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Measuring an Option Value of Investment in Education: A Lifetime Labour Income Approach

ABSTRACT *Heckman, Lochner and Todd (2006) draw attention to the concept of option value in estimating returns to education. Using the framework of Jorgenson and Fraumeni (1989, 1992) lifetime labour income approach, this paper develops a method to estimate an option value as the difference between alternative lifetime labour incomes associated with the corresponding schooling choices upon completing a lower level education.*

Using secondary education in Australia as a case study, this paper demonstrates how the total return to investment in secondary education can be decomposed into the direct return and an option value, which accrued from the opportunities for undertaking tertiary study programs. The empirical results shows that the option values make up significant proportions of total returns to secondary education, ranging from 24.5% to 39.3% for men, and from 32.6% to 51.6% for women over the period 1986–2006. In particular, option values have become increasingly prominent in recent yeas, which have witnessed strong demand for more educated workers.

1. Introduction

Heckman, Lochner and Todd (2006) (HLT hereafter) draw attention to the concept of *option value* in their survey of the returns-to-education literature: "Completing high school generates the option to attend college and attending college generates the option to complete college…This generates an option value of schooling." (p. 313.) Using the framework of Jorgenson and Fraumeni (1989, 1992) lifetime labour income approach, this paper develops a method to estimate an option value as the difference between alternative lifetime labour incomes associated with the corresponding schooling choices upon completing a lower level education. Using secondary education in Australia as a case study, this paper demonstrates how the total return to investment in secondary education can be decomposed into the direct return and an option value, which accrued from the opportunities for undertaking tertiary study programs.

The conventional method of estimating returns to education, represented by the framework of Mincer's (1974) human capital earnings function, is based on the comparative analysis of two educational groups which take an alternative course of action: one group participates in the labour market, while the other group makes an

investment by undertaking additional schooling activities. The returns to additional education are estimated based on the comparison between the two earnings flows associated with these two courses of actions. No option value is accounted for by the conventional method.

HLT (2006) have challenged the conventional cross-sectional based estimation of rates of returns to education. Their central point is that using current cross-sectional earnings profiles as guidelines for lifetime earnings profiles of persons was fine for the 1960s US labour market data. In recent time periods, age/earnings profiles differ considerably across cohorts. They argue that current cross-sectional age earnings profiles are no longer useful for estimating the life cycle earnings of any particular individuals or groups. Under this circumstance, continuing to rely on current cross-sectional information to forecast future earnings patterns would produce a misleading prediction of potential economic benefits. Changing patterns and nonstationarity of earnings across cohorts over time must be accounted for in estimating rates of return to investment in education. They suggest that alternative approaches are needed to incorporate these uncertainties into predictions of the future earnings growth paths.

According to HLT (2006), in dynamic settings in which schooling choices are made sequentially and rates of returns to education vary with alternative levels of schooling activities, there exist sizeable option values generated by completing lower levels of schooling activities. "The return to one year of school may include the potential for larger returns associated with higher levels of education when the returns to school are not constant across all schooling levels. For example, finishing high school provides access to college, and attending college is a necessary first step for obtaining a college degree. Given the large increase in earnings associated with college completion, the total return to high school or college attendance includes the potential for even greater returns associated with finishing college. The return in excess of the direct return (the lifetime income received at a given schooling level) is the option value." (p. 343).

The human capital skills produced by one schooling level are important inputs in the production of additional human capital. In this sense, an option value is the economic benefit of probabilities of higher qualifications for individuals who complete base level education qualifications. In accounting for economic benefits arising from additional schooling, the potential benefits from the probabilities of obtaining higher education qualifications should be included as an important element.

So far methods used for valuing option values generated by investment in education are based on econometric models to separate effects of schooling and ability on wage premiums.[1] In this paper, we show that economic benefits and associated option values can be measured at an aggregate level by using a lifetime labour income approach.

To obtain empirical estimates of option values, this paper uses secondary education[2] in Australia as our case study. The purpose of focusing on secondary school education is to highlight the importance of base level education in the production of human capital over life cycles of young people. The distinctive feature of this exercise is that it attempts to account for the option values generated by completing secondary education which are the opportunities for obtaining more advanced human capital skills through undertaking tertiary study programs. These open up possibilities of getting better paid jobs and entering higher status occupations.

In estimating the economic benefits of completing secondary school education, this study takes a broad view. It not only focuses on participation in the final year of secondary school but also on participation in the years leading up to the final year. This choice arises from two considerations. First, an increase in participation in the final year of secondary school is closely related to increases in school participation in the earlier years of secondary school leading up to Year 12, the final year of secondary education in Australia. Secondly, secondary school participation in the years prior to completing Year 12 contributes to human capital formation and can be estimated in terms of additions to lifetime labour incomes, which forms the central framework of this paper. Ideally, we would like to measure the contribution of each year of post compulsory secondary education (Year 9 to Year 12). Instead, due to data limitations (to be discussed later), this study considers school participation by the age group of 15–18 year olds.

One more introductory comment is necessary on the limitations associated with studies based on the Population Census, the main data source in this study. Census data lacks ability measures and therefore estimates of returns to education derived from Census data usually ignore ability bias.[3] The key assumption underlying these estimates is that the additional earnings obtained by someone with a higher qualification are due to that qualification and not to higher ability. The same applies to the present study. However, many empirical studies suggest that ability biases are

[1] HLT (2006) provides surveys of such models.

[2] The study scope of secondary education in this paper is confined to schooling activities undertaken by 15–18 year olds.

[3] See Heckman, Lochner and Todd (2006).

small and education has a significant impact on the earnings of individuals undertaking additional schooling activities.[4] Even if we could measure the returns to abilities which are independent from education, there is no clear consensus on the best way to correct for ability biases.[5] Nevertheless, readers should be aware of the assumption made about ability bias.

The rest of this paper is structured as follows. Section 2 introduces the JF lifetime labour income approach and presents our method for measuring an option value of investment in education. Section 3 provides summary statistics of the key variables and presents empirical results. Section 4 concludes.

2. Methodology

2.1 Jorgenson and Fraumeni Lifetime Labour Income Approach

Our methodology for estimating returns to investment in secondary education is based on the lifetime labour income approach, developed by Jorgenson and Fraumeni (1989, 1992) (JF hereafter) and subsequently applied to data for other countries.[6]

The JF method measures human capital per capita for a given sex/education/age group as the discounted present value of expected lifetime labour income per capita for that group. Expected income streams are derived from using current cross-sectional information on labour incomes, employment rates and school participation rates. The lifetime labour incomes are projected by backward recursion, which works as follows: an individual's present value of his or her lifetime income is equal to the current period income plus the present value of his or her lifetime income in the next period. Of course, the present value of his or her lifetime income in next period is not readily available and has to be estimated. By working backward from the lifetime income of individuals with the highest level of education and oldest working age, the present value of an individual's next period income can be derived. JF assume that all individuals retire at age of 75. Holding sex and education level as constant, for example, an individual's present value of lifetime labour income at age

[4] See Card (1999) for a selective review of empirical evidence on effect of ability on earnings. In addressing the concern of ability bias to the JF lifetime labour income approach, Fraumeni (2000) provides this response: "Griliches (1970) and Griliches and Mason (1972) pursued this question of ability, income and schooling. Their conclusion is that ability has little effect on income, but that schooling has a significant effect on income."

[5] For recent critical reviews of instrumental and IQ variables models, see Hansen, Heckman and Mullen (2004) as well as HLT (2006).

[6] See Gu and Wong 2008, 2009 for Canada, Le, Gibson and Oxley 2006 for New Zealand, Li, Fraumeni, Liu and Wang 2009 for China, Liu and Greaker 2009 for Norway and Wei 2004, 2008a and 2008b for Australia.

of 74 is just his or her current period's labour income; then, this individual's present value of lifetime labour income can be used to estimate the next period's present value of lifetime labour income for a 73 years old individual with the same sex and education level. By working backward in this way for all possible combinations of sex and education level, all individuals' present value of lifetime labour income in next period can be derived. Given lifetime labour incomes per capita for various educational groups, the economic benefits of undertaking additional educational activities are measured by additions to lifetime labour incomes due to the higher educational attainments achieved.

2.2 Cohort-based Estimation of Lifetime Labour Income

One of the major concerns with the JF approach is that estimation of lifetime labour incomes based on current cross-sectional information is subject to short-term business cycle effects: it tends to under-estimate lifetime labour incomes in recession years and over-estimate in booming years. This problem becomes obvious if the measurement of human capital is confined to labour market activities, which fluctuates with business cycles. For example, since the Australian economy was in recession in 1991 and real wages experienced negative growth, our human capital stock and flow measures for the 1991 figures show significant downturns (Wei, 2004).

In addressing the business cycle effect on projection of lifetime labour incomes, this paper uses a cohort-based moving average method. We start with the JF method which decomposes lifetime labour incomes into two elements: current labour incomes and lifetime labour incomes for the group with the same sex/education characteristics but one year older. In the original JF approach, the second element is approximated by current incomes of older age groups plus uniform real income growth factor. By our simplified moving average method, the second element in the JF framework is approximated by a linear combination of lifetime labour incomes of older age cohorts between Census years. Just like the JF approach which calculates the incomes by a backward recursion, we work backward from the lifetime incomes of individuals in the most recent period (2006 in our case), then move on to the next recent period and so on. In this way, all Census income data is chained together.

2.3 Measuring an Option Value

This study considers three scenarios of an individual life path for 15–18 year olds: joining the working age population without completing secondary education; completing secondary education and joining the working age population without

undertaking any post school studies; and obtaining post school qualifications beyond secondary education. Their current and continuing participation in secondary education gives them options for completing secondary education and undertaking further study.

The computation of lifetime labour incomes for the above three scenarios are based on the following assumptions:

All persons in the same sex/age cohort are identical in terms of their abilities to acquire knowledge and skills at school.

1. An increase in the supply of labour force in one education group (e.g. bachelor degree) has no impact on the average earnings of that group.
2. All returns to investment in education are pecuniary in terms of increases in labour market earnings (nonmarket returns are excluded).
3. Earnings grow at a constant real rate of 1.75% and a constant real discount rate of 5% applies across sex/education/age cohorts over time.[7]
4. All persons complete their studies once they are enrolled in a post-school study (e.g. bachelor degree, a vocational qualification) and in a given year of secondary school study.
5. All persons retire at the age 66.

To construct a measure of option values and economic benefits generated by completing secondary education, we now describe our implementation, beginning with notation, which is similar to those in Jorgenson and Fraumeni:

a = age (15, 16, …, 64, 65);

e = educational attainment, which can take 1 of 5 values:

- $e = 1$ indicates not completed nor participating in secondary education,
- $e = 2$ indicates completed or participating in secondary education,
- $e = 3$ indicates a vocational qualification,
- $e = 4$ indicates a bachelor degree,
- $e = 5$ indicates a higher degree.

Sr = probability of survival rate: the probability of remaining alive at age a,

Si = economic benefit per capita in one additional year of secondary education for individuals of age a when a=15, 16, 17, 18,

[7] These are the assumptions adopted by Australian Government Treasury (2002).

Ov = option value per capita, conditional on current school enrolment for individuals of age a when a=15, 16, 17, 18.

Mi = lifetime labour income per capita for individuals of age a and education level e,

$ymi_{a,e}$ = annual market labour income per capita for individuals of age a and education level e, conditional on being employed,

$empr_{a,e}$ = employment rate for individuals of age a and education level e,

$senr_{a,e}$ = enrolment rate in post-secondary education: the probability that individuals of age a are enrolled in a program to attain education level ($e \neq 1,2$).

g = real income growth rate,

r = discount rate.

Using the above notation, a general equation for calculating the present value of lifetime labour income is given by

$$mi_{a,e} = ymi_{a,e}\, empr_{a,e} + mi_{a+1,e}\, sr_{a+1}\,(1+g)/(1+r) \qquad (1)$$

Using equation (1), the present value of lifetime labour income per capita for those who have not completed secondary education is given by

$$mi_{a,1} = ymi_{a,1}\, empr_{a,1} + mi_{a+1,1}\, sr_{a+1}\,(1+g)/(1+r) \qquad (2)$$

Similarly, the present value of lifetime labour income per capita for those who are participating or have completed secondary education in a given year and sex is given by

$$mi_{a,2} = ymi_{a,2}\, empr_{a,2} + mi_{a+1,2}\, sr_{a+1}\,(1+g)/(1+r) \qquad (3)$$

Equation (2) and equation (3) are assumed to be known with certainty, as individuals can begin working with their existing educational attainment, earning income stream of those with the same level of educational attainment.

People who are of school age (which are defined as those aged between 15 and 18) and who are involved in and complete secondary education have options to undertake formal post-school studies. Given the possibilities of obtaining higher educational attainments in the future, the present value of *expected* lifetime labour income per capita for those who participating or have completed secondary education is given by

$$E(mi_{a,2}) = ymi_{a,2}\, empr_{a,2} + \left\{ \sum_{j=3}^{5} senr_{a,j}\, mi_{a,j} + mi_{a+1,2} \left(1 - \sum_{j=3}^{5} senr_{a,j} \right) \right\} sr_{a+1} \frac{(1+g)}{(1+r)} \qquad (4)$$

where E defines an expectation operator over future educational attainment.

The economic benefits generated by completing one additional year of secondary education, without considering option values, is given by

$$si_a = (mi_{a,2} - mi_{a,1}), \quad a = 15,16,17,18 \qquad (5)$$

Equation (5) measures the incremental increase to lifetime labour income attributable to completing one additional year of secondary education.

The economic benefits generated by completing one additional year of secondary education, with considering option values, is given by

$$\overline{si}_a = \left\{ E(mi_{a,2}) - mi_{a,1} \right\}, \quad a = 15,16,17,18 \qquad (6)$$

Equation (6) measures the incremental increase to lifetime labour income attributable to completing one additional year of secondary education, plus the associated potential opportunities of achieving higher educational attainments above the secondary level.

Finally, the option values by investing in secondary education is given by

$$ov_a = \left\{ E(mi_{a,2}) - mi_{a,2} \right\}, \quad a = 15,16,17,18 \qquad (7)$$

In contrast to Equation (6), Equation (7) gives a separate measure of the incremental increase to lifetime labour income attributable to the potential opportunities brought about by completing one additional year of secondary education.

From Equation (1) to Equation (7), we suppress the time and sex dimensions for the sake of simplicity. These equations can be applied separately for males and females, as well as for each calendar year (1986, 1991, etc.).

3. Data and Empirical Results

3.1 Summary Statistics

The main data source is the Australian Censuses of Population and Housing conducted in 1981, 1986, 1991, 1996, 2001 and 2006. This database includes demographic accounts for all the working age population, cross-classified by sex, educational attainment and age. The data items include the number of persons,

income from all sources, unemployment rate, labour force participation rate and school participation rate. This section presents summaries of three key variables used in estimating these economic benefits of completing secondary education: annual incomes per capita by education/age groups, unemployment rates by education/age groups and school participation rates by the 15–18 year olds. These figures are useful for understanding potential economic benefits from pursuing further education activities beyond secondary education and changing school participation patterns by the 15–18 age group.

(Table 1 about here)

Table 1 presents estimated gross annual incomes in current dollars of those employed, by sex and selected age and highest education level. These gross annual income figures were calculated from the income ranges of corresponding census question. Three points are important to make here. First, like other studies on education and earnings, these figures show a strong positive correlation between educational attainment and income. However, income gaps between alternative educational groups do vary. This may indicate that rates of return to education are not constant across educational levels, which is an important source of existence of option values. Second, income levels peak at an earlier age in recent years, in particular for more educated men. This is an indication of increasing returns over time to education, as highest income flows among life cycle income streams are closer to the present point of time.

While the market value of human capital skills plays an important role in explaining these income patterns across education/age groups, other factors may also be at work. Using the income variable constructed from the Australian census data sets as proxies for labour market earnings has two limitations. First, as the Census definition of income includes all sources of income, it may contain investment and other kinds of incomes. Second, hours worked is an important element in total labour earnings, and changes in earnings patterns across education/age groups could reflect the changes in corresponding patterns of hours worked. As the information on hours worked in the Census data sets was broadly based for pre-2001 periods, it is difficult to separate the effect of hours worked on income levels.

(Table 2 about here)

Table 2 presents unemployment rates for the four education groups, measured as percentage of unemployed people among the corresponding labour force. One can

make four observations from these figures. First, similar to income patterns, higher educational attainment appears to be positively associated with lower unemployment rates. Second, those with lower educational attainment are more vulnerable to tough labour market conditions. For example, the difference in unemployment rates between less educated age groups and more educated age groups is much higher in the recession year 1991 compared with other normal years. Third, the unemployment gaps among different education groups are generally larger for young age cohorts. Finally, women with lower educational attainment consistently experience lower unemployment rates in the labour market than their male counterparts, in particular in tough labour market condition, such as in the recession year 1991. This phenomenon is possibly due to alternative life path options associated with unpaid work and family responsibilities for women.

(Table 3 about here)

Table 3 presents school participation rates for the 15–18 age groups, constructed from the Census data. Two patterns are noticeable from these figures. First, the percentages of students remaining at school across all school age groups (15–18) groups trended upward until 1996 but started to fell since 2001. Second, girls performed better for most of the age groups. The distinct falls observed for 18 year old groups across males and females were because some 18 year olds had completed secondary education and were actually in the work force or participating in formal post-school education.

3.2 Per Capita Measures

As per capita lifetime labour incomes by age and education form the backbone of our estimation, we start our exploration of the results with these figures. We present estimates of economic benefits of remaining at secondary school until the age of 18, which is assumed to be comparable to completing Year 12. We then derive aggregate estimates of economic benefits brought about by increases in school participation in secondary education that occurred in Australia during the 1990s. In order to assess the economic impact of changing school participation rates by the 15–18 age groups, we produce aggregate estimates of economic benefits/losses that are associated with these changes.

(Table 4 about here)

Table 4 presents lifetime labour income per capita in current dollars for 18 year olds by sex and choice of education: leaving school without completing secondary

education; completing secondary education but not obtaining any post school qualifications (i.e. without option); and completing secondary education with possibilities of obtaining post school qualifications (i.e. option). These per capita lifetime labour incomes are calculated by using equation (2) to equation (4) respectively.

The economic benefits are measured as additions to lifetime income due to completing secondary education, which are reported in Table 5. The total economic benefit of completing secondary education is measured by the difference in per capita lifetime labour incomes between those who completed secondary education with options and those who did not complete secondary education. The direct economic benefit of completing secondary education is measured by the difference in per capita lifetime labour income for those who completed secondary education without options and those who did not complete secondary education. Until very recently the returns-to-education literature has been focusing on estimating this type of returns to education. The option value generated by completing secondary education is measured by the difference in per capita lifetime labour income for those who completed secondary education with options and those who completed secondary education without options. These are the sources of returns that have been identified and estimated in theoretical and empirical analysis of schooling choices in dynamic settings.[8]

(Table 5 about here)

Two findings are evident from Table 5. First, the option value increasingly became a prominent element in the total return to completing secondary education, ranging from 24.5% to 39.3% for men, and from 32.6% to 51.6% for women over the period 1986–2006. Second, the economic benefits of completing secondary education grew at faster rates for women than men. For example, the total benefit for women in 1986 accounted for 68.2% of that for men and in 2006 this ratio reached 83.8%. This is largely attributable to the distinctly changing school participation rates for women. However, the economic returns of completing secondary education were still significantly higher for men than women.

3.3 Aggregate Measures

Aggregate measures of economic benefits of secondary schooling activities by the 15–18 year olds in Australia, can serve as measures of the output of secondary

[8] See Section 5 of HLT (2006) for a brief survey of such models.

education. In conducting this computation, we apply the per capita measures of economic benefits, including option values, for the 15–18 year olds, derived by using equation (6) in Section 2, and aggregate to total numbers by using the corresponding school participation rates and number of persons in each sex/age cohort. Table 6 presents the results. It should be noted that these measures (including those to be presented in the rest of the paper) are gross figures, as the cost components of education, such as labour input (teachers' effort) and capital services (rental outlays on school buildings and equipment), are not deducted. The values of economic benefits for each age group from 1986 to 2006 are the products of three factors: per capita economic benefit, school participation rate and number of persons of each age group. Accordingly, the differences of these values across age groups and over time are attributable to the changes underlying these three factors. With reference to Table 3, which shows that the school participation rates trend significantly downwards with age, and upwards with time until 1996 and then downwards since 2001, we can see that the changing patterns of aggregate values of economic benefits are basically reflecting those underlying the school participation rates.

(Table 6 about here)

Over the past decades there have been significant changes to the levels of participation in the secondary education. It may be interesting to estimate the economic benefits brought about by such changes. The school participation rates by the 15–18 year olds, reported in Table 3, show that the percentage of students aged 15–18 remaining at school rose significantly between 1986 and 1996.[9] So our second estimation is concerned with the economic benefits created by increasing school participation rates by the 15–18 age groups.

(Table 7 about here)

Table 7 reports our estimates of economic benefits attributable to the increases in the school participation rates for 1991, 1996, 2001 and 2006, compared with the base year 1986. These figures are derived by applying per capita economic benefits calculated in equation (5) to the number of persons and increases in school participation rates of the corresponding age group for each year.

[9] According to Fullarton *et al.* (2003), the levels of secondary school participation rates peaked in 1992 in Australia. Since this study draws on the Australian Census data, which runs at every five years interval, it is impossible to make comparison with the corresponding figures for 1992 here.

In order to assess the significance of the magnitudes of economic benefits brought about by completing secondary education for the 15–18 year old age groups, we use the GDP figures as reference points. Such a comparison is presented in Table 8.

(Table 8 about here)

One important finding from studying Table 8 is that the secondary schooling activity is a non-negligible part of the broad capital formation (both human and physical capital) in the Australian economy, and the aggregate economic benefits are significant order of magnitudes of total GDP, with the ratio in the order of 0.15–0.23 to GDP. Of course, this comparison does not imply any simple quantitative relationship between the growth of GDP and the increasing school enrolment rates. It is beyond the ambition of this paper to estimate the percentage points of the GDP growth rates over this period that could be attributable to the rise of participation rates in secondary education.

(Table 9 about here)

It is evident from Table 3 that 2001 and 2006 witnessed a significant drop in school participation rates across every age/sex age subgroups of the 15–18 group compared with 1996. Consequently, economic benefits were missed due to this decline and the estimated losses are reported in Table 9. With reference to the GDP figures reported in Table 8, the missed economic benefits were significant: they amounted to 2.7% of GDP in 2001 and 3.9% in 2006. It is important to note that this estimation is based on the assumptions spelled out in Section 2.3 and the associated caveats apply. It is possible that those students who choose to leave school early when economic conditions are buoyant do not have the same abilities as those who stay on to undertake higher study leading to more highly paid jobs. In that respect, these figures can be seen as an upper bound. Also there will be savings in education input costs.

4. Concluding Remarks

This paper presents estimates of per capita economic benefits of completing secondary education for the period 1986–2001 in Australia. Using these per capita estimates, this paper assesses the economic benefits of completing secondary education and increasing school participation rates for the 15–18 year olds group. The economic benefits brought about by secondary education, as measured in this paper, are significant order of magnitudes of total GDP, with the ratio in the order of 15% or 23% of GDP over the period.

This paper shows that option value is a large component in the total return to education, and the proportions of option values in the total returns have been increasing over time. Empirical work with option values of schooling is in its infancy. Our results show that option value is empirically important in estimating returns to education.

The estimates in this study are aggregate based and uses census data. As a result, ability biases are inevitable. However, empirical studies of ability biases suggest that it is relative small, and the figures presented in this paper are useful for providing a big picture view of the importance of completing secondary education.

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Table 1 Annual Gross Incomes Per Capita by Educational Attainment and Selective Age Groups, 1986-2001 (current Australian dollars)

	Age	Bachelor	TAFE	Year 12 Only	Under Year 12
(a) 1986					
Male					
	25	23,742	19,808	18,292	16,725
	35	32,751	24,421	23,636	20,157
	45	36,686	25,669	23,597	20,642
	55	38,794	24,781	22,029	19,735
Female					
	25	21,237	16,766	15,476	13,509
	35	22,260	15,494	14,441	11,868
	45	25,001	16,932	14,089	12,307
	55	25,222	17,143	13,937	12,435
(b) 1991					
Male					
	25	31,884	26,779	24,310	22,272
	35	44,028	32,263	31,043	26,718
	45	48,438	35,318	34,192	29,044
	55	49,174	33,079	29,921	26,979
Female					
	25	28,031	22,277	20,938	18,681
	35	29,008	21,330	19,690	16,808
	45	32,078	23,338	19,560	17,430
	55	31,941	23,945	18,933	16,649
(c) 1996					
Male					
	25	35,044	30,582	27,148	25,305
	35	53,800	37,648	36,143	30,689
	45	56,866	40,590	39,403	33,319
	55	57,316	38,942	37,784	31,977
Female					
	25	30,700	24,890	23,506	21,432
	35	35,284	25,015	23,216	20,063
	45	37,176	27,335	24,411	21,279
	55	37,083	27,556	23,155	20,705
(d) 2001					
Male					
	25	44,310	36,279	32,654	29,013
	35	67,227	47,633	47,203	36,771
	45	68,094	49,786	48,731	39,127
	55	67,393	49,088	47,296	38,763
Female					
	25	38,779	28,996	28,413	24,207
	35	45,081	31,379	31,333	24,896
	45	45,905	32,717	30,395	25,252
	55	45,792	32,834	29,956	24,745

	Age	Bachelor	TAFE	Year 12 Only	Under Year 12
(a) 2006					
Male					
	25	47,830	44,291	35,132	30,656
	35	80,612	57,863	51,104	37,912
	45	84,644	61,240	53,144	39,870
	55	82,613	59,604	48,749	37,460
Female					
	25	44,273	33,467	28,241	21,566
	35	54,285	37,337	30,418	23,812
	45	54,607	36,907	32,890	26,315
	55	55,486	38,691	31,248	24,635

Data sources: Australian Census of Population and Housing, 1981-2006.

Table 2 Unemployment Rates by Educational Attainment and Selective Age Groups (%)

	Age	Bachelor	TAFE	Year 12 Only	Under Year 12
(a) 1986					
Male					
	25	4.0	6.0	11.0	18.0
	35	2.0	4.0	8.0	10.0
	45	2.0	4.0	8.0	7.0
	55	2.0	5.0	9.0	7.0
Female					
	25	4.0	6.0	10.0	15.0
	35	4.0	5.0	9.0	9.0
	45	3.0	4.0	9.0	7.0
	55	2.0	3.0	8.0	5.0
(b) 1991					
Male					
	25	7.0	11.0	16.0	24.0
	35	4.0	8.0	11.0	16.0
	45	3.0	7.0	10.0	10.0
	55	4.0	8.0	11.0	11.0
Female					
	25	6.0	8.0	12.0	16.0
	35	5.0	6.0	11.0	10.0
	45	4.0	5.0	9.0	8.0
	55	3.0	4.0	9.0	7.0
(c) 1996					
Male					
	25	6.0	8.0	13.0	21.0
	35	3.0	5.0	9.0	14.0
	45	3.0	5.0	8.0	10.0
	55	4.0	8.0	10.0	11.0
Female					
	25	4.0	7.0	10.0	14.0
	35	4.0	6.0	8.0	10.0
	45	3.0	4.0	7.0	7.0
	55	3.0	5.0	8.0	8.0
(d) 2001					
Male					
	25	5.0	7.0	10.0	21.0
	35	3.0	4.0	7.0	11.0
	45	3.0	4.0	6.0	9.0
	55	4.0	5.0	8.0	8.0
Female					
	25	3.0	7.0	7.0	18.0
	35	3.0	6.0	6.0	9.0
	45	3.0	4.0	5.0	6.0
	55	2.0	4.0	5.0	5.0

	Age	Bachelor	TAFE	Year 12 Only	Under Year 12
(e) 2006					
Male					
	25	4.0	4.0	6.0	14.0
	35	2.0	3.0	4.0	8.0
	45	2.0	3.0	4.0	6.0
	55	2.0	3.0	5.0	5.0
Female					
	25	3.0	5.0	6.0	14.0
	35	2.0	5.0	5.0	9.0
	45	2.0	4.0	4.0	5.0
	55	2.0	3.0	4.0	4.0

Data sources: Australian Census of Population and Housing, 1981-2006.

Table 3 School Participation Rates by 15-18 Age Groups (%)

	Age	1986	1991	1996	2001	2006
Male						
	15	87.0	98.0	96.0	94.0	90.0
	16	70.0	87.0	92.0	89.0	83.0
	17	53.0	73.0	86.0	78.0	71.0
	18	24.0	40.0	61.0	48.0	43.0
Female						
	15	88.0	98.0	97.0	95.0	92.0
	16	71.0	87.0	93.0	90.0	87.0
	17	55.0	67.0	87.0	81.0	77.0
	18	20.0	31.0	56.0	50.0	46.0

Data sources: Australian Census of Population and Housing, 1981-2006.

Table 4 Lifetime Labour Income Per Capita for 18 Year Olds (current Australian dollars)

		1986	1991	1996	2001	2006
Male	Not completed secondary education	378,102	488,713	536,673	615,795	730,330
	Completed secondary education without options	481,688	630,430	699,131	801,691	946,816
	Completed secondary education with options	515,384	692,460	793,846	922,253	1,062,833
Female	Not completed secondary education	362,254	386,129	428,803	497,894	362,254
	Completed secondary education without options	448,106	489,313	552,908	645,033	448,106
	Completed secondary education with options	512,492	592,169	685,219	776,589	512,492

Data source: author's own calculation.

Table 5 Economic Benefits of Completing Secondary Education for 18 Year Olds (current Australian dollars)

		1986	1991	1996	2001	2006
Male	Total benefit	137,282	203,746	257,173	306,458	332,503
	Direct benefit	103,586	141,717	162,458	185,896	216,486
	Option value	33,696	62,030	94,715	120,562	116,017
Female	Total benefit	93,696	150,238	206,040	256,416	278,695
	Direct benefit	63,144	85,852	103,184	124,104	147,139
	Option value	30,552	64,386	102,856	132,312	131,556

Data source: author's own calculation.

Table 6 Economic Benefits of Completing Secondary Education: 15-18 Year Olds (millions of current Australian dollars)

	age	1986	1991	1996	2001	2006
Male	15	11,377	16,158	18,884	21,508	27,147
	16	8,852	15,297	17,894	21,126	24,000
	17	6,911	13,294	16,888	18,252	19,755
	18	4,077	10,962	19,034	18,437	17,906
	Subtotal	31,217	55,712	72,699	79,323	88,808
Female	15	6,734	9,829	12,008	14,092	17,721
	16	5,277	9,293	11,464	14,128	16,223
	17	4,149	7,245	10,746	12,509	13,990
	18	2,147	5,838	13,395	15,301	14,854
	Subtotal	18,307	32,205	47,613	56,029	62,787
Total		49,524	87,917	120,312	135,352	151,595

Data source: author's own calculation.

Table 7 Economic Benefits Due to Increases in School Participation Rates (millions of current Australian dollars)

	age	1991	1996	2001	2006
Male	15	1,847	1,903	1,645	1,108
	16	3,028	4,289	4,580	3,850
	17	3,605	6,422	5,749	4,847
	18	4,394	11,472	9,086	7,909
	Subtotal	12,874	24,087	21,061	17,715
Female	15	1,009	1,132	1,066	751
	16	1,653	2,694	2,943	2,827
	17	1,259	3,910	4,012	3,944
	18	2,052	8,652	9,205	8,434
	Subtotal	5,972	16,388	17,225	15,956
Total		18,846	40,475	38,286	33,670

Data source: author's own calculation.

Table 8 GDP and Economic Benefits of Completing Secondary Education (millions of current Australian dollars)

Year	GDP*	Economic Benefits	% of GDP
1986	264,060	49,524	19
1991	422,245	87,917	21
1996	532,025	120,312	23
2001	708,889	135,352	19
2006	1,000,787	151,595	15

*GDP figures in current prices is taken from Table 6 of the Time Series Spreadsheets of Australian System of National Accounts, ABS Cat.No 5204.0.

Table 9 Economic Losses due to decreases in school participation rate in 2001 and 2006 (millions of current Australian dollars)

	age	2001	2006
Male	15	582	1,810
	16	636	2,503
	17	1,923	4,302
	18	5,100	7,258
	Subtotal	8,241	15,872
Female	15	208	795
	16	2,163	5,656
	17	3,753	7,935
	18	5,121	9,135
	Subtotal	11,244	23,521
Total		19,485	39,393