

# **ECONOMIC VALUE OF UNIVERSITY BUSINESS EDUCATION**

REPORT BY  
ACCESS ECONOMICS PTY LIMITED

FOR

**AUSTRALIAN BUSINESS DEANS COUNCIL**

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**ACCESS  
ECONOMICS**



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## EXECUTIVE SUMMARY

The Australian Business Deans Council (ABDC) commissioned Access Economics to undertake a study into the economic value of a university business education to the Australian economy and society.

The advantages of tertiary education are well documented. In general, university graduates tend to have higher incomes, more stable job prospects and faster career progression than those without tertiary qualifications.

From an individual's perspective, undertaking education involves a trade off between the expected future benefits accruing to the individual, and the cost of participating in tertiary education. In deciding whether to invest in their 'human capital' by undertaking tertiary education, individuals will assess these private cost and benefits.

We have undertaken a cost benefit analysis (CBA) attempting to measure in monetary terms the net benefit of a university business education from an economy-wide perspective, both for a bachelor degree and a postgraduate qualification.

As such, this study differs from more partial assessments which may assess the impact from an individual or government perspective. For example, there are many studies attempting to estimate the private return to education – from the point of view of a high school graduate faced with the decision whether to undertake further study.

As shown in the table below, the main quantifiable benefit to society from a business education is higher lifetime earnings (with the benefit being shared between the student, and government as tax revenue). However, there are costs associated with education, such as the direct costs of provision incurred by universities and income foregone by students while studying. Transfers between groups in society (such as from taxpayers to welfare recipients) are only a net cost to aggregate welfare to the extent they impose a 'deadweight loss' (DWL) of taxation.

For practical reasons, the report focuses on the quantifiable costs and benefits of a business education. However, there are a range of other, less quantifiable social benefits from a business education (and tertiary education generally). These may include a more innovative, tolerant or stable society, with individuals better able to solve problems or make informed decisions. While the exact value of these other benefits is difficult to ascertain, to the extent there are such additional benefits, CBA will tend to underestimate the true value of a business school education to society.



**THE COSTS AND BENEFITS OF A BUSINESS EDUCATION**

	<b>Student</b>	<b>Universities</b>	<b>Government</b>	<b>Rest of Society</b>
<b>Benefits</b>	Higher after-tax earnings (a)		Higher tax on earnings (b)	Increased profit to firms (c)
<b>Costs</b>	Direct costs – tuition, fees, textbooks, transport costs etc. (d) Foregone after-tax earnings while studying (f)	Direct costs – overheads, staffing, consumables etc. (e)	Foregone tax on earnings while studying (g)	
<b>Transfers</b>		(+) government grants	(-) government grants	DWL of tax for grants (h)
	(+) Lower taxation during education (-) Higher taxation after education (+) Welfare benefits during education		(-) Lower taxation during education (+) Higher taxation after education (-) Welfare benefits during education	DWL of tax for welfare benefits (i)

The net economic benefit of a business education can be simplified as:

$$\begin{aligned}
 \text{Net benefit} &= (\text{economic benefit}) - (\text{economic cost}) \\
 &= (a + b + c) - (d + e + f + g + h + i)
 \end{aligned}$$

As well as quantifying the economic costs of a business education, we have estimated future earnings for a year 12 graduate, a business graduate and non-business tertiary graduate, based on 2001 Census data. Rather than a specific discipline, the results for a 'tertiary graduate' relate to a composite across all disciplines other than business.

Regression analysis was used to control for other influences on earnings such as age, marital status and English proficiency, and derive an estimate of the income premium attributable to a university business education. Three regressions (probit, tobit and ordinary least squares) were undertaken, based on the ABS Census Household Sample File 2001 Confidentialised Unit Record File (CURF). This involved a large scale regression exercise based on comprehensive and detailed data.

As reflected in the estimates contained in this report, business education results in a considerable net economic benefit to the nation. A business education not only provides a significant net benefit against the benchmark of a year 12 education, but also against the benchmark of a tertiary qualification other than business.

Naturally, care should be taken in extrapolating from these results. A large expansion in the number of business graduates would be expected to dilute the economic benefits per business graduate.



**ECONOMIC COSTS AND BENEFITS PER GRADUATE (\$, NET PRESENT VALUE)**

	<b>Business u/grad</b>	<b>Tertiary u/grad</b>	<b>Business postgrad</b>	<b>Tertiary postgrad</b>
University cost of degree	\$30,239	\$47,382	\$60,351	\$76,714
Direct student costs	\$8,082	\$8,082	\$13,084	\$13,084
DWL of tax related to youth allowance	\$2,069	\$2,069	\$3,350	\$3,350
DWL of tax related to university grants	\$3,326	\$9,773	\$0	\$0
<b>Total economic cost</b>	<b>\$43,716</b>	<b>\$67,305</b>	<b>\$76,786</b>	<b>\$93,149</b>
Income premium*	\$542,509	\$250,818	\$736,512	\$347,234
<b>Total economic benefit</b>	<b>\$542,509</b>	<b>\$250,818</b>	<b>\$736,512</b>	<b>\$347,234</b>
<b>Benefit-cost ratio (benefit/cost)</b>	<b>12.4</b>	<b>3.7</b>	<b>9.6</b>	<b>3.7</b>
<b>Net economic benefit</b>	<b>\$498,794</b>	<b>\$183,513</b>	<b>\$659,726</b>	<b>\$254,085</b>

\* Before income tax, compared to year 12 education. Includes income foregone while studying and income premium over working life.

This study finds that in net present value terms, over a working life:

- ❑ the average business undergraduate qualification generates a net economic benefit of around \$498,794 per graduate.
- ❑ the average business postgraduate qualification generates a net economic benefit of over \$659,726 per graduate.

This compares to considerably lower net benefits of around \$183,513 for the average tertiary undergraduate qualification and \$254,085 for the average tertiary postgraduate qualification.

The ratio of benefits to costs ranges from 3.7 for a tertiary undergraduate and a tertiary postgraduate qualification, to 12.4 for a business undergraduate qualification.

The estimates above incorporate 80% of income as being attributable to education, with the remainder due to the 'screening effect' identifying individuals with greater innate ability, and therefore not attributable to education. Sensitivity analysis has been conducted around this assumption (at 70% and 90%), as well as other major parameters in section 5.4. Benefit cost ratios vary with different parameters - for example, the benefit cost ratio for a business undergraduate education varies from 8.1 to 13.9.

Overall, the results above reflect the finding that, relative to other disciplines, business education has been traditionally delivered at a low cost, with business graduates achieving lifetime earnings that are relatively high compared to other fields of tertiary study, and a year 12 education.

**Access Economics**

**April 2005**

## 1. BACKGROUND

The Australian Business Deans Council (ABDC) commissioned Access Economics to undertake a study into the economic value of a university business education to the Australian economy and society.

The advantages of tertiary education are well documented. In general, university graduates tend to have higher incomes, more stable job prospects and faster career progression than those without tertiary qualifications. However, there are costs associated with providing that education, such as the direct costs of provision incurred by universities and income foregone by students while studying.

Most previous studies have estimated the private rate of return to education from an individual's perspective. The focus of this report is on the economy-wide costs and benefits of a university business education, both for a bachelor degree and at a postgraduate level.

Australian business schools cover disciplines such as accounting, management, marketing, finance, and human resource management. As well as bachelor degrees, postgraduate courses are provided, such as those leading to a Master of Business Administration (MBA).

The remainder of this report is structured as follows:

- ❑ Section 2 provides a brief introduction to cost benefit analysis;
- ❑ Section 3 examines the value of a business education;
- ❑ Section 4 outlines the cost benefit methodology in more detail;
- ❑ Section 5 contains the results; and
- ❑ Section 6 presents our conclusions.

Attachment A contains more detail regarding the regression analysis.

## 2. COST BENEFIT ANALYSIS

CBA is an economic tool often used by policy-makers in assessing the merits of an investment or policy change, or the effectiveness of an existing investment or policy.<sup>1</sup>

CBA attempts to measure costs and benefits from an economy-wide perspective, to judge the impact on overall economic welfare. The focus is on *incremental* costs and benefits associated with the investment. As such, the investment is compared against the counterfactual or ‘do nothing’ scenario where it is not undertaken. Costs and benefits are then summed to produce a single estimate of a policy’s net economic benefit.

Accurately valuing costs and benefits requires a common unit of measurement. Where possible, CBA involves expressing costs and benefits in monetary terms. However, the focus is on *economic* costs and benefits, which may extend beyond direct financial flows. While costs or benefits are converted into monetary values where possible, they may not be captured by individuals as an explicit financial flow. For example, the opportunity cost of an individual pursuing education, in the form of foregone wage income does not involve an explicit payment. Similarly, the efficiency cost of raising taxation (or ‘deadweight loss’) is not an explicit financial flow.

It is an important feature of CBA that costs and benefits are measured regardless of who accrues them - ‘a dollar is a dollar is a dollar’. This avoids the more subjective judgement as to whether a dollar should be valued higher when it accrues to one group in society rather than another. For example, the benefit of a business education may flow predominantly to the student, their employer, the government or society more generally.

As such, CBA differs from more partial assessments which may assess the impact on an individual student or level of government or other particular groups. For example, there are many studies attempting to estimate the private return to education – from the point of view of a high school graduate faced with the decision whether to undertake further study.

Economic costs and benefits may extend over a number of years. For equal comparison, CBA is conducted in constant dollars terms, with net present values calculated by ‘discounting’ the flows of future costs and benefits.

The appropriate discount rate is an important consideration. Provided all uncertainties and risks are explicitly addressed in the measurement of costs and benefits, the discount rate should reflect the interest rate on a riskless asset such as 10 year government bonds. Where there is uncertainty surrounding particular costs or benefits, it may be preferable to explicitly model this uncertainty, rather than using the catch-all method of adding a risk premium to the discount rate, which is a rather more blunt instrument for adjusting for uncertainty.

It should be noted that CBA is still a partial decision-making framework. For example, consideration is usually confined to those impacts that can be quantified with reasonable accuracy. Other non-quantifiable impacts (such as greater tolerance or social participation)

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<sup>1</sup> For a fuller exposition see for example, Department of Finance, 1991, *Handbook of Cost-Benefit Analysis*, Australian Government Publishing Service, Canberra.

may be excluded from the formal analysis. However, simply because impacts are difficult to quantify in monetary terms does not mean they are insignificant.

In relying on market prices as a yardstick for valuation, the general assumption is that the social cost of inputs to an industry, and the social value of outputs from an industry, can both be valued at market prices. If this is the case, then market prices reflect values to society.

However, there are a range of circumstances whereby the social return may differ from the market return, including where:

- ❑ market prices do not accurately reflect the opportunity cost of an input;
- ❑ some consumers value an output at more than the amount they must pay for it (this is the concept of consumer surplus);
- ❑ some producers make profits above the cost of the resources valued at market prices (producer surplus);
- ❑ there are costs or benefits that accrue to third parties that are not reflected in market prices (externalities); or
- ❑ there are higher or lower net transfers to Australian residents, or governments.

Of particular relevance for the economic value of education, relying on market wage rates will tend to underestimate the overall benefit of education as it fails to capture the 'positive externalities' or broader social benefits of education. However, the analysis generally assumes that market prices can be relied on as the primary unit of measurement.

### 3. THE VALUE OF A BUSINESS EDUCATION

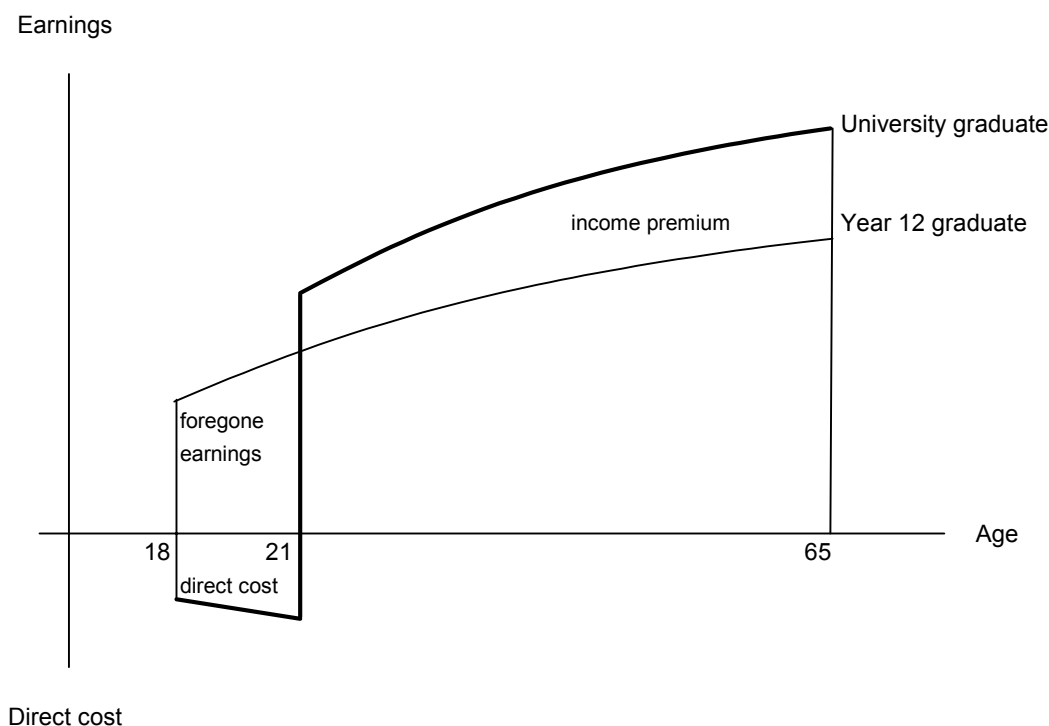
The analysis in this report of the benefits of a business education is informed by ‘human capital theory’. From an individual’s perspective, undertaking education involves a trade off between the expected future benefits accruing to the individual, and the cost of participation. In deciding whether to invest in their ‘human capital’ by undertaking tertiary education, individuals will assess these private cost and benefits.

Personal costs incurred while studying may include direct expenditure on tuition fees, ancillary costs, textbooks, and the opportunity cost of lower labour force participation, in the form of foregone wages. Part of the cost of education will be funded by governments (raising funds through taxation) and partly by individuals (such as student contributions and fees).

The ‘payoff’ to the individual from investing in their education is higher labour productivity which tends to result in higher after tax wages over their working life. Individuals may also derive personal satisfaction, higher self-esteem or other personal, less tangible benefits from further education.

The diagram below is a stylised representation of an age-earnings profile. It shows the costs and benefits of a university education over an individual’s working life, against the benchmark of a year 12 graduate. While society incurs greater costs while the student is studying, including foregone earnings and direct costs, benefits accrue over their working life, as reflected in the income premium above that derived from a year 12 graduate.

**STYLISTED AGE-EARNINGS PROFILE<sup>2</sup>**



<sup>2</sup> Adapted from Psacharopoulos, G., 1995, *The profitability of investment in education: Concepts and methods*, Human Capital Development and Operations Policy, Working Papers, World Bank.



Consistent with the economy-wide perspective of CBA, the focus of this report is on the total resource cost to society of providing education, compared with the total benefits to society. For example, rather than after-tax income accruing to the individual, the return to society is more accurately reflected in gross (pre-tax) income. Part of the income premium will be captured by the government in the form of higher taxation revenue, especially as Australia's progressive income tax system applies higher marginal (and average) tax rates to individuals with higher income.

For practical reasons, the report focuses on the quantifiable costs and benefits of a business education. However, there are a range of other less quantifiable social benefits from a business education (and tertiary education generally). These may include a more innovative, tolerant or stable society, with individuals better able to solve problems or make informed decisions. While the exact value of these other benefits are uncertain, to the extent there are such additional benefits, CBA will tend to underestimate the true value of a business school education to society.

For example, increased labour productivity flowing from education may be reflected in higher rates of economic growth over the longer term. With higher levels of education, individuals are better able to apply existing technology and adapt to new technology, which drives productivity increases across the economy. Similarly, there may be positive externalities where more highly educated people increase the productivity of co-workers.

This report attempts to measure the net benefit to society of an undergraduate business education and postgraduate business education against the counterfactual of a high school education (year 12). This gives a measure of the absolute, 'gross' impact of undertaking a business school degree.

As well as a business education, the costs and benefits of a tertiary education other than business are estimated, against the high school benchmark. Rather than a specific discipline, the results for a 'tertiary undergraduate' and 'tertiary postgraduate' qualification relate to a composite across all disciplines other than business. As such, the costs and benefits of a business education can be compared with a tertiary qualification. This may be relevant if it assumed that the individual would have attained some form of tertiary qualification in the absence of a business degree.

Final results assessing the costs and benefits accruing to society from an individual with a business undergraduate, business postgraduate, tertiary undergraduate and tertiary postgraduate qualification are measured against the benchmark of a high school education (year 12).

### 3.1 ECONOMIC COSTS OF EDUCATION

The total economic costs of a business education include the direct costs of providing that education, as well as the opportunity cost of a student not participating in the labour market.

The resource cost of providing a business education (actual labour and capital deployed) differs from the financing of that education (who pays and how much). The amount financed by the individual is of central importance in calculating the private return on an investment in education. However, for the purposes of our CBA, we are more interested in the total economic or resource cost, regardless of who actually incurs the cost. However, who finances these costs will be relevant to the extent it imposes an additional resource cost to society.



The economic costs of a business education include those incurred by the university<sup>3</sup> in the form of:

- university overheads (buildings, computer equipment, utilities, cleaning, security, administration etc);
- academic staff wages;
- administrative and support staff wages; and
- consumables (stationery, printing costs etc).

Students also incur direct costs such as:

- amenity fees and materials (textbooks, stationery etc); and
- income foregone while studying, through lower labour market participation.

Some of these costs are effectively financed by taxation (such as operating grants to universities and welfare payments to students). While these represent transfers from taxpayers to recipients, there will be an additional economic cost borne by the community in the form of the 'deadweight loss' of taxation (the transfer itself does not impact on total welfare, only the distribution of the total).

Taxes impact on economic decisions by altering the price and quantity of goods and services. The 'deadweight loss' of taxation represents the loss of economic welfare, as a result of taxes distorting relative prices and resource allocation. For example, taxes on labour impact on the choice between work and leisure and whether to employ capital or labour, taxes on particular goods influence the mix of consumption and the choice to consume or save.

In a practical sense, deadweight loss reveals itself as a loss of efficiency in the economy, which means that raising \$100 dollars of revenue, requires consumers and producers to give up more than \$100 of value.

### **3.2 ECONOMIC BENEFITS OF BUSINESS EDUCATION**

The advantages of a university education are well documented. In general, university graduates tend to have higher incomes, more stable job prospects and faster career progression than those without tertiary qualifications. This benefits the individual in terms of higher after-tax earnings and society in terms of higher output and taxation receipts.

The main driver of higher incomes is greater labour productivity, the payoff from investment in human capital.

Tertiary education that increases the marginal productivity of the worker will be reflected in the wage of the employee. In a perfectly competitive labour market, wage rates fully reflect the marginal productivity of labour. In practice, the benefit of this higher productivity will be shared to some degree between the employee and the employer. To the extent higher labour productivity is reflected in higher profits, our estimates, which are based on wage income will tend to underestimate the benefit to society. However, with increasing deregulation of the labour market, especially for high skilled workers, individual wages are more likely to be an accurate representation of marginal productivity. This is especially the

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<sup>3</sup> Either at the business school, faculty or university level.



case for portable skills of the type provided by a university education as general skills increase the marginal productivity of the worker to their current firm, as well as to other firms.

An alternative view to human capital theory known as the ‘screening hypothesis’ challenges the veracity of the link between education, productivity and wages. It contends that education has a signalling or screening effect – as individuals with higher ability are better able to complete a university course, they are perceived by potential employers as being more likely to have higher productivity in the workplace. As such, individuals may use education as a signal to employers, while employers may use education to identify individuals with high innate ability.

Similarly, attending university may increase an individual’s ability to identify desirable jobs or expand social networks, thus increasing the individual’s ability to obtain these desirable jobs<sup>4</sup>. Consequently, some proportion of the higher lifetime earnings may be due to these “matching” effects rather than a productivity enhancing effect from education itself. It is difficult to empirically establish the merit of the screening hypothesis over the more conventional human capital theory as both predict higher earnings for tertiary graduates. This study follows the approach of Borland<sup>5</sup> in assuming that 80 per cent of the increased earnings of those with a high school education and a tertiary education is due to increased productivity, rather than simply the effect of screening.

The costs and benefits of a business school education are summarised in the table below. The main quantifiable benefit to society is higher earnings (with the benefit being shared between the student and government). The main economic costs are the direct costs to students and the university. Transfers between groups in society (such as between taxpayers and welfare recipients) are only a net cost to the extent they impose a deadweight loss of taxation.

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<sup>4</sup> Elliott, R. (1997) *Labour Economics: A comparative text*. Sydney: McGraw Hill, pp 175-182.

<sup>5</sup> Borland, J., Dawkins, Johnson, and Williams, 2000, *Returns to Investment in Higher Education*, The Melbourne Economics of Higher Education Research Program Report Number 1.



**TABLE 1: THE COSTS AND BENEFITS OF A BUSINESS EDUCATION**

	<b>Student</b>	<b>Universities</b>	<b>Government</b>	<b>Rest of Society</b>
<b>Benefits</b>	Higher after-tax earnings (a)		Higher tax on earnings (b)	Increased profit to firms (c)
<b>Costs</b>	Direct costs – tuition, fees, textbooks, transport costs etc. (d) Foregone after-tax earnings while studying (f)	Direct costs – overheads, staffing, consumables etc. (e)	Foregone tax on earnings while studying (g)	
<b>Transfers</b>		(+) government grants	(-) government grants	DWL of tax for grants (h)
	(+) Lower taxation during education (-) Higher taxation after education (+) Welfare benefits during education		(-) Lower taxation during education (+) Higher taxation after education (-) Welfare benefits during education	DWL of tax for welfare benefits (i)

Ignoring transfers (as these cancel out), the net economic benefit of a business education can be simplified as:

$$\text{Net benefit} = (\text{economic benefit}) - (\text{economic cost})$$

$$= (a + b + c) - (d + e + f + g + h + i)$$

It should be noted that CBA is a partial framework in that it does not take into account potential flow on effects from increased education activity. For example, costs associated with administering welfare benefits do not change.<sup>6</sup> Similarly, the analysis assumes that additional business graduates will not impact on the overall wage level of business graduates. While this is more likely to be the case for small increases in the number of graduates, a large increase in the supply of business graduates would ultimately decrease wages.

The market wages of tertiary graduates other than business graduates may not as accurately reflect the value of their work (the marginal product of their labour). For example, public service wage rates may be lower than comparable positions in the private sector. That said, to the extent the public sector offers greater job security, this could be partly offset by the time dimension in the regression modelling (as a lower mean income, but more constant income over time).

Alternatively, the framework above is conservative to the extent it omits other unquantifiable, or difficult to quantify social benefits of education.

<sup>6</sup> However, in practice individuals with a higher level of education are likely to rely less on welfare payments throughout their working life, compared to individuals having completed year 12 only. However, in the absence of detailed micro-simulation modelling of the tax and transfer system, this potentially offsetting effect has not been included in the analysis.

## 4. METHODOLOGY

As previously described, this report aims to measure the net benefit of an undergraduate business education, a postgraduate business education and an undergraduate tertiary education against the counterfactual of a high school education. The analysis relates to domestic and not international students.

This section outlines in more detail the assumptions and methodology employed to quantify the economic costs (university costs, student costs and other costs) and economic benefits (income premium) outlined in table 3.1.

### 4.1 ESTIMATING UNIVERSITY TEACHING COSTS

In estimating the university costs associated with teaching undergraduate and postgraduate students, we surveyed member institutions of the Australian Business Deans Council. We sought information, based on financial data available to each of the institutions, regarding costs actually incurred in providing a business school education per Equivalent Full-Time Student Unit (EFTSU). This included costs such as overheads, total employment costs and consumables, related to teaching but not research activities.

As would be expected, results varied across institutions, reflecting differing course delivery methods and cost structures.

For the purpose of our analysis, we have based university costs associated with the provision of a business education in the profile shown below. The increasing cost per student in later years is largely driven by smaller class sizes and lower economies of scale.

#### UNIVERSITY TEACHING-RELATED COST PER BUSINESS STUDENT (\$2004)

	<b>Business undergrad</b>	<b>Business postgrad</b>
Year 1	6,500	6,500
Year 2	7,800	7,800
Year 3	8,200	8,200
Year 4		11,200
Year 5		12,900
<b>NPV</b>	<b>\$21,167</b>	<b>\$42,246</b>

For the purpose of comparison, we have also reported costs and benefits of a tertiary qualification. This is a hybrid across all disciplines - the costs of providing some disciplines such as science and engineering will be higher, reflecting higher costs such as scientific equipment and smaller-sized practical classes.

We would expect business school teaching costs to be relatively low compared to all tertiary disciplines, as courses are generally delivered in a lecture theatre environment, with fewer consumables. The low cost of business education also reflects low levels of funding relative to other disciplines and the fact that business courses have significant economies of scale with relatively large class sizes.

Given the lack of data available as to the costs attributable to undergraduate compared to postgraduate students, we have estimated an overall cost per tertiary student from aggregate university financial data, available from the Department of Education, Science and Training.<sup>7</sup> For the purpose of our modelling, we have assumed that the real teaching cost per tertiary student (undergraduate and postgraduate) is \$11,726 per annum. As shown below, this is a rough estimate based on total operating expenses for the 40 higher education institutions of \$11.4 billion in 2003, adjusted for proportion spent on teaching rather than research activity, divided by the total number of students (EFTSU).

**TABLE 2: UNIVERSITY TEACHING-RELATED COST PER TERTIARY STUDENT (\$2003)**

Total uni. operating expense	\$11,390,496,000
<i>times</i> proportion related to teaching <sup>8</sup>	0.67
<i>divided by</i> total EFTSU	650,849
equals university cost per student per annum	\$11,726
<b>NPV undergraduate (3 years)</b>	<b>\$33,167</b>
<b>NPV postgraduate (5 years)</b>	<b>\$53,700</b>

## 4.2 ESTIMATING STUDENT COSTS

Students incur a range of costs directly associated with their participation in education. These may include amenity fees, books, stationery and additional travel costs. Consistent with the assumption of Borland, we have incorporated direct student costs of \$2,000 per annum in real terms.<sup>9</sup> This yields the NPV results shown below for a 3 year undergraduate degree and a 5 year postgraduate qualification.

**TABLE 3: DIRECT STUDENT COSTS (\$NPV)**

<b>NPV undergraduate (3 years)</b>	<b>\$5,657</b>
<b>NPV postgraduate (5 years)</b>	<b>\$9,159</b>

### 4.2.1 FOREGONE EARNINGS

Foregone earnings of students is dependent on the level of workforce participation and earnings per hour of students, compared to those with a year 12 education who are already in the workforce. The Census data gives an insight into both these factors.

<sup>7</sup> Commonwealth of Australia 2004, Department of Education, Science and Training, *Finance 2003 and Students 2003: Selected Higher education statistics*.

<sup>8</sup> The Australian Vice-chancellors' Committee reports that around two thirds of total higher education income is primarily for teaching purposes. AVCC, 2003, *The Sources Of University Income: The Facts*

<sup>9</sup> Borland, J., 2002, *New Estimates of the Private Rate of Return to University Education in Australia*, Melbourne Institute Working Paper No. 14/02 (page 6).

As part of assessing the benefits of a tertiary education, the earnings of individuals who have only completed year 12 are deducted from that of business students and tertiary students, to derive the income premium attributable to education. As such, an estimate of foregone earnings is included in the estimate of the income premium reported in section 5.3.

### 4.3 ESTIMATING THE DEADWEIGHT LOSS OF TAXATION

As described previously, raising taxation revenue to fund government activities comes at an additional cost to economic welfare referred to as the 'deadweight loss'. To the extent university and student costs have been financed through taxation, we have included this additional cost in the analysis.

For the purposes of this report, we have used a deadweight loss of 27.5 per cent of each tax dollar that is required to be collected. The Productivity Commission<sup>10</sup> used this estimate in a recent report, following an extensive review of the literature.

In particular, we have estimated the deadweight loss related to youth allowance received by students and government grants received by universities.

#### 4.3.1 YOUTH ALLOWANCE

The main income support available to full time students is youth allowance. While the quantum of youth allowance paid to students is a transfer between taxpayers and recipients, with no impact on aggregate social welfare, the deadweight loss of raising tax is a net cost to society.

The earnings figures derived from the Census include pensions and allowances such as youth allowance as part of total income.

Calculation of the deadweight loss of taxation related to youth allowance is shown in the table below. Not all students receive youth allowance as it is means tested. For the purpose of our representative business and tertiary graduates we have adjusted the average youth allowance payment for the proportion of students usually in receipt of the payment. According to the Department of Family and Community services<sup>11</sup>, around 31.5 per cent of full time students aged between 16 to 24 receive youth allowance.

<sup>10</sup> Productivity Commission 2003, *Evaluation of the Pharmaceutical Industry Investment Program* (page 6.15 to 6.16).

<sup>11</sup> Department of Family and Community Services *Annual Report 2003-04, Volume 2* (page 54).

**TABLE 4: DEADWEIGHT LOSS (DWL) OF TAX FOR YOUTH ALLOWANCE**

<b>Youth allowance</b>	
Total administered cost	\$2,257,447,000
No. of recipients (aged 16 to 24)	381,805
Average payment per annum	\$5,913
<i>times</i> % receiving payment (31.5%)	\$1,862
<i>times</i> deadweight loss percentage (27.5%) <i>equals</i>	
Deadweight loss of tax for youth allowance per student	\$512
<b>NPV undergraduate (3 years)</b>	<b>\$1,448</b>
<b>NPV postgraduate (5 years)</b>	<b>\$2,345</b>

### 4.3.2 UNIVERSITY GRANTS

To the extent the costs incurred by universities in providing education referred to in section 4.1 have been financed through taxation, there is also an additional deadweight loss associated with raising funds for government grants.

The Australian government reports that on average, it contributes about three quarters of the total funding for educational costs for Commonwealth supported students. However, the amount contributed differs across disciplines. Under the differentiated HECS regime that has operated since 1997, charges per band are based on differential course costs as well as expected future income earning potential. Compared to other disciplines, business students have contributed a relatively high proportion of the cost of their education through HECS charges.<sup>12</sup>

Actual costs per discipline are not readily available. However, analysis quoted by the Industry Commission assesses cost recovery across disciplines by comparing the HECS contribution to the Commonwealth recurrent funding level for teaching of each undergraduate discipline. On this basis, business students contributed around 68.8 per cent of their course cost (with the government contribution at 31.2 per cent). Similarly, law students were estimated to contribute around 80.5 per cent. At the other end of the spectrum, high cost courses such as medicine and veterinary science contributed around 30 per cent of the cost, with the government contributing the other 70 per cent.<sup>13</sup>

Similarly, taking the 2004 HECS charge for business students as a proportion of the estimated average cost per undergraduate student shown in section 4.1 gives a government-funded proportion of around 28%.<sup>14</sup>

<sup>12</sup> Following the method of authors such as Borland, we have assumed that HECS is paid up front to simplify the analysis. To the extent students defer HECS contributions or access a loan under the new HECS-HELP scheme, this will involve an additional cost to society. See Borland, J., 2002, *New Estimates of the Private Rate of Return to University Education in Australia*, Melbourne Institute Working Paper No. 14/02.

<sup>13</sup> Based on 1997 figures. See Industry Commission, 1997, *Submission to the Review of Higher Education Financing and Policy* (page 110).

<sup>14</sup> Equals average 2004 undergraduate cost of (\$7500-\$5,367)/\$7500.

However, with partial deregulation of higher education student fees from 1 January 2005, the proportion funded by students and government sources will differ over time, depending on pricing policies across universities and disciplines. Under the new system, universities can charge between \$0 and 25 per cent above the HECS fee for that discipline. As such, in the case of business courses in band 2, student fees may vary from \$0 to \$6,849.

For the purpose of calculating deadweight loss of taxation, we have assumed:

- The government contributes about 40% of the cost of an undergraduate business degree; and
- 75% of the cost of an undergraduate tertiary degree.

Postgraduate coursework degrees are often subject to full fees. For the purpose of our modelling of postgraduate studies, we have assumed that the student covers the full cost of postgraduate education.

Drawing on these parameters, calculation of the deadweight loss of taxation related to government funding of university grants per student (EFTSU) is shown in the table below.

**TABLE 5: DEADWEIGHT LOSS OF TAX, RELATED TO UNIVERSITY GRANTS**

	<b>Business u/grad</b>	<b>Tertiary u/grad</b>	<b>Business postgrad</b>	<b>Tertiary postgrad</b>
University cost of degree (NPV)	\$21,167	\$33,167	\$42,246	\$53,700
Proportion government funded	40%	75%	0%	0%
Amount government funded (NPV)	\$8,467	\$24,875	\$0	\$0
<i>times deadweight loss percentage (27.5%) equals</i>				
<b>Deadweight loss of tax related to university grants per student (NPV)</b>	<b>\$2,328</b>	<b>\$6,841</b>	<b>\$0</b>	<b>\$0</b>

## 4.4 ESTIMATING THE INCOME PREMIUM

In estimating the income premium attributable to a business education we have undertaken regression analysis to estimate future earnings for a year 12 student, a business education student and a tertiary education student, based on the ABS 2001 Census Household Sample File CURF.<sup>15</sup> The purpose of the regression analysis is to isolate the impact of education on earnings by controlling for other explanatory variables such as marital status, number of children, and proficiency in English. Attachment A contains more detail.

The ABS 2001 Census Household Sample File CURF contains a randomly selected sample of 1% of private dwellings, including their associated family and person records, and 1% of persons from all non-private dwellings. The Census, which was conducted on the night of 7 August 2001, collected information regarding various individual characteristics, individual employment status, hours worked, income and education – including field of study and highest non-school level of education obtained.

<sup>15</sup> In terms of the Census-based regression analysis, a 'business' undergraduate or postgraduate education is defined as the Census category 'Management and Commerce'. This report also includes results for a 'tertiary undergraduate' and 'tertiary postgraduate' education. These categories aggregate across all fields of study, excluding management and commerce.

For each gender, we estimated the impact of education on:

- 1 Whether the individual is employed (versus not employed),
- 2 Given that the individual is employed, how many hours does the individual work each week, and
- 3 Given that the individual is employed, how much does the individual earn per hour.

The variables and methodology used in each of the regressions was largely based on Borland.<sup>16</sup>

Three regressions were undertaken. Regression 1 was estimated using a probit model. Regression 2 was estimated using a tobit model (to take into account the censoring of hours worked per week at 49 hours) and Regression 3 was estimated using an ordinary least squares model.

Furthermore, the sample used for Regressions 2 and 3 was restricted to individuals who were employed (i.e. it is only possible to observe the individual's potential earnings or hours if they are employed). This sample selection can lead to bias if there is correlation between the unobservables in the employed equation and those in the hours and earnings equations. To account for this, Heckman's two-step estimation procedure was used in the earnings equation and the inverse Mill's ratio was included as a regressor in the hours equation.

Estimating the income premium attributable to a business and tertiary education involves a number of assumptions, including the following:

- ❑ Annual earnings – annual earnings for cohort are derived by multiplying weekly earnings by 52.
- ❑ Earnings while studying – The individual is taken to work the same hours and earn the same income per hour as that of the average full time student studying at university, as recorded in the census as shown below.

**TABLE 6: EMPLOYMENT, HOURS AND EARNINGS WHILE STUDYING**

	Males	Females
Employed	45.2%	54.1%
Hours Worked per Week	15.6	14.2
Earnings per Hour	\$19.16	\$18.94

- ❑ Age of education – the individual starts a 3-year bachelor degree at 18 years. If the individual undertakes a post-graduate degree it is assumed to take 5 years of continuous study, beginning at 18 years. The individual enters the workforce immediately after completing their education.
- ❑ Age of Retirement – 65 Years, based on the minimum age to receive the Age Pension. The modelling takes into account lower labour force participation before retirement.
- ❑ Productivity versus screening effects – 80% of income of a year 12 graduate and a tertiary graduate is attributed to the increased productivity from education, with the remaining 20% excluded, as it is attributed to the 'screening' effect.

<sup>16</sup> Borland, J., 2002, *New Estimates of the Private Rate of Return to University Education in Australia*, Melbourne Institute Working Paper No. 14/02.



- Future Real Wage Growth – This is conservatively estimated at 1.75% per annum, consistent with the long term projection of real wages growth used by the Commonwealth Government in the *2002-03 Intergenerational Report*.<sup>17</sup> This projection was based on the average rate of growth in labour productivity over the last 30 years.
- Future Unemployment Rate – In September quarter 2001 the unemployment rate was 6.9%. Based on Access Economics' Business Outlook, the forecasted unemployment rate over the next 10 years is 5.1% - thus total rate of employment has been increased by 1.9%.
- Discount rate – A real discount rate of 3% has been used, based on the estimated risk-free rate.

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<sup>17</sup> Commonwealth of Australia, 2002, 2002-03 Budget Paper No.5, Intergenerational Report 2002-03 (page 30).

## 5. RESULTS

### 5.1 RESULTS OF COST ANALYSIS

The table below summarises the economic costs of producing a business or tertiary graduate (NPV over 3 years for undergraduate and over 5 years for a postgraduate).

**TABLE 7: SUMMARY OF ECONOMIC COST PER GRADUATE (NPV)**

	<b>Business u/grad</b>	<b>Tertiary u/grad</b>	<b>Business postgrad</b>	<b>Tertiary postgrad</b>
University cost of degree	\$30,239	\$47,382	\$60,351	\$76,714
Direct student costs	\$8,082	\$8,082	\$13,085	\$13,085
DWL of tax related to youth allowance	\$2,069	\$2,069	\$3,350	\$3,350
Deadweight loss of tax related to university grants per student (NPV)	\$3,326	\$9,773	\$0	\$0
<b>Total economic cost (NPV)</b>	<b>\$43,716</b>	<b>\$67,305</b>	<b>\$76,786</b>	<b>\$93,149</b>

Results previously outlined in section 4 were on a per student basis. However, not all students complete their studies and receive a qualification. All values in the table above have been adjusted upwards to reflect the economic cost **per graduate**. While students not completing a course are likely to accrue benefits for themselves and society from increased productivity and earnings, these are excluded from our analysis. This reflects the fact that society expends resources educating more than one student, in order to produce one graduate.

The values in the table have been divided by 0.7, based on research by the Department of Education, Science and Training that final completion rates for undergraduates are around 70%<sup>18</sup>, to gross up the figures to account for non-completion. This non-completion estimate has been applied to undergraduate and postgraduate scenarios. However, to the extent completion rates are higher for postgraduate studies, our estimates will tend to over-estimate the economic cost per graduate.

### 5.2 RESULTS OF REGRESSION ANALYSIS

Attachment A contains more detail on the results of the regression analysis. The following gives a summary of the impact of the different education levels on the probability of employment, the number of hours worked and earnings per hour.

#### 5.2.1 IMPACT ON PROBABILITY OF EMPLOYMENT

Table 8 below summarises the effects of education on the probability of employment compared to an individual who does not complete year 12. By comparing these differences in probability of employment:

<sup>18</sup> Martin, Y. et al, *Undergraduate completion rates: An update*, 01/F Occasional Paper, Higher Education Group, Department of Education, Science and Training, December 2001.

- ❑ A business undergraduate degree increases the probability of employment by 12.7 percentage points for males and 15 percentage points for females, compared to those who complete year 12 only.
- ❑ A tertiary undergraduate degree increases the probability of employment by 8.3 percentage points for males and 15.7 percentage points for females compared to those who complete year 12 only.
- ❑ A business postgraduate degree increases the probability of employment by 5.8 percentage points for males and 15.7 percentage points for females, compared to those who complete year 12 only.
- ❑ A tertiary postgraduate degree increases the probability of employment by 8.5 percentage points for males and 21.3 percentage points for females, compared to those who complete year 12 only.

**TABLE 8: PROBABILITY EMPLOYED**

Education level	Increased probability of being employed (compared to not completing year 12)	
	Males	Females
Year 12 Only	5.7%	6.0%
Business undergraduate	18.4%	21.0%
Tertiary undergraduate	14.0%	21.7%
Business postgraduate	11.5%	21.7%
Tertiary postgraduate	14.2%	27.3%

### 5.2.2 IMPACT ON HOURS WORKED

Table 9 summarises the effects of education on hours worked if employed, compared to an individual who does not complete year 12. By comparing these differences in hours worked:

- ❑ A business undergraduate degree increases hours worked if employed by 4 hours for males and 7 hours points for females, compared to those who complete year 12 only.
- ❑ A tertiary undergraduate degree increases hours worked if employed by 2 hours for males and 4.7 hours for females, compared to those who complete year 12 only.
- ❑ A business postgraduate degree increases hours worked if employed by 5 hours for males and 7.9 hours for females, compared to those who complete year 12 only.
- ❑ A tertiary postgraduate degree increases hours worked if employed by 3.4 hours for males and 7.1 hours for females, compared to those who complete year 12 only.

**TABLE 9: HOURS WORKED**

Education level	Increased hours worked (compared to not completing year 12)	
	Males	Females
Year 12 Only	-0.317	1.252
Business undergraduate	3.709	8.288
Tertiary undergraduate	1.672	5.957
Business postgraduate	4.668	9.199
Tertiary postgraduate	3.081	8.369

### 5.2.3 IMPACT ON EARNINGS PER HOUR

Table 10 summarises the effects of education on earnings per hour compared to an individual who is still at school. By comparing these percentage increases of earnings per hour:

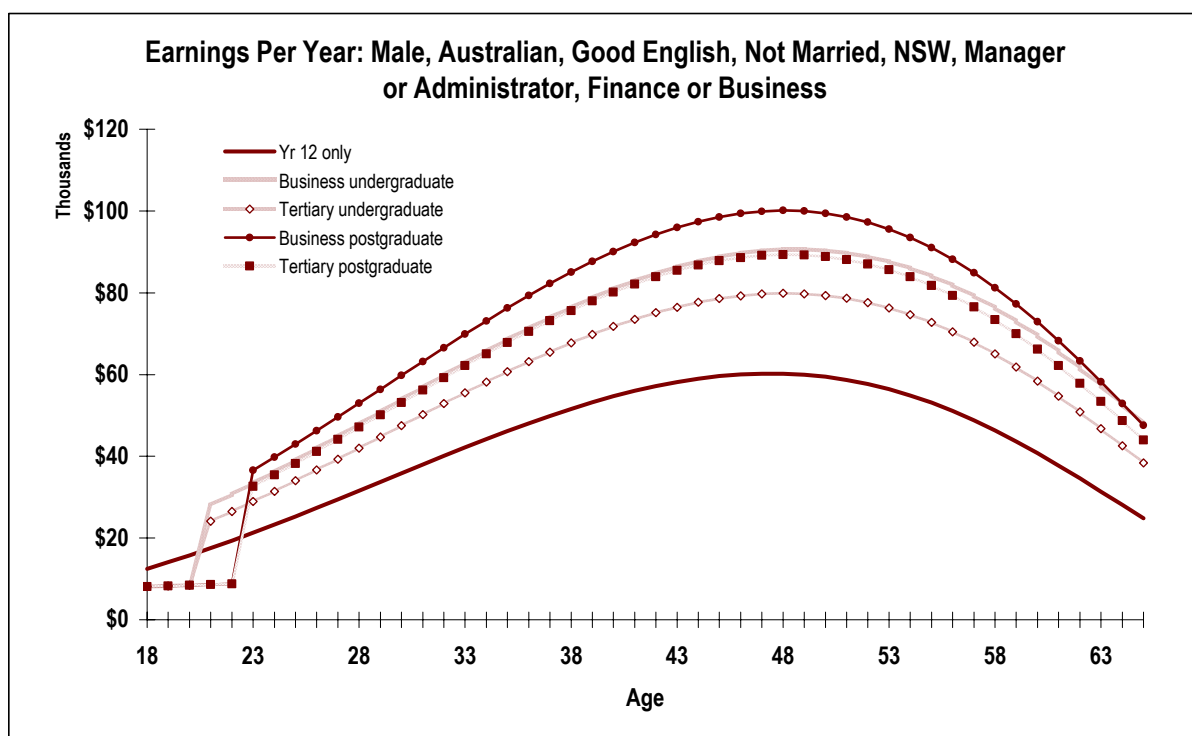
- ❑ A business undergraduate degree increases earnings by 38 percentage points for males and 29 percentage points for females compared to those who complete year 12 only.
- ❑ A tertiary undergraduate degree increases earnings by 28 percentage points for males and 28 percentage points for females compared to those who complete year 12 only.
- ❑ A business postgraduate degree increases earnings by 53 percentage points for males and 77 percentage points for females compared to those who complete year 12 only.
- ❑ A tertiary postgraduate degree increases earnings by 39 percentage points for males and 48 percentage points for females compared to those who complete year 12 only.

**TABLE 10: EARNINGS PER HOUR**

Education level	Increased earnings per hour (compared to not completing year 12)	
	Males	Females
Year 12 Only	15.0%	16.6%
Business undergraduate	52.6%	45.4%
Tertiary undergraduate	42.5%	44.5%
Business postgraduate	67.8%	93.4%
Tertiary postgraduate	53.9%	64.7%

Using the regression results, the expected earnings profile of individual cohorts can be estimated. Reflecting the detail in the underlying census data, the regression results are highly disaggregated, producing estimates by gender, occupation, English proficiency, marital status and other variables. Although similar relativities between education level are evident for other cohorts, the graph below illustrates results for an Australian male with good English, not married, working in NSW in the Finance or business sector as a manager or administrator.<sup>19</sup>

<sup>19</sup> The earnings profile for each level of education is derived from whole population based estimates. We have conducted separate analysis of earnings profiles for each education level. These yield a slightly different pattern, especially in the later years. However, the impact on overall results in NPV terms is negligible.



To isolate the impact of education on earnings, for both males and females who are Australian, speak good English, are not married, and have no children, a range of NPVs have been estimated by industry, state, occupation and schooling type. These have been weighted according to the distribution within each of these categories. This yields the following average estimates of earnings, and income premium compared to a year 12 education, by education level:

**TABLE 11: EARNINGS & INCOME PREMIUM COMPARED TO A YEAR 12 EDUCATION (\$NPV)<sup>20</sup>**

Education level	Males	Females	Persons
<b>Earnings over working life</b>			
Year 12 Only	838,049	716,275	773,335
Business undergraduate	1,397,738	1,206,456	1,315,845
Tertiary undergraduate	1,119,894	945,862	1,024,153
Business postgraduate	1,469,700	1,587,053	1,509,847
Tertiary postgraduate	1,136,449	1,096,669	1,120,569
<b>Income premium (compared to year 12)</b>			
Business undergraduate	559,689	490,181	542,509
Tertiary undergraduate	281,845	229,587	250,818
Business postgraduate	631,651	870,778	736,512
Tertiary postgraduate	298,400	380,394	347,234

As shown in the table above, a business education substantially increases earnings. Compared to completion of year 12 only, a business undergraduate degree increases

<sup>20</sup> The figures in the table above have already been adjusted to reflect the 20% 'screening' impact of education on wages, rather than the productivity enhancing effect. All results, including figures for postgraduate qualifications are against the benchmark of a high school education (year 12).

earnings by 70%, with a business postgraduate degree increasing earnings by 95%. The increase is less for a tertiary undergraduate degree and tertiary postgraduate degree which increase earnings by 32% and 45% respectively, compared to completion of year 12 only.

The finding that a business education enhances earnings by more than the composite of tertiary education overall (excluding business) reflects the fact that the return to a business education is relatively high compared to most other disciplines, such as arts and science. As similarly reported by Borland,<sup>21</sup>

*Rates of return show a wide variation across the field of qualification categories. The estimated returns are relatively high for business and administration, and engineering graduates, and relatively low for graduates in the fields of society and culture, and science.*

The income premium (above a year 12 education) is a measure of the economic benefit to society, in terms of the additional monetary value attributable to that education as measured by market wages. However, to some extent the differential between disciplines may reflect the fact that the market wages of some tertiary graduates (such as government employees) may not fully reflect the value of their work.

### 5.3 OVERALL COST-BENEFIT ANALYSIS

Based on the methodology outlined in this paper, the table below summarises the overall economic costs and benefits across education level per graduate.

**TABLE 12: OVERALL ECONOMIC COSTS AND BENEFITS PER GRADUATE (\$NPV)**

	Business u/grad	Tertiary u/grad	Business postgrad	Tertiary postgrad
University cost of degree	\$30,239	\$47,382	\$60,351	\$76,714
Direct student costs	\$8,082	\$8,082	\$13,084	\$13,084
DWL of tax related to youth allowance	\$2,069	\$2,069	\$3,350	\$3,350
DWL of tax related to university grants	\$3,326	\$9,773	\$0	\$0
<b>Total economic cost</b>	<b>\$43,716</b>	<b>\$67,305</b>	<b>\$76,786</b>	<b>\$93,149</b>
Income premium*	\$542,509	\$250,818	\$736,512	\$347,234
<b>Total economic benefit</b>	<b>\$542,509</b>	<b>\$250,818</b>	<b>\$736,512</b>	<b>\$347,234</b>
<b>Benefit-cost ratio (benefit/cost)</b>	<b>12.4</b>	<b>3.7</b>	<b>9.6</b>	<b>3.7</b>
<b>Net economic benefit</b>	<b>\$498,794</b>	<b>\$183,513</b>	<b>\$659,726</b>	<b>\$254,085</b>

\* Before income tax, compared to year 12 education. Includes income foregone while studying and income premium over working life.

The results show that a business education not only provides a significant net benefit to society against the benchmark of a year 12 education, but also against the benchmark of a tertiary qualification other than business.

In net present value terms, over a working life:

<sup>21</sup> Borland, J., 2002, *New Estimates of the Private Rate of Return to University Education in Australia*, Melbourne Institute Working Paper No. 14/02.



- ❑ the average business undergraduate qualification generates a net economic benefit of around \$498,794 per graduate.
- ❑ the average business postgraduate qualification generates a net economic benefit of over \$659,726 per graduate.

This compares to considerably lower net benefits of around \$183,513 for the average tertiary undergraduate qualification and \$254,085 for the average tertiary postgraduate qualification.

The ratio of benefits to costs ranges from 3.7 for a tertiary undergraduate and a tertiary postgraduate qualification, to 12.4 for a business undergraduate qualification.

These results reflect the finding that, relative to other disciplines, business education has been traditionally delivered at a low cost, with business graduates achieving lifetime earnings that are relatively high compared to other fields of tertiary study, and a year 12 education.

## 5.4 SENSITIVITY ANALYSIS

As is the case with analysis of this type, the conclusions are based on a number of key assumptions and parameters. We have conducted analysis to test the sensitivity of the results to changes in the value of major parameters.

The results are more sensitive to the quantum of the lifetime income premium, rather than the up front costs associated with the investment in education. For example, if the total economic costs of a business undergraduate education were assumed to be 50% higher, this would only decrease the net benefit by around 12%.

In particular, as the income premium accrues in the future over a 45 year period, the results are sensitive to assumptions regarding future real wage growth and the rate applied to discount future values into net present values.

To test the robustness of results, sensitivity analysis was conducted around individual parameters (holding all other parameters constant). The tables below show the impact on net economic benefit for specified changes to:

- ❑ real wages;
- ❑ the real discount rate;
- ❑ the proportion of income attributable to education, rather than the 'screening effect'; and
- ❑ the economic costs associated with business and tertiary studies.

As shown below, benefit cost ratios vary with these different parameters. For example, the benefit cost ratio for a business undergraduate education varies from 8.1 to 13.9.



**TABLE 13: SENSITIVITY - REAL WAGE GROWTH OF 1.5% P.A. (INSTEAD OF 1.75% P.A.)**

	<b>Business u/grad</b>	<b>Tertiary u/grad</b>	<b>Business postgrad</b>	<b>Tertiary postgrad</b>
Total economic cost	\$43,716	\$67,306	\$76,785	\$93,148
Total economic benefit	\$512,227	\$236,676	\$694,177	\$326,502
Benefit-cost ratio (benefit/cost)	11.7	3.5	9.0	3.5
Net economic benefit	<b>\$468,511</b>	<b>\$169,370</b>	<b>\$617,392</b>	<b>\$233,354</b>

**TABLE 14: SENSITIVITY - REAL WAGE GROWTH OF 2.0% P.A. (INSTEAD OF 1.75% P.A.)**

	<b>Business u/grad</b>	<b>Tertiary u/grad</b>	<b>Business postgrad</b>	<b>Tertiary postgrad</b>
Total economic cost	\$43,716	\$67,306	\$76,785	\$93,148
Total economic benefit	\$574,962	\$265,974	\$781,859	\$369,476
Benefit-cost ratio (benefit/cost)	13.2	4.0	10.2	4.0
Net economic benefit	<b>\$531,246</b>	<b>\$198,668</b>	<b>\$705,074</b>	<b>\$276,328</b>

**TABLE 15: SENSITIVITY - REAL DISCOUNT RATE OF 4% P.A. (INSTEAD OF 3% P.A.)**

	<b>Business u/grad</b>	<b>Tertiary u/grad</b>	<b>Business postgrad</b>	<b>Tertiary postgrad</b>
Total economic cost	\$42,864	\$66,032	\$74,444	\$90,548
Total economic benefit	\$434,935	\$200,582	\$586,044	\$273,700
Benefit-cost ratio (benefit/cost)	10.1	3.0	7.9	3.0
Net economic benefit	<b>\$392,071</b>	<b>\$134,551</b>	<b>\$511,599</b>	<b>\$183,152</b>

**TABLE 16: SENSITIVITY - 90% OF INCOME DUE TO EDUCATION (INSTEAD OF 80%)**

	<b>Business u/grad</b>	<b>Tertiary u/grad</b>	<b>Business postgrad</b>	<b>Tertiary postgrad</b>
Total economic cost	\$43,716	\$67,306	\$76,785	\$93,148
Total economic benefit	\$607,194	\$279,011	\$823,458	\$385,497
Benefit-cost ratio (benefit/cost)	13.9	4.1	10.7	4.1
Net economic benefit	<b>\$563,478</b>	<b>\$211,705</b>	<b>\$746,673</b>	<b>\$292,349</b>



TABLE 17: SENSITIVITY - 70% OF INCOME DUE TO EDUCATION (INSTEAD OF 80%)

	Business u/grad	Tertiary u/grad	Business postgrad	Tertiary postgrad
Total economic cost	\$43,716	\$67,306	\$76,785	\$93,148
Total economic benefit	\$477,825	\$222,625	\$649,566	\$308,971
Benefit-cost ratio (benefit/cost)	10.9	3.3	8.5	3.3
Net economic benefit	<b>\$434,109</b>	<b>\$155,319</b>	<b>\$572,781</b>	<b>\$215,823</b>

TABLE 18: SENSITIVITY - 90% OF INCOME DUE TO EDUCATION FOR YEAR 12; 80% OF INCOME DUE TO EDUCATION FOR ABOVE YEAR 12)<sup>22</sup>

	Business u/grad	Tertiary u/grad	Business postgrad	Tertiary postgrad
Total economic cost	\$43,716	\$67,306	\$76,785	\$93,148
Total economic benefit	\$445,843	\$154,151	\$639,845	\$250,567
Benefit-cost ratio (benefit/cost)	10.2	2.3	8.3	2.7
Net economic benefit	<b>\$402,127</b>	<b>\$86,845</b>	<b>\$563,060</b>	<b>\$157,419</b>

TABLE 19: SENSITIVITY – ECO. COSTS THE SAME ACROSS BUSINESS AND TERTIARY DISCIPLINES<sup>23</sup>

	Business u/grad	Tertiary u/grad	Business postgrad	Tertiary postgrad
Total economic cost	\$67,306	\$67,306	\$93,148	\$93,148
Total economic benefit	\$542,509	\$250,818	\$736,512	\$347,234
Benefit-cost ratio (benefit/cost)	8.1	3.7	7.9	3.7
Net economic benefit	<b>\$475,203</b>	<b>\$183,512</b>	<b>\$643,364</b>	<b>\$254,086</b>

<sup>22</sup> This scenario assumes that tertiary education involves a greater 'screening effect' than a year 12 education. That is, while 90% of earnings of those with a year 12 education are attributed to education, only 80% of earnings of those with a business education or tertiary education are attributed to education. In the base case, 80% of earnings are attributed to education, across all education levels.

<sup>23</sup> In this scenario we have assumed the economic costs of a business education are the same as the (higher) costs of a tertiary education other than business. As well as showing the sensitivity to economic costs across the discipline groups, it may be more reflective of costs where postgraduate business students have undertaken an undergraduate degree in a discipline other than business.

## 6. CONCLUSIONS

As reflected in the estimates contained in this report, business education results in a considerable net economic benefit to the nation.

The source of economic value to society from a business education is higher productivity and lifetime earnings, with the benefit being shared mainly between the student and government. However, there are costs associated with providing that education, such as the costs of provision incurred by universities, and student fees and income foregone by students while studying.

Taking into account economic costs and benefits, a business education not only provides a significant net benefit against the benchmark of a year 12 education, but also against the benchmark of a tertiary qualification other than business.

This study finds that in net present value terms, over a working life:

- ❑ the average business undergraduate qualification generates a net economic benefit of around \$498,794 per graduate.
- ❑ the average business postgraduate qualification generates a net economic benefit of over \$659,726 per graduate.

This compares to considerably lower net benefits of around \$183,513 for the average tertiary undergraduate qualification and \$254,085 for the average tertiary postgraduate qualification.

The ratio of benefits to costs ranges from 3.7 for a tertiary undergraduate and a tertiary postgraduate qualification, to 12.4 for a business undergraduate qualification.

Sensitivity analysis shows that cost ratios vary with different parameters - for example, the benefit cost ratio for a business undergraduate education varies from 8.1 to 13.9.

Overall, the results above reflect the finding that, relative to other disciplines, business education has been traditionally delivered at a low cost, with business graduates achieving lifetime earnings that are relatively high compared to other fields of tertiary study, and a year 12 education.



## **7. ATTACHMENT A – REGRESSION ANALYSIS DETAIL**

This attachment contains further detail as to the Census data used for the regression analysis and relevant results.

### **7.1 CENSUS DATA DESCRIPTION**

The Census, was conducted on the night of 7 August 2001. Information was collected regarding various individual characteristics, individual employment status, hours worked, income and education – including field of study and highest non-school level of education obtained.

The ABS 2001 Census Household Sample File CURF contains a randomly selected sample of 1% of private dwellings, including their associated family and person records, and 1% of persons from all non-private dwellings. This amounts to 188,013 individual records, of which 152,063 were aged 15 or older (which the study focused on).

TABLE 7-1 2001 CENSUS MNEMONICS

Mnemonic	Description	Details
<b>General Characteristics</b>		
SEXP	Sex	1 Male 2 Female
AGEP	Age	Continuous between 0-24 then 25-29 years (midpoint: 27) 30-34 years (midpoint: 32) 35-39 years (midpoint: 37) 40-44 years (midpoint: 42) 45-49 years (midpoint: 47) 50-54 years (midpoint: 52) 55-59 years (midpoint: 57) 60-64 years (midpoint: 62) 65-69 years (midpoint: 67) 70-74 years (midpoint: 72) 75-79 years (midpoint: 77) 80-84 years (midpoint: 82) 85 years and over (87)
BPLP	Birthplace of Individual	Australian (11 Australia) Immigrant ESB (12 New Zealand, 21 United Kingdom, 22 Ireland, 81 North America) Immigrant NESB (10, 13-16, 20, 23-24, 30-33, 40-42, 50-52, 60-62, 70-72, 80, 82-84, 90-92)
ENGP01	Proficiency in spoken English/language	Good (1 Speaks English only, 2 Very well, 3 Well) Poor (4 Not well, 5 Not at all) Not stated (6, 7 and 8)
STEUCP	State of usual residence Census Night	1 New South Wales 2 Victoria 3 Queensland 4 South Australia 5 Western Australia Tasmania/Northern Territory/Australian Capital Territory/Other Territories (6,7,8,9)
<b>Employment Variables</b>		
LFSP	Labour Force Status	Employed (1 Employee, 2 Employer, 3 Own account worker or 4 Contributing family worker) Not Employed (5 Unemployed looking for full-time work, 6 Unemployed looking for part-time work, 7 Not in the labour force)
HRSP	Hours worked	1 None (midpoint: 0) 2 1-15 hours (midpoint: 8) 3 16-24 hours (midpoint: 20) 4 25-34 hours (midpoint: 29.5) 5 35-39 hours (midpoint: 37) 6 40 hours (midpoint: 40) 7 41-48 hours (midpoint: 44.5) 8 49 or more hours (midpoint: 49)
INCP	Individual Income (weekly)	***



Mnemonic	Description	Details
OCCP	Occupation	1 Managers & Administrators 2 Professionals 3 Associate Professionals 4 Tradespersons 5 Advanced Clerical & Service 6 Intermediate Clerical, Sales & Service 7 Intermediate Production & Transport 8 Elementary Clerical, Sales & Service 9 Labourers
INDP	Industry employment of	1 Agriculture 2 Mining 3 Manufacturing 4 Electricity, Gas & Water Supply 5 Construction Wholesale & Retail Trade (6, 7, 8) 9 Transport & Storage 10 Communication Services Finance, Insurance, Property & Business (11, 12) 13 Government Administration and Defence Education, Health & Community Services (14, 15) Recreational and Other (16, 17)

**Education Variables**

HSCP	Highest level of schooling completed	Year 12 (7 Year 12 or equivalent) Not Year 12 (1 Still at school, 2 Did not go to school, 3 Year 8 or below, 4 Year 9 or equivalent, 5 Year 10 or equivalent, 6 Year 11 or equivalent)
QALLP	Non-school qualification: level of education	1 Postgraduate Degree Level 2 Graduate Diploma & Graduate Certificate Level 3 Bachelor Degree Level 4 Advanced Diploma and Diploma Level 5 Certificate Level
QALFP	Non-school qualification: field of study	Management & Commerce (08 Management and Commerce) Non management & Commerce (01 Natural and Physical Sciences, 02 Information Technology, 03 Engineering and Related Technologies, 04 Architecture and Building, 05 Agriculture, Environmental and Related Studies, 06 Health, 07 Education, 09 Society and Culture, 10 Creative Arts, 11 Food, Hospitality and Personal Services, 12 Mixed Field Programmes)
STUP	Full/part-time student status	1 Not attending 2 Full-time student 3 Part-time student
TYPF	Type of educational institution attending	University (09 University or other Tertiary Institutions) Non-University (01 Pre-school, 02 Infants/ Primary-Government, 03 Infants/ Primary-Catholic, 04 Infants/ Primary-Other Non Government, 05 Secondary-Government, 06 Secondary-Catholic, 07 Secondary-Other Non Government, 08 Technical or Further Educational Institution (including TAFE Colleges), 10 Other)



As shown above, in terms of the Census-based regression analysis, a 'business' undergraduate or postgraduate education is defined as the Census category 'Management and Commerce'. This report also includes results for a 'tertiary undergraduate' and 'tertiary postgraduate' education (also referred to as non-management and commerce). These categories aggregate across all fields of study, excluding management and commerce.

In the 2001 Census, answers regarding individual income were stated in ranges. In order to estimate household and family income the ABS imputed individual income from these ranges. This study also used these rates of imputed income.

On the other hand, family income is reported in ranges (differing from the ranges used to report individual income). Consequently income was imputed based on the middle point between each income ranges and the income for the top range was based on the ratio between the imputed income and top range for individual income estimates.

**TABLE 7-2 IMPUTED INDIVIDUAL INCOME (INCP)**

<b>Range Identifier</b>	<b>Range</b>	<b>Imputed Income</b>
1	Negative income	\$0
2	Nil income	\$0
3	\$1 - \$39	\$15
4	\$40 - \$79	\$60
5	\$80 - \$119	\$100
6	\$120 - \$159	\$150
7	\$160 - \$199	\$180
8	\$200 - \$299	\$246
9	\$300 - \$399	\$349
10	\$400 - \$499	\$449
11	\$500 - \$599	\$548
12	\$600 - \$699	\$654
13	\$700 - \$799	\$750
14	\$800 - \$999	\$887
15	\$1,000 - \$1,499	\$1,154
16	\$1,500 or more	\$1,831

2001 Census of Population and Housing - 2001 Census Working Paper - Fact Sheet: Income Imputation

**TABLE 7-3 IMPUTED FAMILY INCOME (FINF)**

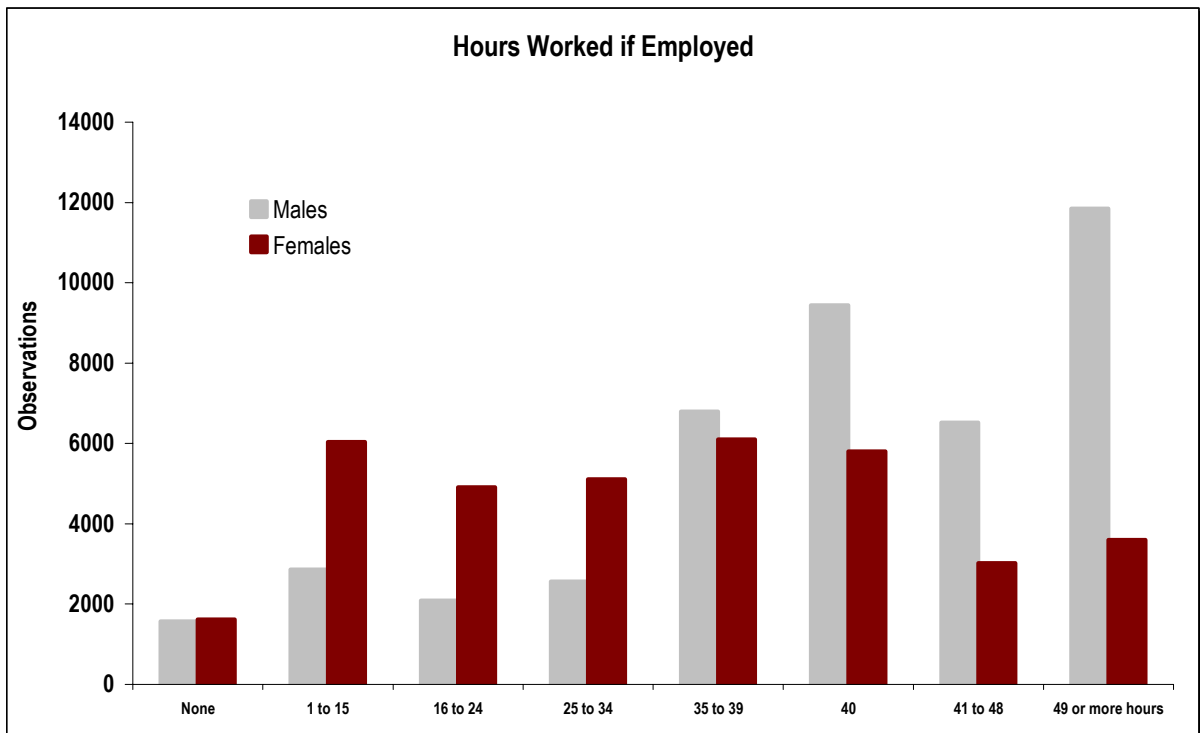
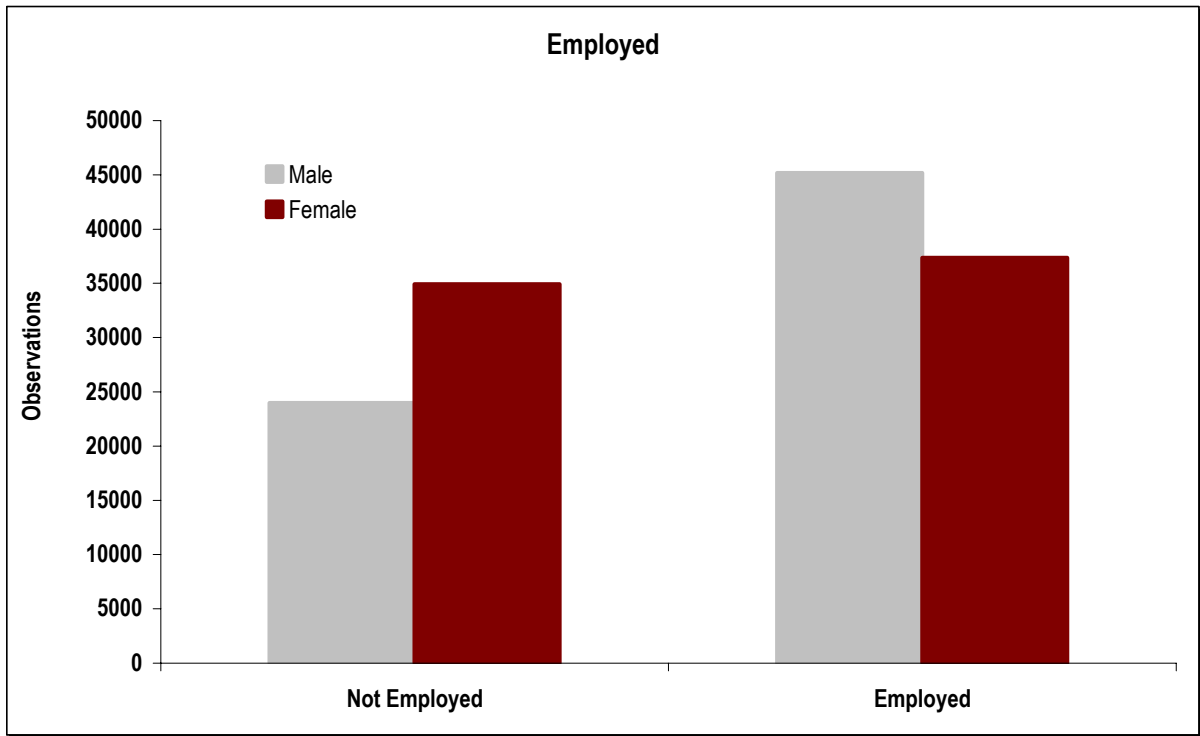
Range Identifier	Range	Imputed Income
1	Negative income	\$0
2	Nil income	\$0
3	\$1 - \$39	\$15
4	\$40 - \$79	\$60
5	\$80 - \$119	\$100
6	\$120 - \$159	\$150
7	\$160 - \$199	\$180
8	\$200 - \$299	\$250
9	\$300 - \$399	\$350
10	\$400 - \$499	\$450
11	\$500 - \$599	\$550
12	\$600 - \$699	\$650
13	\$700 - \$799	\$750
14	\$800 - \$999	\$900
15	\$1,000 - \$1,199	\$1,100
16	\$1,200 - \$1,499	\$1,350
17	\$1,500 - \$1,999	\$1,750
18	\$2,000 or more	\$2,441

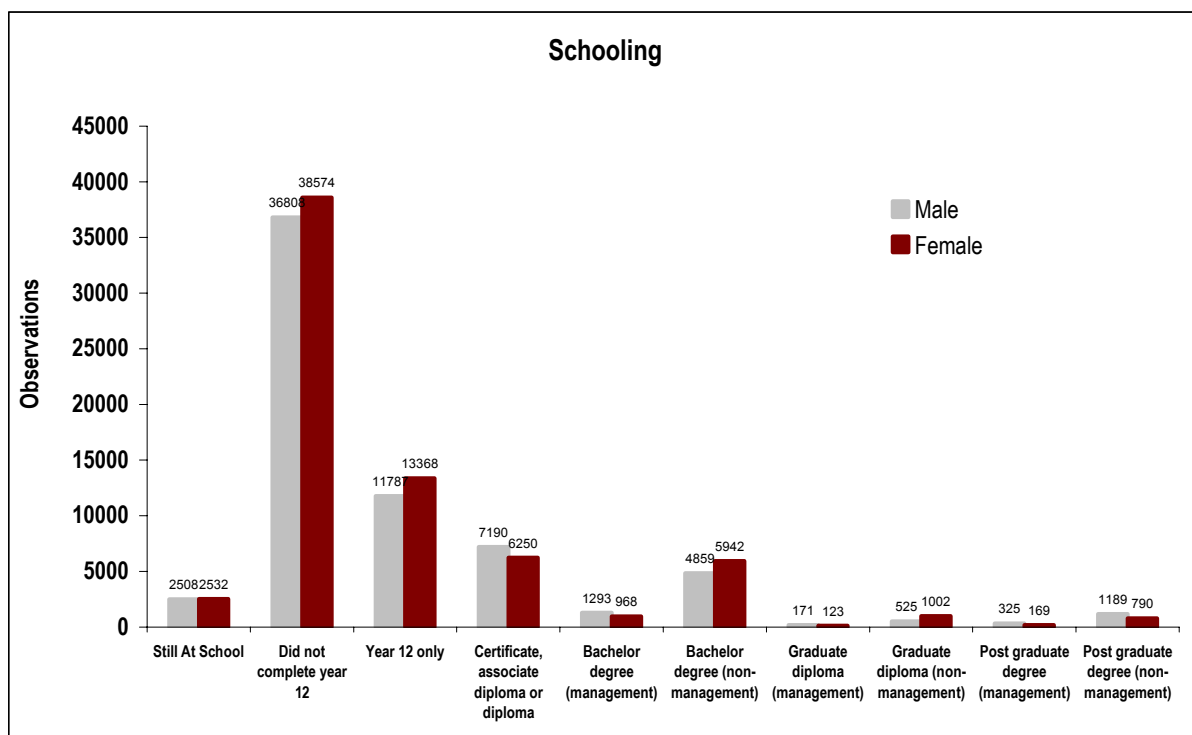
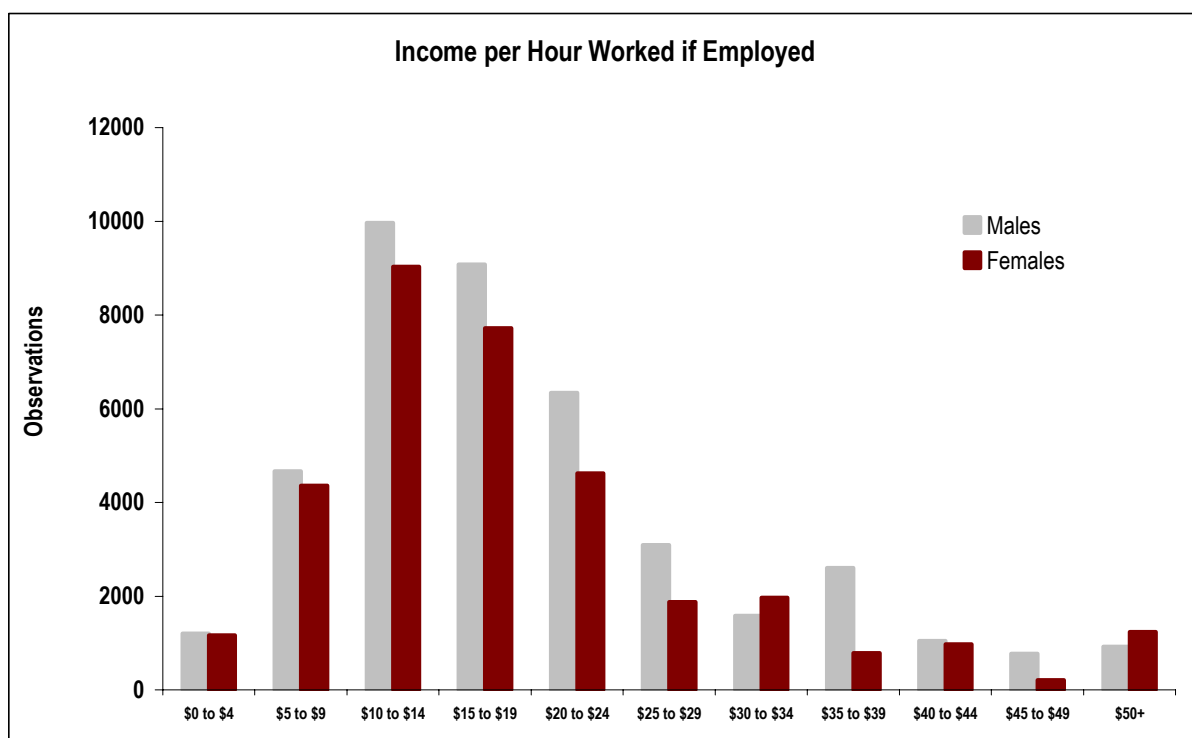
**TABLE 7-4: DATA DESCRIPTION - AVERAGES**

	Given Age >= 15		Given Employed and Age >= 15	
	Male	Female	Male	Female
Sex	49%	51%	55%	45%
<b>General Characteristics</b>				
Age	42.672	44.229	39.360	38.142
AgeSq	2143.158	2314.377	1715.318	1610.732
Immigrant - Australian	0.726	0.731	0.748	0.765
Immigrant - ESB	0.109	0.103	0.110	0.103
Immigrant - NESB	0.165	0.166	0.143	0.133
English - Poor	0.025	0.035	0.013	0.011
Married	0.605	0.578	0.657	0.624
State - NSW	0.337	0.337	0.333	0.332
State - VIC	0.250	0.252	0.253	0.249
State - QLD	0.187	0.186	0.190	0.189
State - WA	0.098	0.096	0.101	0.100
State - SA	0.078	0.080	0.075	0.076
State - TAS/NT/ACT	0.049	0.050	0.050	0.054
<b>Employment</b>				
Employed	0.653	0.517	1.000	1.000
Hours	37.535	29.448	37.535	29.448
Income per Hour	20.933	20.106	20.933	20.106
Industry - Agriculture	0.051	0.026	0.051	0.026
Industry - Mining	0.014	0.003	0.014	0.003
Industry - Manufacturing	0.165	0.075	0.165	0.075



Industry - Electricity, Gas & Water	0.012	0.003	0.012	0.003
Industry - Construction	0.110	0.019	0.110	0.019
Industry – Wholesale & Retail Trade	0.239	0.274	0.239	0.274
Industry - Transport & Storage	0.059	0.026	0.059	0.026
Industry - Communication	0.022	0.014	0.022	0.014
Industry – Finance & Business	0.143	0.162	0.143	0.162
Industry - Government and Defence	0.045	0.044	0.045	0.044
Industry - Education, Health & Community	0.080	0.286	0.080	0.286
Industry - Recreational and Other	0.060	0.067	0.060	0.067
Occupation - Managers & Administrators	0.119	0.058	0.119	0.058
Occupation - Professionals	0.161	0.217	0.161	0.217
Occupation - Associate Professionals	0.124	0.114	0.124	0.114
Occupation - Tradespersons	0.207	0.032	0.207	0.032
Occupation - Advanced Clerical & Service	0.007	0.075	0.007	0.075
Occupation - Intermediate Clerical, Sales & Service	0.088	0.267	0.088	0.267
Occupation - Intermediate Production & Transport	0.130	0.025	0.130	0.025
Occupation - Elementary Clerical, Sales & Service	0.062	0.139	0.062	0.139
Occupation - Labourers	0.101	0.073	0.101	0.073
<b>Education</b>				
Schooling - Still At School	0.038	0.036	0.014	0.024
Schooling - Did not complete year 12	0.552	0.553	0.509	0.444
Schooling - Year 12 only	0.177	0.192	0.187	0.216
Schooling - Certificate, associate diploma or diploma	0.108	0.090	0.128	0.121
Schooling - Bachelor degree (management)	0.019	0.014	0.026	0.021
Schooling - Bachelor degree (non-management)	0.073	0.085	0.093	0.127
Schooling - Graduate diploma (management)	0.003	0.002	0.004	0.003
Schooling - Graduate diploma (non-management)	0.008	0.014	0.010	0.022
Schooling - Post graduate degree (management)	0.005	0.002	0.006	0.004
Schooling - Post graduate degree (non-management)	0.018	0.011	0.022	0.018
<b>Other</b>				
Lambda			0.376	0.534
Number of children under 3		0.086		0.073
Number of children under 15		0.369		0.434
Partner Income		336.269		457.110





The variables and methodology used in each of the regressions was largely based on that of Borland<sup>24</sup>. However:

<sup>24</sup> Borland, J., 2002, *New Estimates of the Private Rate of Return to University Education in Australia*, Melbourne Institute Working Paper No. 14/02.

- ❑ Age was used as a proxy for the number of years of labour market experience;
- ❑ Birthplace of individual was used as a proxy for Immigrant – ESB and Immigrant – NESB;
- ❑ Individuals who were still at school or did not complete year 12 were combined into one category;
- ❑ Information about the size of the employing firm, whether the individual has a disability, and whether the individual is a trade union member (which was reported as insignificant by Borland) were excluded due to these questions not being asked in the census; and
- ❑ Based on Chapman and Gray<sup>25</sup>, each Regressions 1 and 2 included three additional variables: number of children aged 3 or younger, number of children aged 15 or younger, and family income minus individual income (as a proxy for partner income).

Regression 1 was estimated using a probit model. Regression 2 was estimated using a tobit model (to take into account the censoring of hours worked per week at 49 hours) and Regression 3 was estimated using an ordinary least squares model.

Furthermore, the sample used for Regressions 2 and 3 was restricted to individuals who were employed (i.e. it is only possible to observe the individual's potential earnings or hours if they are employed). This sample selection can lead to bias if there is correlation between the unobservables in the employed equation and those in the hours and earnings equations. To account for this, Heckman's two-step estimation procedure was used in the earnings equation and the inverse Mill's ratio was included as a regressor in the hours equation.

We conducted tests on the impact of introducing interaction effects between each of the education variables and age and aged<sup>2</sup>. Although jointly significant, the impact on overall results in NPV terms is negligible.

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<sup>25</sup> Chapman, B. and Gray, M., 2001, *Foregone earnings from child rearing: Changes between 1986 and 1997*, in *Family Matters*, Number 58, Australian Institute of Family Studies.

**TABLE 7-5: EMPLOYED, PROBIT REGRESSION**

<b>Males</b>	<b>Females</b>
Constant	Constant
Age	Age
Age-squared	Age-squared
Birthplace of individual (Immigrant – ESB, Immigrant – NESB)	Birthplace of individual (Immigrant – ESB, Immigrant – NESB)
Proficiency in spoken English/language (Poor)	Proficiency in spoken English/language (Poor)
Social Marital Status (Married)	Social Marital Status (Married)
State of usual residence on census night (VIC, QLD, WA, SA, TAS/NT/WA)	State of usual residence on census night (VIC, QLD, WA, SA, TAS/NT/WA)
Schooling:	Schooling:
Year 12 only,	Year 12 only,
Year 12 and certificate, associate diploma, or diploma,	Year 12 and certificate, associate diploma, or diploma,
Year 12 and bachelor degree (management)	Year 12 and bachelor degree (management)
Year 12 and bachelor degree (non-management)	Year 12 and bachelor degree (non-management)
Year 12 and graduate diploma (management)	Year 12 and graduate diploma (management)
Year 12 and graduate diploma (non-management)	Year 12 and graduate diploma (non-management)
Year 12 and post graduate degree (management)	Year 12 and post graduate degree (management)
Year 12 and post graduate degree (non-management)	Year 12 and post graduate degree (non-management)
	Number of Children aged 3 or younger
	Number of Children aged >3 and < 15
	Natural Log of Family income (weekly) – Individual income

The omitted category is an Australian with good English, living in NSW on census night, who did not complete year 12 (and is not married – for female regression).

**TABLE 7-6: HOURS WORKED, TOBIT REGRESSION**

Males	Females
Constant	Constant
Age	Age
Age-squared	Age-squared
Birthplace of individual (Immigrant – ESB, Immigrant – NESB)	Birthplace of individual (Immigrant – ESB, Immigrant – NESB)
Proficiency in spoken English/language (Poor)	Proficiency in spoken English/language (Poor)
Social Marital Status (Married)	Social Marital Status (Married)
State of usual residence on census night (VIC, QLD, WA, SA, TAS/NT/WA)	State of usual residence on census night (VIC, QLD, WA, SA, TAS/NT/WA)
Schooling:	Schooling:
Did not complete year 12,	Did not complete year 12,
Year 12 only,	Year 12 only,
Year 12 and certificate, associate diploma, or diploma,	Year 12 and certificate, associate diploma, or diploma,
Year 12 and bachelor degree (management)	Year 12 and bachelor degree (management)
Year 12 and bachelor degree (non-management)	Year 12 and bachelor degree (non-management)
Year 12 and graduate diploma (management)	Year 12 and graduate diploma (management)
Year 12 and graduate diploma (non-management)	Year 12 and graduate diploma (non-management)
Year 12 and post graduate degree (management)	Year 12 and post graduate degree (management)
Year 12 and post graduate degree (non-management)	Year 12 and post graduate degree (non-management)
Occupation	Occupation
Professionals	Professionals
Associate Professionals	Associate Professionals
Tradespersons	Tradespersons
Advanced Clerical & Service	Advanced Clerical & Service
Intermediate Clerical, Sales & Service	Intermediate Clerical, Sales & Service
Intermediate Production & Transport	Intermediate Production & Transport
Elementary Clerical, Sales & Service	Elementary Clerical, Sales & Service
Labourers	Labourers
Industry of employment	Industry of employment
Mining	Mining
Manufacturing	Manufacturing
Electricity, Gas & Water Supply	Electricity, Gas & Water Supply
Construction	Construction
Wholesale & Retail Trade	Wholesale & Retail Trade
Transport & Storage	Transport & Storage
Communication Services	Communication Services
Finance, Insurance, Property & Business	Finance, Insurance, Property & Business
Government Administration and Defence	Government Administration and Defence
Education, Health & Community Services	Education, Health & Community Services
Recreational and Other	Recreational and Other
	Number of Children aged 3 or younger
	Number of Children aged >3 and < 15
	Social Marital Status (Married)
	Natural Log of Family income (weekly) – Individual income

The omitted category is an Australian with good English, living in NSW on census night, who did not complete year 12, is employed as a manager or administrator, in the agriculture, forestry and fishing industry (and is not married – for female regression).

**TABLE 7-7 INDIVIDUAL WEEKLY INCOME (NATURAL LOG), ORDINARY LEAST SQUARES**

Males	Females
Constant	Constant
Age	Age
Age-squared	Age-squared
Birthplace of individual (Immigrant – ESB, Immigrant – NESB)	Birthplace of individual (Immigrant – ESB, Immigrant – NESB)
Proficiency in spoken English/language (Poor)	Proficiency in spoken English/language (Poor)
Social Marital Status (Married)	Social Marital Status (Married)
State of usual residence on census night (VIC, QLD, WA, SA, TAS/NT/WA)	State of usual residence on census night (VIC, QLD, WA, SA, TAS/NT/WA)
Schooling:	Schooling:
Did not complete year 12,	Did not complete year 12,
Year 12 only,	Year 12 only,
Year 12 and certificate, associate diploma, or diploma,	Year 12 and certificate, associate diploma, or diploma,
Year 12 and bachelor degree (management)	Year 12 and bachelor degree (management)
Year 12 and bachelor degree (non-management)	Year 12 and bachelor degree (non-management)
Year 12 and graduate diploma (management)	Year 12 and graduate diploma (management)
Year 12 and graduate diploma (non-management)	Year 12 and graduate diploma (non-management)
Year 12 and post graduate degree (management)	Year 12 and post graduate degree (management)
Year 12 and post graduate degree (non-management)	Year 12 and post graduate degree (non-management)
Occupation	Occupation
Professionals	Professionals
Associate Professionals	Associate Professionals
Tradespersons	Tradespersons
Advanced Clerical & Service	Advanced Clerical & Service
Intermediate Clerical, Sales & Service	Intermediate Clerical, Sales & Service
Intermediate Production & Transport	Intermediate Production & Transport
Elementary Clerical, Sales & Service	Elementary Clerical, Sales & Service
Labourers	Labourers
Industry of employment	Industry of employment
Mining	Mining
Manufacturing	Manufacturing
Electricity, Gas & Water Supply	Electricity, Gas & Water Supply
Construction	Construction
Wholesale & Retail Trade	Wholesale & Retail Trade
Transport & Storage	Transport & Storage
Communication Services	Communication Services
Finance, Insurance, Property & Business	Finance, Insurance, Property & Business
Government Administration and Defence	Government Administration and Defence
Education, Health & Community Services	Education, Health & Community Services
Recreational and Other	Recreational and Other

The omitted category is an Australian with good English, living in NSW on census night, who did not complete year 12, is employed as a manager or administrator, in the agriculture, forestry and fishing industry.



## 7.2 DETAILED RESULTS

TABLE 7-8: PROBABILITY EMPLOYED

Explanatory Variable	Coefficient	Z-Statistic	Education increases probability of being employed by
<b>Males</b>			
Year 12 Only	0.310	18.680	5.7%
Year 12 and bachelor degree (management)	0.774	13.969	18.4%
Year 12 and bachelor degree (non-management)	0.575	21.189	14.0%
Year 12 and post graduate degree (management)	0.526	5.210	11.5%
Year 12 and post graduate degree (non-management)	0.612	11.579	14.2%
<b>Females</b>			
Year 12 Only	0.330	21.963	6.0%
Year 12 and bachelor degree (management)	0.741	14.293	21.0%
Year 12 and bachelor degree (non-management)	0.717	32.363	21.7%
Year 12 and post graduate degree (management)	0.766	5.952	21.7%
Year 12 and post graduate degree (non-management)	0.919	15.495	27.3%



TABLE 7-9: HOURS WORKED

Explanatory Variable	Coefficient	Z-Statistic	Education increases hours worked by
<b>Males</b>			
Year 12 Only	0.476	1.660	-0.317
Year 12 and bachelor degree (management)	4.354	6.948	3.709
Year 12 and bachelor degree (non-management)	2.256	5.300	1.672
Year 12 and post graduate degree (management)	5.382	5.011	4.668
Year 12 and post graduate degree (non-management)	3.755	5.708	3.081
<b>Females</b>			
Year 12 Only	4.818	13.944	1.252
Year 12 and bachelor degree (management)	11.947	15.494	8.288
Year 12 and bachelor degree (non-management)	9.039	15.478	5.957
Year 12 and post graduate degree (management)	13.002	8.759	9.199
Year 12 and post graduate degree (non-management)	12.057	13.506	8.369

**TABLE 7-10: EARNINGS PER HOUR**

Explanatory Variable	Coefficient	Z-Statistic	Education increases earnings per hour by
<b>Males</b>			
Year 12 Only	0.140	12.823	15.0%
Year 12 and bachelor degree (management)	0.423	18.345	52.6%
Year 12 and bachelor degree (non-management)	0.354	22.094	42.5%
Year 12 and post graduate degree (management)	0.517	13.766	67.8%
Year 12 and post graduate degree (non-management)	0.431	17.551	53.9%
<b>Females</b>			
Year 12 Only	0.153	14.983	16.6%
Year 12 and bachelor degree (management)	0.374	14.486	45.4%
Year 12 and bachelor degree (non-management)	0.368	25.052	44.5%
Year 12 and post graduate degree (management)	0.660	11.370	93.4%
Year 12 and post graduate degree (non-management)	0.499	17.279	64.7%

**TABLE 7-11: PROBIT REGRESSION RESULTS**

<b>Dependent Variable:</b>	Employed			
<b>Method:</b>	Probit			
<b>Limitations:</b>	Male, Aged 15 or Over			
Variable	Coefficient	Standard Error	Z-Statistic	
C	-2.1957	0.0430	-51.0532	
Age	0.1528	0.0022	69.6059	
Age Squared	-0.0020	0.0000	-82.8564	
Immigrant - ESB	-0.0955	0.0204	-4.6747	
Immigrant - NESB	-0.3969	0.0175	-22.6808	
English Proficiency - Poor	-0.5464	0.0405	-13.5043	
Married	0.5741	0.0150	38.2869	
VIC	0.0546	0.0162	3.3711	
QLD	-0.0430	0.0176	-2.4467	
WA	0.0194	0.0222	0.8736	
SA	-0.0536	0.0238	-2.2504	
TAS/NT/ACT	-0.0651	0.0295	-2.2099	
Year 12 only	0.3104	0.0166	18.6802	
Year 12 and certificate, associate diploma, or diploma	0.4323	0.0214	20.2475	
Year 12 and bachelor degree (management)	0.7739	0.0554	13.9691	
Year 12 and bachelor degree (non-management)	0.5748	0.0271	21.1885	
Year 12 and graduate diploma (management)	0.5645	0.1523	3.7067	
Year 12 and graduate diploma (non-management)	0.6326	0.0841	7.5257	
Year 12 and post graduate degree (management)	0.5257	0.1009	5.2096	
Year 12 and post graduate degree (non-management)	0.6120	0.0529	11.5792	
R-squared	0.2707			
Log-likelihood	-27631.0113			
Number of Observations	60205			



**Dependent Variable:** Employed  
**Method:** Probit  
**Limitations:** Female, Aged 15 or Over

Variable	Coefficient	Standard Error	Z-Statistic
C	-2.0201	0.0451	-44.8382
Age	0.1450	0.0024	60.6414
Age Squared	-0.0020	0.0000	-70.9400
Immigrant - ESB	-0.1146	0.0193	-5.9521
Immigrant - NESB	-0.3953	0.0168	-23.4578
English Proficiency - Poor	-0.7235	0.0397	-18.2059
Married	0.0666	0.0292	2.2838
VIC	-0.0181	0.0151	-1.1925
QLD	-0.0300	0.0164	-1.8229
WA	0.0079	0.0207	0.3830
SA	-0.0456	0.0225	-2.0247
TAS/NT/ACT	0.0317	0.0272	1.1663
Year 12 only	0.3305	0.0150	21.9627
Year 12 and certificate, associate diploma, or diploma	0.5468	0.0207	26.4514
Year 12 and bachelor degree (management)	0.7408	0.0518	14.2927
Year 12 and bachelor degree (non-management)	0.7174	0.0222	32.3629
Year 12 and graduate diploma (management)	0.7921	0.1551	5.1069
Year 12 and graduate diploma (non-management)	0.8286	0.0526	15.7605
Year 12 and post graduate degree (management)	0.7662	0.1287	5.9524
Year 12 and post graduate degree (non-management)	0.9186	0.0593	15.4951
Number of Children aged 3 or younger	-0.8139	0.0171	-47.5900
Number of Children aged >3 and < 15	-0.2571	0.0072	-35.9481
Log of Partner Income	0.0319	0.0044	7.3362
R-squared	0.2486		
Log-likelihood	-32338.2904		
Number of Observations	62474		

**TABLE 7-12: TOBIT REGRESSION RESULTS**

<b>Dependent Variable:</b>		Hours Worked		
<b>Method:</b>		Tobit		
<b>Limitations:</b>		Male, Aged 15 or Over		
<b>Variable</b>	<b>Coefficient</b>	<b>Standard Error</b>	<b>Z-Statistic</b>	
C	16.0095	2.7305	5.8633	
Age	1.6905	0.1147	14.7364	
Age Squared	-0.0199	0.0015	-13.3947	
Immigrant - ESB	-1.0515	0.2651	-3.9668	
Immigrant - NESB	-3.1765	0.3192	-9.9516	
English Proficiency - Poor	-2.9150	0.8281	-3.5201	
Married	3.0447	0.3434	8.8652	
VIC	0.4093	0.2114	1.9358	
QLD	0.2661	0.2315	1.1497	
WA	0.1964	0.2888	0.6801	
SA	-0.8102	0.3201	-2.5311	
TAS/NT/ACT	-1.6272	0.3838	-4.2394	
Year 12 only	0.4759	0.2867	1.6597	
Year 12 and certificate, associate diploma, or diploma	1.4960	0.3371	4.4377	
Year 12 and bachelor degree (management)	4.3544	0.6267	6.9477	
Year 12 and bachelor degree (non-management)	2.2563	0.4257	5.3000	
Year 12 and graduate diploma (management)	1.9823	1.3844	1.4319	
Year 12 and graduate diploma (non-management)	0.5070	0.8310	0.6100	
Year 12 and post graduate degree (management)	5.3825	1.0741	5.0112	
Year 12 and post graduate degree (non-management)	3.7549	0.6579	5.7078	
Professionals	-5.6392	0.3488	-16.1653	
Associate Professionals	-3.1371	0.3526	-8.8981	
Tradespersons	-7.2655	0.3301	-22.0133	
Advanced Clerical & Service	-8.9903	0.9548	-9.4156	
Intermediate Clerical, Sales & Service	-8.2161	0.3783	-21.7207	
Intermediate Production & Transport	-9.0604	0.3584	-25.2824	
Elementary Clerical, Sales & Service	-13.9981	0.4278	-32.7180	
Labourers	-12.9187	0.3683	-35.0787	
Mining	-0.2233	0.8697	-0.2567	
Manufacturing	-2.5312	0.4486	-5.6430	
Electricity, Gas & Water Supply	-6.1265	0.8258	-7.4187	
Construction	-2.6957	0.4763	-5.6599	
Wholesale & Retail Trade	-3.8685	0.4423	-8.7464	
Transport & Storage	-1.4471	0.5340	-2.7099	
Communication Services	-3.4504	0.6702	-5.1479	
Finance, Insurance, Property & Business	-4.2446	0.4701	-9.0284	
Government Administration and Defence	-7.3710	0.5583	-13.2017	
Education, Health & Community Services	-8.9926	0.5140	-17.4955	
Recreational and Other	-8.0055	0.5203	-15.3878	
Lambda	1.9826	1.2753	1.5546	
R-squared	0.1534			
Log-likelihood	-124741.5667			
Number of Observations	38660			



**Dependent Variable:** Hours Worked  
**Method:** Tobit  
**Limitations:** Female, Aged 15 or Over

Variable	Coefficient	Standard Error	Z-Statistic
C	-21.2490	3.3208	-6.3988
Age	3.0431	0.1431	21.2680
Age Squared	-0.0397	0.0019	-20.5992
Immigrant - ESB	-1.4280	0.2807	-5.0870
Immigrant - NESB	-3.9620	0.3944	-10.0466
English Proficiency - Poor	-8.7249	1.1218	-7.7777
Married	2.7340	0.4007	6.8235
VIC	-0.8554	0.2116	-4.0424
QLD	-0.4916	0.2311	-2.1270
WA	-1.1247	0.2864	-3.9266
SA	-2.0296	0.3209	-6.3251
TAS/NT/ACT	-0.0795	0.3729	-0.2132
Year 12 only	4.8178	0.3455	13.9442
Year 12 and certificate, associate diploma, or diploma	7.3149	0.4892	14.9523
Year 12 and bachelor degree (management)	11.9469	0.7711	15.4940
Year 12 and bachelor degree (non-management)	9.0387	0.5840	15.4784
Year 12 and graduate diploma (management)	11.2023	1.6226	6.9037
Year 12 and graduate diploma (non-management)	9.6855	0.7946	12.1891
Year 12 and post graduate degree (management)	13.0016	1.4843	8.7594
Year 12 and post graduate degree (non-management)	12.0570	0.8927	13.5056
Professionals	-6.2264	0.4206	-14.8053
Associate Professionals	-3.7760	0.4424	-8.5353
Tradespersons	-7.9045	0.5956	-13.2706
Advanced Clerical & Service	-9.2990	0.4763	-19.5246
Intermediate Clerical, Sales & Service	-10.0729	0.4097	-24.5850
Intermediate Production & Transport	-10.9854	0.6453	-17.0234
Elementary Clerical, Sales & Service	-15.7206	0.4543	-34.6017
Labourers	-14.8527	0.4795	-30.9760
Mining	2.3297	1.6732	1.3924
Manufacturing	1.0953	0.6315	1.7345
Electricity, Gas & Water Supply	2.1482	1.4602	1.4711
Construction	-3.8246	0.8049	-4.7517
Wholesale & Retail Trade	-2.3315	0.5909	-3.9455
Transport & Storage	0.9325	0.7549	1.2353
Communication Services	1.5731	0.9000	1.7479
Finance, Insurance, Property & Business	-1.3853	0.5998	-2.3097
Government Administration and Defence	-1.2162	0.6832	-1.7803
Education, Health & Community Services	-4.7528	0.5916	-8.0341
Recreational and Other	-3.6635	0.6454	-5.6766
Number of Children aged 3 or younger	-17.5848	0.7424	-23.6862
Number of Children aged >3 and < 15	-6.1235	0.2336	-26.2170
Partner Income	-0.0280	0.0621	-0.4515
Lambda	19.9412	1.5177	13.1387
R-squared	0.1800		
Log-likelihood	-122964.3824		
Number of Observations	32582		



**TABLE 7-13: ORDINARY LEAST SQUARES REGRESSION RESULTS**

<b>Dependent Variable:</b>		Log(Hourly Earnings)		
<b>Method:</b>		Ordinary Least Squares		
<b>Limitations:</b>		Male, Aged 15 or Over		
<b>Variable</b>	<b>Coefficient</b>	<b>Standard Error</b>	<b>Z-Statistic</b>	
C	0.3494	0.1043	3.3509	
Age	0.0854	0.0044	19.4951	
Age Squared	-0.0010	0.0001	-17.4050	
Immigrant - ESB	0.0171	0.0100	1.7050	
Immigrant - NESB	-0.1518	0.0121	-12.4992	
English Proficiency - Poor	-0.3001	0.0319	-9.3996	
Married	0.1875	0.0131	14.2834	
VIC	-0.0174	0.0080	-2.1774	
QLD	-0.0756	0.0087	-8.6432	
WA	-0.0523	0.0109	-4.7824	
SA	-0.0646	0.0121	-5.3225	
TAS/NT/ACT	-0.0340	0.0146	-2.3232	
Year 12 only	0.1400	0.0109	12.8232	
Year 12 and certificate, associate diploma, or diploma	0.2110	0.0128	16.5333	
Year 12 and bachelor degree (management)	0.4227	0.0230	18.3449	
Year 12 and bachelor degree (non-management)	0.3541	0.0160	22.0940	
Year 12 and graduate diploma (management)	0.4462	0.0506	8.8108	
Year 12 and graduate diploma (non-management)	0.3361	0.0313	10.7297	
Year 12 and post graduate degree (management)	0.5174	0.0376	13.7656	
Year 12 and post graduate degree (non-management)	0.4309	0.0246	17.5505	
Professionals	0.0912	0.0127	7.1776	
Associate Professionals	-0.0424	0.0127	-3.3250	
Tradespersons	-0.1160	0.0120	-9.6405	
Advanced Clerical & Service	-0.0046	0.0366	-0.1256	
Intermediate Clerical, Sales & Service	-0.0626	0.0140	-4.4782	
Intermediate Production & Transport	-0.1330	0.0132	-10.0837	
Elementary Clerical, Sales & Service	-0.2213	0.0161	-13.7727	
Labourers	-0.1783	0.0137	-13.0175	
Mining	0.8879	0.0319	27.8179	
Manufacturing	0.5583	0.0164	34.1263	
Electricity, Gas & Water Supply	0.7485	0.0313	23.8782	
Construction	0.5649	0.0175	32.3488	
Wholesale & Retail Trade	0.4035	0.0161	25.0367	
Transport & Storage	0.5665	0.0197	28.8178	
Communication Services	0.6859	0.0251	27.3766	
Finance, Insurance, Property & Business	0.6440	0.0172	37.5005	
Government Administration and Defence	0.6317	0.0208	30.3536	
Education, Health & Community Services	0.5688	0.0190	29.9315	
Recreational and Other	0.5098	0.0193	26.4686	
Lambda	0.4828	0.0491	9.8284	
R-squared	0.2300			
Log-likelihood	-31900.3539			
Number of Observations	36861			



**Dependent Variable:** Log(Hourly Earnings)  
**Method:** Ordinary Least Squares  
**Limitations:** Female, Aged 15 or Over

Variable	Coefficient	Standard Error	Z-Statistic
C	0.5761	0.0569	10.1190
Age	0.0826	0.0024	34.9379
Age Squared	-0.0009	0.0000	-31.4884
Immigrant - ESB	-0.0327	0.0118	-2.7826
Immigrant - NESB	-0.1362	0.0117	-11.6161
English Proficiency - Poor	-0.3543	0.0382	-9.2748
Married	-0.0414	0.0080	-5.1430
VIC	-0.0400	0.0092	-4.3223
QLD	-0.0632	0.0101	-6.2631
WA	-0.0500	0.0126	-3.9785
SA	-0.0500	0.0140	-3.5842
TAS/NT/ACT	-0.0228	0.0164	-1.3898
Year 12 only	0.1532	0.0102	14.9833
Year 12 and certificate, associate diploma, or diploma	0.2140	0.0130	16.5086
Year 12 and bachelor degree (management)	0.3743	0.0258	14.4860
Year 12 and bachelor degree (non-management)	0.3683	0.0147	25.0515
Year 12 and graduate diploma (management)	0.5293	0.0667	7.9392
Year 12 and graduate diploma (non-management)	0.3561	0.0257	13.8436
Year 12 and post graduate degree (management)	0.6597	0.0580	11.3703
Year 12 and post graduate degree (non-management)	0.4989	0.0289	17.2792
Professionals	0.0497	0.0180	2.7688
Associate Professionals	-0.1454	0.0189	-7.6803
Tradespersons	-0.2310	0.0258	-8.9395
Advanced Clerical & Service	-0.0200	0.0205	-0.9771
Intermediate Clerical, Sales & Service	-0.1499	0.0175	-8.5585
Intermediate Production & Transport	-0.2820	0.0282	-10.0174
Elementary Clerical, Sales & Service	-0.2095	0.0195	-10.7285
Labourers	-0.1809	0.0207	-8.7404
Mining	0.6787	0.0733	9.2615
Manufacturing	0.4273	0.0271	15.7586
Electricity, Gas & Water Supply	0.6017	0.0630	9.5540
Construction	0.5686	0.0349	16.2780
Wholesale & Retail Trade	0.3719	0.0253	14.6874
Transport & Storage	0.5430	0.0326	16.6461
Communication Services	0.6261	0.0392	15.9927
Finance, Insurance, Property & Business	0.5360	0.0257	20.8321
Government Administration and Defence	0.5202	0.0296	17.5938
Education, Health & Community Services	0.4449	0.0254	17.5406
Recreational and Other	0.4041	0.0278	14.5337
Lambda	0.3554	0.0207	17.1837
R-squared	0.1731		
Log-likelihood	-28872.9651		
Number of Observations	31105		