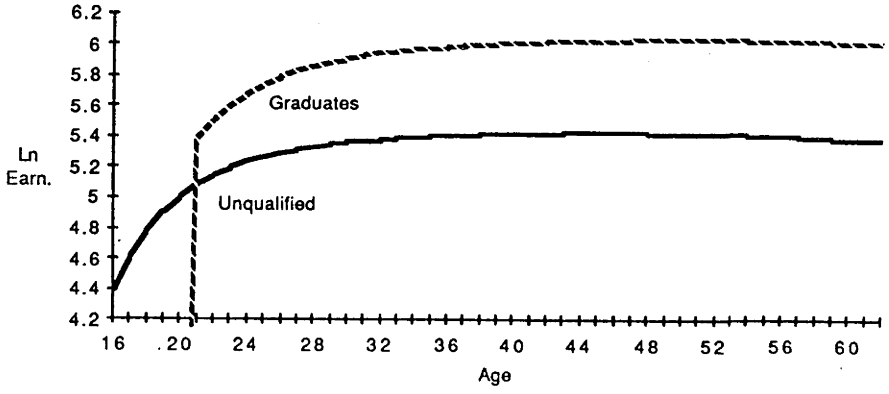


Figure D4: Predicted $ Earnings for Graduates and the Unqualified by Age, Australia, 1981.

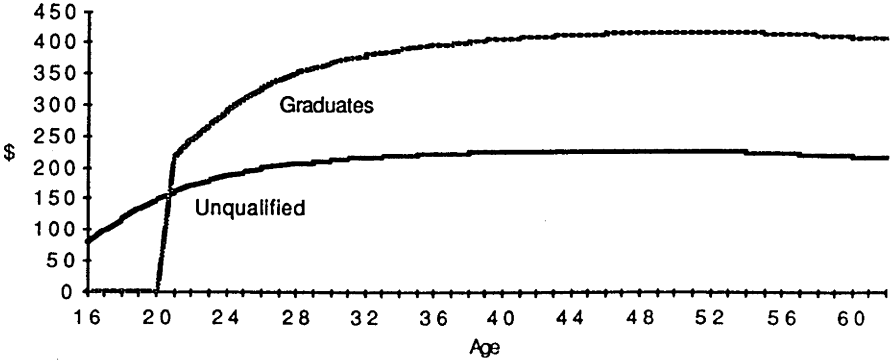


Figure D5: Predicted Earnings for Graduates and the Unqualified by Experience, Great Britain, 1981.

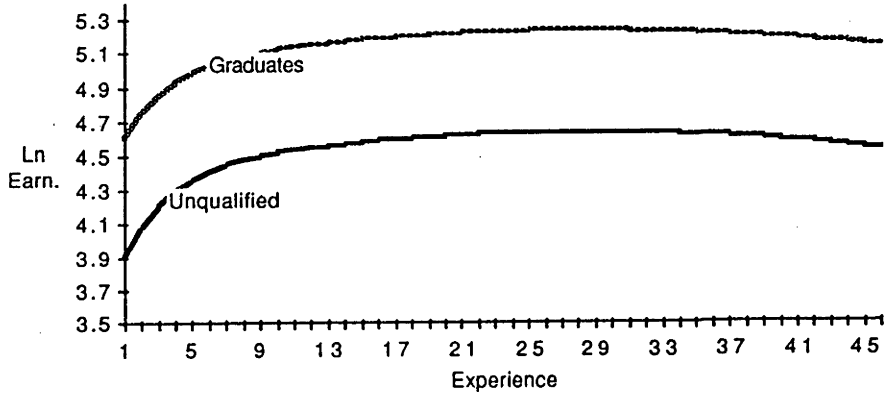


Figure D6: Predicted £ Earnings for Graduates and the Unqualified, Great Britain, 1981.

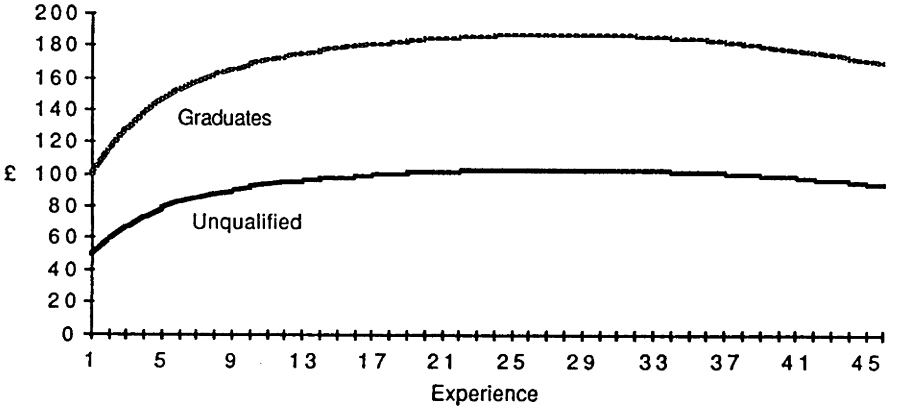


Figure D7: Predicted Earnings for Graduates and the Unqualified by Age, Great Britain, 1981.

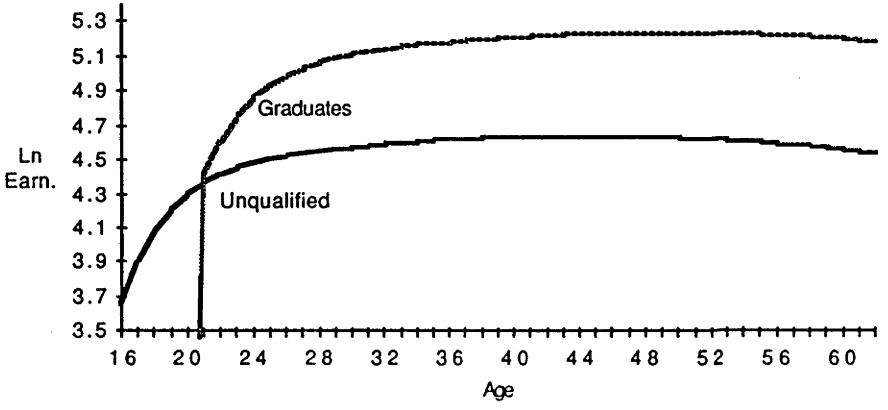


Figure D8: Predicted £ Earnings for Graduates and the Unqualified by Age, Great Britain, 1981.

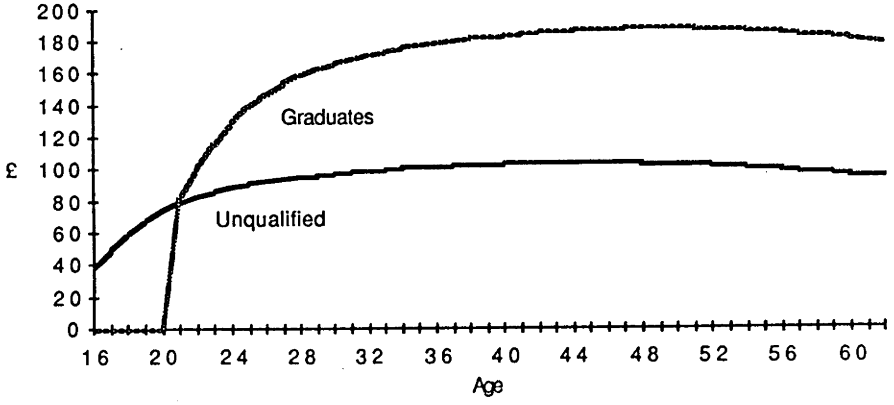


Figure D9: Predicted Earnings for Graduates and the Unqualified by Experience, United States, 1981.

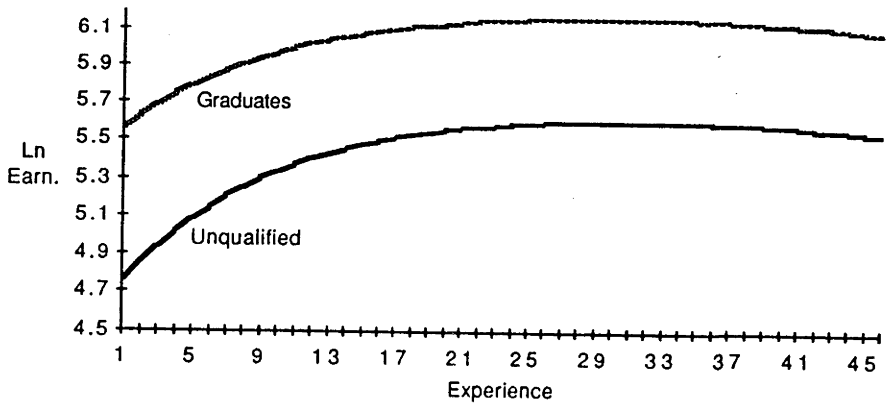


Figure D10: Predicted $ Earnings for Graduates and the Unqualified, United States, 1981.

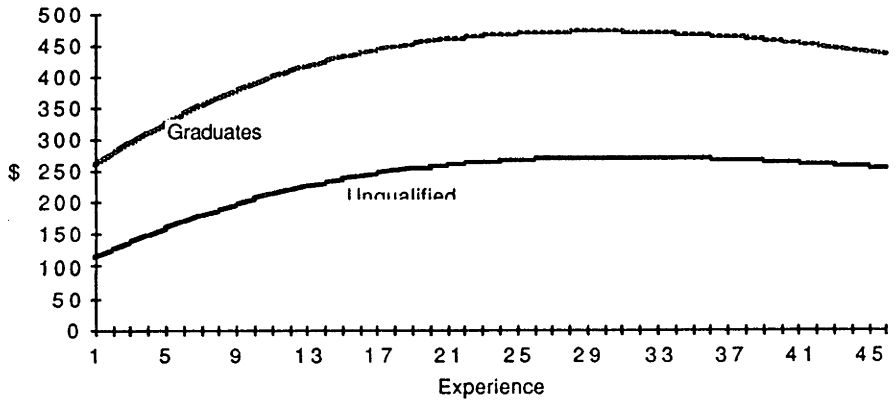


Figure D11: Predicted Earnings for Graduates and the Unqualified by Age, United States, 1981.

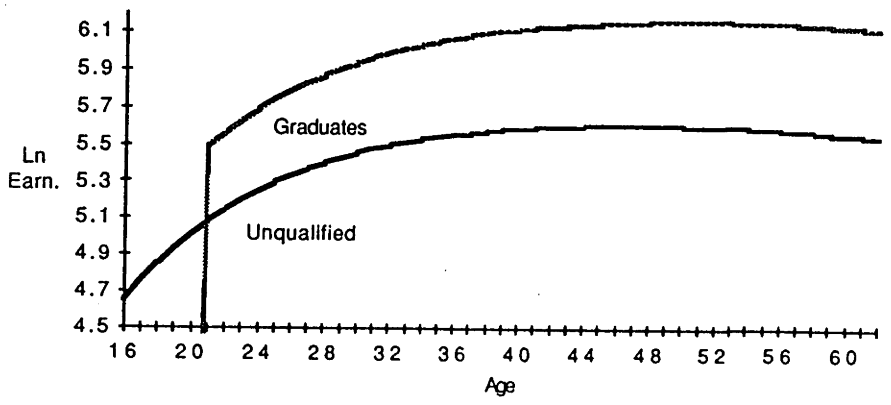
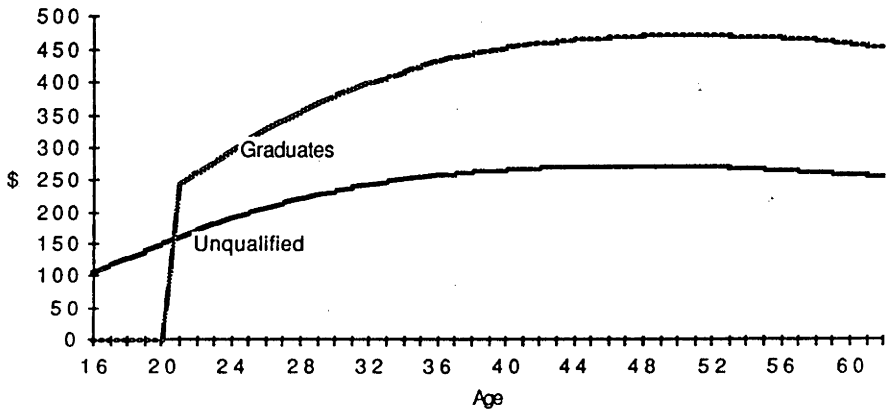


Figure D12: Predicted $ Earnings for Graduates by Age, United States, 1981.



and D8 present the detailed results of these decompositions for selected ages. Table D6 uses Australian weights, D7 British weights and D8, American weights.

We shall work through the comparison for 18 year olds in Table D6 as an example of the results reported in the tables. The first column in Table D6 shows the actual earnings of 18 year old men in each country relative to the earnings of 25 year olds. Australian and British 18 year olds were relatively more highly paid than 18 year olds in the US, earning 56 and 55 per cent respectively of a 25 year old in each country compared with 50 per cent in the US. The second column contains their relative earnings estimated from the regression equations reported in Table 3 chapter 4. The predicted earnings were very close to actual earnings for this age in each country. These two columns are identical in each table and have been repeated for ease of reference.

The remaining columns look at the decomposition outlined in equations (4) and (5) chapter 4. In Table D6, they take Australia as the reference point. So column 4 shows the difference in the relative earnings at each age between Australia and each of the other countries. The first part of Table D6 shows in column 4, the gap between the relative earnings of 18 year olds in Australia and the other two countries. Relative to 25 year olds in each country, 18 year olds in Britain earned 1 percentage points less than 18 year olds in Australia and American 18 year olds earned 6 percentage points less.

The gap between the relative earnings of 18 year olds (column 4) in Australia and in each of the other countries can be divided into two parts. Column 5 contains the residual gap which was not explained by the regression equation and column 6 that part of the gap explained by the regression equation. The regressions were unable to explain any of the gap in relative earnings between Australia and the Great Britain but they explained two-thirds of the gap between Australia and the US. The gap between the relative earnings of 18 year olds in Australia and each of the other countries which was explained by the regression equation (column 6) can be further decomposed into that part which is attributable to endowment differences (column 7), and that part which is

Figure D13: The Decomposition of Relative Earnings of Men, Australia and the United States, 1981.
Earnings of a 25 year old=1.

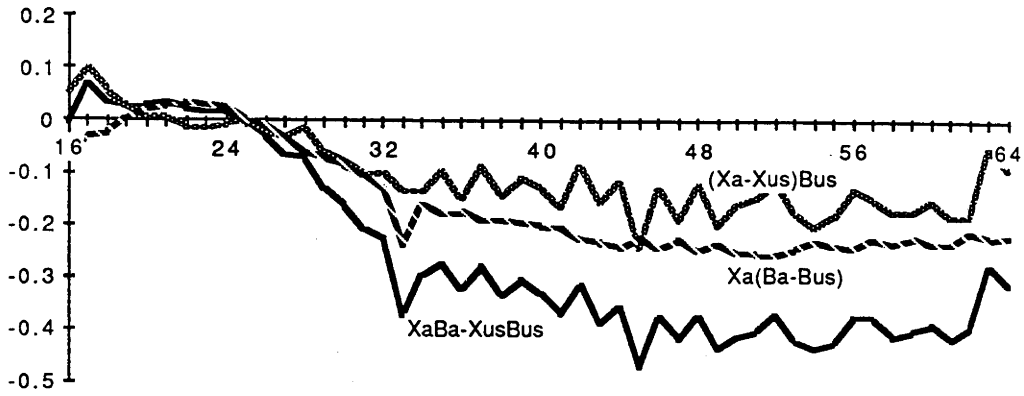


Figure D14: The Decomposition of Relative Earnings of Men, Australia and Great Britain, 1981.
Earnings of a 25 year old=1.

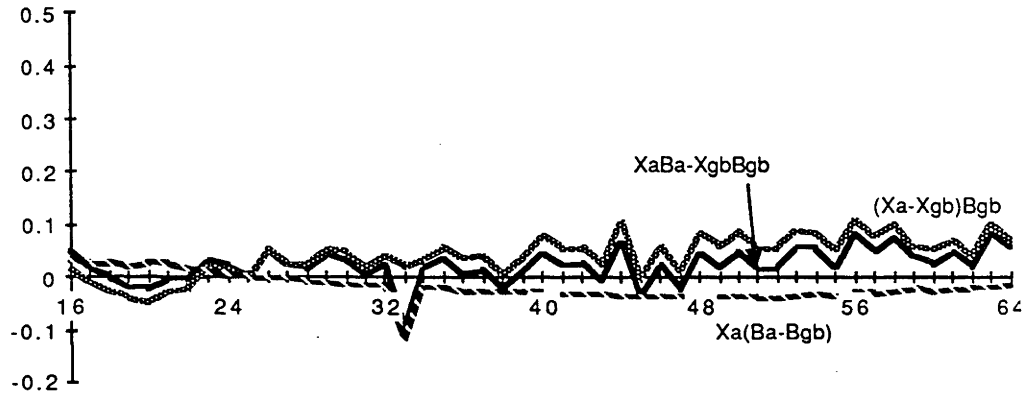
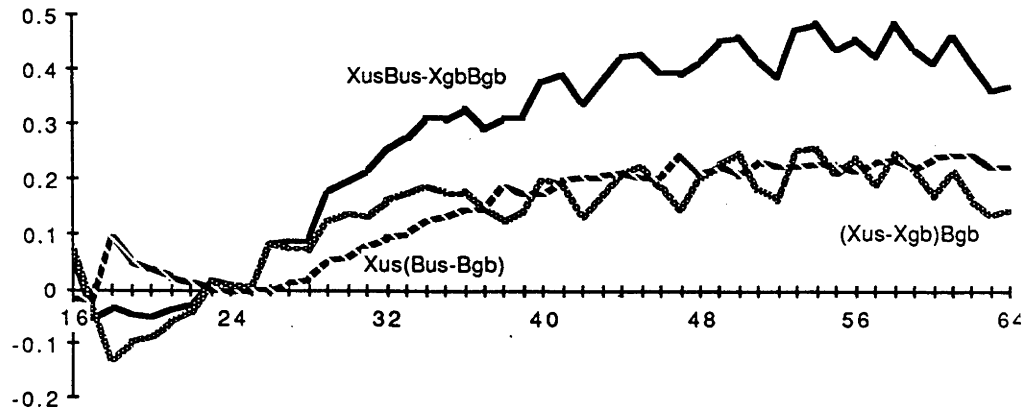


Figure D15: The Decomposition of Relative Earnings of Men, Great Britain and the United States, 1981.
Earnings of a 25 year old=1.



attributable to coefficient differences (column 8).Endowment and coefficient differences were offsetting in the Australia/Great Britain comparison. Endowment differences were important in explaining the gap between Australian and American 18 year olds. While American 18 year old men had lower stocks of human capital than their Australian counterparts, they were more highly rewarded for these endowments so the difference in relative earnings of 18 year olds in the two countries was smaller than the endowment difference.

The decompositions into coefficient and endowment effects raised the question which coefficients and which endowments were the major sources of the differences in relative earnings in the three countries. Tables D9 presents the answers for selected ages. The calculations were made in the following way for each of the component groups. Education is used here as an example. All calculations are in relation to a 25 year old. Define

$$q_{et}^{\,a} = X_{et}^{\,a}\beta_e^{\,a} - X_{e25}^{\,a}\,\beta_e^{a} \quad (1)$$

where X is a vector of education endowments, β is a vector of education coefficients, the t subscript refers to age, the e subscript to education and the a superscript to Australia. Similarly for the United States u

$$q_{et}^{\,u} = X_{et}^{\,u}\beta_e^{\,u} - X_{e25}^{\,u}\,\beta_e^{u} \quad (2)$$

and using the other country's coefficients

$$k_{et}^{\,a} = X_{et}^{\,a}\beta_e^{\,u} - X_{e25}^{\,a}\,\beta_e^{u} \quad (3)$$

$$k_{et}^{\,u} = X_{et}^{\,u}\beta_e^{\,a} - X_{e25}^{\,u}\,\beta_e^{a} \quad (4)$$

The total education gap can be defined as

$$q_{et}^{\,u} - q_{et}^{\,a} = (k_{et}^{\,u} - q_{et}^{\,a}) + (q_{et}^{\,u} - k_{et}^{\,u})$$

where $(k_{et}^{\,u} - q_{et}^{\,a})$ measures the endowment effect and $(q_{et}^{\,u} - k_{et}^{\,u})$ measures the coefficient effect.

Similar calculations were made for each variable groups. For the decomposition using the basic equation the following three groups of variables were distinguished

1. Education = high + postsecondary + graduate

2. Experience = experience + experience ^{2} + X + high*experience + postsec*experience + grad* experience.

3. Other = married + widowed, separated and divorced + rural.

Footnotes

1. This conclusion was also reached by Murphy and Welch (1990) in their comparison of functional forms using US data.

2.The R^2's were as follows, taking the equation which broke the sample at 10 years experience first -for Australia 0.38 compared with 0.40, Great Britain, 0.33 compared with 0.36 and for the US, 0.22 compared with 0.23.

3. See for example, Judge et al. (1982) for a discussion of model comparisons.

Table D6
Relative Earnings by Age; Actual, Predicted and Using Australian Weights, Australia, Great Britain and the United States, 1981. Earnings of Men aged 25 in Country j=100

	yj	XjBj	XjB	yj-ya	uj-ua	XjBj-XaBa	(Xj-Xa)Ba	Xj(Bj-Ba)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Age 18								
j=A	56	55	55	-	-	-	-	-
j=GB	55	55	56	-1	-1	0	1	-1
j=US	50	51	45	-6	-2	-4	-10	6
Age 25								
j=A	100	100	100	-	-	-	-	-
j=GB	100	100	100	0	0	0	0	0
j=US	100	100	100	0	0	0	0	0
Age 35								
j=A	127	120	120	-	-	-		-
j=GB	125	116	114	-2	2	-4	-6	2
j=US	140	147	132	13	-14	27	12	15
Age 45								
j=A	113	111	111	-	-	-	-	-
j=GB	121	114	114	8	5	3	3	0
j=US	142	158	136	29	-18	47	25	22
Age 55								
j=A	110	108	108	-	-	-	-	-
j=GB	111	106	109	1	3	-2	1	-3
j=US	143	150	128	33	-9	42	20	22
Age 64								
j=A	105	100	100	-	-	-	-	-
j=GB	101	95	102	-4	1	-5	2	-7
j=US	113	132	113	8	-24	32	13	19

Notes: y_a, X_a and β_a are respectively the actual earnings, the endowments and the coefficients of Australia.
Column 4 is taken from column 1. It is the sum of columns 5 and 6.
Column 5 = $(y_j - X_j\beta_j) - (y_a - X_a\beta_a)$ taken from columns 1 and 2.
Column 6 is taken from column 2. It is the sum of columns 7 and 8.
Column 7 is taken from column 3.
Column 8 = Column 2- column 3 for each j.

Table D7
Relative Earnings by Age; Actual, Predicted and Using British Weights, Australia, Great Britain and the United States, 1981. Earnings of Men aged 25 in Country j=100

	yj (1)	XjBj (2)	XjBg (3)	yj-yg (4)	uj-ug (5)	XjBj-XgBg (6)	(Xj-Xg)Bg (7)	Xj(Bj-Bg) (8)
Age 18								
j=A	56	55	52	1	1	0	-3	-3
j=GB	55	55	55	-	-		-	-
j=US	50	51	42	-5	-1	-4	-13	9
Age 25								
j=A	100	100	100	0	0	0	0	0
j=GB	100	100	100	-	-	-	-	-
j=US	100	100	100	0	0	0	0	0
Age 35								
j=A	127	120	122	2	-2	4	6	-2
j=GB	125	116	116	-	-	-	-	-
j=US	140	147	134	15	-16	31	18	13
Age 45								
j=A	113	111	120	-8	5	-3	6	-9
j=GB	121	114	114	-	-	-	-	-
j=US	142	158	137	21	-23	44	23	21
Age 55								
j=A	110	108	111	1	-3	2	5	-3
j=GB	111	106	106	-	-	- -	-	
j=US	143	150	127	33	-12	44	21	23
Age 64								
j=A	105	100	102	4	-1	5	7	-2
j=GB	101	95	95	-	-	-	-	-
j=US	113	132	109	12	-25	37	14	23

Notes: y_g, X_g and β_g are respectively the actual earnings, the endowments and the coefficients of Australia.
Column 4 is taken from column 1. It is the sum of columns 5 and 6.
Column 5 = $(y_j - X_j\beta_j) - (y_g - X_g\beta_g)$ taken from columns 1 and 2.
Column 6 is taken from column 2. It is the sum of columns 7 and 8.
Column 7 is taken from column 3.
Column 8 = Column 2- column 3 for each j.

Table D8
Relative Earnings by Age; Actual, Predicted and Using American Weights, Australia, Great Britain and the United States, 1981. Earnings of Men aged 25 in Country j=100

	yj	XjBj	XjBu	yj-yu	uj-uu	XjBj-XuBu	(Xj-Xu)Bu	Xj(Bj-Bu)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Age 18								
j=A	56	55	57	6	2	4	6	-2
j=GB	55	55	55	5	1	4	4	0
j=US	50	51	51	-	-	-	-	-
Age 25								
j=A	100	100	100	0	0	0	0	0
j=GB	100	100	100	0	0	0	0	0
j=US	100	100	100	-	-	-	-	-
Age 35								
j=A	127	120	138	-13	14	-27	-9	-18
j=GB	125	116	131	-15	16	-31	-16	-15
j=US	140	147	147	-	-	-	-	-
Age 45								
j=A	113	111	133	-29	18	-47	-25	-22
j=GB	121	114	135	-21	23	-44	-23	-21
j=US	142	158	158	-	-	-	-	-
Age 55								
j=A	110	108	131	-33	9	-42	-19	-23
j=GB	111	106	127	-32	12	-44	-23	-21
j=US	143	150	150	-	-	-	-	-
Age 64								
j=A	105	100	122	-8	24	-32	-10	-22
j=GB	101	95	115	-12	25	-37	-17	-20
j=US	113	132	132	-	-	-	-	-

Notes: y_u, X_u and β_u are respectively the actual earnings, the endowments and the coefficients of the US
Column 4 is taken from column 1. It is the sum of columns 5 and 6.
Column 5 = $(y_j - X_j\beta_j) - (y_u - X_u\beta_u)$ taken from columns 1 and 2.
Column 6 is taken from column 2. It is the sum of columns 7 and 8.
Column 7 is taken from column 3.
Column 8 = Column 2- column 3 for each j.

Table D9
The Decomposition of the Relative Earnings Gap into its Component Parts for Selected Ages

	US-Aust (1)	GB- Aust (2)	GB- US (3)
Age 18			
Education			
Coefficients	0.1060	0.0339	-0.0676
Endowments	-0.0627	0.0397	0.0979
Total	0.0434	0.0736	0.0303
Experience			
Coefficients	0.1029	-0.0347	0.0355
Endowments	-0.1558	0.0041	-0.0133
Total	-0.0528	-0.0306	0.0222
Other			
Coefficients	-0.0498	-0.0254	0.0325
Endowments	-0.0085	-0.0098	-0.0176
Total	-0.0583	-0.0433	0.0149
Total	-0.0677	-0.0030	0.0674
Age 35			
Education			
Coefficients	-0.0302	0.0172	-0.0154
Endowments	0.1022	-0.1023	-0.1417
Total	0.0720	-0.0851	-0.1571
Experience			
Coefficients	0.1149	-0.0135	-0.0904
Endowments	0.0014	0.0528	0.0134
Total	0.1163	0.0393	-0.0770
Other			
Coefficients	0.0201	0.0166	-0.0083
Endowments	-0.0124	-0.0057	0.0116
Total	0.0077	0.0109	0.0033
Total	0.1960	-0.0349	-0.2308
Age 45			
Education			
Coefficients	-0.0044	0.0435	0.0221
Endowments	0.1931	0.0363	-0.1309
Total	0.1887	0.0798	-0.1089
Experience			
Coefficients	0.1251	-0.0438	-0.1655
Endowments	-0.0179	-0.0236	-0.0092
Total	0.1072	-0.0674	-0.1747

	US-Aust (1)	GB- Aust (2)	GB- US (3)
Other			
Coefficients	0.0242	0.0142	-0.0089
Endowments	-0.0014	-0.0050	-0.0047
Total	0.0228	0.0092	-0.0136
Total	0.3187	0.0216	-0.2972
Age 55			
Education			
Coefficients	0.0032	0.0635	0.0411
Endowments	0.0917	-0.0135	-0.0806
Total	0.0949	0.0500	0.0449
Experience			
Coefficients	0.1177	-0.0869	-0.1958
Endowments	0.0378	0.0007	-0.0458
Total	0.1555	-0.0861	-0.2417
Other			
Coefficients	0.0230	0.0205	-0.0018
Endowments	-0.0027	-0.0180	-0.0159
Total	0.0203	0.0026	-0.0177
Total	0.2707	-0.0335	-0.3043
Age 64			
Education			
Coefficients	0.0289	0.0956	0.0351
Endowments	-0.0206	-0.0883	-0.0361
Total	0.0083	0.0073	-0.0010
Experience			
Coefficients	0.0850	-0.1512	-0.1863
Endowments	0.0793	0.0534	-0.0758
Total	0.1643	-0.0978	-0.2621
Other			
Coefficients	0.0259	0.0192	-0.0037
Endowments	-0.0043	-0.0137	0.0123
Total	0.0216	0.0055	-0.0160
Total	0.1942	0.0850	-0.2771

Appendix E

Appendix to Chapter 5: The Educational Cohort Variables.

This appendix describes the educational cohort variables used in the regression reported in chapter 5 Table 5.3.

Figures E1-E4 present the data on educational cohorts for each of the four education groups we have distinguished. If the sample of each education group was distributed uniformally by age, each age would account for about 2 per cent of the sample. As these figures show, individuals were not distributed evenly by age, the education groups tended to be concentrated at particular ages. There are several possible reasons for this. Firstly, men are concentrated at a particular age by reason of birth. This may result in large cohorts at particular ages for each education group. Secondly, decisions on the desirable level of educational attainment have changed over time. So, for example, where it was unusual for a man to complete high school in the 1930's, by the 1970's it was more common to complete high school than to drop out of school earlier. This would produce large cohorts at different ages for different education groups. A final possible reason for differences in the distribution by age of the male workforce with varying levels of education may be differences in the retirement patterns of these education groups. All workers do not retire at 64 and the tendency to retire earlier may be related to education.

Figure E1 presents the distribution of cohort size by age for the unqualified in each of the countries. It shows that for Great Britain and the United States the relatively large cohorts of unqualified workers were concentrated in the over 55 age group but for Australia, the largest unqualified cohorts were in their thirties. The range of cohort sizes, however, was not very big with most cohorts accounting for between 1.5 and 2.5 per cent of the sample in each country.

There was a much larger range in cohort size for the high school group, especially for Australia where cohort sizes ranged from over 5 per cent to less than 1 per cent (see figure E2). For Australia and Great Britain, this education group was concentrated in the

16-24 age group and a relatively small percentage of the group was over 40 years of age. Completion of high school was more common among older age groups in the US than in the other countries. The age distribution of high school graduates was quite different in the US than in the other two countries.

Figure E3 presents data for the distribution of the post secondary group by age. This group was not as concentrated by age in Australia and Great Britain as the high school group, most of the cohort sizes fell within the range 1 to 3 per cent. In each country those with post secondary qualifications were concentrated in the 24-36 age group but this was particularly pronounced in the US, specifically among 30-35 year olds. After age 38, the distribution by age of the post secondary group looked very similar in the three countries.

Figure E4 relates to university graduates. As might be expected there were no university graduates under 20. In each country they were concentrated in the 24-36 age group. In Great Britain and the US some of the cohorts aged about 30 accounted for over four percent of those with university degrees. For Australia and Great Britain, relatively more graduates were under 30 than in the US where there were relatively more older graduates than in the other countries.

Figure E1: The Distribution of the Unqualified by Age, Australia, Great Britain and the United States, 1981.

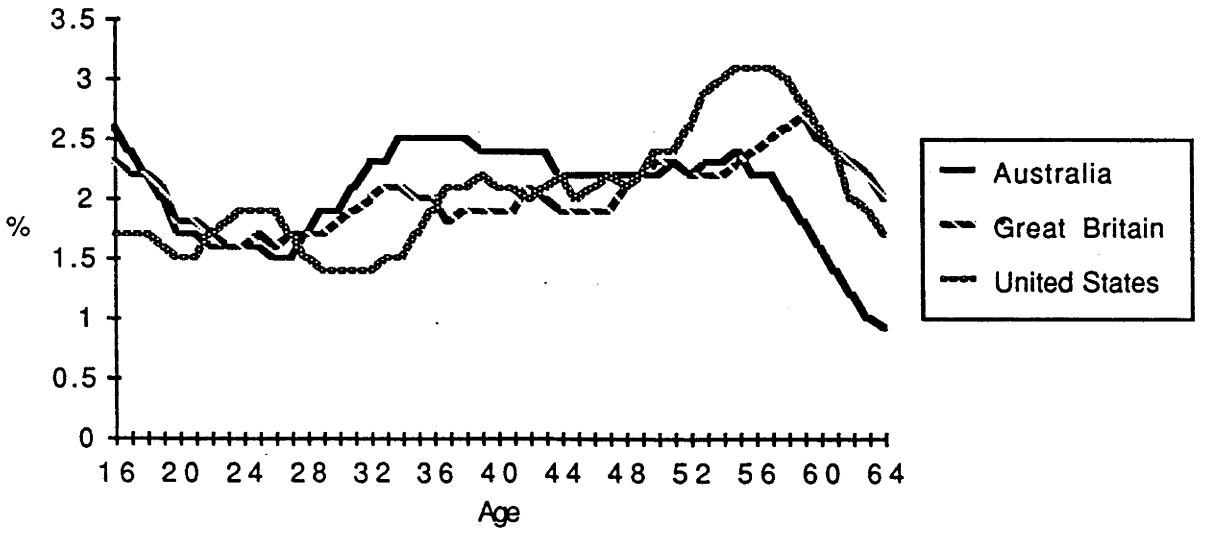


Figure E2: The Distribution of High School Graduates by Age, Australia, Great Britain and the United States, 1981.

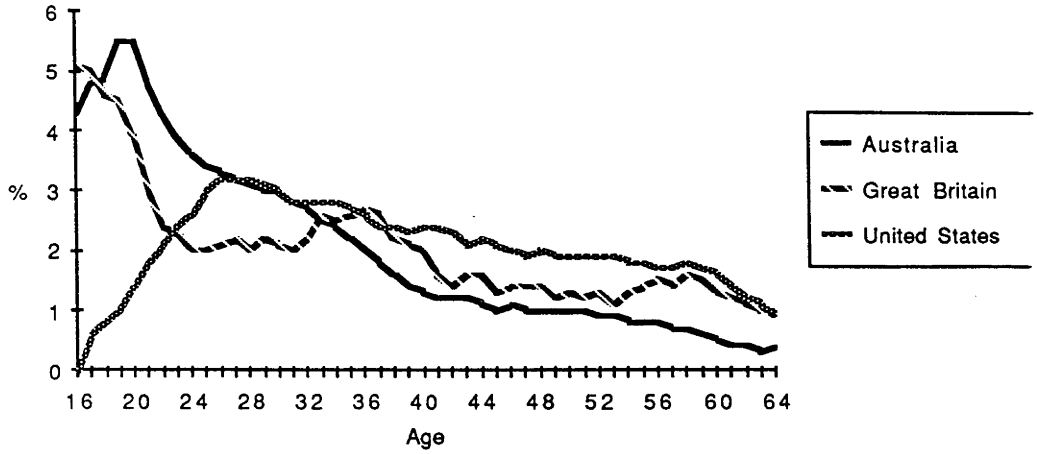
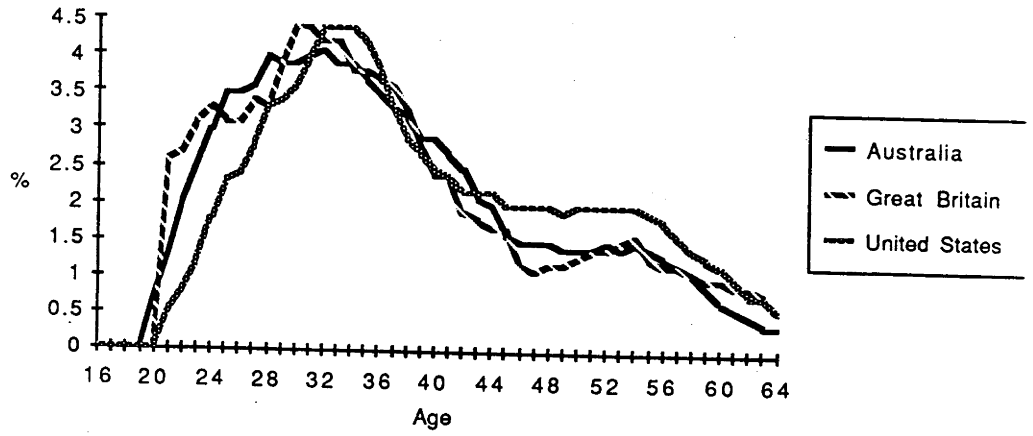


Figure E3: The Distribution of the Post Secondary Group by Age, Australia, Great Britain and the United States, 1981.

Figure E4: The Distribution of University Graduates by Age, Australia, Great Britain and the United States, 1981.



Appendix F

Appendix to Chapter 6: Additional Results from the Industry Chapter

This appendix contains some additional results with respect to the material presented in Chapter 6. Section 1 presents results for the industry regressions without occupational variables. Section 2 includes the data used for the tests of the hypotheses concerning the underlying source of the industry effect on earnings. Section 3 presents further results from the decomposition of relative earnings. Section 4 presents detailed results of the comparison between industries with high and low levels of unionisation.

1.Regression results including industry.

Table F1 presents regression results including the industry variables but omitting occupation. The F test for the joint significance of the industry intercept terms rejected the null hypothesis of zero coefficients at the 1 per cent significance level in each country. Although jointly significant, few of the individual coefficients were statistically significant. For Australia, agriculture, metal goods and engineering, other manufacturing and distribution all had a significantly lower starting wage for the unqualified than that in construction. For Great Britain, energy and water, transport and communications, and other services all had significantly higher starting wages than construction. Energy and water, the manufacture of basic metals and chemicals, and metal goods and engineering paid the unqualified significantly more than construction in the United States.

There was only one Australian industry which had a significantly different earnings profile with experience than that of construction. In the banking and business service industry an additional year of experience added more in percentage terms to earnings than an additional year in another industry. The F test for the joint significance of all the industry by experience interaction terms rejected the null hypothesis that the coefficients were zero but an F test of their joint significance which excluded banking and business services accepted the null hypothesis of zero coefficients.

The industry by experience interaction terms were jointly significant for Great Britain and the United States. For British men, an additional year of experience in energy and water added less to earnings at the beginning of working life than a year in construction, while a year's experience added more to earnings in banking and business services. In the United States, experience contributed significantly less to earnings in agriculture, metal goods and engineering, and banking and business services.

2. Some simple tests of the source of the industry effect.

The data to be used in these tests are presented in Tables F2 and F3. Table F2 show the effect of the industry intercept term on weekly earnings compared with the average for all industries and Table F3 presents the industry by experience intercept terms for each industry in relation to the average for all industries taken at one year of experience. The reference point in each table is just the simple average of the coefficients and has not been weighted by the employment in each industry.

For the Australian sample, energy and water, the manufacture of basic metals and chemicals, construction, transport and communications and other services had initial weekly earnings above the average for the whole sample. In common with Australia, initial weekly earnings in energy and water, transport and communications and other services were above average in Great Britain. British agriculture also had above average starting earnings. For the US, agriculture, energy and water, manufacture of basic metals and chemicals, metal goods and engineering, and transport and communications all had intercept terms above the average.

Table F3 shows that energy and water, and banking and business services had a relatively large growth in earnings with experience in Australia, while other manufacturing, construction and banking and business services did in Great Britain. For the US, the manufacture of basic metals and chemicals, metal goods and engineering,

Table F1

Weekly Earnings of Full-time Men aged 16-64, Australia, Great Britain, the United States, 1981.

Dependent Variable = ln Weekly Earnings

	Australia	Great Britain	United States
Intercept	4.4695 (91.81**)	3.6539 (55.73**)	4.6044 (45.54**)
High	0.2289 (6.29**)	-0.0013 (-0.02**)	0.3473 (4.61**)
Post secondary	0.6472 (15.18**)	0.3357 (5.37**)	0.3951 (4.65**)
Graduate	0.9054 (17.02**)	0.6760 (7.49**)	0.7911 (9.88**)
X	0.7729 (12.99**)	0.7508 (9.85**)	0.9931 (6.11**)
Experience	0.0113 (7.42**)	0.0166 (9.12**)	0.0091 (1.6)
Experience ^{2}	-0.0002 (-7.89**)	-0.0003 (-9.64**)	-0.0002 (-2.06*)
High*X	- 0.0756 (-1.89)	0.1844 (3.0**)	-0.1402 (-1.63)
Postsec*X	-0.4542 (-9.98**)	-0.1513 (-2.32*)	-0.0281 (-0.28)
Graduate*X	-0.3312 (-5.72**)	-0.1055 (-1.07)	-0.1980 (-2.10*)
Married	0.1149 (12.49**)	0.1658 (12.53**)	0.1926 (10.17**)
Widowed, separated, divorced	0.0564 (3.86**)	0.0839 (3.50**)	0.0993 (3.74**)
Rural	-0.0647 (-6.17**)	-0.0210 (-2.40**)	-0.0994 (-7.79**)
Industries			
Agriculture	-0.2512 (-3.54**)	0.0295 (0.21)	0.0919 (0.51)
Energy and water	0.0904 (1.24)	0.5571 (3.87**)	0.4660 (2.63**)
Manu. of metals, chemicals	0.0601 (1.01)	0.0801 (0.56)	0.3507 (2.89**)

	Australia	Great Britain	United States
Metal goods, eng. and vehicles	-0.0999 (-2.05**)	0.089 (1.12)	0.3052 (3.18**)
Other manufacturing	-0.1062 (-2.12**)	0.0459 (0.53)	0.0772 (0.77)
Construction	-	-	-
Distribution	-0.1032 (-2.36**)	-0.1037 (-1.35)	-0.0292 (-0.32)
Trans and Communications	0.0479 (0.78)	0.2801 (2.27**)	0.1411 (1.16)
Banking and bus services	-0.0810 (-1.48)	-0.1739 (-1.67)	0.1759 (1.65)
Other services	0.0479 (0.90)	0.1867 (2.02*)	0.0049 (0.05)
Industry*X			
Agriculture*X	0.0469 (0.58)	-0.2677 (-1.74)	-0.8541 (-3.67**)
Energy and water* X	0.0257 (0.32)	-0.3630 (-2.41**)	-0.3810 (-1.83)
Manu. of metals, chem*X	0.0270 (0.41)	-0.0489 (-0.33)	-0.2388 (-1.65)
Metal goods, eng. and veh*X	0.0702 (1.27)	-0.0888 (-1.05)	-0.2597 (-2.24*)
Other manu*X	0.1076 (1.9)	-0.0339 (-0.37)	-0.1767 (-1.46)
Construction*X	-	-	-
Distribution*X	0.0957 (1.92)	-0.0046 (-0.06)	-0.1660 (-1.49)
Trans and Comm*X	-0.0044 (-0.07)	-0.2193 (-1.71)	-0.0319 (-0.22)
Banking and bus serv*X	0.2178 (3.53**)	0.3115 (2.78**)	-0.3141 (-2.4*)

	Australia	Great Britain	United States
Other services*X	-0.0004 (-0.01)	-0.1569 (-1.60)	-0.1705 (-1.47)
R^2	0.46	0.43	0.28
F	354.86	144.31	94.11
Breusch-Pagan test for heteroskedasticity NR^2	1.25	6.25	5.1
F test for joint significance of education*experience terms	49.98**	8.85**	2.28
F test for joint significance of industry*experience terms	2.46**	3.58**	2.27*
F test for joint significance of industry terms	4.81**	4.75**	4.45**
N	12,533	5,681	7,288
Mean of Dep. Var.	5.513	4.7542	5.8853

Notes:
t statistics in brackets. Significant test statistics at the 5 per cent level are indicated by a * and those significant at the 1 per cent level by **.

$X=(1-(e^{(-0.2643*\text{experience})})$ in the Australian regression, $(1-e^{(-0.3713*\text{experience})})$ in the British regression, and $(1-e^{(-0.1177*\text{experience})})$ in the US regression.

Table F2
The Relative Effect of Industry on Earnings, Australia, Great Britain and the United States, 1981.

	Industry Intercept Term -Average of Intercept Terms		
	Australia	Great Britain	United States
Agriculture	0.92	1.17	1.0
Energy and water	1.08	1.39	1.37
Manu. of metals, chemicals	1.13	0.96	1.21
Metal goods, eng. and vehicles	0.96	0.95	1.12
Other manufacturing	0.96	0.93	0.92
Construction	1.06	0.90	0.86
Distribution	0.96	0.82	0.83
Trans and Communications	1.06	1.18	1.02
Banking and bus services	0.88	0.74	0.98
Other services	1.02	1.11	0.82

Source: Table 6.1 Chapter 6.

Table F3
The Relative Effect of Industry Experience on Earnings, Australia, Great Britain and the United States, 1981.

	Industry *Experience Coefficient - Average of Industry*experience coefficients (a)		
	Australia	Great Britain	United States
Agriculture	0.94	0.77	0.57
Energy and water	1.01	0.81	0.87
Manu. of metals, chemicals	0.93	1.0	1.03
Metal goods, eng. and vehicles	0.97	0.98	1.02
Other manufacturing	1.0	1.01	1.1
Construction	0.92	1.02	1.26
Distribution	0.94	0.95	1.07
Trans and Communications	0.93	0.85	1.23
Banking and bus services	1.13	1.36	0.95
Other services	0.94	0.85	1.11

Source: Table 6.1 Chapter 6

(a) Calculated at one year of experience.

other manufacturing, construction, distribution, transport and communications and other services had above average growth in earnings with experience.

3. The Decomposition of Relative Earnings using the Industry Equations

Figures F1-F3 present further results for the decomposition of relative earnings by age for the three countries using alternative weights to those presented in chapter 6 figures 6.4-6.6. We have also presented in tables F4-F6 some detailed results for selected ages. Table D7 presents the more detiailed decomposition of the differences in the relative earnings by age across the three countries into its component parts for selected ages. In order to focus on the effect of industry and occupation on the results, three groups have been identified, other, industry and occupation. They are defined in the following way -

1. Other = high + postsecondary + graduate + experience + experience ^{2} + X + education*experience + married + widowed, separated and divorced + rural.

2. Industry = all the industry intercept dummies.+ industry experience terms

3. Occupation = all the occupation dummies.

For a fuller discription of the method used in these detailed decompositions see appendix D.

Figure F1: The Decomposition of Relative Earnings, Australia and the United States, 1981.
Earnings of a 25 year old=1.

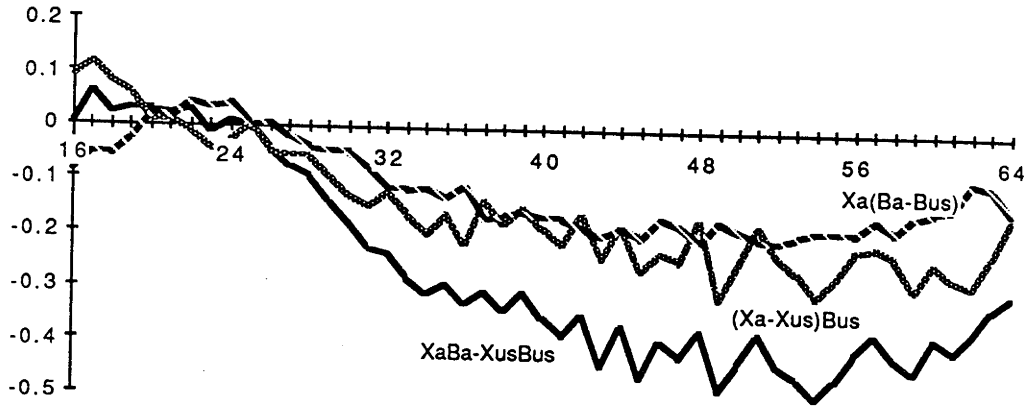


Figure F2: The Decomposition of Relative Earnings of Men, Australia and Great Britain, 1981.
Earnings of a 25 year old=1.

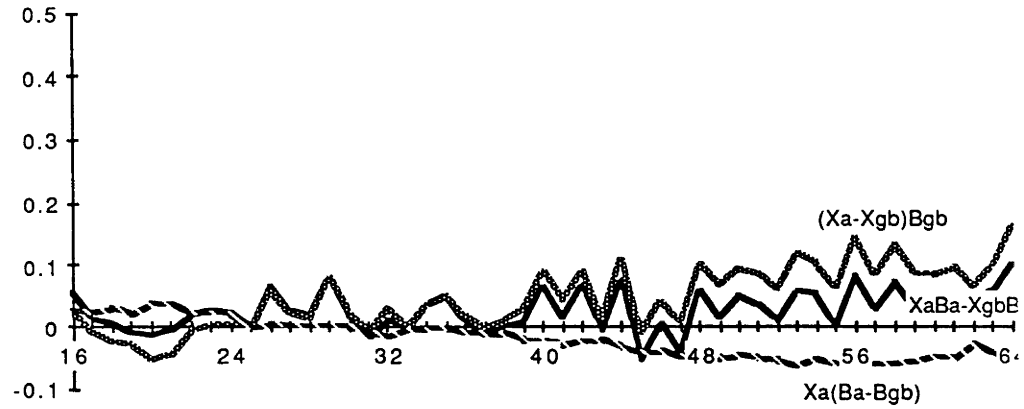


Figure F3: The Decomposition of Relative Earnings of Men, Great Britain and the United States, 1981.
Earnings of a 25 year old=1.

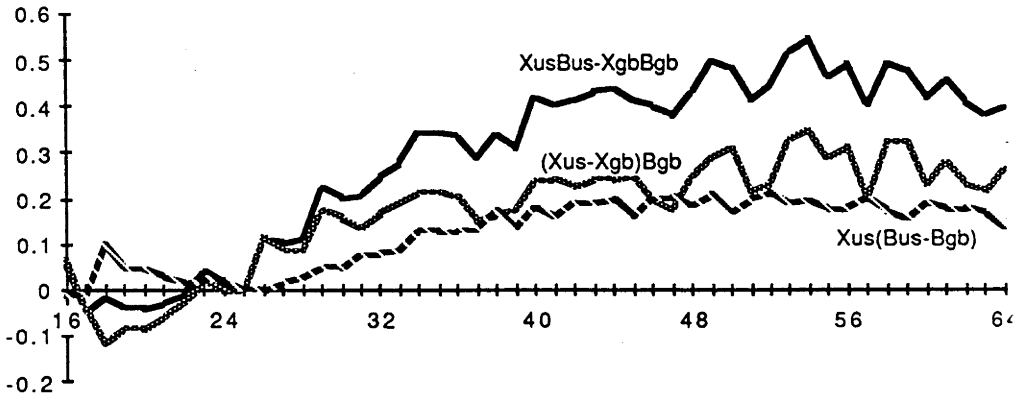


Table F4
Relative Earnings by Age; Actual, Predicted from the Industry Equations and Using Australian Weights, Australia, Great Britain and the United States, 1981.
Earnings of Men aged 25 in Country j=100

	yj	XjBj	XjBa	yj-ya	uj-ua	XjBj-XaBa	(Xj-Xa)Ba	Xj(Bj-Ba)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Age 18								
j=A	56	55	55	-	-	-	-	-
j=GB	55	54	56	-1	0	-1	1	-2
j=US	50	53	45	-6	-4	-2	-10	8
Age 25								
j=A	100	100	100	-	-	-	-	-
j=GB	100	100	100	0	0	0	0	0
j=US	100	100	100	0	0	0	0	0
Age 35								
j=A	127	123	123	-	-	-	-	-
j=GB	125	117	114	-2	4	-6	-9	3
j=US	140	152	135	13	-16	29	12	17
Age 45								
j=A	113	113	113	-	-	-	-	-
j=GB	121	118	109	8	3	5	-4	9
j=US	142	159	129	29	-17	46	16	30
Age 55								
j=A	110	109	109	-	-	-	-	-
j=GB	111	108	100	1	2	-1	1	-2
j=US	143	154	121	33	-12	45	12	33
Age 64								
j=A	105	104	104	-	-	-	-	-
j=GB	101	94	84	-4	6	-10	-20	10
j=US	113	134	101	8	-22	30	-3	33

Notes: y_a, X_a and β_a are respectively the actual earnings, the endowments and the coefficients of Australia.
Column 4 is taken from column 1. It is the sum of columns 5 and 6.
Column 5 = $(y_j - X_j\beta_j) - (y_a - X_a\beta_a)$ taken from columns 1 and 2.
Column 6 is taken from column 2. It is the sum of columns 7 and 8.
Column 7 is taken from column 3.
Column 8 = Column 2- column 3 for each j.

Table F5
Relative Earnings by Age; Actual, Predicted from the Industry Equations and Using British Weights, Australia, Great Britain and the United States, 1981.
Earnings of Men aged 25 in Country j=100

	yj	XjBj	XjBg	yj-yg	uj-ug	XjBj-XgBg	(Xj-Xg)Bg	Xj(Bj-Bg)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Age 18								
j=A	56	55	46	1	0	1	-8	9
j=GB	55	54	54	-	-	-	-	-
j=US	50	53	43	-5	-4	-1	-11	10
Age 25								
j=A	100	100	100	0	0	0	0	0
j=GB	100	100	100	-	-	-	-	-
j=US	100	100	100	0	0	0	0	0
Age 35								
j=A	127	123	123	2	-4	6	6	0
j=GB	125	117	117	-	-	-	-	-
j=US	140	152	139	15	-20	35	22	13
Age 45								
j=A	113	113	117	-8	-3	-5	-1	-5
j=GB	121	118	118	-	-	-	-	-
j=US	142	159	143	21	-20	41	25	16
Age 55								
j=A	110	109	115	1	-2	1	7	-6
j=GB	111	108	108	-	-	-	-	-
j=US	143	154	137	32	-14	46	29	17
Age 64								
j=A	105	104	110	4	-6	10	16	-6
j=GB	101	94	94	-	-	-	-	-
j=US	113	134	120	12	-28	40	26	14

Notes: y_g, X_g and β_g are respectively the actual earnings, the endowments and the coefficients of Graet Britain.
Column 4 is taken from column 1. It is the sum of columns 5 and 6.
Column 5 = $(y_j - X_j\beta_j) - (y_g - X_g\beta_g)$ taken from columns 1 and 2.
Column 6 is taken from column 2. It is the sum of columns 7 and 8.
Column 7 is taken from column 3.
Column 8 = Column 2- column 3 for each j.

Table F6
Relative Earnings by Age; Actual, Predicted from the Industry Equations and Using American Weights, Australia, Great Britain and the United States, 1981.
Earnings of Men aged 25 in Country j=100

	yj	XjBj	XjBu	yj-yu	uj-uu	XjBj-XuBu	(Xj-Xu)Bu	Xj(Bj-Bu)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Age 18								
j=A	56	55	61	6	4	2	8	-6
j=GB	55	54	55	5	4	1	2	-1
j=US	50	53	53	-	-	-	-	-
Age 25								
j=A	100	100	100	0	0	0	0	0
j=GB	100	100	100	0	0	0	0	0
j=US	100	100	100	-	-	-	-	-
Age 35								
j=A	127	123	136	-13	16	-29	-16	-13
j=GB	125	117	131	-15	20	-35	-21	-14
j=US	140	152	152	-	-	-	-	-
Age 45								
j=A	113	113	133	-29	17	-46	-26	-20
j=GB	121	118	136	-21	20	-41	-23	-18
j=US	142	159	159	-	-	-	-	-
Age 55								
j=A	110	109	127	-33	12	-45	-27	-18
j=GB	111	108	124	-32	14	-46	-30	-16
j=US	143	154	154	-	-	-	-	-
Age 64								
j=A	105	104	119	-8	22	-30	-15	-15
j=GB	101	94	101	-12	28	-40	-33	-7
j=US	113	134	134	-	-	-	-	-

Notes: y_u, X_u and β_u are respectively the actual earnings, the endowments and the coefficients of the United States.
Column 4 is taken from column 1. It is the sum of columns 5 and 6.
Column 5 = $(y_j - X_j\beta_j) - (y_u - X_u\beta_u)$ taken from columns 1 and 2.
Column 6 is taken from column 2. It is the sum of columns 7 and 8.
Column 7 is taken from column 3.
Column 8 = Column 2- column 3 for each j.

Table F7
The Decomposition of the Relative Earnings Gap into its Component Parts for Selected Ages

	US-Aust (1)	GB- Aust (2)	GB- US (3)
Age 18			
Other			
Coefficients	0.0432	-0.0646	0.0407
Endowments	-0.1664	0.0305	0.0484
Total	-0.1232	-0.0340	0.0891
Industry			
Coefficients	0.0940	0.0162	-0.0435
Endowments	0.0011	-0.0013	-0.0367
Total	0.0951	0.0149	-0.0802
Occupation			
Coefficients	0.0152	0.0144	-0.0116
Endowments	-0.0343	-0.0143	0.0309
Total	-0.0192	0.0001	0.0193
Total	-0.0473	-0.0190	0.0282
Age 35			
Other			
Coefficients	0.1906	0.0563	-0.1428
Endowments	0.0729	-0.0404	-0.1049
Total	0.2636	0.0159	-0.2477
Industry			
Coefficients	-0.0516	-0.0103	0.0345
Endowments	0.0191	-0.0017	-0.0139
Total	-0.0325	-0.0120	0.0205
Occupation			
Coefficients	0.0306	-0.0012	0.0101
Endowments	0.0162	-0.0253	-0.0223
Total	-0.0143	-0.0265	-0.0122
Total	0.2168	-0.0226	-0.23
Age 45			
Other			
Coefficients	0.2784	0.0996	-0.1679
Endowments	0.1384	0.0047	-0.1446
Total	0.4168	0.1043	-0.3125
Industry			
Coefficients	-0.0780	-0.0020	0.0445
Endowments	0.0102	0.0072	0.0285
Total	-0.0678	0.0052	0.0730
Occupation			
Coefficients	-0.0193	0.0066	0.0079
Endowments	0.0283	-0.0081	-0.0184
Total	0.0090	-0.0015	-0.0105
Total	0.3580	0.1080	-0.2500

	US-Aust (1)	GB- Aust (2)	GB- US (3)
Age 55			
Other			
Coefficients	0.3057	0.1542	-0.1307
Endowments	0.1080	-0.0263	0.1186
Total	0.4137	0.1279	-0.2858
Industry			
Coefficients	-0.0740	-0.0134	0.0445
Endowments	0.0190	-0.0114	0.0393
Total	-0.0549	-0.0248	0.0302
Occupation			
Coefficients	-0.0280	-0.0035	0.0018
Endowments	0.0461	0.0208	-0.0107
Total	0.0181	0.0173	-0.0008
Total	0.3769	0.1204	-0.2564
Age 64			
Other			
Coefficients	0.3126	0.2002	-0.0819
Endowments	0.0530	-0.0401	-0.1236
Total	0.3656	0.1600	-0.2055
Industry			
Coefficients	-0.0716	-0.0041	0.0954
Endowments	0.0021	-0.0260	-0.0560
Total	-0.0696	-0.0302	0.0394
Occupation			
Coefficients	-0.0251	0.0008	-0.0023
Endowments	0.0094	-0.0507	-0.0319
Total	-0.0156	-0.0498	-0.0342
Total	0.2804	0.0800	-0.2003

4. The Effect of Trade Unions on Age Earnings Profiles

Tables F8 and F9 present the regression results for the relatively highly unionised and less unionised industries. Tables F 10 - 12 present the results for Australia of the effect of increases in experience on earnings for the three groups of industries; those with high, medium and low levels of unionisation.

Table F8

Weekly Earnings of Full-time Men aged 16-64 in Highly Unionised Industries, Australia, Great Britain, the United States, 1981.

Dependent Variable= ln Weekly Earnings

	Australia	Great Britain	United States
Intercept	4.7150 (52.98**)	4.0268 (35.45**)	5.1435 (26.38**)
High	0.1224 (1.32)	-0.0657 (-0.47)	0.1348 (0.67)
Post secondary	0.5600 (5.42**)	0.2878 (1.97*)	-0.0704 (-0.34)
Graduate	0.7710 (7.81**)	0.3577 (2.38**)	0.1657 (0.84)
X	0.7301 (7.09**)	0.5460 (4.20**)	0.5198 (1.77)
Experience	0.0103 (4.20**)	0.0142 (4.57**)	-0.0007 (-0.07)
Experience ^{2}	-0.0002 (-4.40**)	-0.0003 (-4.65**)	-0.00002 (-0.13)
High*X	- 0.0544 (-0.56)	0.1542 (1.07)	0.0606 (-0.27)
Postsec*X	-0.4303 (-4.0**)	-0.1498 (-1.0)	0.3442 (1.45)
Graduate*X	-0.3641 (-3.53**)	-0.0303 (-0.19)	0.2750 (1.25)
Married	0.1099 (7.65**)	0.1060 (4.77**)	0.2416 (7.10**)
Widowed, separated, divorced	0.0579 (2.52**)	0.0228 (0.58)	0.2020 (4.14**)
Rural	-0.0427 (-2.57**)	-0.0299 (-1.98*)	-0.1087 (-4.63**)
Occupations			
Managers	0.1641 (7.32**)	0.2405 (8.98**)	0.1732 (4.25**)
Professionals	0.0079 (0.46)	0.2746 (8.34**)	0.0087 (0.25)
Semi and Unskilled Workers	-0.2140 (-16.24**)	-0.1810 (-7.57**)	-0.1179 (-3.60**)
Skilled Workers	-0.1291 (-8.21**)	0.0225 (1.12)	0.1239 (3.23**)

	Australia	Great Britain	United States
R^2	0.44	0.40	0.21
F	208.17	72.03	35.41
N	4,256	1,747	2,168
Mean of Dep. Var.	5.6216	4.8617	5.9477

Notes:
t statistics in brackets. Significant test statistics at the 5 per cent level are indicated by a * and those significant at the 1 per cent level by **.

X=(1- ($e^{(-0.2643*\text{experience})}$)in the Australian regression,(1- $e^{(-0.3713*\text{experience})}$ in the British regression, and (1- $e^{(-0.1177*\text{experience})}$)in the US regression.

Table F9

Weekly Earnings of Full-time Men aged 16-64 in the Less Unionised Industries, Australia, Great Britain, the United States, 1981.

Dependent Variable= ln Weekly Earnings

	Australia	Great Britain	United States
Intercept	4.4238 (83.04**)	3.6343 (44.33**)	4.6144 (37.18**)
High	0.3233 (5.84**)	-0.0122 (-0.11)	0.3255 (2.39**)
Post secondary	0.7698 (11.44**)	0.2327 (1.95)	0.4269 (2.87**)
Graduate	0.6439 (7.47**)	0.4007 (2.29**)	0.8173 (5.84**)
X	0.9182 (12.69**)	0.7432 (6.89**)	0.9863 (3.67**)
Experience	0.0105 (3.84**)	0.0144 (3.19**)	0.0087 (0.7)
Experience ^{2}	-0.0002 (-4.22**)	-0.0003 (-3.59**)	-0.0003 (-1.33)
High*X	- 0.2115 (-3.43**)	0.2031 (1.69)	-0.2002 (-1.23)
Postsec*X	-0.6382 (-8.71**)	-0.0878 (-0.68)	-0.1214 (0.67)
Graduate*X	-0.2657 (-2.81**)	0.1197 (0.59)	-0.3543 (-2.08**)
Married	0.0997 (6.05**)	0.1677 (5.07**)	0.1567 (4.02**)
Widowed, separated, divorced	0.0535 (1.97*)	0.0714 (1.15)	0.0223 (0.4)
Rural	-0.1487 (-9.48**)	-0.0122 (-0.56)	-0.1267 (-4.42**)
Occupations			
Managers	0.3057 (16.35**)	0.2126 (7.14**)	0.1216 (3.18**)
Professionals	0.1802 (7.74**)	0.2379 (3.86**)	0.2110 (4.26**)
Semi and Unskilled Workers	-0.1692 (-12.27**)	-0.1597 (-4.97**)	-0.1434 (-4.02**)
Skilled Workers	-0.1352 (-8.04**)	-0.0350 (-1.18)	-0.0248 (-0.58)

	Australia	Great Britain	United States
R^2	0.55	0.49	0.29
F	282.50	70.15	46.72
N	3,682	1,188	1,865
Mean of Dep. Var.	5.4495	4.6394	5.7415

Notes:
t statistics in brackets. Significant test statistics at the 5 per cent level are indicated by a * and those significant at the 1 per cent level by **.

X=(1- ($e^{(-0.2643*\text{experience})}$)in the Australian regression,(1- $e^{(-0.3713*\text{experience})}$ in the British regression, and (1- $e^{(-0.1177*\text{experience})}$)in the US regression.

Table F10
Percentage Growth in Predicted Earnings with an Additional Year of Experience in Industries with a High, Medium and Low Level of Unionisation, Australia, 1981.

	High	Medium	Low
An additional year of experience starting from the following years of experience			
Unqualified			
1	14	18	17
5	5	6	7
10	2	2	2
20	0.3	-0.07	0.3
30	-0.07	-0.4	-0.2
45	-0.8	-0.7	-0.8
High School			
1	13	16	14
5	5	6	5
10	2	1	2
20	0.3	-0.07	0.3
30	-0.2	-0.4	-0.2
45	-0.8	-0.7	-0.8
Post Secondary			
1	6	8	6
5	3	3	3
10	1	0.8	1
20	0.2	-0.1	0.3
30	-0.2	-0.4	-0.2
40	-0.6	-0.6	-0.6
University Graduates			
1	8	9	13
5	3	3	5
10	1	0.8	2
20	0.3	-0.1	0.3
30	-0.2	-0.4	-0.2
40	-0.6	-0.6	-0.6

Table F11
Percentage Growth in Predicted Earnings with an Additional Year of Experience in Industries with a High, Medium and Low Level of Unionisation, Great Britain, 1981.

	High	Medium	Low
An additional year of experience starting from the following years of experience			
Unqualified			
1	13	19	17
5	4	5	5
10	1	1	1
20	0.2	0.2	0.2
30	-0.4	-0.2	-0.4
45	-1	-0.8	-1
High School			
1	16	21	21
5	4	5	6
10	1	1	2
20	0.2	0.2	0.2
30	-0.4	-0.2	-0.4
45	-1	-0.8	-1
Post Secondary			
1	10	15	15
5	3	4	4
10	1	1	1
20	0.2	0.2	0.2
30	-0.4	-0.2	-0.4
40	-1	-0.6	-1
University Graduates			
1	12	16	20
5	4	4	5
10	1	1	1
20	0.2	0.2	0.2
30	-0.4	-0.2	-0.4
40	-1	-0.6	-1

Table F12
Percentage Growth in Predicted Earnings with an Additional Year of Experience in Industries with a High, Medium and Low Level of Unionisation, United States, 1981.

	High	Medium	Low
An additional year of experience starting from the following years of experience			
Unqualified			
1	5	9	11
5	3	6	7
10	2	4	4
20	0.4	0.1	0.7
30	-0.2	0.3	-0.6
45	-0.2	-0.5	-2
High School			
1	6	7	9
5	3	5	5
10	2	3	3
20	0.5	1	0.5
30	0	0.2	-0.7
45	-0.2	-0.5	-2
Post Secondary			
1	8	7	9
5	5	5	6
10	3	3	3
20	0.8	1	0.6
30	0.1	0.2	-0.7
40	-0.2	-0.3	-1
University Graduates			
1	8	5	7
5	5	4	4
10	3	2	2
20	0.7	0.9	0.3
30	0.1	0.2	-0.8
40	-0.2	-0.3	-2

Appendix G

Appendix to chapter 7: Additional Results for the Comparison of Age Earnings Profiles for Women across the Countries.

This appendix has two sections; the first presents the data used to calculate the correlations between the countries of the industry intercept terms. The second presents further results for the decomposition of relative earnings for women using both the basic equation and the equation including industry.

1. A Comparison of the Effects of Industry on Full-time Earnings for Women.

Table G1 presents the intercept terms for each industry relative to the average of the intercept terms for women in each country. The manufacture of basic metals and chemicals; metal goods, engineering and vehicles; and energy and water had above average earnings in each country, holding everything else constant. Distribution and banking and business services had below average earnings in each country. In contrast to the evidence presented in Table G1 of some pattern of particular industries paying above or below the average in each of the three countries, there was no such general pattern with respect to industry experience (see Table G2). The relative returns to experience by industry differed between the countries and there was no industry which had either an above or below average

Table G1
The Relative Effect of Industry on Female Earnings, Australia, Great Britain and the United States, 1981.

Intercept Terms	Industry Intercept Term -Average of		
	Australia	Great Britain	United States
Agriculture	0.80	1.75	0.79
Energy and water	1.20	1.19	1.24
Manu. of metals, chemicals	1.04	1.09	1.10
Metal goods, eng. and vehicles	1.05	1.09	1.04
Other manufacturing	1.08	0.97	0.95
Construction	0.93	0.75	1.51
Distribution	0.90	0.84	0.87
Trans and Communications	1.08	0.86	0.86
Banking and bus services	0.95	0.90	0.99
Other services	1.03	0.85	0.83

Source: Table 7.3 chapter 7.

Table G2
The Relative Effect of Industry Experience on Female Earnings, Australia, Great Britain and the United States, 1981.

	Industry *Experience Coefficient - Average of Industry*experience coefficients		
	Australia	Great Britain	United States
Agriculture	1.01	0.41	0.80
Energy and water	0.92	1.06	0.94
Manu. of metals, chemicals	1.06	0.94	1.21
Metal goods, eng. and vehicles	0.96	0.97	1.23
Other manufacturing	0.89	1.03	1.05
Construction	1.06	1.38	0.58
Distribution	1.05	0.98	0.94
Trans and Communications	0.96	1.29	1.42
Banking and bus services	1.12	1.11	0.95
Other services	0.98	1.26	1.16

Source: Table 7.3 chapter 7

2. The Decomposition of Relative Earnings.

This appendix presents the figures and tables of calculations for selected ages of the decomposition of the differences in relative earnings between the three countries. Figures G1, G2, and G3 relate to the decomposition based on the regression results reported in Table 7.1 of chapter 7. Tables G3, G4 and G5 use Australian, British and American weights respectively to decompose the differences in relative earnings for selected ages on the basis of this equation. Tables G6, G7 and G8 and figures G4 -G9 present the decomposition of relative earnings for women using the regression equations including industry and occupation. The results using the basic equation were discussed in chapter 7. We shall briefly describe the results using the industry equations.

The decompositions into coefficient and endowment effects raised the question which coefficients and which endowments were the major sources of the differences in relative earnings in the three countries. Tables G9 and G10 present the answers for selected ages. The calculations were made in manner reported in Appendix D. For the decomposition using the basic equation the following three groups of variables were distinguished

1. Education = high + postsecondary + graduate
2. Experience = experience + experience ^{2} + X + high*experience + postsec*experience + grad* experience.
3. Other = married + widowed, separated and divorced + child + rural.

For the decomposition using the equations including industry and occupation, the following groups were distinguished-

3. Other = high + postsecondary + graduate + married + experience + experience ^{2} + X + high*experience + postsec*experience + grad* experience.

widowed, separated and divorced + child + rural.

4. Industry = all the industry intercept dummies + all the industry*experience terms.
5. Occupation = all the occupation dummies.

Figure G1: The Decomposition of Relative Earnings of Women, Australia and the United States, 1981.
Earnings of a 25 Year Old=1.

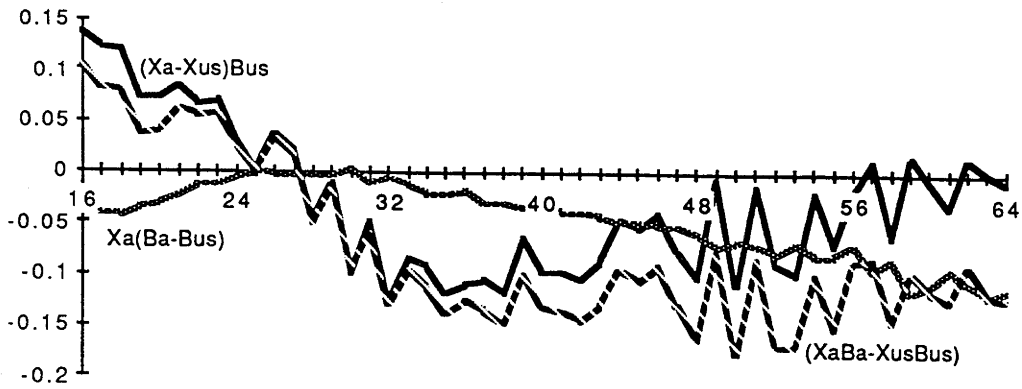


Figure G2: The Decomposition of Relative Earnings of Women, Australia and Great Britain, 1981.
Earnings of a 25 Year Old =1.

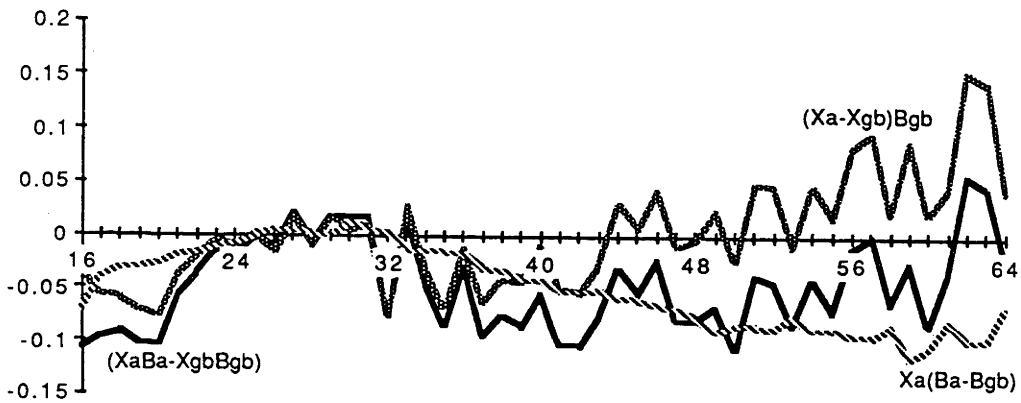
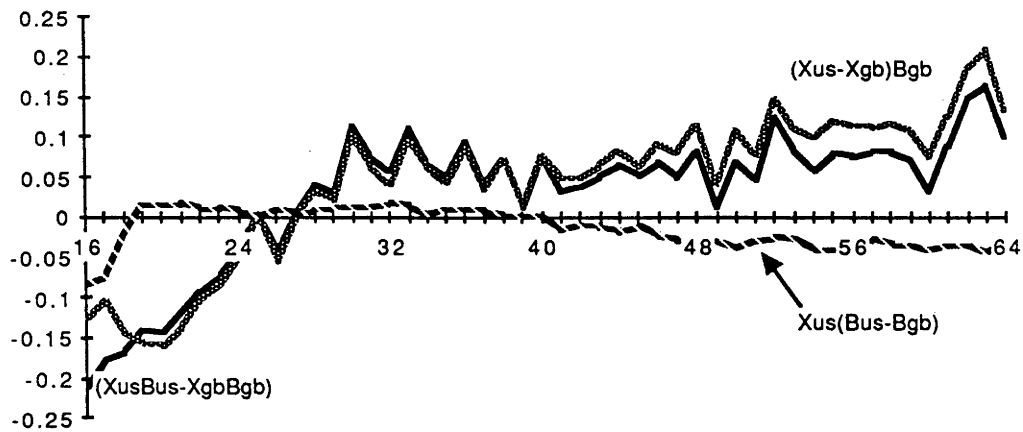


Figure G3: The Decomposition of Relative Earnings of Women, Great Britain and the United States, 1981.



Full definitions of these variables are included in appendix.A.

The broad conclusions of the decompositions described in chapter 7 held for the decompositions using the equations including industry and occupation reported in Tables G6-G8. The results of this exercise are presented in figures G4-G9. Once again using each countries weights for each of the comparisons. We shall summarise the results for three pairwise comparisons.

The inclusion of the industry and occupational variables reduced the size of the unexplained residual differences between Australia and the United States. Relative endowment differences remained the major source of differences in relative earnings between the countries. Among the under 25's, Australian women were relatively better endowed than their American counterparts but after the age of 25, American women held relatively higher levels of human capital endowments. Differences in the rewards for a given set of endowments became a more important contributor for older women to the explained differences between the countries in their relative earnings.

Endowment differences were also the major source of relative earnings differences between Australia and Great Britain. The exception to this conclusion comes from the decomposition of relative earnings for younger women. Differences in the rewards for a given set of endowments were particularly important for this group. British women under the age of 24 received relatively higher earnings for a given set of endowments than they would have received in Australia. However, after their mid 30's, most of the differences in relative earnings can be attributed to the differences in relative endowments. British women held relatively higher stocks of human capital than Australian women of the same age.

Our final country comparison relates to Great Britain and the United States. Among the under 25's, British women were relatively better endowed with human capital than their American counterparts and for all except 16 year olds, earned relatively more than

Figure G4: The Decomposition of Relative Earnings of Women, Australia and the United States, 1981.
Earnings of a 25 year old=1.

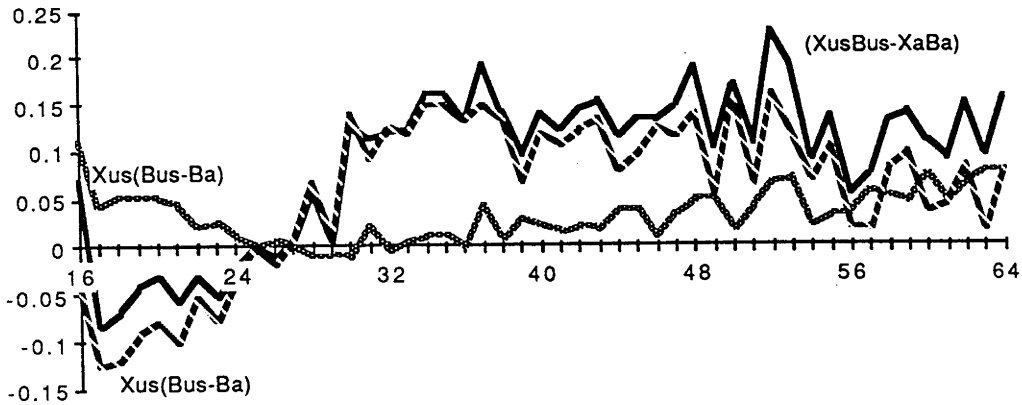


Figure G5: The Decomposition of Relative Earnings , Australia and Great Britain, 1981.
Earnings of a 25 year old=1.

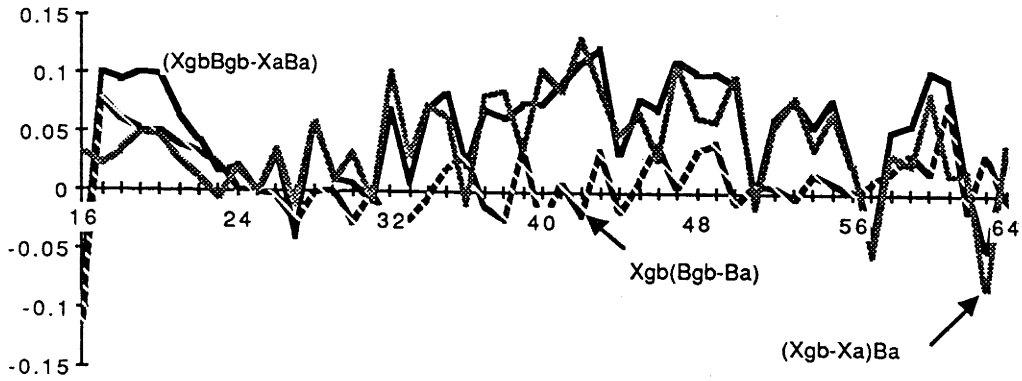


Figure G6: The Decomposition of Relative Earnings of Women, Great Britain and the United States, 1981
Earnings of a 25 year old=1.

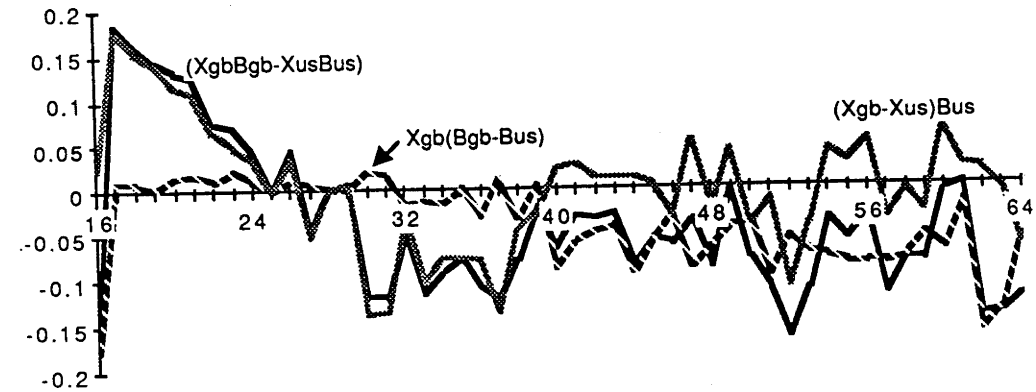


Figure G7: The Decomposition of Relative Earnings of Women, Australia and the United States, 1981.
Earnings of a 25 year old=1.

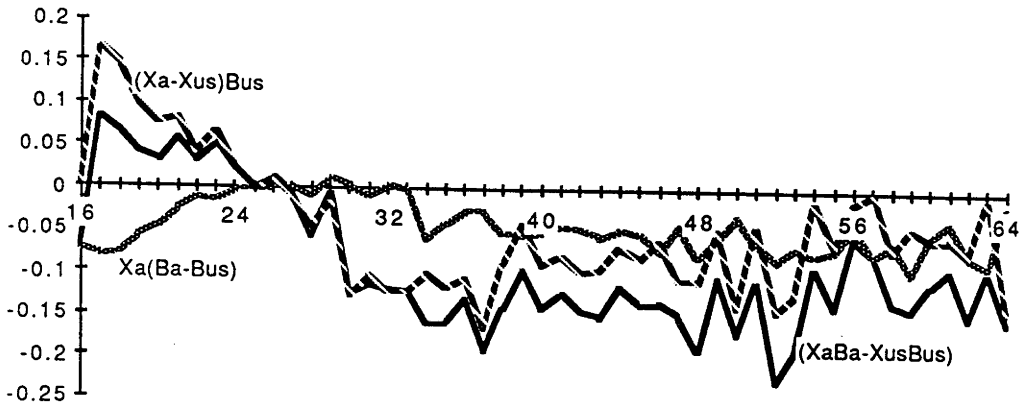


Figure G8: The Decomposition of Relative Earnings, Australia and Great Britain, 1981.
Earnings of a 25 year old=1.

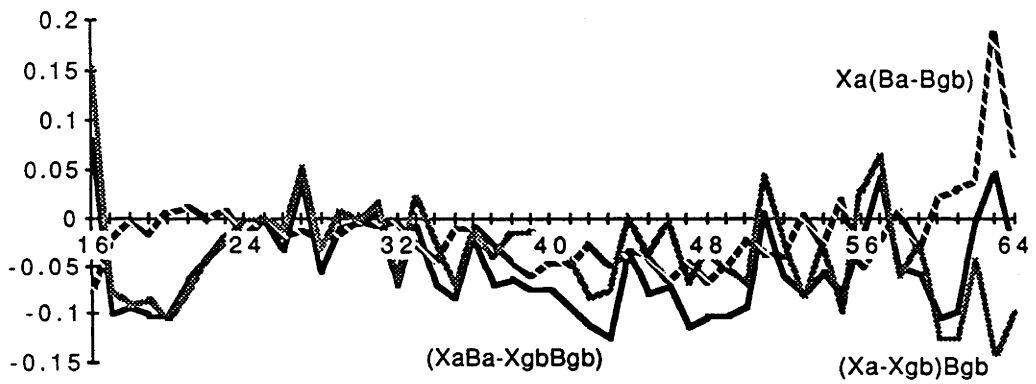
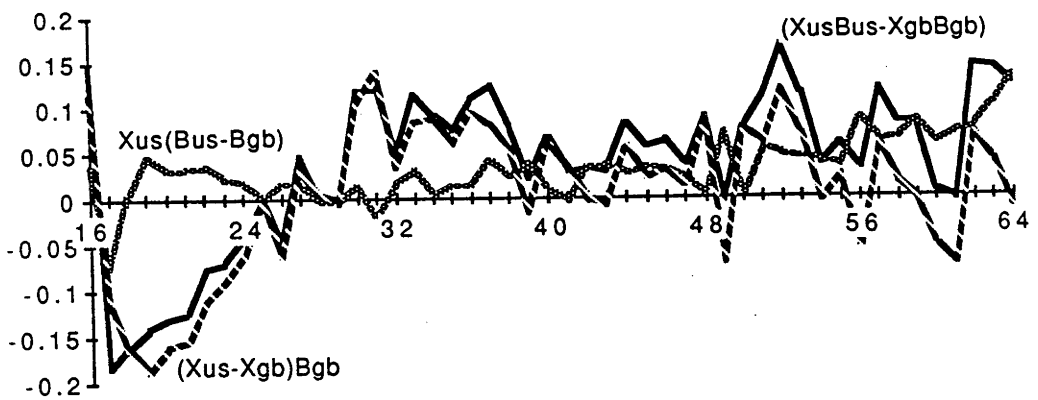


Figure G9: The Decomposition of Relative Earnings of Women, Great Britain and the United States, 1981.
Earnings of a 25 year old =1.



women of the same age in the United States. However, after the age of 30, relative earnings of British women fell below the earnings of American women. Over the age range 30 to 40 their relatively low levels of endowments appeared to be the major determinant of relatively low earnings compared with the United States but for those over 40, the effect of differences in the rewards for a given set of endowments was important.

Table G10 presents the breakdown of the decomposition of relative earnings into groups of variables including industry and occupation. In the comparison between Australia and the United States, 'other' including experience and education, remained the major sources of differences between the countries at most of the selected ages.Differences in the endowments and coefficients on the industry terms were not important in explaining the differences in relative earnings between women in Australia and Great Britain.Differences in the 'other' group which included education and experience remained the major source of the differences at most ages. The occupational distribution also contributed to the higher relative earnings of British women at some ages compared with Australia. Differences in the 'other' group continued to be the major determinant of earnings differences between Great Britain and the United States.

Table G3
Relative Earnings by Age; Actual, Predicted and Using Australian Weights, Australia, Great Britain and the United States, 1981. Earnings of Women aged 25 in Country j=100

	y_j (1)	$X_j\beta_j$ (2)	$X_j\beta_a$ (3)	y_j-y_a (4)	u_j-u_a (5)	$X_j\beta_j-X_a\beta_a$ (6)	$(X_j-X_a)\beta_a$ (7)	$X_j(\beta_j-\beta_a)$ (8)
Age 18								
j=A	54	59	59	-	-	-	-	-
j=GB	63	68	63	9	0	9	4	5
j=US	48	52	49	-6	1	-7	-10	3
Age 25								
j=A	100	100	100	-	-	-	-	-
j=GB	100	100	100	0	0	0	0	0
j=US	100	100	100	0	0	0	0	0
Age 35								
j=A	88	96	96	-	-	-	-	-
j=GB	96	104	104	8	0	8	8	0
j=US	111	109	108	23	10	13	12	1
Age 45								
j=A	89	93	93	-	-	-	-	-
j=GB	89	98	96	0	-5	5	3	2
j=US	104	103	100	15	5	10	7	3
Age 55								
j=A	91	90	90	-	-	-	-	-
j=GB	97	97	95	6	-1	7	5	2
j=US	101	105	100	10	-5	15	10	5
Age 64								
j=A	90	88	88	-	-	-	-	-
j=GB	97	91	94	7	4	3	6	-3
j=US	104	101	96	14	1	13	8	5

Notes: y_a, X_a and β_a are respectively the actual earnings, the endowments and the coefficients of Australia.
Column 5 is taken from column 1. It is the sum of columns 6 and 7.
Column 6 = $(y_j-X_j\beta_j) - (y_a-X_a\beta_a)$ taken from columns 1 and 2.
Column 7 is taken from column 2. It is the sum of columns 8 and 9.
Column 8 is taken from column 3.
Column 9 = Column 2- column 3 for each j.

Table G4
Relative Earnings by Age; Actual, Predicted and Using British Weights, Australia, Great Britain and the United States, 1981. Earnings of Women aged 25 in Country j=100

	y_j (1)	$X_j\beta_j$ (2)	$X_j\beta_g$ (3)	y_j-y_g (4)	u_j-u_g (5)	$X_j\beta_j-X_g\beta_g$ (6)	$(X_j-X_g)\beta_g$ (7)	$X_j(\beta_j-\beta_g)$ (8)
Age 18								
j=A	54	59	62	-9	0	-9	-6	-3
j=GB	63	68	68	-	-	-	-	-
j=US	48	52	54	-15	1	-16	-14	-2
Age 2								
j=A	100	100	100	0	0	0	0	0
j=GB	100	100	100	-	-	-	-	-
j=US	100	100	100	0	0	0	0	0
Age 35								
j=A	88	96	97	-8	0	-8	-7	-1
j=GB	96	104	104	-	-	-	-	-
j=US	111	109	108	15	10	5	4	1
Age 45								
j=A	89	93	99	0	5	-5	1	-6
j=GB	89	98	98	-	-	-	-	
j=US	104	103	105	15	10	5	7	-2
Age 55								
j=A	91	90	98	-6	1	-7	1	-8
j=GB	97	97	97	-	-	-	-	-
j=US	101	105	109	4	-5	8	12	-4
Age 64								
j=A	90	88	95	-7	-4	-3	-4	-7
j=GB	97	91	91	-	-	-	-	-
j=US	104	101	104	7	-3	10	13	-3

Notes: y_g, X_g and β_g are respectively the actual earnings, the endowments and the coefficients of Great Britain.
Column 5 is taken from column 1. It is the sum of columns 6 and 7.
Column 6 = $(y_j-X_j\beta_j) - (y_g-X_g\beta_g)$ taken from columns 1 and 2.
Column 7 is taken from column 2. It is the sum of columns 8 and 9.
Column 8 is taken from column 3.
Column 9 = Column 2- column 3 for each j.

Table G5
Relative Earnings by Age; Actual, Predicted and Using United States Weights, Australia, Great Britain and the United States, 1981.
Earnings of Women aged 25 in Country j=100

	y_j	$X_j\beta_j$	$X_j\beta_u$	y_j-y_u	u_j-u_u	$X_j\beta_j-X_u\beta_u$	$(X_j-X_u)\beta_u$	$X_j(\beta_j-\beta_u)$
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Age 18								
j=A	54	59	64	6	-1	7	12	-5
j=GB	63	68	66	15	-1	16	14	2
j=US	48	52	52	-	-	-	-	-
Age 25								
j=A	100	100	100	0	0	0	0	0
j=GB	100	100	100	0	0	0	0	0
j=US	100	100	100	-	-	-	-	-
Age 35								
j=A	88	96	98	-23	-10	-13	-11	-2
j=GB	96	104	107	-15	-10	-5	-2	-3
j=US	111	109	109	1-	-	-	-	-
Age 45								
j=A	89	93	98	-15	-5	-10	-5	-5
j=GB	89	98	100	-15	-10	-5	-3	-2
j=US	104	103	103	1-	-	-	-	-
Age 55								
j=A	91	90	98	-10	5	-15	-7	-8
j=GB	97	97	101	-4	4	-8	-4	-4
j=US	101	105	105	-	-	-	-	-
Age 64								
j=A	90	88	99	-14	-1	-13	-2	-11
j=GB	97	91	102	-7	3	-10	1	-11
j=US	104	101	101	-	-	-	-	-

Notes: y_u, X_u and β_u are respectively the actual earnings, the endowments and the coefficients of the United States.
Column 5 is taken from column 1. It is the sum of columns 6 and 7.
Column 6 = $(y_j-X_j\beta_j) - (y_u-X_u\beta_u)$ taken from columns 1 and 2.
Column 7 is taken from column 2. It is the sum of columns 8 and 9.
Column 8 is taken from column 3.
Column 9 = Column 2- column 3 for each j.

Table G6
Relative Earnings by Age; Actual, Predicted and Using Australian Weights including Industry and Occupation, Australia, Great Britain and the United States, 1981.
Earnings of Women aged 25 in Country j=100

	y_j	$X_j\beta_j$	$X_j\beta_a$	y_j-y_a	u_j-u_a	$X_j\beta_j - X_a\beta_a$	$(X_j-X_a)\beta_a$	$X_j(\beta_j-\beta_a)$
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Age 18								
j=A	54	58	58	-	-	-	-	-
j=GB	63	67	61	9	0	9	3	6
j=US	48	51	40	-6	1	-7	-12	5
Age 25								
j=A	100	100	100	-	-	-	-	-
j=GB	100	100	100	0	0	0	0	0
j=US	100	100	100	0	0	0	0	0
Age 35								
j=A	88	94	94	-	-	-	-	-
j=GB	96	103	101	8	-1	9	7	2
j=US	111	110	109	23	7	16	15	1
Age 45								
j=A	89	89	89	-	-	-	-	-
j=GB	89	97	96	0	-8	8	7	1
j=US	104	102	99	15	2	13	10	3
Age 55								
j=A	91	90	90	-	-	-	-	-
j=GB	97	98	98	6	-2	8	8	0
j=US	101	104	101	10	-4	14	11	3
Age 64								
j=A	90	87	87	-	-	-	-	-
j=GB	97	91	91	7	3	4	4	0
j=US	104	103	95	14	-2	16	8	8

Notes: y_a, X_a and β_a are respectively the actual earnings, the endowments and the coefficients of Australia.
Column 5 is taken from column 1. It is the sum of columns 6 and 7.
Column 6 = $(y_j-X_j\beta_j) - (y_a-X_a\beta_a)$ taken from columns 1 and 2.
Column 7 is taken from column 2. It is the sum of columns 8 and 9.
Column 8 is taken from column 3.
Column 9 = Column 2- column 3 for each j.

Table G7
Relative Earnings by Age; Actual, Predicted and Using British Weights including Industry and Occupation, Australia, Great Britain and the United States, 1981.
Earnings of Women aged 25 in Country j=100

	y_j (1)	$X_j\beta_j$ (2)	$X_j\beta_g$ (3)	y_j-y_g (4)	u_j-u_g (5)	$X_j\beta_j-X_g\beta_g$ (6)	$(X_j-X_g)\beta_g$ (7)	$X_j(\beta_j-\beta_g)$ (8)
Age 18								
j=A	54	58	58	-9	0	-9	-9	0
j=GB	63	67	67	-	-	-	-	-
j=US	48	51	51	-15	1	-16	-16	0
Age 25								
j=A	100	100	100	0	0	0	0	0
j=GB	100	100	100	-	-	-	-	-
j=US	100	100	100	0	0	0	0	0
Age 35								
j=A	88	94	95	-8	1	-9	-8	-1
j=GB	96	103	103	-	-	-	-	-
j=US	111	110	109	15	8	7	6	1
Age 45								
j=A	89	89	93	0	-8	-8	-4	-4
j=GB	89	97	97	-	-	-	-	-
j=US	104	102	99	15	10	5	2	3
Age 55								
j=A	91	90	89	-6	2	-8	-9	1
j=GB	97	98	98	-	-	-	-	-
j=US	101	104	101	4	-2	6	3	3
Age 64								
j=A	90	87	81	-7	-3	-4	-10	6
j=GB	97	91	91	-	-	-	-	-
j=US	104	103	90	7	-5	12	-1	13

Notes: y_g, X_g and β_g are respectively the actual earnings, the endowments and the coefficients of Great Britain.
Column 5 is taken from column 1. It is the sum of columns 6 and 7.
Column 6 = $(y_j-X_j\beta_j) - (y_g-X_g\beta_g)$ taken from columns 1 and 2.
Column 7 is taken from column 2. It is the sum of columns 8 and 9.
Column 8 is taken from column 3.
Column 9 = Column 2- column 3 for each j.

Table G8
Relative Earnings by Age; Actual, Predicted and Using United States Weights including Industry and Occupation, Australia, Great Britain and the United States, 1981.
Earnings of Women aged 25 in Country j=100

	y_j	$X_j\beta_j$	$X_j\beta_u$	y_j-y_u	u_j-u_u	$X_j\beta_j-X_u\beta_u$	$(X_j-X_u)\beta_u$	$X_j(\beta_j-\beta_u)$
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Age 18								
j=A	54	58	66	6	-1	7	15	-8
j=GB	63	67	67	15	-1	16	16	0
j=US	48	51	51	-	-	-	-	-
Age 25								
j=A	100	100	100	0	0	0	0	0
j=GB	100	100	100	0	0	0	0	0
j=US	100	100	100	-	-	-	-	-
Age 35								
j=A	88	94	98	-23	-7	-16	-12	-4
j=GB	96	103	103	-15	-8	-7	-7	0
j=US	111	110	110	-	-	-	-	-
Age 45								
j=A	89	89	94	-15	-2	-13	-8	-5
j=GB	89	97	103	-15	-10	-5	1	-6
j=US	104	102	102	-	-	-	-	-
Age 55								
j=A	91	90	98	-10	4	-14	-6	-8
j=GB	97	98	107	-4	2	-6	3	-9
j=US	101	104	104	-	-	-	-	-
Age 64								
j=A	90	87	89	-14	2	-16	-14	-2
j=GB	97	91	96	-7	5	-12	-7	-5
j=US	104	103	103	-	-	-	-	-

Notes: y_u, X_u and β_u are respectively the actual earnings, the endowments and the coefficients of the United States.
Column 5 is taken from column 1. It is the sum of columns 6 and 7.
Column 6 = $(y_j-X_j\beta_j) - (y_u-X_u\beta_u)$ taken from columns 1 and 2.
Column 7 is taken from column 2. It is the sum of columns 8 and 9.
Column 8 is taken from column 3.
Column 9 = Column 2- column 3 for each j.

Table G9
The Decomposition of the Relative Earnings Gap into its Component Parts for Selected Ages

	US-Aust (1)	GB- Aust (2)	GB- US (3)
Age 18			
Education			
Coefficients	0.0320	0.0179	0.0087
Endowments	-0.2371	0.0897	0.3040
Total	-0.2051	0.1076	0.3127
Experience			
Coefficients	0.0397	0.0787	0.0143
Endowments	0.0748	-0.0355	-0.0855
Total	0.1145	0.0433	-0.0712
Other			
Coefficients	-0.0137	-0.0142	0.0094
Endowments	-0.0345	-0.0030	0.0276
Total	-0.0483	-0.0112	0.0371
Total	-0.1389	0.1397	0.2786
Age 35			
Education			
Coefficients	0.0147	0.0220	0.0205
Endowments	0.0749	0.1037	0.0155
Total	0.0896	0.1257	0.0361
Experience			
Coefficients	-0.0029	-0.0229	-0.0328
Endowments	0.0272	-0.0026	-0.0571
Total	0.0243	-0.0655	-0.0899
Other			
Coefficients	0.0075	0.0149	-0.0038
Endowments	0.0191	0.0207	0.0128
Total	0.0267	0.0357	0.0090
Total	0.1406	0.0959	-0.0448
Age 45			
Education			
Coefficients	0.0239	0.0761	0.0818
Endowments	-0.0270	0.0260	0.0234
Total	-0.0031	0.1021	0.1052
Experience			
Coefficients	0.0145	-0.0303	-0.0709
Endowments	0.0831	-0.0017	-0.0589
Total	0.0976	-0.0321	-0.1298
Other			
Coefficients	0.0111	0.0112	0.0056
Endowments	0.0228	0.0072	-0.0210
Total	0.0338	0.0185	-0.0154
Total	0.1283	0.0885	-0.0400

	US-Aust (1)	GB- Aust (2)	GB- US (3)
Age 55			
Education			
Coefficients	0.0235	0.0788	0.0805
Endowments	0.0317	0.0519	-0.0051
Total	0.0552	0.1307	0.0754
Experience			
Coefficients	0.0592	0.0007	-0.0737
Endowments	0.0476	-0.0079	-0.0402
Total	0.1068	-0.0072	-0.1139
Other			
Coefficients	0.0013	-0.0022	0.0023
Endowments	0.0316	0.0163	-0.0211
Total	0.0329	0.0141	-0.0188
Total	0.1949	0.1376	-0.0573
Age 64			
Education			
Coefficients	0.0334	0.1299	0.1405
Endowments	0.0300	0.0723	-0.0016
Total	0.0634	0.2023	0.1389
Experience			
Coefficients	0.0808	-0.0610	-0.1668
Endowments	0.0380	-0.0170	-0.0301
Total	0.1188	-0.0780	-0.1969
Other			
Coefficients	-0.0097	-0.0143	-0.0001
Endowments	0.0221	0.0137	-0.0130
Total	0.0124	-0.0006	-0.0131
Total	0.1946	0.1237	-0.0711

Table G10
The Decomposition of the Relative Earnings Gap into its Component Parts including Industry and Occupation for Selected Ages

	US-Aust (1)	GB-Aust (2)	GB-US (3)
Age 18			
Other			
Coefficients	0.3854	0.0109	-0.3853
Endowments	-0.1553	0.0380	0.2042
Total	0.2301	0.0490	-0.1811
Industry			
Coefficients	-0.2526	0.0799	0.3864
Endowments	-0.0212	0.0163	-0.0164
Total	-0.2738	0.0946	0.3700
Occupation			
Coefficients	-0.0240	0.0042	0.0102
Endowments	-0.0555	0.0010	0.0745
Total	-0.0796	0.0051	0.0847
Total	-0.1233	0.1503	0.2736
Age 35			
Other			
Coefficients	-0.2225	0.0025	0.1475
Endowments	0.0981	0.0582	0.0375
Total	-0.1244	0.0606	0.1850
Industry			
Coefficients	0.2342	0.0042	-0.1610
Endowments	0.0043	-0.0000	-0.0733
Total	0.2385	0.0042	0.2343
Occupation			
Coefficients	0.0049	0.0096	0.0106
Endowments	0.0476	0.0106	-0.0429
Total	0.0526	0.0202	-0.0326
Total	0.1666	0.0851	-0.0816
Age 45			
Other			
Coefficients	-0.2350	0.0072	0.1650
Endowments	0.0725	0.0262	0.0308
Total	-0.1624	0.0334	0.1959
Industry			
Coefficients	0.2909	-0.0137	-0.2374
Endowments	0.0099	0.0212	-0.0559
Total	0.3008	0.0075	-0.2933
Occupation			
Coefficients	-0.0025	0.0079	0.0024
Endowments	0.0319	0.0351	0.0111
Total	0.0294	0.0429	0.0136
Total	0.1678	0.0838	-0.0838

	US-Aust (1)	GB-Aust (2)	GB-US (3)
Age 55			
Other			
Coefficients	-0.2102	-0.0126	0.1205
Endowments	0.0944	0.0497	0.0324
Total	-0.1158	0.0371	0.1529
Industry			
Coefficients	0.2788	-0.0067	-0.2305
Endowments	-0.0147	0.0031	-0.0372
Total	0.2641	-0.0035	-0.2677
Occupation			
Coefficients	-0.0088	0.0055	0.0038
Endowments	0.0510	0.0428	0.0023
Total	0.0422	0.0483	0.0061
Total	0.1905	0.0819	-0.1087
Age 64			
Other			
Coefficients	-0.1813	-0.0643	0.0417
Endowments	0.0741	0.0556	0.0570
Total	-0.1073	-0.0086	0.0986
Industry			
Coefficients	0.3151	0.0010	-0.1658
Endowments	0.0151	0.0106	-0.1527
Total	0.3301	0.0116	-0.3185
Occupation			
Coefficients	-0.0086	0.0203	0.0289
Endowments	-0.0309	0.0128	-0.0181
Total	0.0223	0.0331	0.0108
Total	0.2451	0.0361	-0.2091

Appendix H

Appendix to Chapter 8: Additional Results from the Chapter on Men and Women.

Table H.1

Weekly Earnings of Full-time Men and Single Women aged 16-64, Australia, Great Britain, the United States, 1981.

Dependent Variable = ln Weekly Earnings

	Australia	Great Britain	United States
Intercept [a]	4.5685 (298.38**)	3.6660 (136.29**)	4.8127 (149.49**)
High	0.1521 (18.89**)	0.1680 (12.49**)	0.2376 (15.66**)
Post secondary	0.2357 (30.22**)	0.2007 (20.17**)	0.3493 (18.68**)
Graduate	0.6404 (60.19**)	0.6153 (29.40**)	0.5775 (33.42**)
X	0.6874 (25.24**)	0.7537 (18.45**)	0.7080 (6.79**)
Experience	0.0102 (6.82**)	0.0157 (8.53**)	0.0087 (1.69)
Experience ^{2}	-0.0002 (-7.25**)	-0.0003 (-9.09**)	-0.0002 (-2.19*)
Married	0.1294 (14.22**)	0.1778 (13.18**)	0.2336 (13.31**)
Widowed, separated, divorced	0.0674 (4.64**)	0.0928 (3.78**)	0.1241 (5.02**)
Rural	-0.1096 (-11.27**)	-0.0216 (-2.42**)	-0.1207 (-10.40**)
Female variables			
Female	-0.0521 (-1.93)	0.0291 (0.62)	-0.3366 (-4.49**)
Female*high	0.0318 (1.63)	-0.0353 (-1.26)	0.1032 (1.82)
Female*post secondary	0.0926 (3.94**)	0.0971 (2.95**)	0.0963 (1.51)
Female*graduate	0.0978 (3.71**)	0.1216 (1.81)	0.1964 (3.22**)
Female*X	-0.1296 (-2.33**)	-0.3229 (-3.82**)	0.8404 (2.82**)
Female*experience	0.0052 (1.03)	0.0061 (0.93)	-0.0628 (-3.36**)

	Australia	Great Britain	United States
Female*experience ^{2}	-0.0001 (-0.45)	-0.0001 (-0.41)	0.0011 (3.32**)
Female*rural	0.0167 (0.60)	-0.0198 (-0.82)	-0.0009 (-0.02)
R^2	0.49	0.49	0.30
F test for joint significance of the female experience coefficients	3.12*	8.17**	4.85**
F test for the joint significance of all the female variables	10.10**	20.80**	12.61**

Notes:
t statistics in brackets. Significant test statistics at the 5 per cent level are indicated by a * and those significant at the 1 per cent level by **.

X=(1- (e $^{(-0.2643*\text{experience})}$)in the Australian regression,(1- e $^{(-0.3713*\text{experience})}$ in the British regression, and (1- e $^{(-0.1177*\text{experience})}$)in the US regression.

(a) The intercept measures ln earnings for an unqualified, urban, never married man. The intercept term for women can be calculated by adding the coefficient on "Female" to the intercept term. The education coefficients are interpreted in the following way, taking as an example female graduates. The effect of being a female graduate on earnings is measured by adding to the intercept term, female, graduate and female*graduate.

Table H.2

Weekly Earnings of Full-time Men and Women aged 16-64,using an Adjusted Measure of Experience for Women, Australia, Great Britain, the United States, 1981.

Dependent Variable = ln Weekly Earnings

	Australia	Great Britain	United States
Intercept (a)	4.5680 (295.36**)	3.6660 (136.46**)	4.8123 (153.47**)
High	0.1530 (18.79**)	0.1680 (12.50**)	0.2381 (16.03**)
Post secondary	0.2366 (29.99**)	0.2007 (20.19**)	0.3500 (19.13**)
Graduate	0.6410 (59.63**)	0.6153 (29.43**)	0.5785 (34.02**)
X	0.6929 (25.08**)	0.7539 (18.44**)	0.7071 (6.96**)
Experience	0.0093 (5.92**)	0.0157 (8.24**)	0.0086 (1.71)
Experience ^{2}	-0.0002 (-6.04**)	-0.0003 (-8.52**)	-0.0002 (-2.18*)
Married	0.1200 (11.73**)	0.1773 (11.86**)	0.2310 (12.47**)
Widowed, separated, divorced	0.0659 (4.48**)	0.0926 (3.77**)	0.1238 (5.14**)
Child	0.0169 (2.11*)	0.0010 (0.09)	0.0047 (0.37)
Rural	-0.1100 (-11.20**)	-0.0216 (-2.42**)	-0.1207 (-10.69**)
Female variables			
Female	0.0050 (0.21)	-0.4868 (-6.55**)	-0.3132 (-4.17**)
Female*high	-0.0374 (-2.70**)	-0.0296 (-1.44)	-0.0415 (1.72)
Female*post secondary	-0.0443 (-2.82**)	0.0700 (3.06**)	-0.0302 (1.01)
Female*graduate	-0.1681 (-9.12**)	-0.1229 (-2.49**)	-0.0244 (0.85)
Female*X	1.2376 (10.58**)	1.4561 (9.86**)	2.3341 (2.64**)
Female*experience	-0.0585 (-3.21**)	-0.0335 (-2.52**)	-0.1015 (1.33)

	Australia	Great Britain	United States
Female*experience ^{2}	0.0014 (1.74)	-0.0009 (-1.98*)	0.0015 (0.75)
Female*rural	0.0405 (2.08*)	-0.0213 (-1.27)	-0.0062 (-0.34)
Female*married	-0.1165 (-7.26**)	-0.1704 (-7.19**)	-0.1998 (-7.38**)
Female*wid, sep, div.	-0.0045 (-0.20)	-0.0688 (-1.82)	-0.0956 (-2.87**)
Female*child	-0.1309 (-8.78**)	-0.0841 (-3.51**)	-0.1129 (-5.67**)
R^2	0.46	0.49	0.35
F test for the joint significance of all the female variables	181.23**	59.86**	36.84**

Notes:
t statistics in brackets. Significant test statistics at the 5 per cent level are indicated by a * and those significant at the 1 per cent level by **.

$X=(1-(e^{(-0.2643*experience)})$ in the Australian regression, $(1-e^{(-0.3713*experience)})$ in the British regression, and $(1-e^{(-0.1177*experience)})$ in the US regression.

(a) The intercept measures ln earnings for an unqualified, urban, never married man. The intercept term for women can be calculated by adding the coefficient on "Female" to the intercept term. The education coefficients are interpreted in the following way, taking as an example female graduates. The effect of being a female graduate on earnings is measured by adding to the intercept term, female, graduate and female*graduate.