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# DISCUSSION PAPERS

THE RATE OF RETURN TO EDUCATION -  
THE EVIDENCE FROM THE 1976 CENSUS

P.W. Miller

Discussion Paper No. 25

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I. INTRODUCTION AND SUMMARY

What is the private rate of return to education in Australia? and how does this rate differ between males and females, and between Australian born and Overseas born residents? This study attempts to answer these questions using data from the 1976 Australian Census of Population and Housing.

The rate of return to incremental years of schooling - calculated by applying the internal rate of return technique to annual earnings data - mostly varies between 6 and 10 percent, and the return to a three year university degree is as high as 20 percent. Returns for males generally exceed those for females, although the percentage point differences are small.

Compared to the rate of return to education obtained by Australian born males, Overseas born males obtain a lower rate of return from additional years of schooling. However, overseas born males can expect a higher return from some types of tertiary education (e.g. graduate diplomas). Overseas born females tend to receive a higher rate of return to each incremental education level than Australian born females.

Rates of return calculated from hourly earnings differ only slightly from those based on annual earnings data. But when we adjust the earnings data for the probability of unemployment and the probability of participating in the labour force, some rather large changes result. For example, for an Australian born male, the rate of return to a three year university degree is increased by around five percentage points.

This study has seven sections.

Section I outlines a conceptual framework and lists some of the questions to be addressed. The second section examines the data and analytical procedure. Section III presents and discusses unadjusted age-earnings profiles. The internal rates of return to various incremental education levels calculated from these profiles are presented. Then, in Section IV, the internal rates of return

calculated from hourly earnings are presented and compared with the results in Section III. The effects on the rates of return of adjusting the earnings data for unemployment rates and participation rates are also discussed. In Section V we examine the gains to both males and females from additional education under the assumption that individuals acquire additional education partly to increase the probability of their marrying a more educated spouse [ASSORTATIVE MATING]. The returns to trade qualifications are discussed in Section VI, whilst Section VII gives the conclusions reached.

#### A Conceptual Framework

The human capital literature has focussed upon increments in lifetime earnings as the payoff to additional years of schooling. Earnings ( $Y$ ) are viewed as being functionally related to the individual's age ( $t$ ), his level of schooling ( $s$ ) and other personal and environmental characteristics ( $x$ )

$$Y = Y(s, t; x) \quad (1)$$

Consider an individual who has completed  $s-1$  years of schooling and who chooses between leaving school immediately and receiving the income stream represented by the sequence of values  $Y_t(s-1; x)$ ,  $t = 0, \dots, N$ , or acquiring one additional year of schooling and receiving the income stream represented by the sequence of values  $Y_t(s; x)$ ,  $t = 0, \dots, N$ .

The effect of the additional year of schooling on earnings at any given age [ $D(s; x)$ ] is defined as the difference between the two income streams - i.e.

$$D_t(s; x) = Y_t(s; x) - Y_t(s-1; x) \quad (2)$$

The individual is assumed to make decisions so as to maximise the net present value of his lifetime earnings. Equivalently, he will want to maximise the net present value of the future stream of  $D_t(s; x)$ 's.

$$\text{MAX } V \quad \sum_{t=1}^n \frac{D_t(s; x)}{(1+r)^t} \quad (3)$$

where  $n$  is the length of working life.

So long as  $D_t(s;x) < 0$  for some values of  $t$ , the individual faces a non-trivial decision problem. With this framework in mind we may ask the following questions.

First, what are the shapes of the age-earnings profiles? A common proposition based largely on notions of diminishing returns to learning by doing and of obsolescence of human capital is that age-earnings profiles initially rise, then decline as age increases. Hence we examine:

(i) is there a well-defined peak in the age-earnings profiles and, if so, at what age do they peak?

(ii) does the peak vary between school leaving age levels?

Second, in as far as the schooling decision represents an investment decision, what is the rate of return to an additional year of schooling? Further, as the internal rate of return is intended to provide a summary of the measurable economic effects of education, how is it altered by taking account of the effects of schooling on the probability of being unemployed and the effects of schooling on the probability of participating in the workforce.

Third, how do the above features of age-earnings profiles differ between the Australian born and the overseas born, and between males and females? In particular, what conclusions can be drawn as to the determinants of the relative demands for schooling by these groups?

Fourth, does the relative steepness of age earnings profiles differ between school leaving age levels? This characteristic of the age-earnings profiles can be used to infer differences in the amounts of on-the-job training received. For the earnings we observe include the costs of, and returns to, any investments in human capital undertaken on the job. Hence, during the period on-the-job training is received, and if the costs of and returns to this training are shared by employer and employee, earnings  $[Y_t(S;x)]$  will be lower than in the absence of such training. After the completion of the training period, and the returns to the training accrue,  $Y_t(S;x)$  will be higher than in the

no-training situation. Accordingly, the age-earnings profiles will be steeper the greater the amounts of on-the-job training received.<sup>1</sup> Such analysis of the age-earnings profiles may be useful in advancing our understanding of the relationships between school leaving age, labour force experience and unemployment rates. For example, one hypothesis advanced in the literature is that unemployment rates are negatively related to the amount of on-the-job training received. If the amount of on-the-job training received varies with school leaving age, then this should be reflected in the lifetime pattern of unemployment.

## II. THE DATA AND ANALYTICAL CONSIDERATIONS

Income data cross-classified by age, sex, school leaving age, birthplace and hours worked were obtained from the 1976 Census Matrix Tape MXT32. These data are used to calculate the internal rate of return to various investment (schooling) projects.

The internal rate of return approach was used by Becker (1964) in his study of the returns to college education in the United States. Australian studies which have used this approach include the study of Blandy and Goldworthy (1972) of the returns to higher education for males in South Australia and Chapman's (1977) study of the returns to higher education for males in the Australian Public Service.<sup>2</sup>

The internal rate of return ( $r$ ) is simply a summary device describing the relationship between the costs and benefits associated with a project. It is computed by setting the sum given in (3) equal to zero.<sup>3</sup> Fundamental to this approach is the derivation of the life cycle income stream from cross-section data. Because of the secular growth in earnings resulting from productivity increases, a person of given educational attainment will expect to have greater earnings at a specific future age than a person presently within the same age-education category. The usual practice is to use cross-

section age-earnings profiles to set the relative patterns of earnings across age groups and a geometric growth factor (to capture the secular growth in earnings) to estimate a life cycle profile. For example, let  $D(s,t;x)$  be the differential observed in 1976. Then our estimate of the differential  $z$  years later will be given by:

$$D(s,t;x) (1+g)^z$$

where  $g$  is the annual rate of growth of the differential.

The application of a uniform rate of growth ( $g$ ) to all incomes implies that the relative incomes earned by different educational attainment levels remain unchanged over time.<sup>4</sup> This will tend to increase the rate of return to education, since the absolute difference in income  $D(s,t;x)$  - which enters into the internal rate of return formula - will tend to increase with age.

Becker (1964, p. 73) argues that the most plausible value for  $g$  for the United States is about 0.0125. He also presents results for  $g=0$  and  $g=0.2$ . Selby-Smith (1975) also presents calculations for a range of values of  $g$ ; namely, 0, 2 and 3 per cent per annum. Similarly, our calculations are performed under the alternative assumptions of  $g$  equally 0, 1 and 2 per cent.

Furthermore, as we are concerned with private rates of return, the income differentials  $D(s,t;x)$  are calculated from after tax income. An adjustment for income tax at current tax scales is made to both benefits and foregone earnings. No consideration is given to expected changes in tax rates. Nor is any attempt made to take account of possible differences in income tax deductions at the different income levels (see Appendix A).

Finally, before calculating an internal rate of return to education we need to consider how much of the observed income differential  $D(s,t;x)$  can reasonably be attributed to education. Earnings are a function of many variables (such as education, ability and experience) and of complicated interactions between these variables.

To date, empirical research has failed to arrive at a clear consensus as to the magnitude of education's separate effect on earnings. The estimates of the percentage of the income differentials by education level attributable to factors other than education range from zero to 60 percent. Psacharopoulos [1975], after reviewing these estimates, concludes that the greatest part of the observed earnings differentials by education level are due to education. He presents the following summary statistics.

Earnings differentials by education level

-% attributable to	%
(i) ability only	14
(ii) ability plus other factors (parental class, religion)	23

Psacharopoulos also finds the evidence to be so mixed as to preclude any inference on whether the above percentage figures rise or fall with the education level. We will assume that the percentage of the income difference between education levels attributable to ability and other non-education factors is identical for all education levels. We adopt the expedient approach of calculating the internal rate of return under the alternative assumptions of this percentage figure equalling 20 and zero percent.

### III. AGE EARNINGS PROFILES : AGGREGATE CHARACTERISTICS.

Figures 1 - 4 show the age-earnings profiles for males and females in paid employment at each of eight education levels. These profiles have not been adjusted for hours worked or for any other education-related factors. Corrections for hours worked and differential unemployment and participation rates are made in Section V.

The profiles for males [Figures 1, 2] exhibit five characteristics. First, the better educated tend to have higher starting salaries than the less educated. Second, irrespective of the level of educational attainment,

FIGURE 1

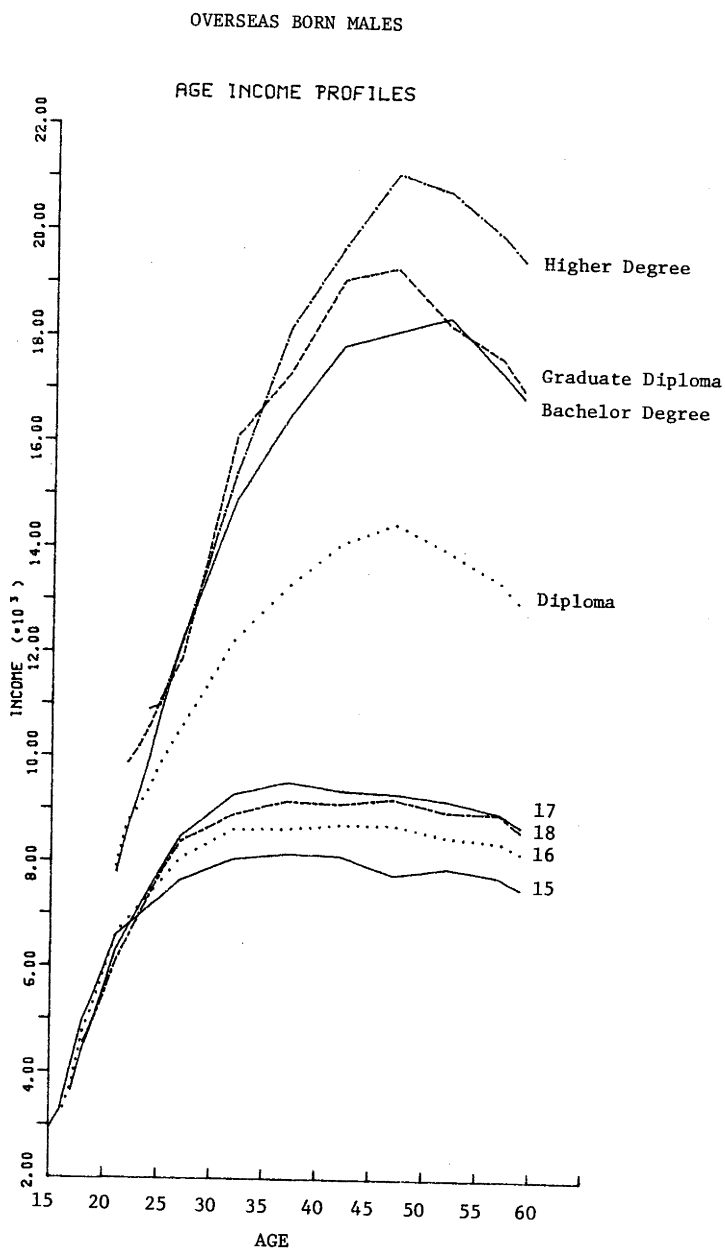


FIGURE 2

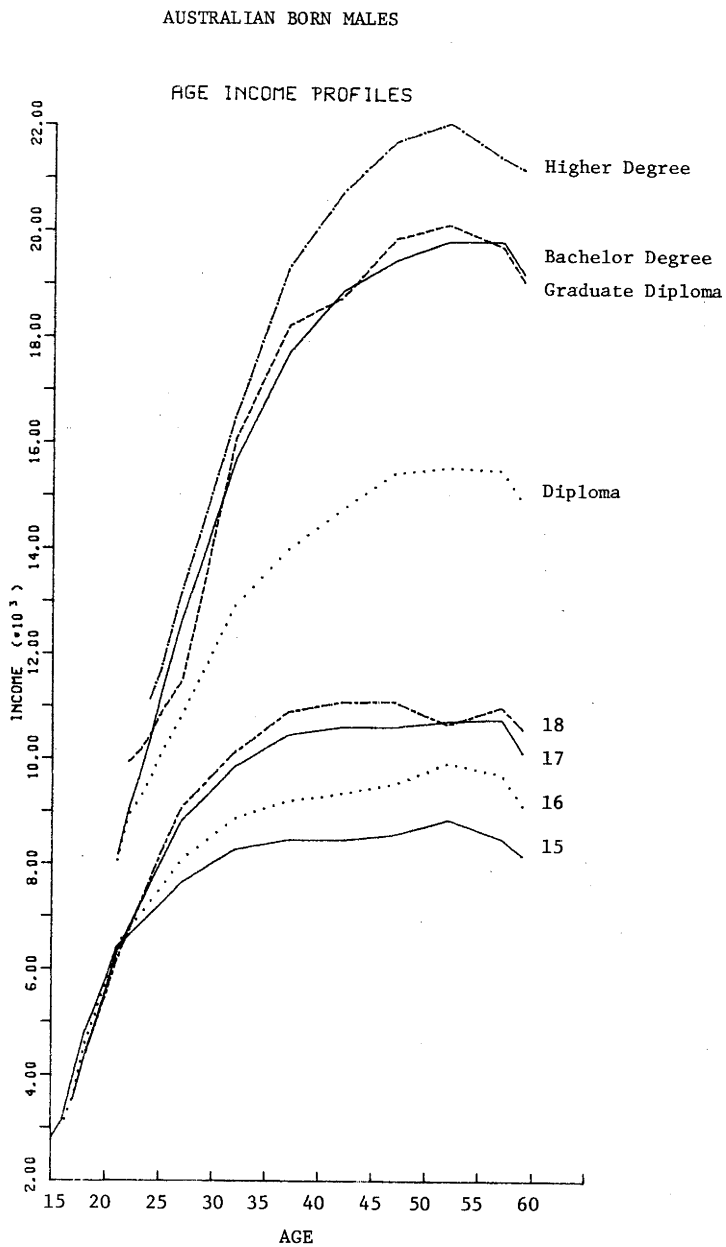


FIGURE 3

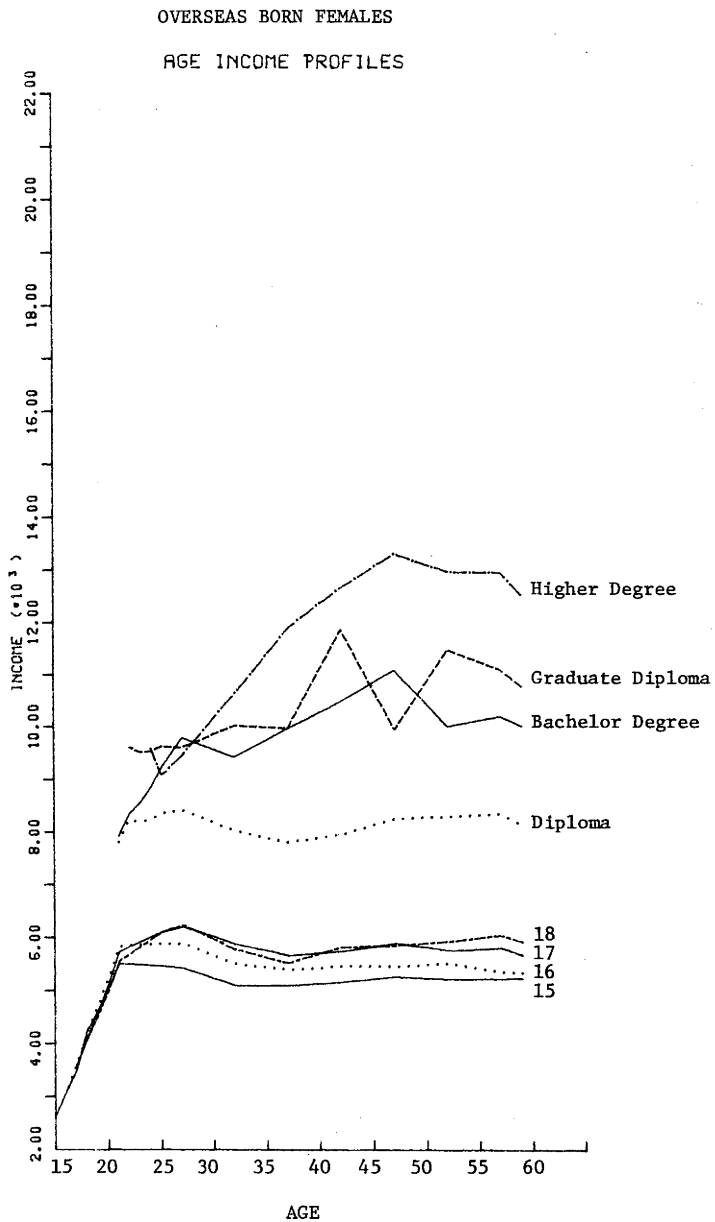
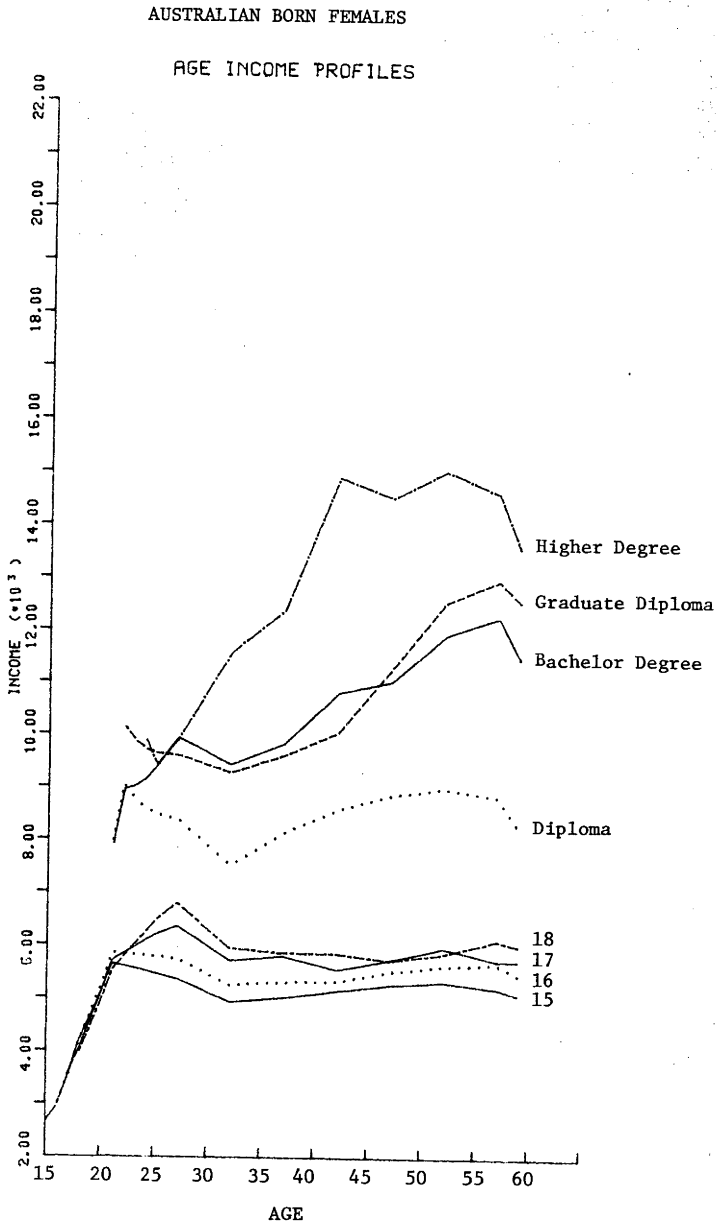


FIGURE 4



earnings increase with age up to a maximum sometime after the age of 35 years. After this maximum is reached, earnings tend to level off, and then decline. Third, the higher the educational attainment, the later the age at which maximum earnings are reached. This point is best seen by comparing persons with and without tertiary qualifications. For example, the earnings of an Australian born male having no tertiary qualifications and who left school at 18 years of age peak around age 35, while the earnings of an Australian born male possessing a bachelor degree peak at age 55. Fourth, the higher the educational attainment, the steeper the age-earnings profiles during the early phase of the working life.<sup>6</sup> Following on from our discussion in Section II, this leads to the suggestion that the better educated receive more on-the-job training than the less educated.

Fifth, the age-earnings profiles of overseas born males tend to be flatter and lower than the profiles of the comparable Australian born.

In the case of females (Figures 3, 4) the profiles of the Australian born and the overseas born are remarkably similar. As was the case for males, the age-earnings profiles of better educated females lie above those of the less educated for the greater part of their working lives. However, the female profiles differ from the male profiles in two ways. First, the female age-earnings profiles tend to be double peaked:<sup>7</sup> peaking first at around 25-29 years, declining and then peaking again at around 50-54 years. Second, the female age-earnings profiles are much flatter than the male profiles.

The decline in the age earnings profiles in the last one or two decades of working life requires further discussion. Two causes are identified. First, it is, in part, the result of a confounding of labour-leisure choices with the returns to human capital. Average hours worked per week decline in the final few years of working life. For example, 40-44 year old Australian born males who left school at 16 years of age worked an average of 44 hours per week. Those aged 55-59 and 60-64 with the same school leaving age worked an average of 42 and 41 hours per week respectively. Calculation of

average hourly earnings reveals them to follow a pattern very much the same as Figures 1-4. In other words, average hourly earnings decline in the final years of working life.

The second reason behind the levelling off and eventual decline of the age-earnings profiles is that human capital accumulated early in the lifetime may become obsolete after several decades.<sup>8</sup>

It is noted that not all age-earnings profiles decline in the pre-retirement years. For example, the Chapman (1977) age earnings profiles for males employed in the Australian Public Service do not decline in the final years of working life.

It is evident from the age-earnings profiles that the better educated tend to receive higher incomes. Is education a profitable investment?

Table 1 presents the internal rate of return to various increments of education calculated on the assumptions of:<sup>9</sup>

- (i) individuals work the same number of hours;
- (ii) 100 per cent participation in the workforce;
- (iii) zero unemployment;
- (iv) the lifetime profiles of each sex-birthplace group may be inferred from the characteristics of the Census cross-section observations on the same sex-birthplace group. In other words, the average income in 1976 of (say) 35 year old overseas born males of given educational attainment - after adjustment for the projected secular growth in incomes - is taken as our best estimate of the income in 20 years' time of an overseas born male of the same educational attainment who is 15 years of age in 1976;

In the first three columns of Table 1 the diagonal cells are to be interpreted as marginal rates (based on one schooling increment). But in

TABLE 1  
RATES OF RETURN TO EDUCATION<sup>#</sup>

## 1. AUSTRALIAN BORN MALES.

FROM	SCHOOL LEAVING AGE				DIPLOMA	BACHELORS DEGREE
TO	15	16	17	18		
16	8.15					
17	9.20	10.35				
18	7.95	7.95	4.10			
DIPLOMA	10.85	11.70	12.25	15.35		
BACH. DEGREE	13.45	14.80	16.25	20.45		
GRAD. DIPLOMA	12.60	13.60	14.60	17.45	21.35	(2.00)
HIGHER DEGREE	11.65	12.35	12.75	14.35	13.00	4.70

## 2. OVERSEAS BORN MALES.

FROM	SCHOOL LEAVING AGE				DIPLOMA	BACHELORS DEGREE
TO	15	16	17	18		
16	7.00					
17	7.00	7.10				
18	4.28	2.20	+			
DIPLOMA	10.00	10.80	12.05	16.50		
BACH. DEGREE	12.45	13.65	15.55	20.35		
GRAD. DIPLOMA	12.40	13.50	15.15	19.05	24.80	10.95
HIGHER DEGREE	10.90	11.55	12.40	14.60	12.40	5.10

## 3. AUSTRALIAN BORN FEMALES.

FROM	SCHOOL LEAVING AGE				DIPLOMA	BACHELORS DEGREE
TO	15	16	17	18		
16	6.20					
17	6.30	6.35				
18	4.80	4.00	1.35			
DIPLOMA	9.55	10.25	11.35	15.55		
BACH. DEGREE	12.10	13.10	14.80	19.85		
GRAD. DIPLOMA	11.20	11.95	13.20	16.75	18.30	1.45
HIGHER DEGREE	11.05	11.55	12.30	14.10	12.60	8.25

## 4. OVERSEAS BORN FEMALES.

FROM	SCHOOL LEAVING AGE				DIPLOMA	BACHELORS DEGREE
TO	15	16	17	18		
16	11.90					
17	9.35	7.50				
18	5.80	3.55	+			
DIPLOMA	10.90	10.75	11.60	15.50		
BACH. DEGREE	13.75	14.00	15.40	19.70		
GRAD. DIPLOMA	13.15	13.30	14.40	17.65	21.50	7.55
HIGHER DEGREE	11.35	11.30	11.75	13.40	11.40	6.40

Note: ( ) negative rate; + rate not determined

These rates of return were calculated on the basis of ability differences accounting for 20% of the income differentials, and a secular income growth rate of 2 per cent.

Reducing ability's assumed contribution to the income differentials to zero tends to increase the rate of return by 1.5-1.8 percentage points at rates of return between 6 and 10 per cent and by 2.0-2.6 percentage points at rates of return between 13 and 16 per cent.

As an approximation, one extra percentage point of income growth raises the rate of return by one percentage point.

the final three columns, the first two cells of each column are to be interpreted as marginal rates. For example, an Australian born male aged 15 years who continues on at school for one additional year can expect a marginal rate of return of 8.15 percent.

All other cells in the table are to be interpreted as average rates (based on more than one schooling increment). For example, if a 15 year old Australian born male is contemplating an additional two years of study, the average rate of return on his investment is expected to be 9.20 percent.

Australian born males obtain a higher return for additional years of schooling than the overseas born. For example, the marginal rate of return to an extra year of schooling for a 15 year old Australian born is 8.15 per cent, and for a 15 year old overseas born, 7.00 per cent. However, the overseas born can expect a higher return from some types of tertiary education than can the Australian born. For example, the rate of return to a diploma is 16.50 per cent for the overseas born, compared with 15.35 per cent for the Australian born.

For females, the rates of return to incremental years of education are, in many cases, higher for the overseas born. For example, a 15 year old overseas born female can expect a rate of return of 11.90 percent from an additional year of schooling compared with the 6.20 percent return expected by a comparable Australian born female. Likewise, a 16 year old overseas born female can expect a return of 7.50 percent from one extra year of schooling, compared with a return of 6.35 percent for an Australian born female.<sup>10</sup>

It might be expected that the rate of return for females would always be lower than for males because of both the lower labour force attachment of females and their flatter age-earning profiles. But as we are comparing the absolute earnings of more and less educated females and not the absolute earnings of males and females, it is possible for the rate of return for females to exceed that for males. We find this to be the case for the returns to schooling for the overseas born. In all other male-female comparisons males

tend to receive a higher return.

Whilst our rates of return to schooling are lower than those calculated in previous studies, our rates of return to tertiary education are higher. For example, rates of return for males calculated from 1976 Census data on the basis of the same assumptions as Blandy and Goldsworthy (1972) give an internal rate of return to schooling around 3-4 percentage points lower than the Blandy estimates, and a return to tertiary education around 4 percentage points higher.<sup>11</sup>

If, as postulated by economic theory, school enrolments are positively related to the rate of return to education, and if the relationship between school enrolments and rates of return has not changed in the interim, this fall in the rate of return to schooling could explain the decline in male school enrolments during the 1970's. This theme is elaborated upon in Appendix B. As well, Appendix B presents an analysis of the association between the rate of return differences among demographic groups and differences in their 1976 school enrolment rates.

The four assumptions stated at the beginning of this presentation of results may be contributing factors to the differences in the internal rates of return between the Australian and the Overseas born, and between males and females.

For, as already noted, education alters both the probability of the individual becoming unemployed and his probability of participating in the workforce. It also alters the average number of hours the individual works per employed week. Consequently, our estimates of the internal rates of return will be in error to the extent that individuals are in receipt of their earnings for varying proportions of the year: these proportions being related to the individual's educational attainment. As well, it is debatable whether, for the overseas born contemplating further education in Australia, it is reasonable to assume that the pattern of future income differentials is set by the income differentials in Figures 1 and 3.

We now turn to examine these assumptions.

IV. HOURS WORKED, UNEMPLOYMENT RATES, PARTICIPATION RATES AND THE INFERENCE OF LIFETIME PROFILES FROM CROSS-SECTION EVIDENCE : THEIR EFFECT UPON THE INTERNAL RATE OF RETURN TO EDUCATION

1. Hours Worked

Hours of work differ according to education levels. For example, Australian born 40-44 year olds with a school leaving age of 15 years worked an average of 43.6 hours per week. Those with a bachelor's degree worked an average of 45.3 hours per week.

What is the correct treatment of hours of work in the internal rate of return calculations? Two viewpoints seem possible.

First, higher education provides access to different jobs from those available to individuals with a lower level of education. Two differing job characteristics might be higher income and higher hours. In this case, it can be argued that the higher hours worked by the better educated forms part of the economic returns to education, with these returns being adequately measured by the estimates in Table 1.

Second, the higher hours worked by the higher educated will entail some disutility to the individual in the form of the sacrifice of leisure. Accordingly, the rates of return presented in Table 1 confound returns to education with issues of labour-leisure choice.

To distinguish between the effects of education and hours worked on earnings, we adopt Eckaus' (1973) approximation and adjust observed earnings to a standard 2000-hour year. This is equivalent to calculating the internal rates of return from hourly, as opposed to annual, earnings. If there is a tendency for hours worked to increase with the level of education, this adjustment will reduce the rates of return.

Table 2 presents the results of the internal rate of return computations using hourly earnings data.

TABLE 2

## RATES OF RETURN TO EDUCATION ADJUSTED FOR HOURS WORKED

## 1. AUSTRALIAN BORN MALES.

FROM		SCHOOL LEAVING AGE				DIPLOMA	BACHELORS DEGREE
TO	15	16	17	18			
16	7.45						
17	9.05	10.90					
18	7.80	8.10	3.65				
DIPLOMA	11.10	12.15	12.55	15.45			
BACH. DEGREE	13.45	14.90	16.10	19.80			
GRAD. DIPLOMA	12.55	13.75	14.45	17.10	20.50	+	
HIGHER DEGREE	11.35	12.05	12.20	13.50	11.25		2.95

## 2. OVERSEAS BORN MALES.

FROM		SCHOOL LEAVING AGE				DIPLOMA	BACHELORS DEGREE
TO	15	16	17	18			
16	11.35						
17	11.50	11.50					
18	7.65	4.95	+				
DIPLOMA	12.70	13.00	13.35	16.10			
BACH. DEGREE	15.35	16.05	16.95	19.95			
GRAD. DIPLOMA	14.55	15.05	15.65	18.00	22.70	3.00 *	
HIGHER DEGREE	12.30	12.45	13.85	13.85	11.15		4.15

## 3. AUSTRALIAN BORN FEMALES.

FROM		SCHOOL LEAVING AGE				DIPLOMA	BACHELORS DEGREE
TO	15	16	17	18			
16	4.70						
17	5.35	6.10					
18	3.50	2.65	+				
DIPLOMA	10.70	11.85	13.20	18.20			
BACH. DEGREE	12.75	14.10	15.75	20.90			
GRAD. DIPLOMA	11.95	13.00	14.25	18.05	16.80	1.40	
HIGHER DEGREE	10.55	11.15	11.70	13.40	9.65		4.65

## 4. OVERSEAS BORN FEMALES.

FROM		SCHOOL LEAVING AGE				DIPLOMA	BACHELORS DEGREE
TO	15	16	17	18			
16	6.85						
17	6.45	6.10					
18	2.60	+	+				
DIPLOMA	10.50	11.20	12.60	19.10			
BACH. DEGREE	12.65	13.60	15.40	22.10			
GRAD. DIPLOMA	12.45	13.25	14.75	20.05	21.25	9.80	
HIGHER DEGREE	10.15	10.50	11.10	13.70	9.05		3.45

Note: + rate not determined

\* multiple root

Comparing Tables 2 and 1 prompts the following comments:

- (a) There are only small differences between the internal rates of return calculated from hourly earnings and those calculated from annual earnings data. This contrasts with Eckaus' finding of 'drastic' changes in the rate of return after standardising the data for hours worked.
- (b) The rates of return in Table 2 are not always lower than those in Table 1. This reflects a tendency for hours worked to fall as education level increases in some age groups. For example, up to age 35 years, males with a school leaving age of 15 or 16 years tend to work longer hours than those with a school leaving age of 17 or 18 years.
- (c) For males, the internal rate of return to tertiary education is generally lower when calculated from hourly earnings data than when annual earnings data are used. The rate of return to a graduate diploma for a diploma holder is reduced most - by 0.85 percentage points for the Australian born and by 2.1 percentage points for the overseas born. In contrast, the returns to tertiary education for females are frequently higher. For example, for the 'school leaving age 18 years - diploma' choice, the rate of return calculated from hourly earnings data is 2.65 percentage points higher for the Australian born and 3.60 percentage points higher for the overseas born.
- (d) The returns to incremental years of schooling for females in Table 2 are all lower than in Table 1. By way of example, the return to one additional year of schooling for a 15 year old Australian born female is reduced from 6.2% to 4.7%, and that for a 15 year old overseas born female reduced from 11.9% to 6.85%. Mixed results are obtained for the returns to schooling for males. All marginal rates of return for the overseas born are substantially higher in Table 2 than in Table 1, as is the return to one extra year of schooling for Australian born 16 year olds. However, the marginal rates of return to schooling for 15 and 17 year old Australian born males are lower in Table 2.

## 2. Unemployment Rates

The income data refer to persons in paid employment at June 1976. But an individual may not be in receipt of this income for the whole year; one reason being that he may experience periods of unemployment. As such, the income data should be adjusted for the probability of being unemployed.

The unemployment adjustment we make is to multiply after tax income at each education level by the complement of the average unemployment rate at that education level. Unemployment benefits (at 1976 rates) received during periods of unemployment are added to these figures to give expected earnings. These expected earnings are used to repeat the internal rate of return calculations.

Reflecting the inverse relationship between unemployment rates and education level, the unemployment rate adjustment increases the rate of return to most education levels. Furthermore, as 15 year olds are ineligible for unemployment benefits, there are relatively large increases in the marginal rate of return to schooling at that age. Table 3 presents results for Australian born males.

TABLE 3

RATES OF RETURN TO EDUCATION ADJUSTED FOR HOURS WORKED  
AND UNEMPLOYMENT, AUSTRALIAN BORN MALES

FROM TO	SCHOOL LEAVING AGE			DIPLOMA	BACHELORS DEGREE	
	15	16	17			18
16	9.70					
17	10.70	11.70				
18	8.90	8.55	3.75			
DIPLOMA	12.10	12.65	12.95	16.10		
BACH. DEGREE	14.60	15.65	16.80	21.10		
GRAD. DIPLOMA	13.50	14.25	14.85	17.75	21.15	+
HIGHER DEGREE	12.15	12.55	12.65	14.05	11.70	2.90

Note: + - rate could not be determined

The marginal rate of return to additional years of schooling is raised by between 0.1 and 2.5 percentage points above the rates presented in Table 2. Similarly, the marginal rate to a diploma is raised by 0.65 percentage points and that to a bachelor's degree by 1.3 percentage points. It is only for incremental education investments involving a higher degree that the unemployment rate correction results in a lower rate of return.

The results for overseas born males and for females are generally similar to those present for Australian born males.

Given that the relatively large increase in the rate of return for 15 year olds following the unemployment rate adjustment is simply reflecting the institutional framework, the question which naturally arises is: "What would be the effect on the rate of return calculations if 16 and 17 year olds were ineligible for unemployment benefits?"

Table 4 presents rates of return for Australian born males calculated under such conditions.

TABLE 4  
RATES OF RETURN TO EDUCATION, AUSTRALIAN BORN MALES

FROM TO	SCHOOL LEAVING AGE		
	15	16	17
16	9.75		
17	11.25	12.80	
18	9.40	9.25	4.15
DIPLOMA	12.45	13.10	13.15
BACH. DEGREE	15.00	16.15	17.05
GRAD. DIPLOMA	13.85	14.65	15.05
HIGHER DEGREE	12.40	12.80	12.75

Comparing Table 4 with Table 3, it appears that the withdrawal of unemployment benefits would increase the marginal rate of return to formal education for 16 and 17 year olds by around 10%. Considering that other "changes" have resulted in the internal rate of return to education falling by about 3 percentage points between 1969 and 1976, this 10% increase - which translates into about a 1 percentage point change - is of relatively minor importance.

### 3. Participation Rates

A second reason why an individual may not be in receipt of his weekly income all the year is that he may withdraw from the labour force. To take this factor into account, we multiply the income at each education level by the relevant participation rate. Table 5 presents rates of return incorporating this adjustment.

Allowing for participation rate differences between education levels results in the following changes to the rates of return:

#### For Males:

- (i) An increase in the rate of return to tertiary education of between 0.5 and 3.95 percentage points;
- (ii) a raising of the marginal rate of return to schooling for Australian born males and a lowering of the return for overseas born males.

#### For Females:

- (i) The marginal rate of return is raised to all education investments except the graduate diploma and higher degree courses;
- (ii) the increases are quite dramatic in some instances. For example, the rate of return to the 'school leaving age 18 years - diploma' choice is raised from 19.10%<sup>12</sup> to 28.90% for the Australian born and from 20.85%<sup>12</sup> to 27.30% for the overseas born.

TABLE 5

RATES OF RETURN TO EDUCATION ADJUSTED FOR HOURS WORKED, UNEMPLOYMENT  
RATES AND PARTICIPATION RATES

## 1. AUSTRALIAN BORN MALES.

FROM	SCHOOL LEAVING AGE					BACHELORS DEGREE
TO	15	16	17	18	DIPLOMA	
16	10.90					
17	11.35	11.80				
18	9.10	8.25	1.35			
DIPLOMA	12.65	13.00	14.75	19.40		
BACH. DEGREE	15.25	16.10	18.90	24.95		
GRAD. DIPLOMA	13.90	14.45	16.40	20.55	21.75	+
HIGHER DEGREE	12.70	12.90	14.15	16.50	12.50	2.25

## 2. OVERSEAS BORN MALES.

FROM	SCHOOL LEAVING AGE					BACHELORS DEGREE
TO	15	16	17	18	DIPLOMA	
16	17.40					
17	14.25	12.40				
18	8.30	4.45	+			
DIPLOMA	14.05	13.85	15.45	20.00		
BACH. DEGREE	17.60	17.75	20.40	25.75		
GRAD. DIPLOMA	15.85	15.80	17.75	21.65	24.10	+
HIGHER DEGREE	13.65	13.50	14.55	17.05	12.90	3.25

## 3. AUSTRALIAN BORN FEMALES.

FROM	SCHOOL LEAVING AGE					BACHELORS DEGREE
TO	15	16	17	18	DIPLOMA	
16	11.30					
17	10.00	9.25				
18	7.95	6.30	3.60			
DIPLOMA	15.70	16.35	20.20	28.90		
BACH. DEGREE	16.55	17.35	21.45	30.55		
GRAD. DIPLOMA	15.15	15.40	18.60	25.05	7.20	+
HIGHER DEGREE	13.75	13.50	14.90	17.75	4.95	0.60

## 4. OVERSEAS BORN FEMALES.

FROM	SCHOOL LEAVING AGE					BACHELORS DEGREE
TO	15	16	17	18	DIPLOMA	
16	11.35					
17	9.10	7.90				
18	5.65	3.35	+			
DIPLOMA	14.10	14.45	17.30	27.30		
BACH. DEGREE	16.45	17.20	20.70	32.00		
GRAD. DIPLOMA	14.95	15.25	17.95	26.15	21.45	+
HIGHER DEGREE	12.90	12.65	13.85	18.05	7.95	+

Note: + rate not determined

4. The inference of Lifetime Profiles from Cross-Section Evidence.

We have questioned whether it is appropriate to assume that for the overseas born contemplating further education in Australia, the pattern of future income differentials is set by the income differentials in figures 1 and 3. For in the older age groups represented in these figures, increasing proportions would have completed their schooling in overseas countries. This prompts the question: Does the payoff to education received overseas differ from the payoff to education received in Australia?

There is no Australian evidence on this subject. Chiswick's study of the earnings of foreign born adult white men as reported in the 1970 US Census of Population yielded the surprising result that:

When years of schooling pre and post immigration are treated as separate variables, an extra year of schooling prior to immigration raises earnings by 5.8 per cent, while an extra year after immigration raises earnings by 5.0 per cent. The difference of about 1 percentage point is small, and it is on the margin of statistical significance (10 per cent level, 2 tailed test).

Chiswick's finding is similar to one finding of our unemployment rate study.<sup>13</sup> There it was found that the effect of education prior to immigration upon the migrant's unemployment rate was similar to the effect of education after immigration.<sup>14</sup>

One could assume that there is discrimination against migrants who complete their education in Australia which results in their incomes being a fixed dollar amount lower than the incomes of the comparable Australian born; this fixed dollar amount being independent of the level of educational attainment.<sup>15</sup> The life cycle income profiles of these individuals would then have the same slope and relative positions as those of the Australian born, but would all be shifted downwards by the fixed dollar amount associated with discrimination. In this case, the rate of return to additional years of education in Australia for migrants would be the same as calculated for the Australian born.

Many other assumptions as to the pattern of future income differentials between education levels for migrants completing their education in Australia could be made. "Which assumption most closely accords with reality" remains unanswered at this stage.

#### V. THE RETURNS TO EDUCATION. A PATHOLOGICAL EXTENSION

It has been suggested (Becker (1964, p. 101)) that individuals pursue additional education partly to increase the probability of marrying a more educated spouse. A recent Australian study reports evidence of associative mating: Broom et. al. (1980, p. 25) find a correlation of 0.486 between spouses' education levels.

The higher earnings of a more educated spouse could be regarded as part of the gain to the individual from additional education. If this marriage factor were important, what would be its effect upon the rates of return to education for males? for females?

To provide one answer to this question we repeated the rate of return calculations under the assumption of a perfect correlation between spouses' education levels.<sup>15</sup>

Table 6 presents results for the Australian born.

TABLE 6  
RATES OF RETURN TO EDUCATION

FROM TO	SCHOOL LEAVING AGE				DIPLOMA	BACHELORS DEGREE
	15	16	17	18		
<u>1. Australian born males</u>						
16	10.05					
17	11.45	12.95				
18	10.20	10.35	6.45			
Diploma	14.20	15.40	16.45	20.55		
Bach. Degree	17.15	18.95	21.00	26.35		
Grad. Diploma	16.30	17.75	19.20	23.10	28.90	2.15
Higher Degree	15.85	16.90	17.80	20.15	19.10	10.80

TABLE 6 (cont)  
RATES OF RETURN TO EDUCATION

FROM TO	15	16	17	18	DIPLOMA	BACHELORS DEGREE
<u>2. Australian born females</u>						
16	11.80					
17	12.65	13.40				
18	10.90	10.45	6.25			
Diploma	15.30	16.15	17.30	22.65		
Bach. Degree	18.20	19.60	21.70	28.15		
Grad. Diploma	17.30	18.40	19.90	24.70	28.55	2.35
Higher Degree	16.70	17.45	18.35	21.15	19.00	10.90

No adjustments were made to the age-earnings profiles so these rates of return are to be compared with the rates contained in Table 1. As is to be expected - given that we have already established the profitability of education for both males and females - the rates of return in Table 6 are substantially greater than in Table 1. Thus, if it is correct to incorporate this marriage factor into the rate of return calculations, the monetary gain from education would be much higher than suggested by our initial estimates (Table 1).

#### VI. THE RETURN TO TRADE QUALIFICATIONS

In this section we examine the rate of return to trade qualifications. Trade qualifications are generally acquired through the serving of an apprenticeship of four to five years' duration. During the period of apprenticeship the apprentice receives a wage below that which a qualified tradesman would receive. Scherer (1981) lists the percentages of a tradesman's wage payable to an apprentice employed under the Federal Metal

Trades Award. For a four-year term, these are as follows:

	YEAR			
	1	2	3	4
Percentage	0.42	0.55	0.75	0.88

The apprentice's wage would generally be lower than the amount that could be earned from other types of employment. Such foregone earnings constitute an investment in future earnings capacity. We can assess the profitability of such an investment using the internal rate of return technique.

As the majority of persons who acquire trade qualifications leave school aged 16 years or less (e.g. almost 85% of 25-29 year old males possessing trade qualifications left school at 16 years of age or less), we restrict the analysis to 15 and 16 year olds.

Using hourly earnings data, we find that trade qualifications yield a high rate of return for males. For 15 year old Australian born males, the rate is 43.95% and for 16 year olds it is 89.40%. Overseas born persons receive a lower rate of return: 24.60% for 15 year olds and 35.15% for 16 year olds. For females, trade qualifications yield a positive rate of return only in the case of Australian born 15 year olds (5.55%).

Adjusting the age-earnings profiles for unemployment rates and participation rates increases the rate of return to trade qualifications for all groups. For 15 year old Australian born males the decision problem becomes trivial, whilst for other groups the rates (listed in Table 7) generally exceed the rate of return to formal education by a marked degree.

TABLE 7  
 RATES OF RETURN TO TRADE QUALIFICATIONS

AGE	M A L E S		F E M A L E S	
	AUSTRALIAN BORN	OVERSEAS BORN	AUSTRALIAN BORN	OVERSEAS BORN
15		308.0	48.05	8.75
16	208.15	71.05	17.65	16.15

#### VII. CONCLUSION

According to our internal rate of return calculations, formal education is a profitable investment - the rate of return being as high as 20 per cent in some instances. Adjusting the age-earnings profiles for unemployment rates and participation rates left unaltered the overall profitability of an investment in human capital. But the net effect of adjustment for these two factors was quite marked in most cases. For example, for an Australian born male, the rate of return to the "school leaving age of 18 years - bachelor degree" choice was raised by 5.15 percentage points from 19.80 per cent (Table 2) to 24.95 per cent (Table 5).

Trade qualifications were also shown to yield a high rate of return. Calculated from hourly earnings data unadjusted for differentials in unemployment and participation rates, the return to the acquisition of trade qualifications for an Australian born male who left school at 16 years of age was 89.40 per cent.

The study also examined the effect upon the rate of return to education of the payment of unemployment benefits to 16 and 17 year olds. This was considered to be of relatively minor importance: if 16 and 17 year olds were ineligible for unemployment benefits, the rate of return to education would rise by about 10 per cent.

Finally, we note that the rates of return presented in this paper are in fact averages of the return to formal schooling, and the return to post-school investments in on-the-job training. Our subsequent research will aim to calculate the rate of return to each of these components of the individuals human capital portfolio.

## APPENDIX A

This appendix lists our treatment of various complications to the rate of age return calculations.

1: Taxation

The 1979 Census income question related to before tax income. As we are interested in private rates of return, an adjustment needs to be made for income tax. 1979-80 income tax scales were applied to the income data to derive an 'after-tax' income measure. No explicit allowance is made for income tax deductions/rebates. This may impart a downward bias to the calculations. For example, higher income persons have higher levels of concessional expenditure (higher life insurance, superannuation contributions, rates on sole residence).

In 1979-80 incomes below \$3,893 were exempt from income tax. Thus adjusting for income tax penalises future benefits more heavily than foregone earnings. This tends to lower the rate of return to education below that calculated under no tax or proportional tax assumptions by 2-3 percentage points.

2: Costs of education

The Federal Government abolished fees at universities, colleges of advanced education and technical colleges from the beginning of 1974 onwards. Hence the main costs to students of full-time attendance at these institutions are foregone earnings and non-fee direct costs (e.g. 'compulsory' union fees, expenditure on books, stationery). An estimate of median student expenditure on these items in 1974 was gained from the Department of Education (1975). This estimate was adjusted for changes in the consumer price index to give a value of the costs in 1976 of approximately \$275.

The value of earnings foregone may be approximated by the earnings of individuals not undertaking the incremental year(s) of education. Offsetting these foregone earnings is the value of financial assistance received under schemes such as the Tertiary Education Assistance Scheme, teacher training

schemes and other State Government, Federal Government and private company scholarship schemes as well as income from part-time employment and from gifts. Student income data for 1974 are available from the Department of Education (1975). These were adjusted by the percentage change in the maximum value of benefits under the Tertiary Education Assistance Scheme to estimate student income by age for 1976. These income figures were then subtracted from the foregone earnings to give *net* foregone earnings.

### 3: Income data

Census questionnaire respondents were not asked for their exact dollar earnings, but rather to report their income in a specified series of dollar ranges. We assume that the mean income in each range is at the midpoint, except in the case of the open-ended upper range (over \$18,000) where we specify a mean of \$25,000 and in the case of the lowest range (less than \$1,500) where we specify a mean of \$1,000.

We find that the rate of return to post-secondary education is sensitive to the mean income value chosen for the \$18,000 and over income interval. Our choice of \$25,000 as the mean for the open terminal group may be compared with Treadgold's (1980) assumption of \$27,000 and Maxwell and Peter's (1980) assumption of \$25,000. We note that calculations from the 1973 Income Survey (*Income Distribution, 1973-74, Part 3, Catalogue No. 6504.0; Table 25*) reveal that \$25,000 would be an appropriate mean for "married couple income units". Whether the mean for personal income (the measure used in our study) differs substantially from the mean for this married couple income concept could not be determined.

The average income for each five year age interval was calculated. We assume that this income is earned by individuals of average age in each age group. Income figures for other individual ages were then interpolated using the following weighting factors:

(i) for ages 15-24, the ratio of average income at each individual age to the average income for the five year age interval. These ratios were calculated from 1976 Census Matrix Tape MXT36(B).

(ii) for ages over 24, a simple linear weighting of the average income for each five year age group.

Income was defined in the Census as including wages and salaries, overtime, child endowment, pensions, superannuation, tips, gratuities, business or farm income, interest and scholarships. In an attempt to minimise the biases stemming from this definition of income (e.g. non-human wealth tends to be correlated with human wealth), the analysis was repeated for various populations, for example all employed persons, wage and salary earners, all persons in paid employment. This experimentation had a miniscule effect on the calculated rates of return. Results in the paper are for persons in paid employment.

Finally, we note that the Census income question referred to weekly incomes. The annual income data published by the A.B.S. were calculated from the answer to this question. Hence the justification for our adjustments for unemployment and participation rates.

#### 4: Time periods

We assume that students take three years to complete a diploma or bachelor's degree, an additional year to complete a graduate diploma, and an additional two years to complete a higher degree (e.g. masters, PhD).

Individuals are assumed to retire at 60 years of age irrespective of education attainment. It is obvious that the sensitivity of our calculated rates of return to this assumption will be a function of the size of the rate of return itself.

#### 5: Mortality probabilities

No adjustment is made for the different age specific probabilities of death at the various educational attainment levels. Overseas studies which have made a mortality adjustment find it to have a negligible effect on rates of return.

6: Consumption benefits

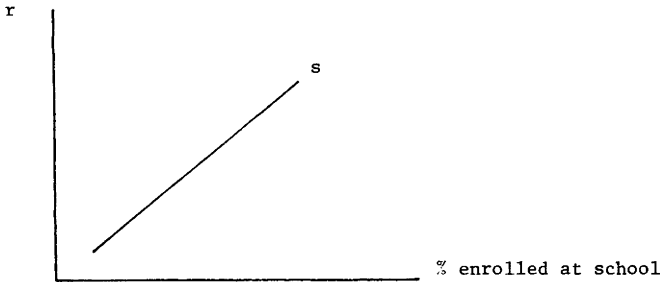
No attempt is made at quantifying the consumption benefits of education. Accordingly, our rates of return refer only to the investment component of education. As a portion of the costs of education are associated with the consumption aspect, our rates of return will underestimate the true rate of return.

7: Participation rates and unemployment rates

Participation and unemployment rates for five year age groups were obtained from Census Matrix Tape MXT32. Rates for individual ages were derived using the same method as for incomes.

## APPENDIX B

Becker (1964, p. 95) postulates a positive relationship between the percentage of any demographic group enrolled at school and the rate of return they can expect from the additional schooling. This he terms a supply schedule.



The position and elasticity of the above curve will presumably be determined by such factors as taste, availability of finance and attitudes towards risk. Generally speaking, the curve for disadvantaged groups should lie to the left of that for more affluent groups.

Assume that the supply curve is fixed at S. Then, should the rate of return to schooling fall, we would expect that a lower percentage of the group would be enrolled at school. Accordingly, following the fall in the rate of return to schooling for males between 1969 and 1976, the percentage of 15-19 year old males enrolled at school should have declined. Indeed, this is what happened!

Now let us consider differences in school enrolments of various demographic groups in 1976. These are given in Table 8.

TABLE 8

## % 15-19 YEAR OLDS ENROLLED AT SCHOOL

	1976	
	MALES	FEMALES
Australian born	39.77	38.34
Overseas born	43.37	38.39

When discussing Table 1, we pointed to the differences in the rates of return obtained by Australian and Overseas born students. Australian born males obtain a higher rate of return to schooling than overseas born males, while the rate of return obtained by Overseas born females exceeds that obtained by Australian born females.

The school enrolment and rate of return data are clearly incompatible with their being identical supply curves for the Australian and overseas born. If there is a deterministic relationship between rates of return and school enrolments, then the relationship for the overseas born must lie to the left of that for the Australian born in the case of females and to the right in the case of males.

Is there any justification for supposing this to be an approximate description of reality?

Let us assume that Australian born males and females have identical supply curves. Further, assume that, *ceteris paribus*, the supply curve for overseas born males and females lies to the left of that for the Australian born. Then, the above finding implies that migrants place a (much) higher premium upon educational attainment for their sons than for their daughters. Such a premium may be associated with non-monetary factors.

Is this plausible?

It is generally believed that migrant groups regard education as a path to upward social mobility. And Sturman (1979) notes that the generally higher aspirations for their children's education level of non-English speaking migrant families do not extend as strongly for females as for males.

Thus, one can say that the evidence in this paper is not inconsistent with the literature (e.g. Sturman). But without further knowledge of the relative positions of the supply curves for various demographic groups, we cannot, on the basis of our rate of return calculations, make confident predictions of relative demands for education.

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## FOOTNOTES

1. See Mincer (1958) for an exposition of this hypothesis.
2. See Blandy *et al.* (1979) for a commentary on these studies.
3. Hirschleifer (1970), Ch. 3 discusses some of the problems associated with this method.
4. It is questionable whether productivity gains are shared in this manner. An overall growth in income is consistent with a variety of income differentials between education categories. The present assumption, which appears more plausible than the assumption that absolute income differences remain unchanged over time, is a convenient mechanical adjustment.
5. The later assumption will facilitate comparisons with studies which do not make any adjustment for non-education factors.
6. The Blandy and Goldsworthy (1972) profiles for males in South Australia in 1968-69 were adjusted for movements in the consumer price index and compared with the lifetime profiles presented in Figure 1. The Figure 1 profiles tended to be characterised by higher starting salaries and to be more convex than the Blandy-Goldsworthy profiles.
7. This is predicted by Mincer and Pollachek (1974).
8. Given that at a point in time the annual earnings of (say) 50-64 year olds are less than 40-44 year olds, a natural question to ask is: 'is it reasonable for a 20 year old today to expect his earnings at age 60 to be lower than at age 40. It would seem that the answer is NO! For the individual will presumably share in the overall growth of the economy as outlined in Section II. A correction for the secular growth in earnings removes the decline in older age groups: the

profiles continue to rise throughout the working life as suggested by a growing body of longitudinal data (see Psacharopoulos (1980)).

9. Our treatment of various complications to the rate of return calculations is documented in Appendix A.
10. Repeating the internal rate of return calculations under the assumption that teenagers are employed part-time whilst attending school increases the rates of return by 2 to 3 percentage points. Furthermore, because the overseas born teenagers who attend school and who are employed part-time earn more than the Australian born (\$250 more in the case of males and \$100 more in the case of females), their internal rates of return increase by more than the increase in the internal rates of return of the Australian born.
11. For results of Overseas studies see Blaug (1970), pp. 224-234.
12. Rates of return after adjusting for hours worked and unemployment rates.
13. The overseas born currently completing their education in Australia will, when (for example) 40-45 years old, have a higher average period of residence than the present 40-45 year olds. However, Haig's study of Australian earnings suggests that there is no systematic variation in the effect of labour market discrimination on earnings with the period of residence in Australia.
14. See Centre for Economic Policy Research, A.N.U. Discussion Paper No. 19, page 46.
15. As suggested by Haigs (1979) specification of the earnings function.

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16. There are many ways of dealing with this issue. We assume:

- (i) individuals marry at 24 years of age;
- (ii) they marry a spouse of the same education level as themselves.

Becker suggests using family income cross-classified by the individuals education level. However, a cross-classification of variables from the 1976 Census suitable for implementing this suggestion could not be obtained.

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