

cadence|economics

THE GRADUATE EFFECT: HIGHER
EDUCATION SPILLOVERS TO THE
AUSTRALIAN WORKFORCE

REPORT FOR UNIVERSITIES AUSTRALIA

MAY 2016

Table of contents

- Glossary 3
- Key Points 4
- Executive summary 5
- 1. Introduction 7
- 2. Background to the literature 8
 - Summary of the literature 8
 - Summary of key spillovers 9
- 3. Data underpinning the analysis 11
 - Parameterising the analysis 11
 - Composition of the Australian labour market and new graduates 12
 - Participation rates and productivity 13
- 4. Results of the analysis 15
 - Scenario specification 16
 - Key results 16
 - The sensitivity of labour market elasticities 19
- 5. Conclusions 21
- 6. References 23
- Appendix – Detailed Literature Review 25

GLOSSARY

ABS	Australian Bureau of Statistics
AUD	Australian dollar
CEGEM	Cadence Economics General Equilibrium Model
CGE	Computable General Equilibrium
FTE	Full Time Equivalent
GDP	Gross Domestic Product
GNI	Gross National Income
GNP	Gross National Product
GTAP	Global Trade Analysis Project
IRR	Internal Rate of Return
NPV	Net Present Value
R&D	Research and Development
UA	Universities Australia

KEY POINTS

Jobs

- For every 1,000 university graduates entering the workforce, 120 new jobs are created for people without a university degree.
- In 2014–15, the effect of new graduates entering the Australian workforce created 25,000 new jobs for people without a university degree.
- The spillover employment benefits for those without a university degree are spread across a range of jobs and industries. Tradespeople, managers, machinery drivers, labourers and administrative workers benefit the most from graduates entering the workforce.
- For example, an additional 8,064 technicians and trades workers found jobs in 2014–15 because of new university graduates entering the Australian workforce.

Wages

- In 2014–15, the wages of workers without a university degree rose by \$4.8 billion due to new university graduates entering the Australian workforce.
- This equates to a weekly wage increase of \$12.60 in 2014–15—or \$655 a year—for workers without a university degree due to the spillover benefits of university education.
- The estimated wage increase is 1.12 per cent. This is comparable with earlier research by Moretti (2004) which was based on analysis of US data.

Growth

- Without new university graduates entering the workforce, the growth rate in employment for those without a university degree would have been zero over the last eight years.
- University graduates account for almost 90 per cent of Australia's jobs growth over the last eight years.
- In 2014–15, new skilled graduates entering the Australian workforce grew the nation's economic activity by \$26.4 billion (as measured by GDP).
- Every graduate entering the workforce increases Australian GDP by \$124,450.
- Due to higher economic activity driven by new university graduates entering the Australian workforce, government revenue increased by approximately \$5.1 billion in 2014–15.

EXECUTIVE SUMMARY

Australia needs new university graduates.

The Australian economy is undergoing a major transition. A shift is underway from the mining construction boom era—in which significant resources were applied to the development of our natural resources—to a new phase in our history. **We are now faced with the challenge of diversifying our economy and seizing new opportunities through innovation, entrepreneurship and greater integration within our region.** The development of our human capital—the skills and smarts of our people—is now a crucial element of Australia’s economic development into the future.

Higher education plays a critical role in developing Australia’s human capital. The ability of our nation to expand the knowledge and skills of our workforce to drive productivity growth is vital if Australia is to raise living standards into the future. While the private benefits of higher education have been well documented, minimal attention has been paid to the associated spillover benefits of higher education to other parts of the workforce and the Australian community.

To fill this knowledge gap, this report estimates the benefits to the wider economy and to workers without a degree when new higher education graduates enter the Australian workforce.

The analysis is based on an application of a computable general equilibrium (CGE) model. The Cadence Economics General Equilibrium Model (CEGEM) is of a genre of economic models that are used extensively by the Australian Government to assess the economy-wide impacts of major policy changes and economic developments. For example, the Commonwealth Treasury undertook a series of assessments of the economic impacts of climate change response policies using CGE models in the early 2000s. The Productivity Commission has also used CGE modelling to consider the impact of economic reforms.

In spite of the obvious advantages of CGE models, which contain all the linkages between employment, tax and consumption, they have not been widely used to capture the spillover effects from new graduates entering the workforce. **This report provides a powerful new insight into the positive effects of new university graduates on Australia’s jobs, wages and economic growth.**

The estimated spillover benefits

The growth in economic activity generated by graduates entering the workforce improves the employment prospects for other parts of the labour market. **Higher levels of economic activity and income increase the demand for retail services and, therefore, demand for employment in that industry—including for those people without degrees.** In addition, at the industry level, **having access to a more productive workforce of those with university degrees improves the competitiveness of Australian industry.** This increased competitiveness will increase output and

employment in these industries, including the demand for those without university degrees. For example, access to employees with degrees can greatly improve the competitiveness of our traditional exporters such as agriculture and mining. As these sectors expand, there would be a corresponding increase in demand for employees without university degrees.

The positive effects of new university graduates are seen not only in the creation of new jobs for those without university degrees but also in their wages, as well as the overall employment and economic growth of the nation.

Jobs

- For every 1,000 university graduates entering the workforce, 120 new jobs are created for people without a university degree.
- In 2014–15, the effect of new graduates entering the Australian workforce created 25,000 new jobs for people without a university degree.

The spillover employment benefits for those without a university degree are spread across a range of jobs and industries. Tradespeople, managers, machinery drivers, labourers and administrative workers benefit the most from graduates entering the workforce. For example, an additional 8,064 technicians and trades workers found jobs in 2014–15 because of new university graduates entering the Australian workforce. An additional 4,383 labourers found jobs for the same reason.

Wages

- In 2014–15, the wages of workers without a university degree rose by \$4.8 billion due to new university graduates entering the Australian workforce.
- This equates to a weekly wage increase of \$12.60 in 2014–15—or \$655 a year—for workers without a university degree due to the spillover benefits of university education.
- The estimated wage increase is 1.12 per cent. This is comparable with earlier research by Moretti (2004) which was based on analysis of US data.

Growth

- Without new university graduates entering the workforce, the growth rate in employment for those without a university degree would have been zero over the last eight years.
- University graduates account for almost 90 per cent of Australia's jobs growth over the last eight years.
- In 2014–15, skilled graduates entering the Australian workforce grew the nation's economic activity by \$26.4 billion (as measured by GDP).
- Every graduate entering the workforce increases Australian GDP by \$124,450.
- Due to higher economic activity driven by new university graduates entering the Australian workforce, government revenue increased by approximately \$5.1 billion in 2014–15.

1. INTRODUCTION

The Australian economy is undergoing a major transition. A shift is underway from the mining construction boom era—in which significant resources were applied to the development of our natural resources—to a new phase in our history. **We are now faced with the challenge of diversifying our economy and seizing new opportunities through innovation, entrepreneurship and greater integration within our region.** The development of our human capital—the skills and smarts of our people—is now a crucial element of Australia’s economic development into the future.

Higher education plays a critical role in developing our human capital. The ability of our nation to expand the knowledge and skills of our workforce to drive productivity growth is vital if Australia is to raise living standards into the future. While the private benefits of higher education have been well considered in the literature, a key issue that has not been given as much attention is the spillover benefits of higher education to other parts of the workforce.

Put simply, the analysis in this report estimates the benefits to those without university degrees as a result of those with university degrees entering the workforce: ‘the graduate effect’.

The report proceeds as follows. An introduction to the relevant literature and concepts is presented in Chapter 2, supplemented by more detailed coverage in the Appendix. The key data used to underpin the analysis is summarised in Chapter 3. The framework used to undertake the analysis is presented in Chapter 4 followed by an exposition of the results from the analysis in Chapter 5. Conclusions drawn from the analysis are in Chapter 6.

2. BACKGROUND TO THE LITERATURE

A large number of studies have examined various aspects of the economic returns to education and components within education (primary, secondary, undergraduate, postgraduate and other post-secondary qualifications). The literature has also investigated the components of the returns to both the student and the spillovers to others, providing a substantial evidence base to inform the economic modelling. We supplement this literature with updated estimates (based on more recent data) and improved techniques for capturing the economy-wide effects of spillovers, with a focus on the university sector of the education system.

A full review of the relevant literature is provided in the Appendix.

Summary of the literature

The literature on the spillovers of higher education to the broader economy is eclectic, focusing on a specific type of spillover, or one-off estimates based on varying definitions of benefits and returns, or novel estimation techniques. There are no estimates that are updated on a regular basis using standardised definitions or consistent approaches over time. As such, it is difficult to compare across time or across different approaches.

Despite these difficulties, there is extensive evidence of higher wages accruing to people who have attained university education, for example:

- OECD estimates the rate of return for Australian males and females, public and private as a percentage of the cost of education. The private rate of return is 10.4 per cent for males and 8.5 per cent for females. The public (taxpayer) rate of return is 11.6 per cent (male) and 9.7 per cent (female). Note that the percentages relate to different base cost figures so are not comparable.
- Daly *et al.* (2015) estimates a return in the range of 8 per cent to 15 per cent (Australian male and female students, for 3 and 4 year degrees). The return varies by field of education, but is also very sensitive to some other factors:
 - Students that work part time while studying (less 'foregone earnings') generate a higher rate of return.
 - Students that complete their degree more quickly (e.g. only take the minimum 3 years for an undergraduate degree) achieve a higher rate of return.
 - Deferred repayment of tuition (HECS-HELP) improves the private rate of return.

That noted, much of the literature is either based on older data sources (up to the 2006 Census) or countries other than Australia. For spillovers most literature is based on McMahon (2004) and Moretti (2004), which in turn are based on data from the 1990s.

Summary of key spillovers

While there are many dimensions of monetary spillovers from university graduates, the most substantial and commonly referenced components are:

- **Productivity improvements:** through 'team work', more highly skilled workers improve the productivity of their colleagues in the workplace.
- **Labour market substitutes:** increasing the population of workers with higher education attainment can reduce the population of those without higher education attainment. This increases the demand for labour without higher education attainment and generates higher income for this group of workers.
- **Consumption effects:** increased incomes for those with higher education attainment increases their consumption of goods and services, some of which is supplied by those without higher education attainment.
- **Fiscal externalities:** higher incomes earned by university graduates generate more tax revenue that can be used to fund goods and services provided by the government (better roads, services, etc.) or to have taxes lower than they otherwise would be.

Productivity spillovers estimated in Mas and Moretti (2006) were as follows:

We find strong evidence of positive productivity spillovers from the introduction of highly productive personnel into a shift. A 10 per cent increase in average co-worker permanent productivity is associated with 1.7 per cent increase in a worker's effort.

Wage spillovers from Moretti (2004) yielded the following results:

I find that a percentage point increase in the supply of college graduates raises high school drop-outs' wages by 1.9 per cent, high school graduates by 1.6 per cent and college graduates by 0.4 per cent.

In previous studies, these various effects have proved hard to untangle. While empirical observations of higher wages for those with a degree have been observed, it is not possible to determine the root cause of these empirical results.

Of the above effects, a CGE modelling framework automatically captures the economic linkages that cause increased productivity (and hence earnings) for graduates to generate flow-on effects of fiscal externalities, consumption effects and labour market substitute. These effects are all interdependent in this type of model. Increased productivity of those with a degree due to an increased number of graduates in the workforce is a separate effect (it is external to the model, so requires explicit adjustment to allow the model to capture this effect).

A key benefit of general equilibrium modelling approach is that it automatically captures the flow-on effects from graduates and the linkages that cause them, which cannot be achieved through partial equilibrium techniques.

In spite of the obvious advantages of CGE models, which contain all the linkages between employment, tax and consumption, they have not been widely used to capture the spillover effects from increased graduate earnings.

We found no CGE studies of this phenomena for Australia in the literature. There are a small number of international studies that use a CGE approach:

- Giesecke and Madden (2006) analyse the regional economic effects (both research and teaching) of a university, using a CGE approach.
- Junga and Thorbecke (2003) analyse public investment in higher education in Tanzania and Zambia.

Based on the literature review, this report makes the following contributions to understanding the private returns and spillovers from university education:

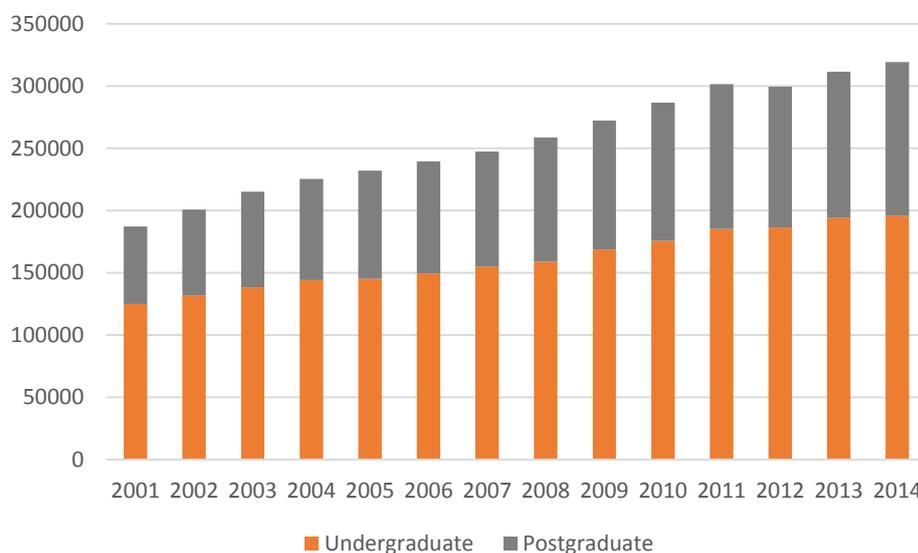
- Using a standardised (CGE modelling) approach that captures all the key linkages within the model, capable of being replicated and updated on a regular basis.
- Avoiding the use of partial estimates that only capture one aspect of the spillovers from higher education, or do not account for crowding out effects.
- Applying definitions of private returns and spillovers that are consistent with estimating the economic benefits for society as a whole.
- The use of more recent 2011 Census data and graduate numbers up to 2015.
- Capturing the economy wide effect of graduates, without the overlap, double counting or omission that can occur when aggregating results from previous studies.

3. DATA UNDERPINNING THE ANALYSIS

This section provides an overview of the recent historical growth in the number of higher education qualifications and a description of how we parameterised the modelling.

In recent years, from 2001 to 2014, the number of higher education qualifications has increased from about 187,000 to just below 320,000, an increase of 70 per cent as shown in Figure 1. Over the same period the number of postgraduate students has almost doubled, growing from about 62,000 to just over 123,000.

Figure 1: Higher education award attainment, all students (2001–2014)



Source: *uCube*, Commonwealth Department of Education and Training

The *uCube* data captures the number of higher education award completions, including those students that may already have a higher education degree. In addition the *uCube* data does not indicate how many students enter the workforce. To parameterise the modelling the number of recent graduates that entered the workforce was required, outlined below in more detail.

Parameterising the analysis

The analysis in this report is based on recent historical data from official sources, primarily including data published by the Australian Bureau of Statistics and the Commonwealth Department of Education and Training. Usage of official Australian statistics, rather than relying on academic studies based on overseas experience, ensures that the results are consistent with the Australian labour market experience.

To parameterise the analysis there are four main data requirements:

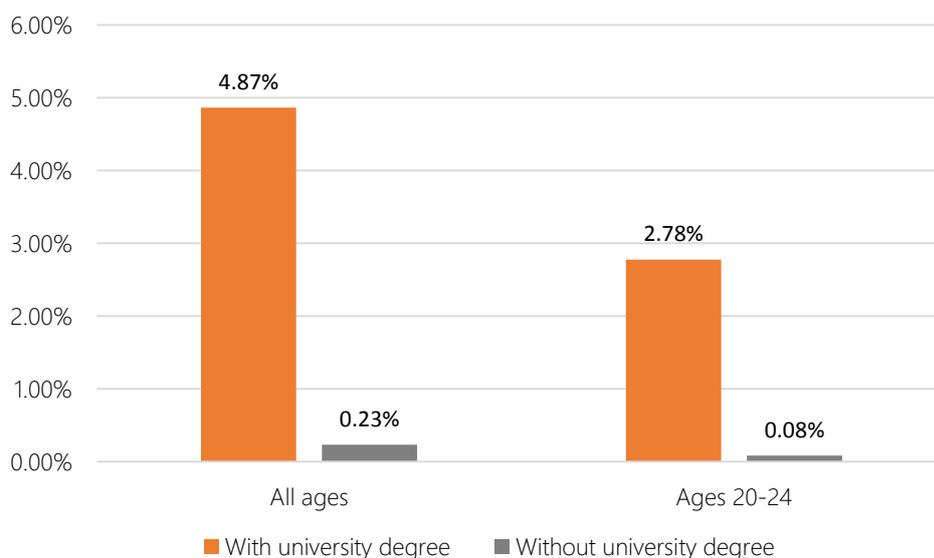
1. **Composition of the Australian labour market** – the distribution of those with and without university degrees, both over time and by industry.
2. **Estimates of new graduates entering the workforce** – proxied by movements in labour force numbers for those aged 20 to 24.
3. **Participation rates** – the comparative participation (or hours worked) by those with and without university degrees.
4. **Productivity** – the productivity dividend experienced as a result of university education attainment.

Composition of the Australian labour market and new graduates

In recent years, from the year ending May 2007 to May 2015, employment growth has been driven by those with university degrees. The average annual growth rate of employment for people of all ages employed with university degrees has been 4.9 per cent, as shown in Figure 2. Conversely, employment among those without university degrees grew by 0.23 per cent.

The age bracket of 20 to 24 in ABS data is important as it represents a proxy for new graduates entering the workforce, as the average age of a university graduate is 23. The data shows that employment for those in the 20 to 24 age bracket with university degrees has grown at an annual rate of 2.8 per cent compared with 0.08 per cent for those without university degrees.

Figure 2: Average annual employment growth, by age and education attainment (2007–2015)

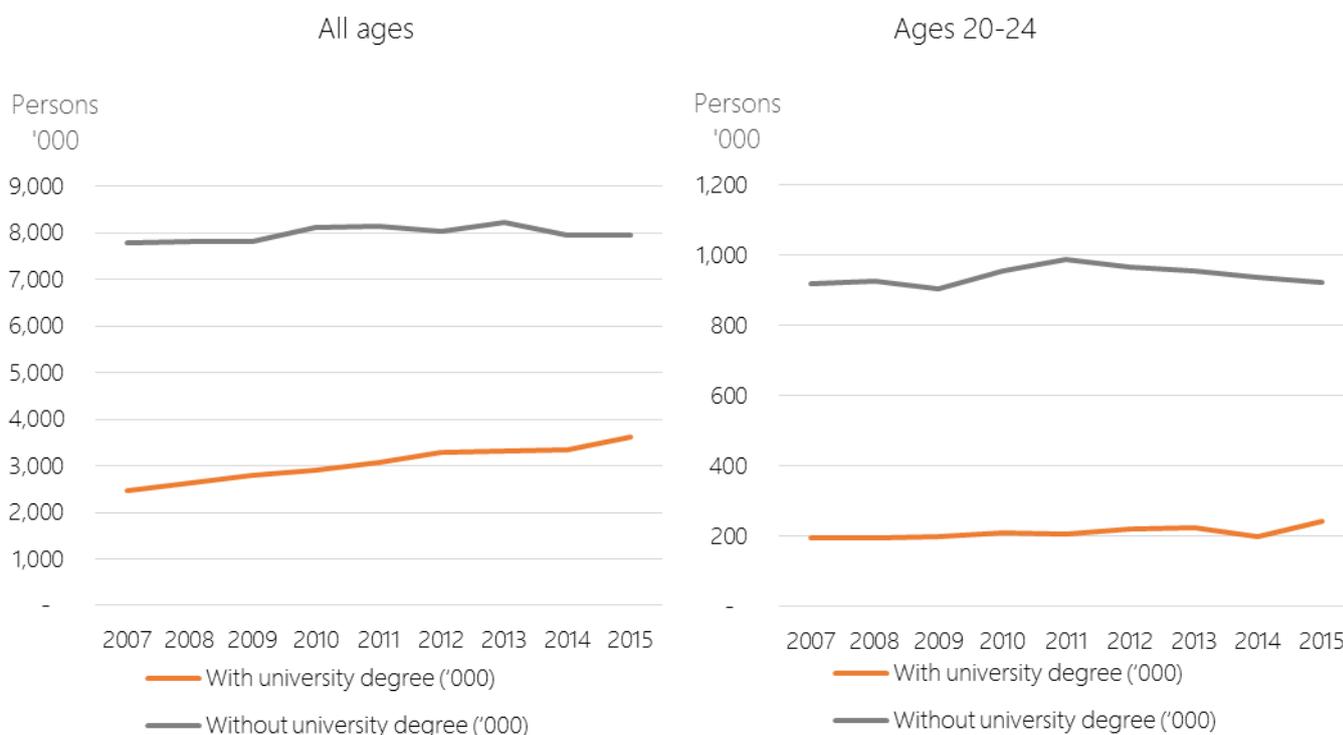


Source: ABS *Education and Work Australia*, Cat. No. 6220.0 (2007–2015)

While the number of people with higher education has grown significantly, this growth comes from a lower base. In 2007 there were approximately 7.8 million people without a university degree employed, compared with 2.5 million with a degree, as shown in Figure 3. The growth in higher education attainment has seen employment of people with a degree increase to 3.6 million in 2015.

For recent entrants into the labour market (aged 20 to 24), in 2007 there was approximately 195,000 people employed with a higher education degree, compared to 917,000 without a degree. Over the period from 2007 to 2015 an average of just over 212,000 people aged 20 to 24 with university degrees entered the workforce each year. In this analysis this figure forms the basis for the number of additional graduates entering the workforce each year.

Figure 3: Employment, by age and education attainment (2007–2015)

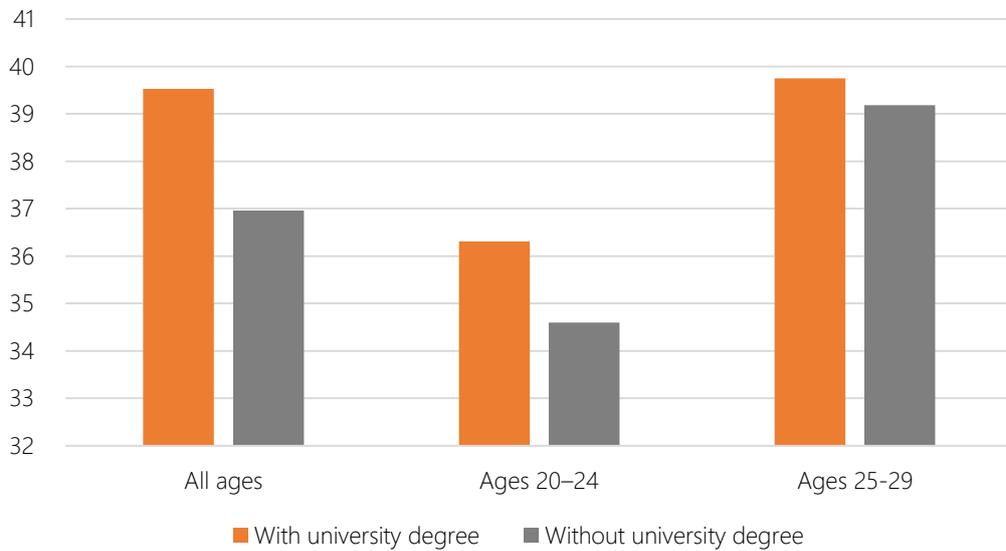


Source: ABS *Education and Work Australia*, Cat. No. 6220.0 (2007–2015)

Participation rates and productivity

The 2011 Census data shows that measured across the entire workforce, those with a university degree work on average 39.5 hours per week or about 7 per cent more than those without a university degree, as shown in Figure 4. Those aged 20 to 24 with university degrees work on average 36.3 hours per week, 5 per cent more than those without university degrees in the same age bracket.

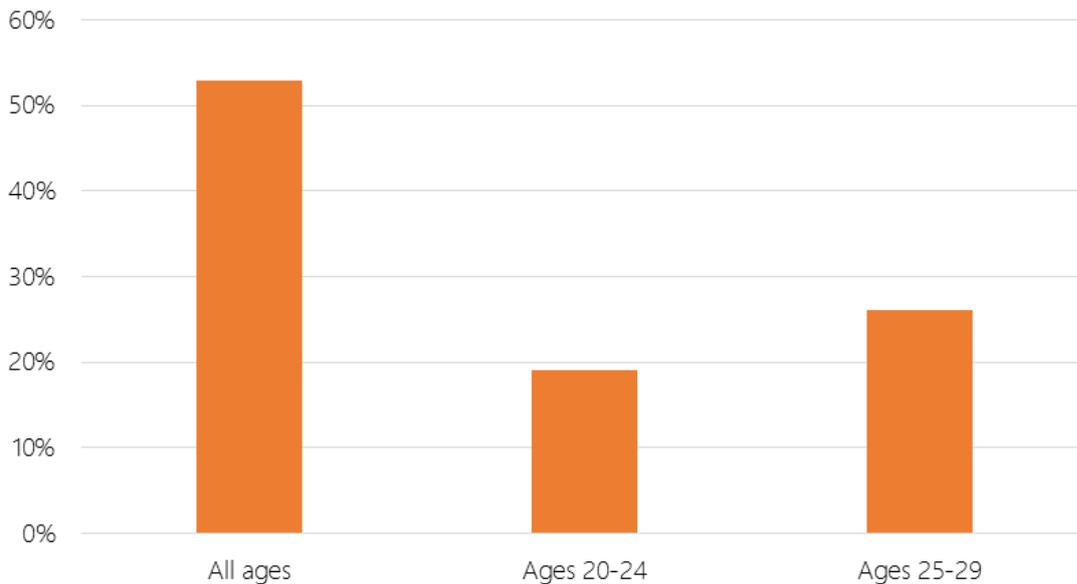
Figure 4: Number of hours worked per week, by age and educational attainment (2011)



Source: ABS 2012, 2011 *Census and Housing Data*

For all employees, those with university degrees earn 53 per cent more income compared to those without university degrees. For recent entrants into the labour force, the income premium earned by university graduates is lower. Those with a degree between the ages of 20 to 24 earn 19 per cent more than those without a degree.

Figure 5: Income premium to those with university degrees (2011)



Source: ABS 2012, 2011 *Census and Housing Data*
 Income as measured by Individual Income (weekly)

4. RESULTS OF THE ANALYSIS

This section details the estimated spillovers of higher education on the Australian labour market, based on the estimates derived in the previous section.

The estimates are based on the Cadence Economics General Equilibrium Model (CEGEM). This model is ideally suited to analysing issues relating to labour productivity as it is a multi-region, multi-sector representation of the global economy. The model has significant flexibility in its sectoral and regional specification, which is important in the context of this analysis. A description of the model is presented in Box 1. The model has been enhanced with additional labour market detail (by level of higher education attainment) for the purposes of this report.

Box 1: An overview of the CEGEM model

CEGEM is a multi-commodity, multi-region, dynamic model of the world economy. Like all economic models, CEGEM is based on a range of assumptions, parameters and data that constitute an approximation to the working structure of an economy. Its construction has drawn on the key features of other economic models such as the global economic framework underpinning models such as GTAP and GTEM, with state and regional modelling frameworks such as Monash-MMRF and TERM.

Labour, capital, land and a natural resource comprise the four factors of production. On a year-by-year basis, capital and labour are mobile between sectors, while land is mobile across agriculture. The natural resource is specific to mining and is not mobile. A representative household in each region owns all factors of production. This representative household receives all factor payments, tax revenue and interregional transfers. The household also determines the allocation of income between household consumption, government consumption and savings.

Capital in each region of the model accumulates by investment less depreciation in each period. Capital is mobile internationally in CEGEM where global investment equals global savings. Global savings are made available to invest across regions. Rates of return can differ to reflect region specific differences in risk premiums.

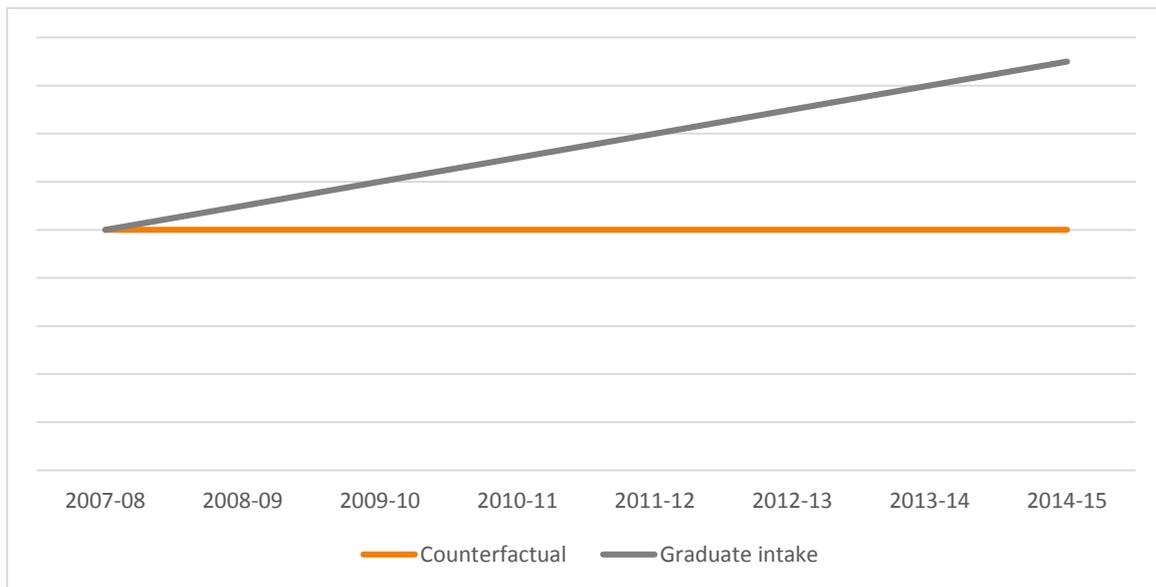
The model assumes labour markets operate in a model where employment and wages adjust in each year so that, for example, in the case of an increase in the demand for labour, the real wage rate increases in proportion to the increase in employment from its base case forecast level.

CEGEM determines regional supplies and demands of commodities through optimising behaviour of agents in perfectly competitive markets using constant returns to scale technologies. Under these assumptions, prices are set to cover costs and firms earn zero pure profits, with all returns paid to primary factors. This implies that changes in output prices are determined by changes in input prices of materials and primary factors.

Scenario specification

To estimate the spillover benefits of graduates, the difference in Australia’s economic growth is considered under two scenarios. The baseline scenario assumes that no university graduates enter the Australian workforce. The alternative scenario assumes that graduates enter the workforce with the additional rate of participation and productivity as estimated using ABS data. The modelling then estimates the benefits to Australian economy broadly from the additional supply of workers with degrees, and specifically to the part of the workforce without degrees.

Figure 6: Stylised description of scenarios



Source: Cadence Economics

Key results

Graduates entering the Australian workforce are estimated to make a significant contribution both to the Australian economy as a whole and to the economic outcomes for those people without university degrees.

Key results are summarised in Table 1.

Table 1: Effects of graduates entering the workforce

Macroeconomic impacts		
	8 year average	Per average annual graduate
GDP	\$26.4b	\$124,250
GNI	\$25.0b	\$118,001
Investment	\$8.8b	\$41,683
Exports	\$2.2b	\$10,225
Impacts on those without university degrees		
Without degree employment	24,914 FTE	0.12 FTE
Wage impact – per cent change	1.12	
Wage impact – total	\$4.8b	0.12 FTE
Wage impact – weekly per person	\$12.60	

Source: Cadence Economics estimates

Output and welfare

There are a number of mechanisms that improve the economic outcomes of those without university degrees due to those with degrees entering the workforce. These mechanisms include increased demand for goods and services driven by higher private consumption, improved business performance as a result of a more productive workforce, and increased government consumption driven by higher revenues.

These outcomes are measured at a high level by changes in real gross domestic product (GDP) and real gross national income (GNI, sometimes referred to as gross national product – GNP). GDP is a commonly used measure of the net output of an economy (that is, the total output minus business inputs), while GNI captures the total income in a region through payments to labour, capital and taxes and is a better measure of welfare in a region.

The results of the analysis show that in 2014–15, graduates entering the Australian workforce increased economic activity by \$26.4 billion, measured by real GDP, an increase of **1.9 per cent** over what would have otherwise occurred if these graduates did not enter the workforce. This implies that every graduate **entering the workforce increased Australian GDP by \$124,450 in 2014–15.**

In terms of economic welfare, GNI is estimated to be \$25.0 billion higher 2014–15 as a result of new graduates entering the workforce, an increase of 1.8 per cent above the counterfactual in that year.

Employment

It follows that the increase in economic activity generated by graduates entering the workforce improves the employment prospects for other parts of the labour market. This is because, for example, higher levels of economic activity and income increase the demand for retail services and, therefore, demand for employment in this industry including those without degrees. In addition, at the industry level, having access to a more productive workforce of those who have attained higher education improves the competitiveness of Australian industry. This increased competitiveness will increase output and employment in these industries, including the demand for those without university degrees. For example, access to employees with degrees can greatly improve the competitiveness of our traditional exporters such as agriculture and mining. As these sectors expand, there would be a corresponding increase in demand for employees without university degrees.

An estimated 25,000 jobs are created for those without university degrees as a result of graduates entering the labour market in 2014–15. This implies that **for every 1,000 graduates entering the workforce, 120 jobs are created for those without university degrees**. Without these positive employment spillovers from graduates, the growth rate in employment for those without university degrees is estimated to be zero over the last eight years.

Wages

Apart from this spillover benefit in terms of the level of employment, higher economic growth attributable to graduates also increases the wage prospects for those without university degrees. The analysis estimates that graduates entering the workforce increase the incomes of those without university degrees by \$4.8 billion in total in 2014–15. **This equates to a weekly wage increase of \$12.60 in 2014–15—or \$655 a year.**

Government revenue

More graduates entering the workforce increases government revenue through a range of taxes, particularly income taxes. This increased government revenue in turn increases the ability for government to provide government services and infrastructure investment. This increased demand for public goods in turn requires a mix of labour, improving employment possibilities for those without a university degree. **Due to higher economic activity driven by new university graduates entering the Australian workforce, government revenue increased by approximately \$5.1 billion in 2014–15.**

Occupations

The spillover employment benefits are spread across a range of occupations for those without university degrees. Significantly, spillover employment benefits are shown to accrue primarily to Technicians and trades workers, Managers, Machinery operators and drivers, Labourers, and Clerical and administrative workers. For example, it is estimated that graduates entering the

workforce in 2014–15 resulted in an additional 8,064 Technicians and trades workers being employed.

At the sectoral level the changes in employment for those without degrees are driven by a variety of factors, including the export exposure of the sector, the share of these people employed by the sector, and the level of household demand for outputs from the sector. Table shows a breakdown of the changes in non-degree employment by occupation.

Table 2: Changes in non-degree employment by occupation

Occupation	Contribution to employment
Managers	4448
Professionals	273
Technicians and Trades Workers	8159
Community and Professional Service Workers	-401
Clerical and Administrative Workers	1876
Sales Workers	1866
Machinery Operators and Drivers	4310
Labourers	4383

Source: Cadence Economics estimates

Note: Occupations defined as per ANZSCO First Edition, Revision 1, ABS Cat. No. 1220.0

The total contribution of 24,917 full time equivalent positions is differentiated by occupational classification, with a particularly strong contribution to Technicians and Trades Workers, which includes categories such as automotive and engineering trades workers, constructions trades workers and food trades workers.

It is important to note that strong demand for workers without a degree across the range of occupations leads to muted results in those occupations that traditionally employ a high proportion of university graduates. For community and professional service workers, the potential for higher wages in alternative roles leads to movements out of this category.

THE SENSITIVITY OF LABOUR MARKET ELASTICITIES

A key sensitivity for any analysis involving labour market dynamics is the sensitivity of results to changes in the assumed labour elasticity— that is, how increases (or decreases) in wage rates affect people’s decisions to enter (or exit) the workforce. For the core scenario we have adopted a labour supply elasticity of 0.15 for those with a degree, and 0.3 for those without a degree. Labour

supply elasticities are interpreted as saying that, assuming a labour supply elasticity of 0.15 (for example), an increase in wages of 1 per cent increases the available pool of labour by 0.15 per cent.

In recent modelling of the impacts of changing taxation arrangements, the Commonwealth Treasury adopted a standard labour supply elasticity of 0.15, with a higher labour supply elasticity of 0.30. Based on the literature, it is a reasonable assumption that the labour market characterised by those without a university degree would have a labour supply elasticity at the higher end of the range, particularly given the recent position of the economy in relation to the economic cycle.

In line with our focus on the contribution of graduates to the outcomes of those workers without university degrees, we have repeated the analysis using a more conservative assumption of a labour supply elasticity of 0.15 for both components of the workforce, the results of which are presented in Table .

Importantly, we see under the assumption that workers without university degrees are less responsive to changes in wages, although the number of jobs created is significantly lower than previously observed, the wage premium is significantly higher. This leads to a similar total wage bill outcome for the section of the workforce without university education of \$4.5 billion compared to \$4.8 billion in the previous scenario.

Table 3: Effects of graduates entering the workforce – labour supply sensitivity

Macroeconomic Impacts		
	8 year average	Per average annual graduate
GDP	\$25.2b	\$118,614
GNI	\$25.0b	\$112,521
Investment	\$8.3b	\$38,922
Exports	\$2.1b	\$9,802
Impacts on those without university degrees		
Without degree employment	13,150 FTE	0.06 FTE
Wage impact – per cent change	1.19	
Wage impact – total	\$4.5b	

Source: Cadence Economics estimates

5. CONCLUSIONS

While the private benefits of higher education have been well documented, minimal attention has been paid to the associated spillover benefits of higher education to other parts of the workforce. To fill this gap, this report estimates the benefits to the wider economy and to workers without a degree when higher education graduates enter the Australian workforce: 'the graduate effect'.

The analysis is based on an application of a computable general equilibrium (CGE) model. The Cadence Economics General Equilibrium Model (CEGEM) is of a genre of economic models that are used extensively by the Australian Government to assess the economy-wide impact of major policy changes and economic developments. The key advantage of this approach is that CGE modelling contains all the linkages between employment, tax and consumption.

This report finds that the contributions made by those with university degrees to the employment opportunities of those without degrees are significant.

In 2014–15, new graduates entering the Australian workforce were estimated to increase economic activity by \$26.4 billion, measured by real GDP. This implies that every graduate entering the workforce is estimated to increase Australian GDP by \$124,450 in 2014–15.

This growth in economic activity generated by graduates entering the workforce improves the employment prospects for other parts of the labour market. From these new graduates entering the workforce, an estimated 25,000 jobs are created for those without university degrees as a result of graduates entering the labour market in 2014–15. For every 1,000 graduates entering the workforce, 120 jobs are created for those without university degrees. Indeed, without these positive employment spillovers from graduates, the growth rate in employment for those without university degrees is estimated to be zero over the last 8 years.

Apart from this spillover benefit in terms of the level of employment, higher economic growth attributable to graduates also increases the wage prospects for those without university degrees. The analysis estimates that graduates entering the workforce increase the incomes of those without university degrees by \$4.8 billion in total in 2014–15. This estimate is based on a projected increase in wages of 1.12 per cent, which is comparable with earlier research by Moretti (2004) which was based on analysis of US data.

More graduates entering the workforce increases government revenue through a range of taxes, particularly income taxes. The analysis demonstrated that due to higher economic activity driven by new university graduates entering the Australian workforce, government revenue increased by approximately \$5.1 billion in 2014–15.

The spillover employment benefits are spread across a range of occupations for those without university degrees. Significantly, spillover employment benefits are shown to accrue primarily to

technicians and trades workers, managers, machinery operators and drivers, labourers, and clerical and administrative workers.

6. REFERENCES

- Australian Bureau of Statistics (ABS) 2012, *2011 Census of Population and Housing*, Commonwealth of Australia.
- ABS, *Education and Work Australia*, Cat. No. 6227.0, May 2007 to May 2015, Commonwealth of Australia.
- Chapman, B and Lounkaew, K 2015, 'Measuring the value of externalities from higher education', *Higher Education* 70: 767–785.
- Commonwealth Department of Education and Training 2016, *uCube*.
- Daly, A, Lewis, P, Corliss, M and Heaslip, T 2015, 'The private rate of return to a university degree in Australia', *Australian Journal of Education*, 59(1): 97–112.
- Deloitte Access Economics (2015) *The importance of universities to Australia's prosperity*, Deloitte Access Economics, Canberra.
- Giesecke, J and Madden, J 2006, 'CGE evaluation of a university's effects on a regional economy: an integrated assessment of expenditure and knowledge impacts', *Review of Urban & Regional Development Studies*, 18(3): 229–251.
- Junga, H-S and Thorbecke, E 2003, 'The impact of public education expenditure on human capital, growth, and poverty in Tanzania and Zambia: a general equilibrium approach', *Journal of Policy Modelling*, 25(8): 701–725.
- Lange, F and Topel, R 2004, 'The social value of education and human capital', *Handbook of the Economics of Education*, 1: 459–509.
- Leigh, A 2007, 'Returns to education in Australia', *Economic Papers*, 27: 233–249.
- Mas, A and Moretti, E 2006, *Peers at work*, NBER Working Paper, National Bureau of Economic Research.
- Mazzolari, F and Ragusa, G 2007, *Spillovers from high-skill consumption to low-skill labor markets* IZA Discussion Papers, No. 3048.
- McMahon, W 2004, 'The social and external benefits of education' in *International Handbook on the Economics of Education*, G. Johnes and J. Johnes (Eds), Edward Elgar Publishing.
- Mincer, J 1974, 'Education, Experience, and the Distribution of Earnings and Employment: An Overview' in *Education, Income, and Human Behavior*, F. Thomas Juster, (Ed), National Bureau of Economic Research.
- Moretti, E 2004, 'Estimating the social return to higher education: evidence from longitudinal and repeated cross-sectional data', *Journal of Econometrics* 121: 175–212.
- OECD 2015, *Education at a Glance 2015* OECD Indicators, OECD Publishing.

Pant, H, Brown, S, Buetre, B and Tulpulé, V 2000, Measurement and decomposition of welfare changes in GTEM, paper presented to the Third Annual Conference on Global Economic Analysis, Monash University, Melbourne, 27–30 June 2000, <http://www.copsmodels.com/2000gtapconf.htm>.

Psacharopoulos, G and Patrinos, H 2002, 'Returns to investment in education: a further update'. *Education Economics* 12(2): 111–134.

Wei, H 2010, *Measuring Economic Returns to Post-School Education in Australia*, Research Paper, Cat. No. 1351.0.55.032, Australian Bureau of Statistics, Canberra.

APPENDIX – DETAILED LITERATURE REVIEW

The focus of this Appendix is on the teaching and learning outputs of universities. Research outputs of universities also generate economic returns, but these are outside the scope of this report. We also exclude benefits that accrue to non-residents that depart Australia on completion of their studies. For estimates of the value of university research and university exports, see Deloitte Access Economics (2015).

Spillovers in context

The sum of private and spillover benefits equals the benefit to society. Private benefits (after excluding non-residents) form a large part of the total benefit accruing to all Australian residents as a whole.

Spillover effects (or at least some of the components of the aggregate spillover effect) can be negative, if certain aspects of increased university education displaces or offsets some of the private returns. Estimating the spillover effects requires consideration of effects such as crowding out and screening effects (discussed further below), in order to estimate a net contribution to an economy.

The term 'spillover' is referred to elsewhere using various labels. While these have broadly the same meaning, there can be differences in what these include and how they are calculated:

- **Flow-on** effects or flow-on economic impacts
- **Externalities** or pecuniary externalities
- **Multiplier** effects
- **Indirect and induced** effects

For the purpose of this report, spillovers covers any impacts from increased university education which do not accrue to the person undertaking the study (or their immediate family).

Returns versus benefits

There are several metrics commonly used to describe the results of university education:

- **Return:** generally refers to the real internal rate of return (the real IRR), expressed as a **percentage** return on the costs incurred to undertake higher education, net of inflation.
 - The IRR is the breakeven real interest rate required for the real benefits to equal the real costs (see example below).
- **Benefits (or gross benefits):** usually a dollar measure of the increase in lifetime after-tax earnings in today's dollars (adjusted for inflation).
- **Costs:** relate to the foregone earnings while studying, tuition and other costs.

- **Net benefit:** benefits minus costs. Some studies report this in net present value (NPV) terms, and others in undiscounted dollars (the latter are used to calculate the IRR).

Monetary versus non-monetary returns

Returns to university education are generally divided into monetary (or pecuniary) returns, and other non-monetary or intangible returns. They are further divided into the returns accruing to the individual undertaking study and the spillover benefits accruing to others, as shown in Figure 7: Categories of returns. Non-monetary benefits are often reported in dollar terms, but relate to the money-equivalent of a benefit that is not reflected in transactions in the economy, nor reflected in measures of economic activity (such as GDP or GNI).

For the purposes of this report, we are interested in the economic impacts, so focus on the monetary benefits accruing to the individual and society, excluding intangible benefits. As a result, any benefits due to education (such as reduced crime or better health) are additional to the estimates in this report.

Figure 7: Categories of returns

	Private benefits (or rate of return)	Spillover benefits (added to private to give social return)
Monetary (market or pecuniary benefits)	Increased real after-tax income, vs. cost of study and income foregone while studying	Fiscal externalities: increased tax (net of govt funding) Also: productivity of co-workers, consumption effects, screening effects (negative)
Non-monetary (intangible or non-pecuniary)	Other personal benefits: health, longevity, social aspects of attending university (converted into \$ equivalent)	Other spillover benefits: less crime, political stability, volunteering (converted into \$ equivalent)

Source: Adapted from McMahon 2004, *The social and external benefits of education*

Further details on the four components of benefits:

1. Private monetary returns (top left in Figure 7): this generally refers to the higher real incomes of university graduates relative to those with a degree, following the approach of Mincer (1974). Other recent studies include OECD (2015), Daly et al (2015), Psacharopoulos and Patrinos (2002) and Leigh (2007). Due to data limitations, many of these studies exclude self-employed people.
2. Private non-monetary/intangible returns (bottom left in Figure 7): this includes benefits of education accruing to the individual. These can include health and longevity. Examples include McMahon (2004) and Psacharopoulos and Patrinos (2002).
3. Monetary spillovers (top right in Figure 7): benefits flowing to people other than the person undertaking education (and their immediate family/dependents). These include higher taxes paid (fiscal externalities), consumption effects from higher expenditure by graduates generating demand for goods and services produced by those with a degree and knowledge spillovers. Examples include Moretti (2004), Chapman and Lounkaew (2015), and Mazzolari and Ragusa (2007). As noted earlier, the research outputs of universities are not included in these studies (R&D spillovers from university research are additional).
4. Non-monetary spillovers (bottom right in Figure 7): these include other intangible benefits to society such as reduce crime, increased political stability and volunteering, as a result of increased university education. Examples include McMahon (2004).

Screening effect

It has been suggested in some literature¹ that university education partly has a screening effect (also called a signalling or filtering effect). That is, some of the higher wages earned by graduates is due to a degree placing them ahead in the queue for high-paying jobs compared with a person of equal ability but without a degree, and not because of the skills (or human capital) gained during their university education. As a result, the skills acquired while at university could only be responsible for part of the higher wages earned – this would suggest that a reasonable proportion of the time and money in a university qualification only serve to place the student further ahead in the queue for high-paying jobs, and not adding to the stock of human capital in the economy. The net effect of screening (a negative externality) could cause the returns to society as a whole to be lower than the private return.

Other literature suggests that the screening effect is less important. Many of the available studies conducted are from the US, where the university/college education system has a higher proportion of 'generalist' degrees, whereas in Australia, many more standard undergraduate qualifications are 'specialist' degrees involve training for a specific career from the age of 18/first

¹ See Chapman and Lounkaew (2015) for a recent summary

year of study (such as a nurse, teacher, pharmacist, dentist or accountant). Lange and Topel (2004) observe that while screening may exist, over a long period of time (in growth studies) the effect is not observed—there is a chance that this may be a result of the screening effects cancelling out the spillover effects by happenstance, but the more likely explanation is that social benefits are not well below private benefits because the screening hypothesis is incorrect.

If it were true that a degree was simply a ‘piece of paper’ and provided no (or limited) additional human capital, then it would suggest that employers are paying over the mark for skills, and would be better off hiring non-graduates. Large firms that employ graduates also use other mechanisms (such as aptitude tests and other recruitment screening), so if the skills acquired from higher education were of no value, then these other methods would result in the observed wage differentials reducing over time. That is, if there was a ‘screening’ effect, mechanisms would have been developed to reduce and remove this inefficiency.

As discussed further below, there is little empirical evidence for a social return that is substantially lower than the private return.

Social benefits: combining private benefits and spillover benefits

‘Social’ or ‘public’ benefit is defined inconsistently in the literature, and so varies depending on the author. Care is required when comparing and compiling data from the literature. Some examples of definitions used elsewhere:

- Government outlays vs. tax revenue recouped from graduates is most accurately labelled as the fiscal externalities, as in Chapman and Loukaew (2015). The OCED estimates of ‘public return’ relate to the additional taxes paid by graduates versus subsidies paid towards their higher education. While the ‘return to the taxpayer’ is useful information for some purposes, it is not a measure of economic welfare (nor social return).
- Some studies report the social return as the private benefit less the screening effect. However, this does not account for any other types of spillovers – it is based on the assumption that part of the private return is simply at the expense of others.
- The ‘social’ return in McMahon (2004), based on Psacharopoulos and Patrinos (2002) is the private benefits compared with the sum of private and public costs (i.e. the public subsidy is added to the denominator). This is an incorrect estimate of the true social return, as it does not account for spillovers on the numerator. As a result, McMahon (2004) and Psacharopoulos and Patrinos (2002) are not a ‘social’ return in terms of economic welfare, and should not be confused with ‘social’ return as used in this report.

- Long run growth models measure trends and cross sectional changes in GDP² per capita as a result of increased education. These studies measure observed differences in living standards across time and countries or regions (so account for crowding out effects). These studies also capture self-employed people, and implicitly capture monetary spillovers, so are similar in concept to the economy-wide modelling in this report.
- The correct definition (as used in this report) for social return is the sum of the private return and spillovers. It is also necessary to allow for crowding out effects (e.g. resource constraints in the economy) in order to estimate aggregate welfare from a partial (or 'first round effect') estimate of the social return.

² While GDP is not a valid welfare measure for incremental policy changes, it is closely correlated with differences in economic welfare over long time periods and across countries.