

A Smart Investment for a Smarter Australia: Economic analysis of universal early childhood education in the year before school in Australia

The Front Project
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Executive summary

There is an increasingly strong evidence base that demonstrates the impact of the early years on outcomes later on in life. While early childhood experiences do not entirely dictate future trajectories, they do create the foundations for all future learning, health and wellbeing.

Over the past 50 years, numerous international studies have shown that high quality early childhood education can have substantial and sustained impacts on a whole range of skills that are important for children's futures. However, to date, no economic assessments of Australian early childhood education programs have been undertaken. International models do not necessarily reflect the unique nature of early child education provision in Australia or the specific social and economic circumstances of Australian society.

The Front Project commissioned PwC to undertake an economic analysis of early childhood education in Australia. The analysis focusses on the early childhood education provided to children in the year before they start school – often known as either preschool or kindergarten.

Scope of the analysis

The analysis has considered the benefits of early childhood education for children, their parents or carers, governments and employers against the costs of providing that early childhood education. It has used a methodology that is consistent with similar past studies and accepted approaches to economic analysis. It considers a broad range of short, medium and long-term benefits, all of which are strongly supported by either Australian or international evidence and use contemporary Australian data.

Benefits:

Children, their parents or carers, governments and business all benefit from the provision of a quality early childhood education:

- The benefits of early childhood education for **children** include increased cognitive capabilities, which can be measured in terms of improved literacy and numeracy. These can be linked to improved achievement at school, which in turn affect school completion rates and levels of educational attainment. Educational attainment is in turn a strong predictor of earnings over a lifetime.
- Some of the **parents and carers** of children who participate in early childhood education are able to participate in paid work, when they otherwise would not be able to, or choose to work more hours. They benefit from higher incomes, including over an extended period as a result of less career disruption.
- Early childhood education also contributes to a more capable and highly qualified workforce, which is a benefit to **business** in terms of higher productivity and greater levels of innovation.
- **Governments** are long-term beneficiaries of the provision of early childhood education. They benefit from higher taxes paid by parents and carers who are able to work more, and children who earn more over their lifetimes. Early childhood education also reduces unemployment and the resulting payments of unemployment benefits and other forms of social expenditure. State and Territory governments are beneficiaries as a result of fewer children repeating a year of school or needing special education placements, as well as lower health and criminal justice systems costs.

Whilst this study has been able to quantify in economic terms a broad range of benefits from investment in early childhood education, there are additional benefits from early childhood education that have not been quantified. A significant benefit of early childhood education is the improved social and emotional skills it provides children. Social and emotional skills have a significant and lasting impact on children and affect outcomes over their lifetime, contributing to achievement at school and at work, to positive relationships and social cohesion, to mental health and wellbeing. There is emerging evidence that early social and emotional capabilities developed in early childhood education predict later outcomes, but there is currently insufficient evidence to track these benefits and quantify them in monetary terms over a lifetime. As such, our analysis is likely to be a conservative estimate of the overall benefits of early childhood education.

Costs:

The study has focussed on children accessing 15 hours of early childhood education in the year-before-school. Contributors to this cost include:

- The **Commonwealth Government**, who is the major funder of early childhood education provided through the Child Care Subsidy¹ as well as payments made to State and Territory Governments under the National Partnership Agreement on Universal Access to Early Childhood Education (NP UAECE).
- The **governments of Australia's states and territories**, who contribute to the cost by directly delivering early childhood education programs or funding other providers to do so, as well as undertaking regulatory and policy functions.
- **Parents and carers**, who contribute to costs in terms of fees paid to providers of early childhood education services.

Key findings

Using 2017 as the reference year, this study has identified **\$2.34 billion in costs** associated with the provision of early 15 hours of early childhood education in the year-before-school. These costs are split between government (79 per cent) and parents or carers (21 per cent).

The study has also identified **\$4.74 billion in benefits** associated with providing this one year of early childhood education. Some of these benefits will be realised in the short-term, including the additional income and higher taxes paid by parents or carers who choose to work more because early childhood education is available (\$1.46 billion and \$313 million respectively). Other benefits will be realised over a much longer period. The cognitive benefits for children who receive a quality early childhood education can be linked with to \$1.06 billion in higher earnings over a lifetime and a further \$495 million in higher taxes paid to government.

The timing of the benefits has been accounted for using a discount rate of 3 per cent, which is consistent with other studies of the long-term benefits of social programs. The beneficiaries include:

- Children - \$997 million or 21 per cent of benefits
- Parents and carers – \$1.46 billion or 31 per cent of benefits
- Governments – \$1.96 billion or 41 per cent of benefits
- Employers and businesses – \$319 million or 7 per cent of benefits

A graphical representation of the results of the economic analysis is below.

¹ This study has used 2017 data, so has calculated the costs of the Commonwealth Government's Child Care Benefit (CCB) and the Child Care Rebate (CCR), which were replaced by the CCS in July 2018.

Figure 1: Results of the economic analysis (NPV, 3 per cent)

	Costs	Benefits	
Children		Increase in wages for children attending ECE \$1,064 million	Reduction in welfare payments to individuals - \$67 million
Parents	Out-of-pocket costs (fees) \$501 million	Improved employment/earnings of parents \$1,463 million	
Government	Commonwealth NP UAECE funding \$422 million	Benefits from reduction in children repeating a year of school \$11 million	Increased government receipts (taxation) from parents \$313 million
	State and Territory funding (excluding Commonwealth NP UAECE funding) \$1,011 million	Lower criminal activity \$522 million	Lower placement in special education classes \$3 million
	Commonwealth Government childcare assistance funding \$402 million	Health benefits - Lower long term health issues, smoking rates and obesity \$605 million	Increased government receipts (taxation) from children \$495 million
	Other costs – additional schooling costs \$58 million	Lower welfare costs \$67 million	
Employers		Additional lifetime productivity benefits from children \$319 million	

Source: PwC analysis

Overall, the study has identified approximately \$2 of benefits for every \$1 spent on early childhood education. Expressed differently, this is a return on investment (ROI) of 103%. Our study demonstrates that expenditure on early childhood education can be viewed as a strong long-term investment with quantifiable financial returns.

Table 1: Results of economic analysis, present value

	Group affected	Present value (3 per cent discount rate) \$ million
Cost of early childhood education		
Cost to government	Government	1,835
Cost to households	Parents/carers	501
Total cost		2,336
Benefits of early childhood education		
Parental earnings benefits	Parents/carers	\$1,463
Taxation benefits of additional parental income	Government	\$313
Higher earnings for children over lifetime	Children	\$1,064
Additional productivity benefits from children	Employers	\$319
Taxation benefits from children's additional lifetime earnings	Government	\$495
Reduced expenditure on special education	Government	\$3
Reduced expenditure on school repetition	Government	\$11
Reduced health expenditure	Government	\$605
Reduced crime-related expenditure	Government	\$522
Reduced welfare expenditure	Government	\$67
Reduction in welfare payments to individuals	Children	-\$67
Other costs – additional schooling costs	Government	-\$58
Total early childhood education benefits		4,737
Net benefits / NPV		2,401
Benefit-cost ratio		2.0

Note: Levels of benefits and costs are not necessarily comparable between policies given that they have different base cases. The benefit-cost ratio (BCR) is a more appropriate comparator.
Source: PwC analysis

1 Introduction

The Front Project is an independent national enterprise working to improve quality and create positive change in Australia's early childhood education system. They work with government, business and the early education sector to improve outcomes for children and in turn increase the short and long-term gains for Australia. The Front Project aims to improve quality and create positive change across Australia's early childhood education system through:

- activating a network of influential business and community leaders to boldly advocate for high quality early learning
- research and policy development that supports a high quality early learning system so all children benefit and progress
- convening and equipping leaders from the early learning sector to ignite change and improve the quality of early learning for all children
- campaigning for universal access to high quality early education programs that suit families
- co-designing and implementing innovative program solutions that address gaps and strengthen the early learning system.

The Front Project commissioned PwC to undertake an economic analysis of early childhood education in Australia. The analysis focusses on the early childhood education provided to children in the year before they start school – often known as either preschool or kindergarten.

There is an increasingly strong evidence base that demonstrates the impact of the early years on outcomes later in life. While early childhood experiences do not entirely dictate future trajectories, they are the foundations for future learning, health and wellbeing.

Over the past 50 years, numerous international studies have shown that high quality early childhood education can have substantial and sustained impacts on a whole range of skills that are important for children's futures.

High quality early childhood education impacts children's language, literacy and numeracy skills, as well as their reasoning, problem-solving and analytical capabilities. It also impacts their social and emotional development, including getting along well with others, listening and communicating well, showing empathy, being motivated, possessing self-confidence, having initiative, paying attention and focusing, persevering on challenging tasks, solving problems, managing emotions and impulses, following rules (Heckman, Stixrud, & Urzua, 2006).

Improving children's cognitive, social and emotional development can have substantial benefits for children themselves, their families, and society and the economy. Economic analysis in the United States and Europe has demonstrated that investments in early childhood education can boost education achievement, employment and productivity while reducing expenditure on health, education and justice.

To date, no economic assessments of Australian early childhood education programs have been undertaken. International models do not necessarily reflect the nature of early child education provision in Australia or the specific social and economic circumstances of Australian society. This study addresses this gap by focusing on the costs and likely benefits of modern Australian early childhood education programs, and using Australian education, employment, health and welfare data to the greatest extent possible.

There is a long history of economic analysis being used to inform decisions about public policy initiatives and priorities for government investment. Cost-benefit analysis has been used, for example, to document economic returns on investment for education and public health that have led to major initiatives in these fields.

Applying an economic lens to social policy issues involves identification of benefits that are observable, quantifiable and, importantly, able to be expressed in monetary terms. In practice, this can mean economic analysis focuses only on a narrow range of potential benefits, leaving out more intangible (but important) social outcomes like enhanced social cohesion or improved wellbeing. However, a consistent approach to identifying and quantifying direct economic benefits supports decision-makers to understand likely short and long-term impacts and make informed decisions about where to focus their effort and place investment.

Early childhood education programs – known as preschool or kindergarten – are structured, play-based, teacher-led early learning programs, currently attended by children in Australia for about 15 hours per week in the year before they start school. Children can attend their early childhood education programs in long day care services, stand-alone centres, or in schools. All references to early childhood education in this report refer to these preschool or kindergarten programs.

This report demonstrates why investment in the early years is central to Australia's long-term productivity and prosperity. The aim of this analysis is to answer the following research questions:

Box 1 Key research questions

- Do the benefits of Australian early childhood education programs outweigh the costs of delivering them, and what is the return on investment?
- What are the individual, social and government benefits of early childhood education?

The remainder of the report is structured as follows:

- Chapter 2 – describes the methodology used to undertake the analysis
- Chapter 3 – describes analytical framework used
- Chapter 4 – outlines some the key assumptions used in the analysis
- Chapter 5 – describes the calculation of the costs
- Chapter 6 – describes the calculation of the benefits
- Chapter 7 – sets out the results of the analysis
- Appendix A – list of the references used
- Appendix B – outlines the methodology for determining the effect size of early childhood education on educational outcomes
- Appendix C – sets out further details on the methodology behind the estimation of workforce participation and societal benefits

2 Project approach

This chapter sets out the methodology we have used to undertake the economic analysis of early childhood education and our consultation approach.

2.1 Economic analysis of early childhood education

This economic analysis of early childhood education in Australia compares the upfront cost of early childhood education with the expected long-term economic benefits, such as reduced need for special education services, improved education outcomes and higher lifetime earnings. By undertaking this analysis, we aim to increase the evidence base for investing in early childhood education. This in turn will enable more informed decisions about the allocation of resources for early childhood education programs in Australia.

The contribution of early childhood education on the economy is characterised by a compelling international evidence base. Much of the international evidence about the economic benefits of early childhood education is drawn from a number of well known, small-scale randomised controlled trials (RCTs) of targeted early childhood education interventions in the United States. The cost-benefit analyses based on RCTs of targeted interventions generally provide support for expanding early childhood education and care for disadvantaged children. These studies include:

- High/Scope Perry Preschool (Heckman, Moon, Pinto, Savelyev, & Yavitz, 2010)
- Abecedarian (Barnett & Masse, 2007)
- Chicago Child-Parent Centers (Reynolds, 2002 and 2011) (Temple & Reynolds, 2015)

These RCTs studied high-intensity programs targeted at highly vulnerable children (in the US around the 1960 and 70s). These programs generated a cost-benefit ratio of between 10 and 17, with reduced crime being the most significant driver of savings (delivering 88 per cent of total benefits), largely reflecting the social context of the United States (Schweinhart, et al., 2005). The returns are higher the longer the children's outcomes are measured (the children in the Perry Preschool study are now aged over 55) (Heckman, Moon, Pinto, Savelyev, & Yavitz, 2010).

More recent cost-benefit analyses have examined universal early childhood education programs delivered to a more socio-economically diverse cohort and generally involving lower levels of quality (Cannon, et al., 2017) (Washington State Institute for Public Policy, 2018). These programs have also been implemented more recently (i.e. from the mid 2000's onwards), so participants are much younger – and previous experience shows a large proportion of the benefits accrue in adulthood, with proportionately small benefits from 'education savings'. The benefit-cost ratios for these studies have been around two to four. The majority of the benefits generated through anticipated increases in employment, earnings and tax revenue and decreases in crime. The reduction in expenditure on students repeating years of schooling and on special education for children with learning difficulties was a minor component of the benefits.

In addition to the United States studies, there have also been several recent economic analyses of universal early childhood education programs from elsewhere around the world, including:

- A Cost-Benefit Analysis of Universal Preschool Education: Evidence from a Spanish Reform (2016) (Van Huizen, Dumhs, & Plantenga, 2016)
- The economic effects of pre-school education and quality, based on the EPPSE study (2014) (Cattan, Crawford, & Dearden, 2014).

The analysis of Spanish preschool reform provides causal evidence based cost-benefit analysis of expanding universal access to preschool. This reform, implemented in Spain in the early 1990s, lowered the age of universal eligibility for publicly subsidized preschool from age four to age three. The results showed a benefit-cost ratio of over four euros for every euro invested in preschool. This study included the benefits from reduced grade retention (repeating a year of school), improved lifetime earnings and increased taxation as well as benefits from increased maternal employment (Van Huizen, Dumhs, & Plantenga, 2016).

The EPPSE project was the first large-scale British study of the effects of different preschool experiences on children’s outcomes. Researchers looked at the impact of both preschool education and preschool quality on short-term and long-term education outcomes, and future labour market outcomes. It found that, on average, early childhood education increases the probability of obtaining five or more pass grades for General Certificates of Secondary Education (GCSE) by 8.4 percentage points, while it increases the average number of GCSEs achieved by 0.8 GCSEs (Cattan, Crawford, & Dearden, 2014). They estimate these children will go on to earn on additional 7.9 per cent of gross earnings per individual (Hayward, Hunt, & Lord, 2014).

A selection of the studies discussed above and their results are shown in the table below.

Table 2: International economic analyses of early childhood education programs

Study	Universal	Year	Benefit-cost ratio
Perry Preschool (U.S.)	×	1960's	12.2
Abecedarian (U.S.)	×	1972	2.5
Chicago Child-Parent Centres (U.S.)	×	1980's	10.8
Tulsa Universal Pre-K Program (U.S.)	✓	2006	2.1
Spanish reforms (Spain)	✓	1990's	4.3
Washington State's Early Childhood Education and Assistance Programs (U.S.)	×	2003 to 2009	4.6

Source: PwC analysis; Heckman, Moon, Pinto, Savelyev, & Yavitz, 2010; Karoly, 2017; Reynolds, 2011; Bartik, Belford, Gomley, & Anderson, 2016; Van Huizen, Dumhs, & Plantenga, 2016; Washington State Institute for Public Policy, 2018

Note: The Benefit-cost ratio for Washington State's Early Childhood Education and Assistance Programs includes programs that are universal or target low-income students.

2.2 Overview of the approach

PwC has undertaken this project, working closely with the Front Project. The project was undertaken from late 2018 to early 2019. The key steps in our analysis have included:

1. undertaking a literature review of existing evidence
2. developing a framework to capture the costs and benefits of early childhood education in Australia
3. undertaking the economic analysis.

Throughout the project we have also undertaken consultations with a range of stakeholders from academia, government and the early-childhood sector.

2.3 Literature review

We have undertaken a review of the Australian and international evidence of the impacts of early childhood education. Our review included:

- evidence of the cognitive and social and emotional impacts of early childhood education, in the short and long term
- previous analysis of the economic impacts of early childhood education.

In undertaking the literature review we also identified data sources for input into our analysis. To the greatest extent possible, we have used Australian data, so the model reflects the real costs of delivery in Australia, as well as the impact of improved education on lifetime earnings and taxation in Australia. However, Australian data has not been available in all cases and we have needed to rely on some international evidence to address gaps in the Australian evidence-base. In particular, there are few studies of the impact of modern Australian early childhood education programs (especially after the introduction of the significant reforms 2008-2012 that introduced the National Quality Standard and universal access to preschool), or on the health and social impacts of early childhood education programs in Australia. Further details on the sources used for the analysis is provided in Appendix A).

2.4 Framework development

Developing the analytical framework for the economic analysis has involved the following steps, which are set out in more detail in Chapter 3 (and also Appendix B and C). The methodology has been developed to be as consistent with international norms for economic analysis and Australian Government guidance on cost-benefit analysis.

Table 3: Steps to develop the cost-benefit analysis (1)

No.	Approach	Description
1	Decide whose costs and benefits count	Identifying all those who contribute to the cost of early childhood education and all those who are likely to benefit in the short and long term.
2	Identify the impacts	Reviewing the international and Australian literature to identify the full range of potential short and long term impacts, establishing the impacts that are backed by strong evidence and are 'monetisable' for the purpose of the economic analysis.
3	Predict the impacts over time	Identifying the timeframes in which the costs are incurred and the benefits are reaped, and using data to calculate the cumulative impacts over time. The approach forecasts the likely future benefits of the early childhood education provided today.
4	Monetise (attach dollar values to) impacts	Converting all of the non-monetary impacts (costs and benefits) into dollar values so the costs and benefits can be aggregated and then compared against one another. For example, calculating the dollar value of improved school achievement in respect to reduced need for expenditure on special education, and increased earnings from better jobs.
5	Discount future costs and benefits to obtain present values	As the benefits occur over a long time period, in order to compare the costs and the benefits there is a need to convert these into 'today's dollars'. This is done by applying a 'discount rate' to the values that occur in the future.
6	Compute the net present value and a benefit cost ratio	The net present value involves the summation of all impacts, costs and benefits in 'today's dollars', and generates the ratio of costs to benefits.
7	Perform sensitivity analysis	This technique is used to determine how different assumptions would impact the net present value. In doing so, it tests the robustness of the model and the results of the analysis. Example scenarios include an increase of the discount rate or the size of the impacts.
8	Reach a conclusion	After computing the net present value and performing a sensitivity analysis we are able to make a conclusion about the overall impact of early childhood education.

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2.5 Consultation approach

In developing the analysis, we undertook consultations with a range of stakeholders from government and the early childhood sector, as well as Australian and international economists.

2.5.1 Presentation of methodology to stakeholders

Following the development of the analytical framework, a national consultation session was held involving representatives from the early childhood education sector, the business community, academia and government to discuss:

- The framework we proposed for the analysis
- Potential data sources to incorporate into the analysis
- Options for presenting the results

Where possible, feedback obtained through the consultation session has been incorporated into the final analysis.

2.5.2 Project reference group

Throughout the project, we have consulted with a reference group with expertise in economics, government and early childhood education. This group assisted in the development of the analysis. The Front Project and PwC engaged with the reference group at various stages of the project, including:

- Providing input on the cost-benefit analysis approach, with the aim of ensuring our approach accurately reflects established methods and approaches in early childhood education economic assessments
- Helping identify suitable options for managing potential issues surrounding modelling, such as data availability, and evaluating and comparing our analysis with other studies in Australia and around the world
- Framing and communicating the economic analysis

The table below lists the participants engaged in the reference group during the course of our analysis.

Table 4: Project reference group participants

Reference group member	Organisation
Professor Adrian Piccoli	Gonski Institute, University of New South Wales
Emeritus Associate Professor Gordon Cleveland	University of Toronto
Dr Dan Cloney	Australian Council for Educational Research
Ms Seri Renkin	ten20 Foundation
Mr Mark Johnson	Board Director, G8 Education, Coca-Cola Amatil and others
Professor Deborah Brennan	Social Policy Research Centre, University of New South Wales

The paper was peer reviewed by two international economists with expertise in early childhood education and the economics of education.

3 Analytical framework

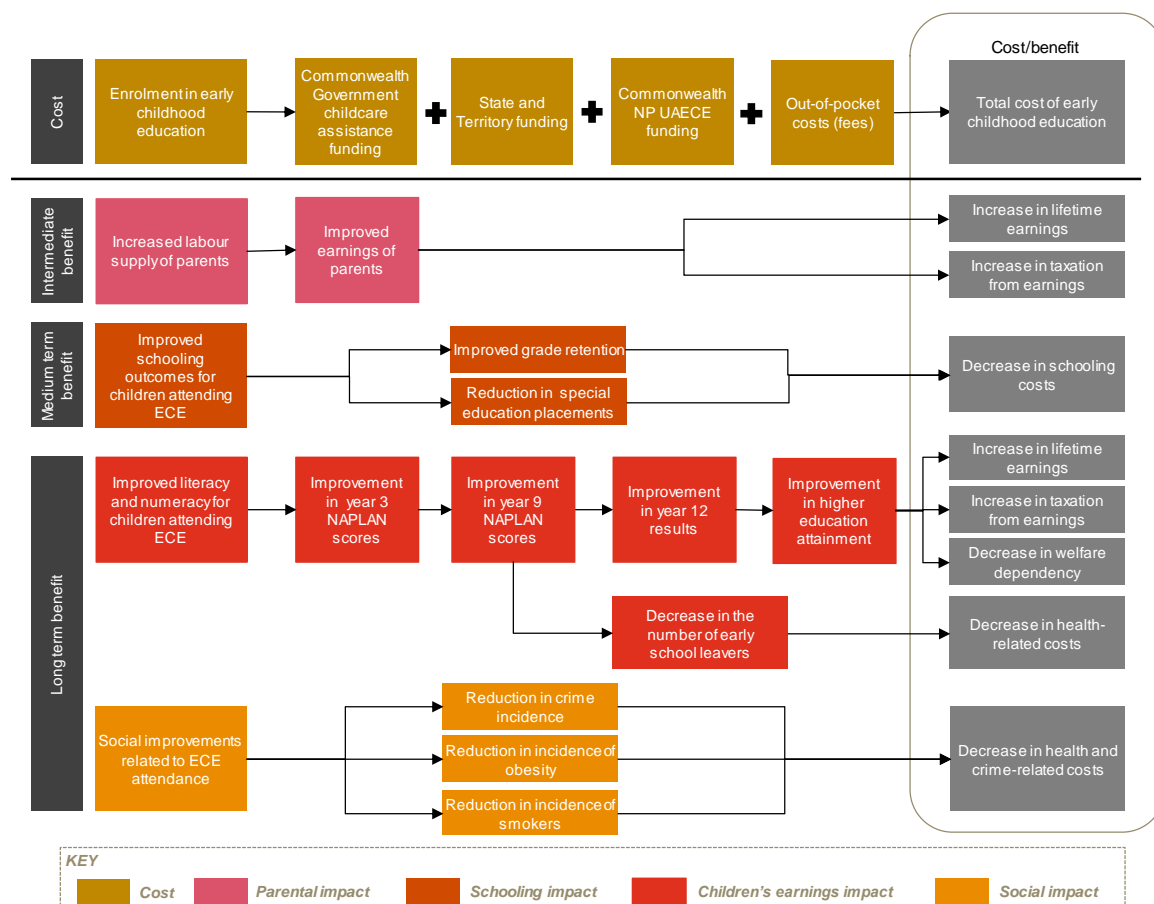
This chapter sets out the framework we have used to undertake our analysis, including the impacts that are counted, who these impacts relate to and the time periods in which they occur.

3.1 Overview of the approach

The approach to the cost benefit analysis is summarised in the figure below. In our analysis we considered the costs and benefits of early childhood education in the year before school for children, their parents or carers and government. The analysis has considered the cost of providing that education and a broad range of short, medium and long-term benefits, all of which are strongly supported by either Australian or international evidence.

In Australia, all early childhood education and care for children aged birth to age five is delivered by qualified educators under a National Quality Framework (NQF). The NQF establishes the requirements for children's safety, learning wellbeing and ensures children's learning is guided by the Early Years Learning Framework. Australian governments make an additional investment to enable universal access to a preschool or kindergarten program, delivered by a Bachelor-qualified teacher for 15 hours per week, for all children in the year before formal school (children generally aged 4-5). The Universal Access policy is a partnership between the Commonwealth and State and Territory governments that was established in 2008 – and has made structured, play-based early childhood education programs available to 90 per cent of children (Parliament of Australia, 2019). Our economic analysis focuses on the impact of this policy setting and all references to early childhood education in this report refer to programs delivered in the year-before-school (preschool/kindergarten). The base year for the analysis is 2017, the most recent year for which full data is available.

Figure 2: Overview of the approach to the analysis



Source: PwC analysis

3.2 The groups affected

The key groups impacted by the provision of early childhood education are children, their parents or carers and governments – both the Commonwealth Government and the governments of the states and territories. The costs and benefits that accrue to the providers of early childhood education have been considered but are not specifically accounted for in the analysis.

3.2.1 Children

Children are the key beneficiaries of early childhood education. Much of the literature on the impacts of early childhood education are divided into two categories, cognitive benefits and social/emotional impacts:

- Cognitive impacts** – a comprehensive international evidence base, supported by a number of Australian studies, shows that children who participate in high quality early childhood education tend to have stronger cognitive capabilities than children who do not participate, or children who participate in low quality programs. Cognitive impacts include language and communication, numeracy skills, memory, judgement and reasoning. This cognitive impact can lead to higher educational outcomes and achievement in later schooling (Houng & Justman, 2014) (Gormley, Gayer, Phillips, & Dawson, 2005) (Melhuish, et al., 2015) (Taggart, Sylva, Melhuish, Sammons, & Siraj, 2015).

- **Social and emotional impacts** – early childhood education also impacts a range of social and emotional capabilities, including understanding and managing emotions, feeling and showing empathy for others, establishing positive relationships, confidence and self-esteem, setting goals, staying focused and managing distractions, and making responsible decisions (Morris, Mattera, Castells, Bangser, & Bierman, 2014) (Moore, et al., 2015) (Nix, Bierman, Heinrichs, Gest, & Welsh, 2016) (Taggart, Sylva, Melhuish, Sammons, & Siraj, 2015).

There is stronger evidence and data about the cognitive impacts of early childhood education, internationally and in Australia, as this has been the exclusive focus of numerous studies over decades. The tools for assessing cognitive abilities are also well-developed. We also have a strong and comprehensive evidence base on the lifetime impacts of educational achievement (for schools and tertiary education), with decades of Australian research showing education predicts of an individual's earnings, health and wellbeing over their life.

Social and emotional skills can have a significant and lasting impact on children and affect outcomes over their lifetime, contributing to achievement at school and at work, to positive relationships and social cohesion, to mental health and wellbeing. There is growing empirical evidence that early social and emotional capabilities predict later outcomes – for example, one study shows three year old children with good self-control have better financial security as adults, as they are more likely to save, have built good financial building blocks for the future, and have good credit (Moffitt et al., 2011).

These impacts potentially have even more significant influence on children's lives and may yield greater returns than the cognitive impacts. Yet because social and emotional capabilities are a newer field of study they have not been systematically tracked through a lifetime in the same way that cognitive abilities (and school achievement) have been for many decades. Although a recent Australian study found a causal relationship between mental health competence at school entry (via AEDC) and Year 3 NAPLAN results (O'Connor, Cloney, Kvalsvig, & Goldfeld, 2019), overall there has been limited research on the causal relationship between social and emotional skills gained through participation in early childhood education and potential later outcomes, like better mental health or improved performance in the workforce. As we have not been able to quantify their benefits in the model, the analysis should be considered a conservative estimate of the benefits and likely long-term impacts.

3.2.2 Parents or carers

The parents or carers of children who receive early childhood education incur both a cost of that provision and are also a beneficiary:

- **Fees paid to providers** – in many cases, parents or carers make a financial contribution to the cost of their early child education, which is the difference between the price charged by providers and the contribution provided by governments.
- **Increased earnings** – the availability of early childhood education allows some parents to participate in paid work, when they otherwise would not be able to, or work more hours than they would be able to otherwise. The income they receive from this work, after taxes paid to governments, is a benefit to these parents.

3.2.3 Governments

Both the Commonwealth Government and the governments of Australia's states and territories contribute to cost of early childhood education.

The Commonwealth Government is also a beneficiary of early childhood education. It receives higher taxes, paid by parents/carers who are able to work more because of the availability of early childhood education, or children who earn more over their lifetimes. Early childhood education also reduces unemployment and the payment of unemployment benefits, delivering reduced social expenditure as well.

State and Territory governments are beneficiaries of early childhood education, to the extent that the provision of early childhood education results in a reduction of the number of children repeating a year of school and special education placements at school and lower levels of demand for the health and criminal justice systems. They also benefit from a well-educated workforce and strong economy.

3.2.4 Employers

A more capable and educated workforce will deliver higher productivity. As noted above, part of the benefit of this increase in productivity accrues to employees in the form of higher wages. However, employers and businesses are also beneficiaries in the form of increases in the value-add produced by more educated employees, which increases their competitiveness as well as profitability. A more highly educated and capable workforce is likely to lead to:

- Higher levels of productivity, both of workers and of enterprises
- Higher levels of future innovation and development
- More attractive opportunities domestic and foreign investment, and thus job growth

3.2.5 Providers of early childhood education

The providers of early childhood education are not separately accounted for in the analysis. While the early childhood sector makes a contribution to Australia's economy in terms of employment, taxes and overall economic output, it is not appropriate to count this expenditure in an economic impact assessment like this. This is because it must be assumed that, in the absence of expenditure on early childhood education, this expenditure would be directed to other initiatives and would have similar effects on overall output. To count the transfer of funds from government and households to the sector as a separate economic impact would be double-counting the impacts.

3.3 The nature of the impacts

The analysis has considered a broad range of costs and benefits of early childhood education on children, their parents or carers and government. Detailed analysis of costs and benefits is set out in Chapter 5 (costs) and Chapter 6 (benefits). They are summarised below.

3.3.1 Costs

The costs we have included in the analysis relate to the cost of providing 15 hours per week of early childhood education to children in the year before they start school – often known as either preschool or kindergarten. These costs include:

- Commonwealth Government funding under the National Partnership Agreement on Universal Access to Early Childhood Education (NP UAECE) – this is the funding the Commonwealth Government provides to the governments of the States and Territories.
- Commonwealth Government funding for early childhood education provided through the Child Care Benefit (CCB) and the Child Care Rebate (CCR). The study has focussed on the component of this funding that relates to children accessing their 15 hours of early childhood education in the year-before-school in a CCB-approved long day care service.²
- State and Territory government funding for early childhood education – excluding the amount that State and Territory governments receive from the Commonwealth Government through the NP UAECE.
- Private expenditure or out-of-pocket costs for households associated with the provision of early childhood education.

3.3.2 Benefits

The benefits included in the analysis are all consistent with standard international approaches to measuring the economic impact of early childhood education.³ The benefits are set out below.

- **Higher levels of workforce participation by parents and carers** – for the parents and carers who choose to participate in additional paid employment while their children are participating in early childhood education and who would not otherwise have done so.
- **Improved literacy and numeracy** – for the children attending early childhood education, which in turn leads to:
 - **Education cost savings** – due to lower levels of children repeating a year of school and reduced need for special education programs.
 - **Improved educational achievement, resulting in higher lifetime earnings for recipients** – the improved cognitive abilities that result from participating in early childhood education can be measured in later school achievement, educational attainment and the resulting impact on employment, earnings, taxation and welfare.
 - **Other social benefits and costs flowing from improved education and earnings** – resulting in cost savings for government due to a reduction in crime and a reduction in health care costs associated with smoking and obesity.

3.3.3 Summary of costs and benefits

The figure below summarises the costs and benefits that have been considered in the analysis and who they accrue to.

² Note: CCB and CCR have now been replaced by a single payment, the Child Care Subsidy (CCS), but because the analysis is focused on provision in 2017, all costings are based on 2017 policy and funding settings.

³ For example, see Cannon, J., Kilburn, R., Karoly, L., Mattox, T., Muchow, A., & Buenaventura, M. (2017). Investing Early: Taking Stock of Outcomes and Economic Returns from Early Childhood Programs. *RAND Corporation*

Figure 3: How the costs and benefits of early childhood education accrue to different groups

	Costs	Benefits	
Children		Increase in wages for children attending ECE	Reduction in welfare payments to individuals
Parents	Out-of-pocket costs (fees)	Improved employment/earnings of parents	
Government	Commonwealth NP UAECE funding	Benefits from reduction in children repeating a year of school	Increased government receipts (taxation) from parents
	State and Territory funding (excluding Commonwealth NP UAECE funding)	Lower criminal activity	Lower placement in special education classes
	Commonwealth Government childcare assistance funding	Health benefits - Lower long term health issues, smoking rates and obesity	Increased government receipts (taxation) from children
		Lower welfare costs	
Employers		Additional lifetime productivity benefits from children	

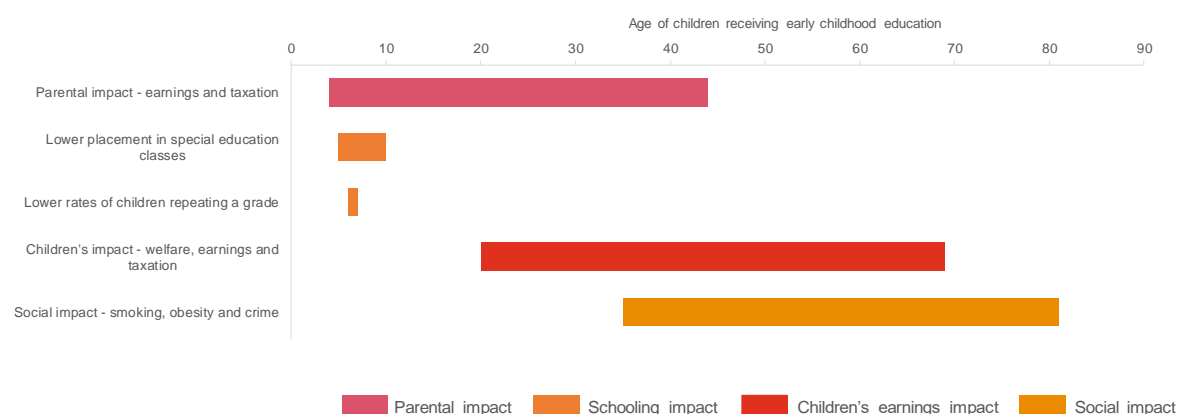
Source: PwC analysis

3.4 The timing of the impacts

Many of the economic benefits of early childhood education take a long time to be realised – for example, children who receive early childhood education today will enter the workforce almost two decades later and will work for a further four decades.

The timeframe for the analysis captures the lifetime benefits for the children receiving early childhood education in 2017. Some of the longer-term benefits, such as health-related benefits occur later in life. The cohort of children in this study are roughly four years old in 2017 and we have considered the lifetime benefits of early childhood education for this cohort.

Figure 4: Timeframe of the benefits of early childhood education



Source: PwC analysis.

Note: The costs for the analysis are incurred in 2017.

4 Key assumptions used in the analysis

This chapter sets out the key assumptions used in the analysis, which related to the calculation of both the costs (Chapter 5) and the benefits (Chapter 6) of early childhood education.

4.1 Overview

The following concepts are relevant to the analysis of the costs and benefits of early childhood education and are explained in this chapter:

- how we are defining early childhood education
- how we have estimated the effect size of early childhood education
- the discount rate used.

4.2 Defining early childhood education

The analysis focusses on the early childhood education programs that are provided to children in the year before they start school. The NP UAECE specifies 15 hours per week (or 600 hours per year) of structured, play-based learning led by a Bachelor-qualified early childhood teacher. Depending on where you are in Australia, this is known as either preschool or kindergarten.

Focusing on educationally-focused programs for children aged four to five, prior to formal schooling, is consistent with international evidence on the impacts of early childhood education (Melhuish, et al., 2015) (Phillips, et al., 2017).

In Australia, preschool or kindergarten programs are provided in different settings and by different providers – including programs delivered directly by government (often co-located with schools), non-government programs (including community and not-for-profit services and private schools), and in long day care services (which can be for-profit or not-for-profit). Each state and territory has a different distribution of services and different patterns of access.

Table 5: Children in year-before-school early childhood education programs, 2017

State / territory	Program	Age of entry	Government delivered program	Non-government delivered program	Long day care program
New South Wales	Preschool	4 and 5 year olds	10%	25%	65%
Victoria	Kindergarten	4 by 30 April	16%	36%	49%
Queensland	Kindergarten	4 by 30 June	2%	27%	70%
Western Australia	Kindergarten	4 by 30 June	72%	26%	2%
South Australia	Preschool	4 by 1 May	68%	4%	27%
Tasmania	Kindergarten	4 by 1 January	51%	13%	36%
Australian Capital Territory	Preschool	4 by 30 April	53%	3%	44%
Northern Territory	Preschool	4 by 30 June	81%	3%	16%
Australia			20%	29%	51%

Note: Government delivered programs include preschool and preschool programs within a centre based day care. Long day care programs are preschool program within a long day care centre. Non-government delivered programs are preschool only programs. Source: PwC analysis, ABS cat. No. 4240.0 - Preschool Education 2017, Table 3

4.3 Early childhood education hours

To estimate the expenditure associated with early childhood education provision, we need to understand the total number of hours provided.

In this analysis, we have assumed 15 hours per child per week of attendance at year before-school early childhood education. Some children attend long day care for more hours, but this analysis only counts the costs of providing 15 hours. Conversely, not all children who are enrolled in an early childhood education in the year-before-school are attending for the full 15 hours. However, the analysis assumes the full cost of delivery. For further discussion, see [Appendix C](#).

4.4 The impact (effect size) of early childhood education on early school achievement

A key component of this study is to determine the link between early childhood education and outcomes in later life. In particular, we focus on the effect early childhood education has on future educational and employment outcomes, based on empirical evidence. The educational outcomes of early childhood education underpins our estimates of the majority of the benefits of early childhood education. The link between improvement in educational outcomes and later life benefits such as lifetime earnings, taxation, welfare and health-related costs is well-established and particularly important for this analysis.

To establish the effect of early childhood education on education outcomes, we have estimated the 'effect size' that early childhood education has on children's cognitive skills in early primary school. Effect size is a simple way of quantifying the difference between two groups (in this case those that receive early childhood education and those that do not), and is measured in *standard deviations* between means (averages).

To determine an appropriate effect size we reviewed previously published studies that estimated the effects of early childhood education on children's outcomes. A range of Australian and international studies and meta-analyses were assessed according to their relevance for this cost-benefit analysis. Criteria in this assessment included:

- whether the study was Australian or international (with a preference for Australian-located studies)
- how recently the study had been undertaken (with a preference for studies from the last 10 years)
- whether the study focused on specific cohorts (with a preference for those considering universal provision)
- whether the study measured school achievement (with a preference for those linking early childhood education experiences with standardised tests comparable to NAPLAN).

Through this assessment (detailed in [Appendix B](#)), we identified three studies that were particularly relevant to this analysis:

- *Investing in Preschool Programs* (Magnuson & Duncan, 2013)

Magnuson & Duncan's study looked at the impact on cognitive or achievement-related outcomes for 84 programs, measured at the end of each program, which is typically when the children are commencing primary school (Magnuson & Duncan, 2013). This meta-analysis found that the simple average effect sizes for early childhood education on cognitive and achievement scores was a 0.35 standard deviation difference between the groups that had received early childhood education, and those that had not.

- Analysis on the *Introduction of the National Quality Framework* (Centre for Education Statistics and Evaluation Department of Education, 2017)

The impact of the *Introduction of the National Quality Framework* involved analysis of school enrolment data collected by the New South Wales (NSW) Department of Education. While we were not able to access detail on the statistical methods for analysis, this study reported a statistically significant positive relationship between early childhood education attendance and outcomes at school (Centre for Education Statistics and Evaluation Department of Education, 2017). This preliminary analysis found that at least six hours of early childhood education was associated with about 10 additional NAPLAN points in Year 3, equivalent to a difference between groups of between 0.14 standard deviations.

- The Melbourne Institute’s “Early Bird Catches the Worm” study (Warren & Haisken-DeNew, 2013)

The *Early Bird Catches the Worm* study used unit record data from the Longitudinal Study of Australian Children (LSAC) Survey to determine the link between early childhood education and NAPLAN results. The LSAC is a major study following the development of 10,000 children and families from all parts of Australia. The children in LSAC were aged 4-5 in 2004. This predates the establishment of the NQF, which has substantially improved key requirements for quality early childhood education (qualifications for educators, ratios of children to teachers, and a national learning framework), as well as the national policy on universal access of year-before-school early childhood education, which has significantly increased participation in teacher-led early childhood education programs. As such, it does not fully reflect levels of quality, attendance and impact in 2017. However, this study found the average preschool effects were between 13.1 and 18.1 points for different NAPLAN tests, accounting for variation in children’s ability and home learning environment. This equates to a difference of around 0.14 to 0.17 standard deviations. Importantly, the study highlighted the importance of high-quality provision for children’s outcomes.

This project highlights the need for further research on the short and long-term impacts of current Australian early childhood education programs.

4.4.1 Chosen effect size

Due to the lack of recent publicly available Australian data linking early childhood education and school achievement, we took into account a broad range of available data sources, domestic and international, to inform our chosen effect size. Our method was to prioritise studies that were from Australia initially, but also consider the effect sizes for international studies that analysed universal-style access to early childhood education programs, particularly programs with at least moderate quality.⁴ Based on those studies and meta-analyses, we chose an estimated effect size of 0.17 standard deviations. This is the estimated average impact for all children attending early childhood education programs.

⁴ International and Australian research indicates that there is a socio-economic gradient for early childhood education impacts, with lower socio-economic children generally benefiting more than children from wealthier backgrounds. This study focuses on the average impact across the whole population, likely understating the impact on disadvantaged children and overstating the impact on advantaged children. We were unable to analyse the impacts for each socio-economic quintile because Australia does not publish sufficiently granular data. This kind of analysis would require linking early childhood, schooling, higher education and tax data for a representative sample of the population.

We believe this is a reasonable estimation, reflecting the expected average impact of moderate to high quality universal early childhood education. It is consistent with available Australian evidence and the much more extensive international evidence base. We note that an effect size of 0.17 standard deviations is much less than some international estimates of the impact, which can be as large as 0.35. However, many of these studies are focused on intensive programs targeted at disadvantaged cohorts, with these targeted programs generally demonstrating much larger impacts.

The discount rate

Our model forecasts the future benefits of the early childhood education provided in 2017. For our cost-benefit analysis of early childhood education, the majority of the costs occur today, while the benefits occur over a much longer time period. In order to compare the costs and the benefits there is a need to convert all of them into 'today's dollars'. This is done by applying a 'discount rate' to the future values.

Because so many of the benefits in this cost-benefit analysis occur so far in the future, the choice of discount rate has a significant impact on the overall results of the analysis. Much of the literature on the costs and benefits of early childhood education use discount rates of three per cent (Van Huizen, Dumhs, & Plantenga, 2016) (Temple & Reynolds, 2015) or 4 per cent (Kilburn & Karoly, 2008). By contrast, governments in Australia use a range of different discount rates for different purposes. These range from three to seven per cent.⁵ However, most guidance suggests that for areas where benefits are not easily quantifiable (i.e. many social policy programs) the lower three or four per cent rate should be used.

For this evaluation a three per cent discount rate has been adopted, sensitivity testing has been undertaken at four per cent and seven per cent.

⁵ See for example: https://economicdevelopment.vic.gov.au/__data/assets/word_doc/0007/1492603/Guidance-on-discount-rates-internet1.docx or <https://www.pmc.gov.au/sites/default/files/publications/cosst-benefit-analysis.docx>

5 Costs of early childhood education

This chapter provides an overview of the costs of early childhood education and the way these have been incorporated in the analysis

5.1 Introduction

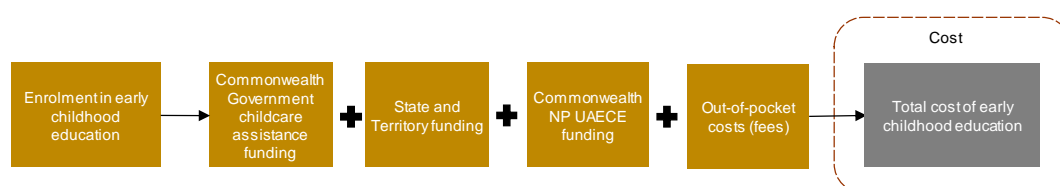
In this analysis, the costs of providing early childhood education have been estimated by adding up the expenditure by government (including Commonwealth, State and Territory governments), and private or household expenditure associated with providing 15 hours of year-before-school, teacher-led early childhood education in 2017 (as defined in the previous chapter).

This 'expenditure approach' to assessing cost takes the value of government and household expenditure on early childhood education, along with assumptions about the proportion of children attending preschool or kindergarten programs, and assumes this reflects the costs of providing early childhood education. In our approach, profits are not separately accounted for, based on the assumption that the market for the provision of early childhood education is relatively competitive (Productivity Commission, 2015) (see page 373 and Appendix H).

This section describes our estimates of each of the major groups of funding. These include:

- Commonwealth Government funding provided under the NP UAECE – this is funding that the Commonwealth Government provides to the governments of the states and territories for the provision of early childhood education
- Commonwealth Government funding for early childhood education provided through the CCB and the CCR. The study has focussed on the component of this funding that relates to funding children accessing their year-before-school early childhood education program in a long day care service
- State and Territory government funding for early childhood education – excluding the amount that State and Territory governments receive from the Commonwealth Government through the NP UAECE
- Private expenditure or out-of-pocket costs for households associated with the provision early childhood education.

Figure 5: Overview of the costs included in the analysis



Source: PwC analysis

5.2 Costs to government

The Commonwealth Government and State and Territory governments have different but complementary roles in funding early childhood education programs. Both levels of government contribute funding to early childhood services, with many preschool or kindergarten programs funded and delivered directly by state, territory and local governments.

Total government expenditure includes three different sources of funding:

- Commonwealth Government – NP UAECE funding
- Commonwealth Government – CCB and CCR funding
- State and Territory government funding.

The following sections set out the estimates for each expenditure group.

5.2.1 Commonwealth Government – NP UAECE

In 2017, the total level of funding the Commonwealth Government provided to State and Territory governments under the NP UAECE was \$421.8 million (Productivity Commission, 2019). Table 6 provides a breakdown of this total across the states and territories.

Table 6: NP UAECE payments to States and Territories, 2017

State / territory	NP UAECE payments (\$ millions)
New South Wales	135.1
Victoria	102.6
Queensland	88.3
Western Australia	47.1
South Australia	27.8
Tasmania	8.7
Australian Capital Territory	7.2
Northern Territory	5.2
Total (Australia)	421.8

Source: ROGS 2019 – Table 3A.8

5.2.2 Commonwealth Government Child Care Benefit and Child Care Rebate

The 2018-19 Commonwealth Government Budget Paper 6 reported the total CCB and CCR expenditure in 2017 as \$7.2 billion (Department of Finance, 2018).⁶ This study is interested in the component of this funding relating to year-before-school early childhood education.

⁶ As our analysis focuses on the 2017 cohort of child in their year-before-school, we have used the CCB and CCR as these were the prevailing funding mechanisms. They have subsequently been replaced by the CCS

Figure 6: Approach to the calculation of Commonwealth Government childcare assistance funding



Source: PwC analysis

To estimate the relevant portion of the total CCB and CCR expenditure, we calculated the attendance, in the form of number of enrolment hours, of children in year-before-school early childhood education. This figure was compared with the total number of hours of care that were covered under the CCB and CCR. Figure 6 explains the approach to calculating the proportion of total Commonwealth Government CCB/CCR from these data tables. The hours of attendance in CCB-approved services are noted in Table 7. Further information on this methodology is in [Appendix C](#).

Table 7: Annual hours of attendance for children enrolled in long day care, 2017

State / territory	Number of attendance hours	
	Hours for children attending year-before-school preschool through long day care services	Hours for all children 0-5 attending CCB/CCR approved childcare services
New South Wales	862,549	11,726,528
Victoria	458,244	8,332,740
Queensland	580,976	8,483,615
Western Australia	10,006	2,510,888
South Australia	68,202	2,050,157
Tasmania	4,267	522,097
Australian Capital Territory	21,150	768,043
Northern Territory	6,303	330,181
Total (Australia)	2,011,697	34,724,249

Source: Various sources, PwC analysis

Note: CCB/CCR approved childcare services includes long day care, family day care, vacation care, OSHC, occasional and in-home care. For this part of our analysis, we were only interested in hours of attendance for children attending year-before-school preschool through long day care services.

Our analysis found that roughly six per cent of total hours accrued in CCB approved childcare services (for children aged zero to five and older) could be attributed to children attending year-before-school early childhood education.

This corresponds to around \$402 million of the total \$7.2 billion of CCB/CCR funding in 2017.

5.2.3 State and Territory government funding

Total State and Territory government expenditure on early childhood education in 2016-17 was \$1.01 billion. Table 8 provides a breakdown of this funding.

Table 8: State and Territory government expenditure on preschool/ early childhood education programs, 2016-17

State / territory	Recurrent expenditure (\$ millions)	less NP UAECE funding from CwltH (\$ millions)	Total expenditure from States and Territories (\$ millions)
New South Wales	280.8	-135.1	145.7
Victoria	375.3	-102.6	272.8
Queensland	176.0	-88.3	87.7
Western Australia	307.8	-47.1	260.8
South Australia	170.1	-27.8	142.3
Tasmania	48.1	-8.7	39.5
Australian Capital Territory	35.7	-7.2	28.4
Northern Territory	39.2	-5.2	34.1
Total (Australia)	1,433.0	-421.8	1,011.2

Source: ROGS 2019 – Table 3A.8 and Table 3A.9

This State and Territory government funding supports services and roles related to:

- providing preschool services and, in some cases, providing funding to other early childhood education services (including some that also receive Commonwealth Government funding)
- regulating approved services under the NQF and licensing and/or registering child care services not approved under the NQF
- implementing strategies to improve the quality of early childhood education programs
- providing curriculum, information, support, advice, and training and development to early childhood education providers (Productivity Commission, 2019).

Some of the expenditure above likely relates to early childhood education and care other than in the year before school, therefore there is a possibility that it slightly overstates the costs to State and Territory governments.

5.2.4 Total costs to government

Based on these calculations, we estimate that the total government expenditure on early childhood education during 2017 was approximately \$1.83 billion, with State and Territory governments providing the largest funding source (Table 9).

Table 9: Total costs to government of preschool or early childhood education programs, 2016-17

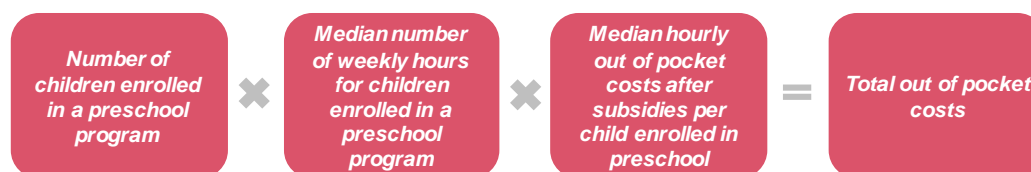
Funding source	Total cost (\$ millions)
State and Territory government funding (excluding NP UAECE)	1,011
Commonwealth Government NP UAECE funding	422
Commonwealth Government CCB/CCR funding	402

Source: PwC analysis, ROGS 2019 – Table 3A.8 and Table 3A.9

5.3 Costs to households

The fourth and final group of costs are those associated with private household expenditure on early childhood education.

Figure 7: Approach to calculating costs to households



Source: PwC analysis

This has been estimated based on the hours of early childhood education attendance across all types of year-before-school preschool (see [Appendix C](#) for our estimates of these hours) and the average hourly out-of-pocket cost of year-before-school early childhood education childcare (see Figure 7). The average hourly out-of-pocket cost of preschool is reported in the Productivity Commission, Steering Committee for the Review of Government Service Provision's *Report on Government Services* (ROGS).

Table 10: Median out-of-pocket hourly cost of year-before-school early childhood education per child enrolled, 2017

State / territory	Government preschool (\$)	Non-government preschool (\$)	Preschool in long day care (\$)	Total across all provider types (\$)
New South Wales	1.67	1.28	3.95	3.14
Victoria	1.60	2.33	5.06	3.39
Queensland	–	4.03	3.68	3.71
Western Australia	–	2.73	4.26	0.81
South Australia	–	2.20	3.39	1.07
Tasmania	–	2.33	3.64	0.67
Australian Capital Territory	–	12.09	5.56	2.28
Northern Territory	–	–	3.61	0.56
Total (Australia)	–	2.13	3.94	2.61

Source: ROGS 2019 – Table 3A.25

Based on this, our analysis found that the total out-of-pocket costs to parents for early childhood education was around \$0.5 billion in 2017.

Table 11: Total costs to households of preschool / early childhood education, 2017

Funding source	Total cost (\$ millions)
Household out-of-pocket costs of preschool	500

Source: PwC analysis, ROGS 2019 – Table 3A.25

5.4 Total cost of year-before-school early childhood education

The total value of government and household expenditure on early childhood education was calculated at \$2.3 billion, see Table 12.

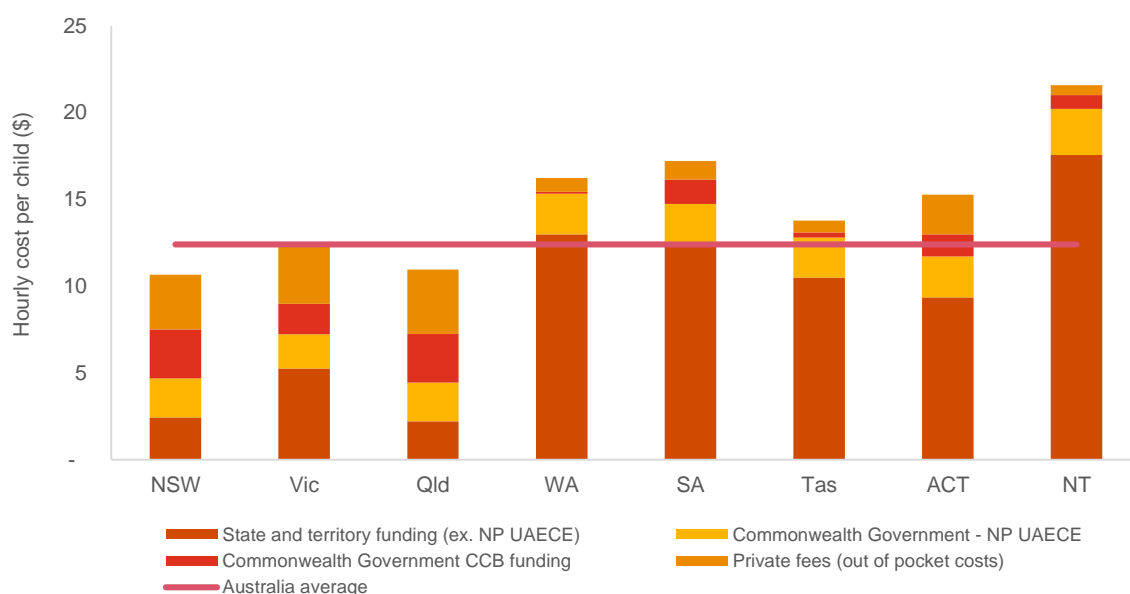
Table 12: Total cost of year-before-school early childhood education, 2017

State / territory	Cost to State and Territory governments (\$ million)	Cost to Cwlth government (\$ million)	Cost to households (\$ million)	Total cost (\$ million)
New South Wales	146	305	188	639
Victoria	273	193	176	642
Queensland	88	199	147	433
Western Australia	261	49	16	326
South Australia	142	44	12	199
Tasmania	39	10	3	52
Australian Capital Territory	28	11	7	46
Northern Territory	34	7	1	42
Total (Australia)	1,011	824	501	2,336

Source: various sources, PwC analysis

After calculating the cost to households and the Federal and state governments, it is possible to determine the hourly cost per child enrolled across all early childhood education providers, see Figure 8.

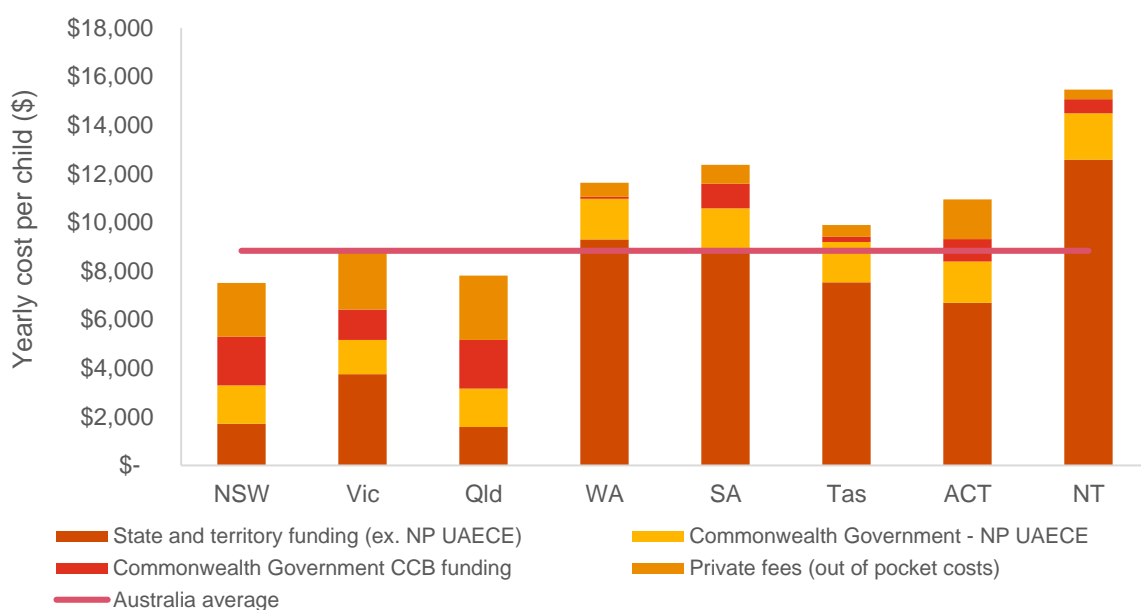
Figure 8: Total hourly cost per child enrolled – year-before-school early childhood education



Source: various sources, PwC analysis

This analysis also shows an average total annual cost per child of \$8,831. The average total government expenditure is \$6,789 per child, per year, see Figure 9.

Figure 9: Total yearly cost per child enrolled – year-before-school early childhood education



Source: various sources, PwC analysis

5.5 Sense checking of cost estimates

In order to test the reasonableness and reliability of our cost estimates, we also tested our calculations against two other methods for determining cost of year-before-school early childhood education.⁷ Overall, these two approaches provided similar results to the expenditure approach, which gives us a degree of confidence that the assumptions we have applied in the modelling are representative of the cost of delivering early childhood education in Australia.

An important caveat on these cost estimates is the issue of fee cross-subsidisation, whereby early childhood education and care centres may use funding for children over the age of three to offset the cost of running a service for children aged birth to 5. Further, as only regulated educator to child ratios are known – not actual operating ratios – we were unable to calculate the actual price of early childhood education.

⁷ First, we estimated the average early childhood education costs per hour accrued from a provider's perspective. The primary basis for this analysis is the breakdown of providers' costs by type of expenditure. Wages and salaries are estimated to make up the majority of early childhood education and care costs, around 60 per cent (Productivity Commission, 2014). These wages were estimated using industry and ABS Census 2016 data (Australian Bureau of Statistics, 2016). The remainder of the provider costs were calculated by estimating wage-related-on-costs and a profit margin. Wage-related on-costs includes operating costs such as rent, building costs, equipment, and food, among others. Second, we projected the cost estimates prepared by Deloitte Access Economics in 2014 for the review of the National Partnership Agreement on Universal Access to Early Childhood Education (Deloitte Access Economics, 2014) forward to 2017 by including an inflationary measure to reflect the change in the price of education services, sourced from ABS (Australian Bureau of Statistics, 2018). As the mix of provider types (government, non-government and long day care settings) across different Australian jurisdictions has also changed since 2014, we transformed the Deloitte analysis to reflect the current distribution using ROGS data.

6 Benefits of early childhood education

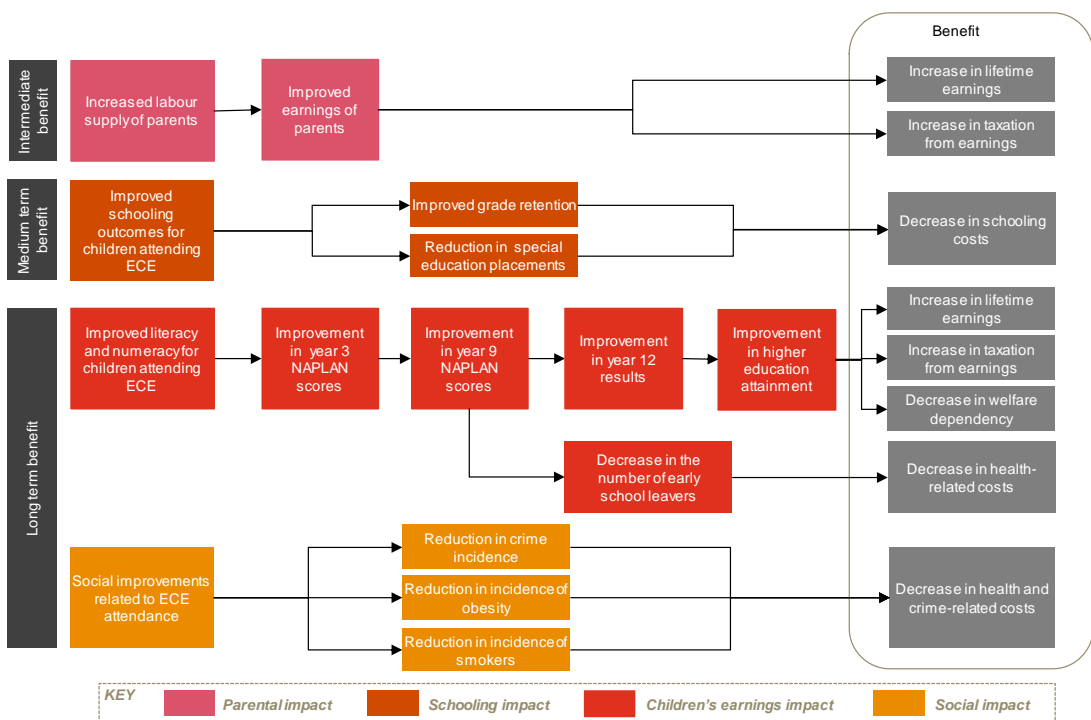
This chapter provides an overview of the benefits of early childhood education and the way these have been incorporated in the analysis

The benefits associated with early childhood education include:

- **Higher levels of workforce participation by parents and carers** – for the parents and carers who choose to participate in additional paid employment while their children are participating in early childhood education, who would have done so otherwise.
- **Improved literacy and numeracy** – for the children attending early childhood education, which in turn leads to:
 - **Education cost savings** – due to lower levels of children repeating a year of school and reduced need for special education programs.
 - **Higher educational achievement resulting in higher lifetime earnings for recipients** – the improved cognitive abilities that result from participating in early childhood education can be measured in later school achievement, educational attainment and the resulting impact on employment, earnings, taxation and welfare.
- **Other social benefits and costs flowing from improved education and earnings** – resulting in cost savings for government due to a reduction in crime and a reduction in health care costs associated with smoking and obesity.

In our analysis, these benefits accrue to different groups. They also occur across different periods (see a summary of this in Figure 10).

Figure 10: Overview of the benefits included in the analysis



Source: PwC analysis

The following describes our approach to quantifying these benefits for the analysis.

6.1 Higher levels of workforce participation by parents and carers

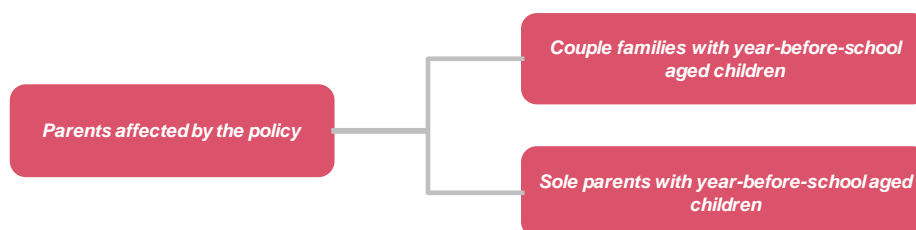
There is a substantial level of Australian and international evidence to suggest that workforce participation by parents and carers is influenced by the availability of affordable early childhood education and care.

This study has focussed on determining the amount of additional hours parents or carers may work due to government investment in year-before-school early childhood education. This is the impact of the reduced cost of early childhood education on workforce participation of parents and carers, with most parents paying much less (or nothing) for the year-before-school programs than other forms of early childhood education and care. The value of these additional hours in the workforce to parents and carers is additional income. The additional income also results in increases to income taxation, with the Commonwealth Government the beneficiary.⁸

In addition, we know that time spent out of the workforce caring for young children can have a longer lasting impact on the earnings of parents and carers. The analysis includes an estimate of the increase in earnings for parents and carers as a result of being better able to maintain an ongoing role in the workforce.

To quantify the change in workforce participation, we estimated the number of parents who are either participating in the workforce or who work more hours due to government contributions to year-before-school early childhood education. The analysis considers two categories of parents or carers who receive subsidies for their children's participation in early childhood education (see Figure 11).

Figure 11: Types of households impacted by changes to the cost of early childhood education



Source: PwC analysis

For each of these groups, we identified the number of parents or carers whose workforce participation might be affected, either through increasing existing employment or through entering the workforce, and estimated the likely impact of a change in the cost of early childhood education on work hours per week. This has been calculated using an elasticity of labour supply due to early childhood education subsidies established in previous studies. A detailed discussion of the methodology can be found in [Appendix C](#). Table 13 and Table 14 summarise the additional annual hours of employment suggested by our modelling.

⁸ The Commonwealth Government is also a beneficiary of a reduction in Family Payments. This is due to an increase in income for sole and couple families earning less than \$100,000. However, we have not included these savings in our analysis.

Table 13: Estimated impacts of early childhood education on workforce participation – additional hours worked

	Number of parents/ carers	Estimated change in work hours per week	Total annual additional hours
Number of sole parents with primary carer employed	35,749	4.95 hours	8,501,171
Number of couple families with primary carer employed	113,840	1.77 hours	9,668,369
Total additional hours worked due to subsidies			18,169,540

Source: PwC analysis, various sources

Table 14: Estimated impacts of early childhood education on workforce participation – primary carers joining workforce

	Parents/ carers joining workforce	Number of parents/ carers joining workforce	Average weekly hours worked by primary carer	Total annual additional hours
Sole parents	13 per cent	4,624	23 hours	5,100,703
Couple families	5 per cent	8,766	23 hours	9,668,369
Total additional hours worked due to subsidies				14,769,072

Source: PwC analysis, various sources

Note: These figures assume primary carers with children under six years of age work 23 hours a week (Australian Institute of Family Studies, 2019).

To estimate the monetary value of these additional hours, we use an hourly rate based on the average weekly wage of primary carers with children zero to five (Australian Bureau of Statistics, 2016).⁹ This change in labour supply is estimated to increase total earnings by \$1.4 billion. Alongside this, taxation increases are estimated to equal over \$292 million.¹⁰ This calculation is summarised in Table 15 below.

There may also be a reduction in government payments to parents (e.g. parenting payments or family tax benefits), although this has not been quantified in the analysis.

Table 15: Value of additional workforce participation

	Total annual additional hours	Value of additional hours (\$, million)
Additional hours worked	18,169,540	410.3
Additional hours worked due to joining workforce	14,769,072	626.7
Total value of additional hours (\$42.43 per hour)	32,938,612	1,397.7

Note: Monetary values are in 2017 dollars.

Source: PwC analysis

⁹ We acknowledge that workforce participation for primary carers fluctuates given the age of the child, with workforce participation the lowest when the child is aged zero to one. Due to difficulties in obtaining more granular data, we were required to use an average weekly wage of primary carers with children zero to five.

¹⁰ This benefit is expected to only occur when children are attending year-before-school preschool; this is 2017 in our analysis.

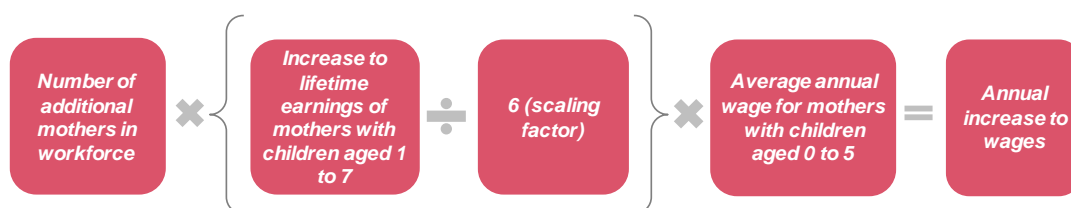
6.1.1 Boost to parental earnings from additional workforce experience

There is a longer-term impact to parental wages, whereby additional workforce experience leads to higher wages over time, as parents with children in early childhood education improve their skills and employability through increased labour participation and training. PwC UK estimated this longer-term impact by projecting the workforce participation of women in ten years' time, and applying an estimate of wages growth as a function of the higher immediate participation rates (PwC United Kingdom, 2004). In their study, PwC UK found that there would be a lifetime increase in the earnings of mothers of three per cent for those enabled to work full-time, and one per cent for those enabled to work part-time while their children were aged one to seven years.

We used the findings of the PwC UK study to estimate the increase in lifetime earnings for primary carers in the workforce due to affordable year-before-school early childhood education. In order to incorporate the growth of lifetime earnings of primary carers, we scaled down the impact from the PwC UK study to reflect the impact of one additional year of workforce participation. As the PwC UK study identified the impact to lifetime earnings from mothers who were able to work over the six years while their children were aged one to seven, we used a scaling factor of six.

The growth to parental wages was only applied to those parents who were estimated to join the workforce due to government investment in early childhood education. This was because we were unable to calculate a scaling factor for primary carers working additional hours while already within the workforce. This is a conservative assumption.

Figure 12: Approach to calculating annual increase to parental wages



Source: PwC analysis

The increase in parental wages from the additional workforce experience due to universal access to year-before-school early childhood education was assumed to last for the rest of the working life of parents who joined the workforce. Parents who work additional hours due to government investment and subsidisation of early childhood education are expected to experience growth in lifetime earnings from increased labour participation, however, we have not included this impact in our analysis. The results are shown in the table below.

Table 16: Summary of modelling outputs for growth in parental wages from additional workforce experience

Description of output	Impact from UK study	Scaled impact	Number of parents / carers	Increase to annual wage, including taxation (\$)
Full-time primary carers	3 per cent	0.5 per cent	5,449	1,889,154
Part-time primary carers	1 per cent	0.17 per cent	7,941	917,719
Value of increase to annual wages (\$)				2,806,873

Note: Monetary values are in 2017 dollars. We assume that the PwC analysis of the impact on mothers' wages would replicate those for primary carers.

Source: PwC analysis

6.2 Improvements in literacy and numeracy: education cost savings

The development of a strong foundation of cognitive and social skills has been demonstrated to be an important factor in early primary school outcomes. Analysis of the Australian Early Development Census shows that children who are experience developmental vulnerabilities at school entry are much less likely to score in the top bands of NAPLAN at Year 3, with language, communication and social competence having the largest impacts (Pascoe & Brennan, 2017). The monetisable benefits of stronger cognitive and social skills on school entry include:

- reduced need for special education placements
- number of children repeating a year of school.

6.2.1 Special education requirements

Early childhood education can reduce children's likelihood of needing additional education support, with demonstrated reductions in children with mild intellectual disabilities or significant behavioural challenges being placed into special education programs. There are currently no public Australian sources that demonstrate the relationship between early childhood education and special education placement. However, a U.S. meta-analysis of 22 studies conducted between 1960 and 2016 found that, on average, participation in early childhood education leads to significant reductions in special education placement for children with mild cognitive impairments. The effect size noted was 0.33 standard deviations or 8.1 percentage points (McCoy & et al, 2017). A recent analysis of the UK's EPPSE data has demonstrated similar impacts in a UK context, with substantial reduction in children's risk of needing additional support (Philpott, Young, Maich, Penney, & & Butler, 2019).

Our approach has been to apply the average impact identified in the international meta-analysis to the prevalence rate in Australia, to take into account potential differences in diagnosis and access to additional support for children with disability in Australia.¹¹ A change in propensity of 8.1 percentage points would mean that 54 fewer children in the cohort require special schooling, with an annual cost saving of approximately \$8,500. Over the five-year period from 2018 until 2023, when the cohort is aged 10, this amounts to a total annual reduction in special education costs from early childhood education of around \$475,000.

6.2.2 Children repeating a year of school

Improvement in school readiness and early achievement can also reduce the requirement for children to repeat a year in primary school. The U.S. meta-analysis cited above also found that participation in early childhood education leads to statistically significant decreases in the number of children repeating a year of school, with the effect size roughly equal to 0.26 standard deviations or 8.3 percentage points (McCoy & et al, 2017).

Australia has lower rates of children being held back a year than the US. Our approach has been to apply the size of the impact identified in the meta-analysis and apply it to the proportion of children who repeat a year in Australia. Currently, around 2.5 per cent of Australian children repeat a year of school (Anderson R. , 2014). If this was reduced by 8.3 percentage points due to participation in early childhood education, it would mean 662 fewer children repeating, with a cost saving of around \$17,275 each. The total annual reduction in the costs from children repeating a year of school would therefore be approximately \$11.8 million.

¹¹ Around 6.8 per cent of children aged five to 14 years have a disability that restricts their schooling education, with 1.48 per cent of those children experiencing mild schooling restrictions. Our analysis assumes that this cohort of children will be the best placed to be assisted by year-before-school early childhood education.

6.3 Improvements in literacy and numeracy: higher educational attainment and lifetime earnings

Experiences early in life can significantly influence outcomes later in life. Early childhood education outcomes shape school experiences and outcomes, which in turn affect higher education experiences and outcomes, which affect employment and earnings potential in the long term. This section describes how we have estimated the scale of this benefit – and the difference that early childhood education might make to children’s education, employment and earnings throughout their lives. Additional detail is also provided in [Appendix C](#).

Our analysis explains the link between early childhood education and primary school NAPLAN scores, which then link to Year 3 and Year 9 NAPLAN scores and finally Australian Tertiary Admission Rank (ATAR) results (Goss & Sonnemann, 2016) (Department of Education and Training, 2018). There is evidence that higher ATAR results are associated with higher education completion and greater attainment, which then impacts employment and earnings (Leigh, 2008).

6.3.1 Improvements in literacy and numeracy: early childhood to NAPLAN results

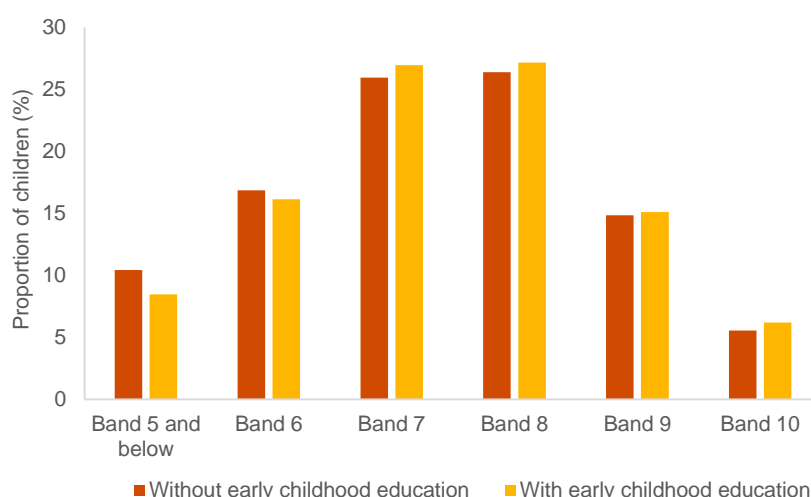
We have already discussed approaches to measuring the impact of early childhood education on school outcomes, in particular on primary school literacy and numeracy as measured in standardised test scores such as NAPLAN results (see Section 4.4 and [Appendix B](#)).

Our projections of how literacy and numeracy at Year 3 predicts achievement at Year 9, measured using NAPLAN scores, draws on earlier work by the Grattan Institute. Their study showed the link between NAPLAN results over time and also demonstrated that the gap between low and high achievers increases with time.¹² This suggests that if early childhood education puts students ahead at the start of primary school, this will have increasingly larger impacts as they move through the education system.

Using the early childhood education effect size of 0.17 standard deviations, we projected this impact on to low, medium and high achievers from Years 3 to Year 9. When comparing against our baseline of not receiving year-before-school early childhood education, the impact was an increase in the number of children receiving higher levels of Year 9 NAPLAN results, see [Figure 13](#).

¹² Grattan Institute de-identified linked student-level NAPLAN data, 2009 Year 3 cohort from the Victorian Curriculum and Assessment Authority and Australian Curriculum Assessment and Reporting Authority de-identified student-level NAPLAN data, 2014 results linked to 2012.

Figure 13: Proportion of children within each National Assessment Program – Literacy and Numeracy band



Source: PwC analysis, Australian Curriculum, Assessment and Reporting Authority, 2019

Note: 2017 NAPLAN results used in analysis

6.3.2 Improvements in literacy and numeracy: Year 9 to Year 12 results

In considering the impacts of early years schooling on educational attainment, we assessed whether there is an effect on early school leavers as well as on the ATAR or tertiary admissions scores of those who stay at school until Year 12.

6.3.3 Impacts through reducing early school leavers

In order to determine the impact of early childhood education on early school leavers, it was necessary to establish the link between educational achievement and early school leavers. The only Australian-sourced study which measures the relationship between NAPLAN results and early school leavers is Australian Bureau of Statistics (ABS) analysis which integrated Tasmanian NAPLAN findings with data from the ABS Census of Population and Housing, Australian Early Development Census (AEDC), National Early Childhood Education and Care Collection and Tasmanian government school enrolments.¹³ This study found that students with lower NAPLAN results are less likely to continue on to Year 12, with 57 per cent of students attaining a Band 5 or less in Year 9 NAPLAN dropping, compared with five per cent for Band 10 (Australian Bureau of Statistics, 2014).

Based on this, and extending the projected impact of early childhood education on Year 9 NAPLAN score results, we estimate that 4,000 additional children would graduate from high school (where they would otherwise have been on track to drop out).

A number of Australian studies have identified the impact of leaving school early on long-term employment and other social factors such as health and crime, see Section 6.4.

¹³ This is the only Australian-sourced study we could identify, unfortunately it relies on data from one state (Tasmania), rather than the whole of Australia.

6.3.4 Impacts through stronger higher education results

In 2014 the Melbourne Institute analysed the link between Year 9 NAPLAN results and Year 12 ATAR scores. This study shows that individuals which obtain a 'strong' NAPLAN result are almost twice as likely to obtain an ATAR greater than 70, compared with individuals who obtain an 'above average' NAPLAN result, with the findings summarised in Table 17 (Houng & Justman, 2014). We adopted the Melbourne Institute's definitions of NAPLAN scores, with reading and numeracy NAPLAN scores:

- above the 80th percentile defined as 'strong' NAPLAN results
- above the 60th percentile defined as 'above average' NAPLAN results
- above the 20th percentile defined as 'below average' NAPLAN results
- below the 20th percentile defined as 'weak' NAPLAN results.

This relationship between 'strong', 'above average', 'below average' and 'weak' NAPLAN results and ATAR results were used to determine a set of probabilities for ATAR scores based on Year 9 NAPLAN results, linking Year 9 NAPLAN to ATAR results.

Table 17: Relationship between Australian Tertiary Admission Rank and National Assessment Program – Literacy and Numeracy scores

Category of ATAR results	Weak NAPLAN scores (%)	Below average NAPLAN scores (%)	Above average NAPLAN scores (%)	Strong NAPLAN scores (%)
Early school leavers and students with no ATAR	61	17	7	6
ATAR 0 to 50	29	50	25	7
ATAR 50 to 70	7	23	28	11
ATAR 70 to 90	2	10	32	38
ATAR greater than 90	1	1	7	38
Total	100	100	100	100

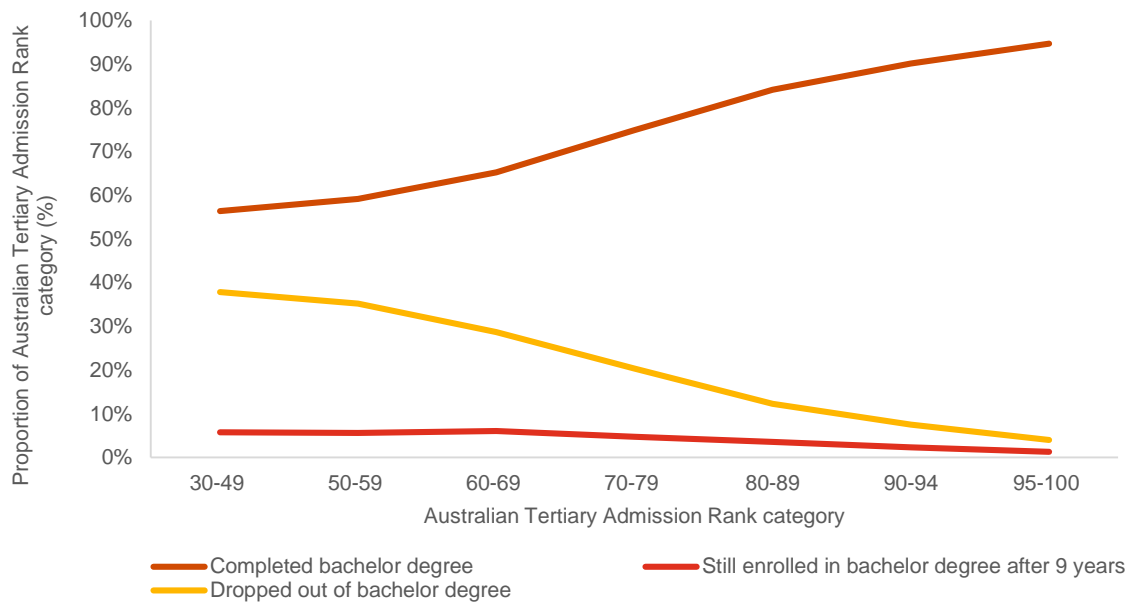
Source: PwC analysis

Our analysis shows that students who receive strong NAPLAN scores are much more likely to obtain an ATAR of above 70 than students who receive above or below average NAPLAN scores. As ATAR results represent a ranking, we were required to compare a hypothetical increase in ATAR results, based on improved NAPLAN scores.

6.3.5 Improvements in literacy and numeracy: Year 12 to higher education attainment

ATAR scores, on average, can predict the level of higher education attainment. The Commonwealth Government publishes higher education completion rates which identify the proportion of students who have completed or dropped out of a bachelor's degree based on an ATAR score. Around 95 per cent of individuals with an ATAR result of 95 and above have completed a bachelor degree, compared with 66 per cent for individuals who attained an ATAR result of 60 to 69 (Department of Education and Training, 2018).

Figure 14: Propensity for bachelor degree completion by Australian Tertiary Admission Rank category

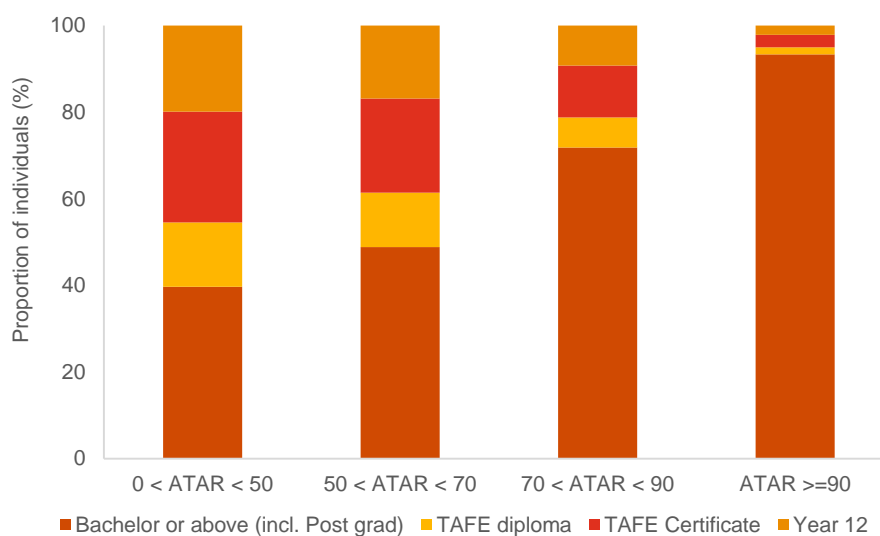


Source: PwC analysis, Department of Education and Training, 2018
 Note: 2009 cohort analysed

Analysis of 2016 Census data for individuals aged 30 to 35 years provided the higher education attainment rates for individuals who either did not go or dropped out of university (Australian Bureau of Statistics, 2016). For this cohort, their highest education attainment was split between vocational education and training (VET), in the form of Technical and Further Education (TAFE) diplomas or certificates, and Year 12 (no further education).

Using these statistics, we were able to estimate a probability of higher education attainment for a given ATAR result, see Figure 15. These probabilities, along with the movement of individuals within the ATAR categories (discussed in the previous section), were used to determine the number of individuals shifting between higher education attainment categories.

Figure 15: Propensity for higher education completion by Australian Tertiary Admission Rank category



Source: PwC analysis.



6.3.6 Increased employment outcomes for children attending early childhood education

The previous sections highlight how attendance in early childhood education improves the likelihood of these children attending higher education. This section explains the methodology we have used for calculating the resulting impact on lifetime earnings.

Increased lifetime earnings due to improved higher education attainment

The relationship between higher education attainment and lifetime earnings has been studied extensively in Australia. Our analysis used a report titled 'Returns to Education in Australia' which identified the percentage increase to lifetime earnings given higher education attainment, in particular, Master's degrees and doctorates, Bachelor degrees, VET Diplomas and Certificates (Leigh, 2008). This study found that a bachelor degree increased annual earnings by 45 to 50 per cent, when compared to Year 12 completion alone.

Table 18: Impact on annual earnings by higher education attainment, compared with a baseline of year 12 completion alone

Higher education attainment	Increase in annual earnings
Vocational education and training diploma and certificates	17-19 per cent
Bachelor degree	45-50 per cent
Master degree	66-74 per cent

Source: Leigh, 2008.

The results of this study was combined with the results of the higher education attainment projections discussed in the previous section. This allowed us to estimate the increase in annual earnings for the children obtaining a higher level of higher education attainment, see Figure 16.

Figure 16: Approach to calculating increased employment for children



Source: PwC analysis

The number of children estimated to move between higher education attainment categories is shown in Figure 17. It shows that, as a result of their participation in early childhood education, there is expected to be fewer people whose highest educational attainment is either Year 12 or below and more graduates of Bachelor or higher degrees.

Figure 17: Change in higher education attainment

Higher education attainment	Change in higher education attainment (no. individuals)	Value of change in earnings (\$ millions)*	Value of change in taxation (\$ millions)*
Below year 12	-1,706	-89	-19
Year 12	-116	-7	-2
VET certificate or diploma	-152	-11	-3
Bachelor degree	1,349	127	42
Post-graduate degree	626	68	24
Total	N/A	87	42

Note: *For individuals aged 35 to 39

Source: Various sources, PwC analysis

This change in higher education attainment is estimated to produce earning increases of over \$87 million annually for the cohort of children receiving early childhood education for individuals. These benefits are expected to occur from 2033 to 2082, when the cohort is aged between 20 and 69 (assumed working age). Higher incomes over this time are estimated to result in increases in income taxation revenue of \$42 million each year.

Spill-over benefits from higher qualifications and earnings

In addition to the increase in lifetime earnings for individuals who attain higher education, there are also benefits to firms that hire these individuals. The evidence suggests that these individuals are more efficient in their completion of tasks, which leads to increased productivity and profits for the firms that employ them. These productivity benefits are greater than the cost of hiring these individuals. To incorporate this return for firms, we have used an estimate of the additional productivity benefits for firms that hire individuals with higher qualifications.

A research report from the UK Department of Education analysed the benefits to firms from higher education, over and above wage returns (Hayward, Hunt, & Lord, 2014). The UK study found that these benefits were somewhere between 17 and 100 per cent of the increase to lifetime earnings, with 30 per cent being their chosen impact.¹⁴ To be consistent with the final estimate used by the UK Department of Education, we used an estimate of 30 per cent to incorporate the spill-over benefits of higher qualifications to employers. In our analysis, the additional productivity benefits from higher education attainment averages around \$22 million annually.

Welfare benefits

A number of studies suggest a significant community-wide benefit of early childhood education stems from reduction in long-term unemployment and reliance on welfare support (Australian Institute of Health and Welfare, 2015). We have estimated the welfare reductions based on the educational attainment information referred to above and the unemployment levels for different levels of educational attainment. To monetise these benefits, we have used the fortnightly rates of payment for Austudy and Newstart Allowance from the Department of Human Services (Department of Human Services, 2019). These benefits were estimated to be around \$524.28 for a mix of all household situations – single no children, single with children, couple no children, couple with children.

These welfare benefits valued at \$4.6 million annually. The benefits were assumed to occur between 2033 and 2078, when individuals are aged 20 to 65. However, while these benefits represent a reduction in costs to the Commonwealth Government, they are also a reduction in earnings for individuals and this has been accounted for in the model.

Table 19: Summary of modelling outputs – increase in lifetime earnings for children attending early childhood education

Description of output	Change in number of individuals unemployed or not in labour force	Annual welfare payments (\$)	Value of change in labour force status (\$)
Below year 12	-544	--	--
Year 12	-31	--	--
Vocational education and training diploma	-24	--	--
Bachelor degree	183	--	--
Master degree	78	--	--
Total	-338	13,631	4,606,078

Source: PwC analysis, Department of Human Services, 2019.

¹⁴ The top estimate of the range came from a study by Dearden et al which found that workers only gain half the firms' productivity returns to training in the form of extra wages (Dearden, Reed, & Van Reenan, 2005). However, this study analysed the impact of work-related training on productivity, so the type of training explored in the study is not completely analogous to higher qualifications.

6.4 Other benefits to society associated with children attending early childhood education

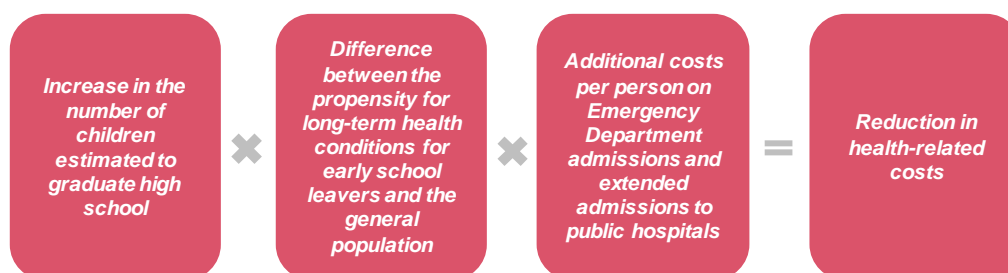
Low educational attainment is a major risk factor for a variety of health metrics such as smoking, and obesity, as well as involvement in crime, and mental health problems (Australian Institute of Health and Welfare, 2016). As demonstrated in our analysis, early childhood education attendance increases educational attainment, and there is substantial Australian evidence on the relationship between education and lifetime health and wellbeing.

Previous studies, primarily from the United States, have established a more direct connection between early childhood education and various social and health benefits. The evidence suggests that early childhood education can improve health behaviour in the long run, lowering the risk factors that lead to the prevalence of diseases, particular those associated with later life disadvantage such as obesity and smoking-related disease.

6.4.1 Reduction in health related costs for early school leavers

Studies show that early school leavers are statistically more likely to have long-term health issues. The Mitchell Institute calculated that 42 per cent of male and female early leavers in the working age population have a long-term health condition. The rates in the general working age population were 24.6 per cent for males and 27.1 per cent for females (Lamb & Huo, 2017). The estimated decrease in the number of early school leavers means that this group of people would be expected to have fewer health problems, leading to reduced health related costs.

Figure 18: Approach to estimating reduced health-related costs



Source: PwC

The benefit was calculated as the increased number of children graduating from high school instead of leaving early (approximately 4,000), by the reduced propensity to long-term health conditions. In order to monetise the benefit, we used calculations of the estimated additional costs per person on Emergency Department admissions and extended admissions to public hospitals (this approach is illustrated in Figure 18). This is a conservative estimate, as people with long-term health conditions are likely to have higher use of primary and allied health as well. However, consistent data was not available to calculate the full benefit.

The total annual reduction in health-related costs due to the increase in the number of children graduating high school was calculated at \$420,000. These benefits are expected to start in 2048, when the children who receive early childhood education are aged 35.

6.4.2 Decreased rates of obesity

Early childhood education attendance has been linked with a reduced incidence of obesity related illness. Currently obesity is estimated to be prevalent in 28.2 per cent of the population (Australian Bureau of Statistics, 2015).

The Head Start study from the U.S. found that early childhood education is estimated to reduce rates of obesity by 28 per cent (Frisvold, 2006). For our study, we reduced this rate and incorporated a 9.2 per cent decrease in obesity propensity to better reflect the Australian context. This implies that around 8,500 children who would otherwise be expected to be obese will, instead, be of healthy weight. The estimated benefit in monetary terms is calculated by determining the reduced healthcare expenditure from lower prevalence of obesity related illnesses. Healthcare expenditure associated with obesity-related illnesses was almost \$8,000 per person (\$2017-18) per annum (PwC Australia, 2015).

The total annual reduction in obesity related costs due to early childhood education attendance was calculated at over \$67 million. This benefit was assumed to start in 2048, when the study cohort is aged 35 and continue until they are aged 81.

6.4.3 Decreased rates of smoking

Early childhood education attendance has also been linked with a reduced incidence of smoking related illness. Currently, around 12.2 per cent of the Australian population smokes. The Head Start study from the U.S. found that early childhood education is estimated to reduce rates of smoking by 6.2 per cent. We reduced the size of this expected benefit by 50 per cent, to better reflect the Australian context. This results in an estimated 2,300 fewer children who will grow up to be smokers. Healthcare expenditure associated with smoking-related illnesses was over \$8,000 per person (2017-18) per annum.

The total annual reduction in crime, smoking and obesity related costs due to early childhood education attendance was calculated at over \$19 million. These benefits are assumed to start in 2048, when the cohort is aged 35 and continue until they are aged 81.

6.4.4 Decreased rates of crime

Children who participate in quality early childhood education have been shown in a number of studies to be less likely to commit crimes either as juveniles or as adults (Heckman, Moon, Pinto, Savelyev, & Yavitz, 2010). In Australia, one of the most significant predictors of involvement in the justice system is low educational attainment, with a 2015 report showing two in three prisoners had not studied past Year 10 (Prichard & Payne, 2005) (Australian Institute of Health and Welfare, 2015).

Our estimate of the impact of early childhood education on crime is based on a reduced propensity to commit a crime of 8.6 per cent (see [Appendix C](#) for details of the approach to estimating this rate). This assumes that approximately 760 children will not go on to commit a crime (where they would otherwise be expected to). To monetise the benefits of this shift, we included the following costs which would be reduced:

- social costs to the community from reduced rates of crime
- policing costs to government, with less need to respond to reported crimes
- court costs to government from reduced rates of offending
- prison costs to government from reduced rates of offending resulting in prison.

We estimate that the benefits associated with reduced crime were valued at close to \$40,000 per person, for a total annual reduction in criminal costs linked to early childhood education of around \$19 million for individuals aged 35 to 39. These benefits are assumed to start in 2033, when the cohort is aged 20 and continue until they are aged 65.

7 Results of cost-benefit analysis

This chapter presents the results of the cost-benefit analysis and the study's conclusions.

The aim of our analysis was to answer the following research questions:

Box 2 Key research questions

- Do the benefits of Australian early childhood education programs outweigh the costs of delivering them, and what is the return on investment?
- What are the individual, social and government benefits of early childhood education?

In answering these questions, we estimated the present value (NPV) to society of early childhood education in Australia, the benefit-cost ratio (BCR) and return on investment (ROI) of investment in early childhood education. The definitions of these concepts are:

- **Net present value** – represents the discounted value of benefits net of costs. Discounting is the process of determining the present value of a payment or a number of payments that is to be received in the future. Given the time value of money, a dollar is worth more today than it would be worth tomorrow.
- **Benefit cost ratio** – an indicator used in cost-benefit analysis to show the relationship between the relative costs and benefits, expressed in monetary terms. If a project has a BCR greater than 1.0, the project is expected to deliver a positive net present value.
- **Return on investment** – a performance measure used to evaluate the efficiency of an investment. ROI tries to directly measure the amount of return on a particular investment, relative to the investment's cost. To calculate ROI, the benefit (or return) of an investment is divided by the cost of the investment. The result is expressed as a percentage or a ratio.

7.1 Overall results

Using 2017 as the reference year, this study has identified **\$2.36 billion in costs** associated with the provision of early 15 hours of early childhood education in the year-before-school. These costs are split between government (79 per cent) and parents or carers (21 per cent).

The study has also identified **\$4.74 billion in benefits** associated with providing this one year of providing early childhood education. Some of these benefits will be realised in the short-term, including the additional income and higher taxes paid by parents or carers who choose to work more because early childhood education is available (\$1.46 billion and \$313 million respectively). Other benefits will be realised over a much longer period. The cognitive benefits for children who receive a quality early childhood education can be linked with to \$1.064 billion in higher earnings over a lifetime and a further \$495 million in higher taxes paid to government. The beneficiaries include:

- Children - \$997 million or 21 per cent of benefits
- Governments – \$1.958 billion or 41 per cent of benefits
- Parents and carers – \$1.463 billion or 31 per cent of benefits
- Employers and businesses – \$319 million or 7 per cent of benefits

Overall, the study has identified approximately \$2 of benefits for every \$1 spent on early childhood education. Expressed differently, this is a return on investment (ROI) of 103%. Our study demonstrates that expenditure on early childhood education can be viewed as a long-term investment with quantifiable financial returns.

The timing of the benefits has been accounted for using a discount rate of 3 per cent, which is consistent with other studies of the long-term benefits of social programs. The timing of the benefits and the choice of discount rate are significant for the analysis, as the results in the table below shows, the nominal benefits (i.e. before the discount rate is applied) are much higher than the present value of the benefits. This is because many of the benefits will take a significant amount of time to be realised.

Table 20: Results of economic analysis, present value

	Group affected	Nominal values (no discount rate) \$ million	Present value (3 per cent discount rate) \$ million
Cost of early childhood education			
Cost to government	Government	1,835	1,835
Cost to households	Parents/carers	501	501
Total cost		2,336	2,336
Benefits of early childhood education			
Parental earnings benefits	Parents/carers	\$1,510	\$1,463
Taxation benefits of additional parental income	Government	\$328	\$313
Higher earnings for children over lifetime	Children	\$3,636	\$1,064
Additional productivity benefits from children	Employers	\$1,091	\$319
Taxation benefits from children's additional lifetime earnings	Government	\$1,721	\$495
Reduced expenditure on special education	Government	\$3	\$3
Reduced expenditure on school repetition	Government	\$12	\$11
Reduced health expenditure	Government	\$4,078	\$605
Reduced crime-related expenditure	Government	\$1,079	\$522
Reduced welfare expenditure	Government	\$212	\$67
Reduction in welfare payments to individuals	Children	-\$212	-\$67
Other costs – additional schooling costs	Government	-\$85	-\$58
Total early childhood education benefits		13,373	4,737
Net benefits / NPV		11,037	2,401
Benefit-cost ratio		5.7	2.0

Note: Levels of benefits and costs are not necessarily comparable between policies given that they have different base cases. The BCR is a more appropriate comparator.

Source: PwC analysis

Significant drivers of benefit-cost ratio

One of the most significant drivers of the positive BCR is the growth of children's earnings, from improved educational and higher education outcomes, which also leads to an increase in taxation returns to government. There was also a significant decrease in government expenditure associated with health benefits.

7.2 Impacts on different groups

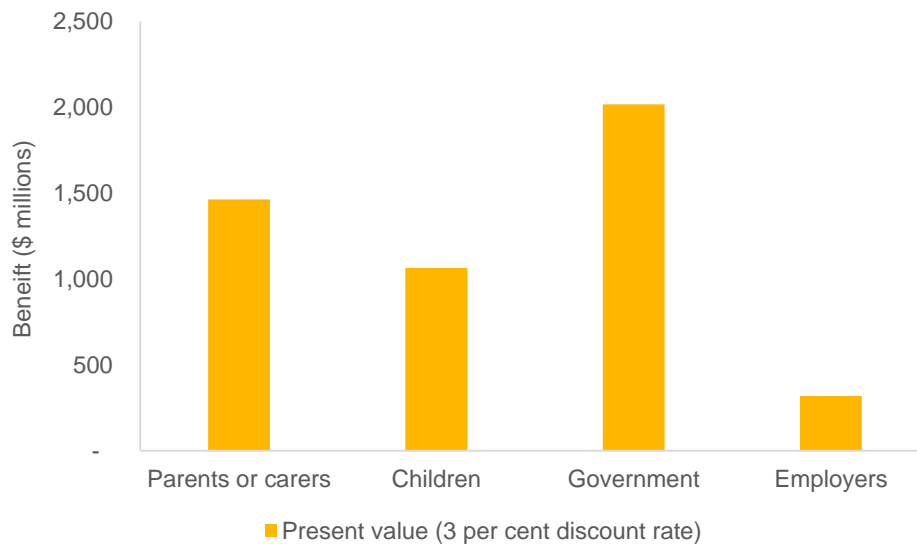
The key groups that have been identified as being impacted by the provision of early childhood education are children, parents or carers and governments. The figure below shows how these costs and benefits accrue to these groups.

Figure 19: Results of the economic analysis (NPV, 3 per cent)

	Costs	Benefits																								
Children		<table border="1"> <tr> <td>Increase in wages for children attending ECE</td> <td>\$1,064 million</td> <td>Reduction in welfare payments to individuals</td> <td>-\$67 million</td> </tr> </table>	Increase in wages for children attending ECE	\$1,064 million	Reduction in welfare payments to individuals	-\$67 million																				
Increase in wages for children attending ECE	\$1,064 million	Reduction in welfare payments to individuals	-\$67 million																							
Parents	<table border="1"> <tr> <td>Out-of-pocket costs (fees)</td> <td>\$501 million</td> </tr> </table>	Out-of-pocket costs (fees)	\$501 million	<table border="1"> <tr> <td>Improved employment/earnings of parents</td> <td>\$1,463 million</td> </tr> </table>	Improved employment/earnings of parents	\$1,463 million																				
Out-of-pocket costs (fees)	\$501 million																									
Improved employment/earnings of parents	\$1,463 million																									
Government	<table border="1"> <tr> <td>Commonwealth NP UAECE funding</td> <td>\$422 million</td> </tr> <tr> <td>State and Territory funding (excluding Commonwealth NP UAECE funding)</td> <td>\$1,011 million</td> </tr> <tr> <td>Commonwealth Government childcare assistance funding</td> <td>\$402 million</td> </tr> <tr> <td>Other costs – additional schooling costs</td> <td>\$58 million</td> </tr> </table>	Commonwealth NP UAECE funding	\$422 million	State and Territory funding (excluding Commonwealth NP UAECE funding)	\$1,011 million	Commonwealth Government childcare assistance funding	\$402 million	Other costs – additional schooling costs	\$58 million	<table border="1"> <tr> <td>Benefits from reduction in children repeating a year of school</td> <td>\$11 million</td> <td>Increased government receipts (taxation) from parents</td> <td>\$313 million</td> </tr> <tr> <td>Lower criminal activity</td> <td>\$522 million</td> <td>Lower placement in special education classes</td> <td>\$3 million</td> </tr> <tr> <td>Health benefits – Lower long term health issues, smoking rates and obesity</td> <td>\$605 million</td> <td>Increased government receipts (taxation) from children</td> <td>\$495 million</td> </tr> <tr> <td>Lower welfare costs</td> <td>\$67 million</td> <td></td> <td></td> </tr> </table>	Benefits from reduction in children repeating a year of school	\$11 million	Increased government receipts (taxation) from parents	\$313 million	Lower criminal activity	\$522 million	Lower placement in special education classes	\$3 million	Health benefits – Lower long term health issues, smoking rates and obesity	\$605 million	Increased government receipts (taxation) from children	\$495 million	Lower welfare costs	\$67 million		
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Lower welfare costs	\$67 million																									
Employers		<table border="1"> <tr> <td>Additional lifetime productivity benefits from children</td> <td>\$319 million</td> </tr> </table>	Additional lifetime productivity benefits from children	\$319 million																						
Additional lifetime productivity benefits from children	\$319 million																									

Note: Present value was calculated at 3 per cent discount rate.
Source: PwC analysis

Figure 20: Benefits accruing to different groups



7.2.1 Government

The Commonwealth Government and State and Territory governments contribute a sizeable share of the funding for early childhood education, estimated at \$1.8 billion.

The Commonwealth Government is also a beneficiary of early childhood education, in the form of higher taxes paid by parents/carers who are able to work more because of the availability of early childhood education, or children who earn more over their lifetimes. The Commonwealth Government is also a beneficiary of reduced social expenditure, including, reduction in welfare payments, health and crime-related expenditure. Many of these social benefits are also positives for society in general, particularly the reduction in criminality.

The reduced social expenditure and increase in taxation was estimated at \$7.3 billion over the analysis period, \$2.0 billion when discounted at 3 per cent. By assuming the welfare and taxation benefits accrue to the Commonwealth Government and the health, crime and schooling-related benefits go to the state governments, we were able to split up the total return to the Commonwealth and state governments of early childhood education. The value of early childhood education to the Commonwealth Government is \$2.3 billion over the analysis period, \$0.9 billion when discounted at 3 per cent, with the state government obtaining \$5.1 billion over the analysis period, \$1.1 billion when discounted at 3 per cent.

7.2.2 Children

The cost-benefit analysis has focussed on quantifying the economic impacts of improvements in the cognitive performance of children who receive early childhood education, as these can be linked to educational achievement, which then also relates to higher earnings over a lifetime. The increase in lifetime earnings was calculated at \$3.6 billion nominal over the total analysis period, \$1.1 billion when discounted at 3 per cent.

7.2.3 Parents/carers

In most cases, parents or carers make a financial contribution to the cost of their early child education, which is the difference between the price charged by providers and the rate of subsidies provided by governments. Our analysis calculated this financial contribution as \$0.5 billion in 2017.

The availability of early childhood education allows some parents participate in paid work, when they otherwise would not be able to. The income they receive from this work, less taxes paid to governments is a benefit to these parents. Over the analysis period, the increase in earnings was calculated at \$1.5 billion nominal, \$1.5 billion when discounted at 3 per cent.

7.2.4 Employers

In addition to the higher earnings estimated for the children who received a high quality early childhood education, the higher productivity of these workers over their lifetime is estimated to result in benefits of \$1.1 billion in nominal terms, or \$319 million when discounted at 3 per cent.

7.3 Sensitivity analysis

The sensitivity of the results of our cost-benefit analysis to changes in inputs is tested in several ways. Our sensitivity analysis includes:

- varying the discount rate to 7 per cent
- varying the discount rate to 4 per cent
- increasing the effect size of the relationship between early childhood education and educational outcomes (effect size) to 0.3 standard deviations
- decreasing the effect size of the relationship between early childhood education and educational outcomes (effect size) to 0.1 standard deviations, acknowledging uncertainty over the magnitude of these effects in the empirical literature.

Testing the sensitivity of results to changes in the discount rate is a common practice, reflecting the variation in the literature on choosing a particular rate, see [Appendix B](#) for more information. Acknowledging uncertainty in the empirical literature over the magnitude of the relationship between early childhood education and educational outcomes, we have tested an increase and decrease in the chosen effect size of 0.17 standard deviations. The results, shown in Table 21, indicate that a positive or neutral return to investment is achieved under all sensitivity tests. This highlights the overall desirability of universal early childhood education as a policy.

Table 21: Results of sensitivity tests

Measure	BCR
3 per cent discount rate	2.0
4 per cent discount rate	1.7
7 per cent discount rate	1.1
Increasing the effect size of the relationship between early childhood education and educational outcomes (effect size) to 0.30 standard deviations (3 per cent discount rate)	2.3
Decreasing the effect size of the relationship between early childhood education and educational outcomes (effect size) to 0.10 standard deviations (3 per cent discount rate)	1.7
Increasing the effect size of the relationship between early childhood education and educational outcomes (effect size) to 0.30 standard deviations (7 per cent discount rate)	1.2
Decreasing the effect size of the relationship between early childhood education and educational outcomes (effect size) to 0.10 standard deviations (7 per cent discount rate)	1.0

Source: PwC analysis

7.4 Conclusion

Our analysis shows that expenditure on early childhood education has a significant return on investment. We have estimated that each \$1 spent on early childhood education generates benefits of \$2 to the children themselves, to their parents/carers, to government and also to business.

The largest driver of these benefits is the impact that early childhood education has on children's cognitive abilities. The higher cognitive abilities of children who receive early childhood education translates into stronger academic performance during their school years, which in turn reduces the likelihood they will leave school early and increases the likelihood they will go onto attain higher levels of education. Educational attainment is key determinant of future incomes and a range of other social outcomes, with broad benefits to individuals, to government and to employers – only some of which have been captured in this analysis.

It is significant that early childhood education programs are delivering a clear return on investment even though there is not yet enough Australian data to directly quantify and monetise the broader social and emotional impacts of early childhood education.

The study demonstrates the impact of Australian's investment in universal early childhood education, with each cohort of children attending a quality early education program generating returns now and into the future. But there is still room for improvement.

There are persistent issues with affordability, access for the most vulnerable children, and ensuring consistent quality across the system. There is an opportunity to increase the return on investment by:

- Investing in raising the quality of early education programs.
- Offering two years of quality early education in the years before school.
- Ensuring children in disadvantaged communities have access to quality early childhood education.

This study has used more Australian evidence and data than previous analyses of the impacts of early childhood education. However, there is still a relatively significant gap in our understanding of the overall impacts that the universal provision of early childhood education is having on children's outcomes in Australia. Several states and territories have done work to link children's early childhood education data with their later school achievement. But to-date, this information has not been made publicly available. If it were to be made available to researchers, this information would be useful in helping to explain the impacts of early childhood education in later life. It would also be a useful resource for program review and design.

Appendix

Appendix A References

Appendix B Determining effect size

Appendix C Model analysis details

References

Key references used in the cost-benefit analysis

A summary of the references used in the cost-benefit is below.

Table 22: Key references

Description	Sources
Higher workforce participation by parents and carers	<ul style="list-style-type: none"> - Australian studies on the impact of childcare cost on parent employment (Doiron & Kalb, 2005; Gong & Breunig, 2012; Rammohan & Whelan, 2007; Productivity Commission, 2014) - Australian data on income and workforce participation (Australian Bureau of Statistics, 2016; Australian Institute of Family Studies, 2019; Australian Bureau of Statistics, 2016) - International studies on the impact of career breaks on earnings (PwC United Kingdom, 2004)
Impact of early childhood education on early primary achievement	<ul style="list-style-type: none"> - Australian studies on the impact of early childhood education (Warren & Haisken-DeNew, 2013; Centre for Education Statistics and Evaluation, 2017; Boardman, 2005) - International studies on the impact of early childhood education (Magnuson & Duncan, 2013; Bakken, Brown, & Downing, 2017; Barnett, Jung, Youn, & Frede, 2013; Cattan, Crawford, & Dearden, 2014; Havnes & Mogstad, 2011; Magnuson, Ruhm, & Waldfogel, 2007; Mostafa & Green, 2012; Muschkin, Ladd, & Dodge, 2015; Puma et al., 2012; van Huizen, Thomas, Dumhs, Lisa, & Plantenga, Janneke, 2016; WSIPP, 2017; Phillips, Gormley & Anderson, 2016)
Improvements in literacy and numeracy: education cost savings	<ul style="list-style-type: none"> - International data on the impact of early childhood education on special education and repeating a year of school (McCoy & et al, 2017; Philpott, Young, Maich, Penney, & & Butler, 2019) - Australian data on number and cost of students with disability and children repeating a year of school (Anderson R , 2014; Australian Bureau of Statistics, 2009; Australian Curriculum Assessment and Reporting Authority, 2019; Department of Education and Training, 2019, Productivity Commission, 2019)
Improvements in literacy and numeracy: higher educational attainment and lifetime earnings	<ul style="list-style-type: none"> - Australian studies on earlier school achievement predicting later outcomes (Goss and Sonnerman 2019; Australian Curriculum Assessment and Reporting Authority, 2019) - Australian studies on school achievement and higher education attainment (Houng & Justman, 2014; Department of Education and Training, 2018) - Australian data on qualifications, earnings and welfare (Leigh, 2008; Australian Bureau of Statistics, 2014; Hayward, Hunt, & Lord, 2014; Australian Bureau of Statistics, 2016; Department of Human Services, 2019)
Other benefits to society associated with children attending early childhood education	<ul style="list-style-type: none"> - International studies on the impact of early childhood education on health and crime (Frisvold, 2006; - Australian data on health prevalence and cost (Lamb & Huo, 2017; Australian Bureau of Statistics, 2015; PwC Australia, 2015) - Australian crime prevalence and cost data (Bureau of Crime Statistics and Research, 2018; Australian Bureau of Statistics, 2016-17; Bureau of Crime Statistics and Research, 2018; Smith et al, 2011; Productivity Commission, 2018)

Source: PwC analysis

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Determining effect sizes

A key component of this study is to determine the link between schooling and educational outcomes. This drives our estimates of the majority of the benefits of early childhood education, particularly later life benefits such as lifetime earnings, taxation, welfare and health-related costs.

There are no publicly available studies or datasets quantifying the impact that contemporary Australian early childhood education has on early school achievement that could form the basis of the economic analysis. There are Australian studies that indicate early childhood education reduces developmental vulnerability in the first year of school (AEDC, 2014), and there is Victorian research showing nearly 60 per cent of children who are on track (not developmentally vulnerable) score in the highest bands in Year 3 NAPLAN test results (Pascoe & Brennan, 2017). However, these studies do not draw a sufficiently direct link between early childhood education and early school achievement and show a clear, average impact that could be utilised for the economic analysis.

Similarly, there are several Australian studies that look at the impact of early childhood education on NAPLAN, but they either are not reported with sufficient granularity or were undertaken before the introduction of the National Quality Framework (NQF) and Universal Access policies – and therefore do not fully reflect the likely impact of the contemporary Australian early childhood education system. It is critical to take into account the impact of the NQF as the research literature is very clear that only high quality programs achieve a positive and sustained impact.

Because an appropriate Australian study was not available, we decided to draw on the best available evidence to determine the likely impact of Australia's model of universal provision. To determine an appropriate effect size (or range of effect sizes), we reviewed previously published studies that estimated the effects of early childhood education on children's outcomes.

Effect size is a simple way of quantifying the difference between two groups, which emphasises the size of the difference by accounting for sample size within the calculation of the magnitude. Effect size is measured in terms of the number of standard deviations, in other words, it takes into account the variation, or how spread out a group is from the average.

Estimating the effect of early childhood education: review of available literature

Our review of previously published studies included various international and domestic analyses. The studies have been assessed according to their relevance for this economic analysis in order to identify a range for the effect size to use in the analysis. The criteria to assess the relevance of the studies included:

- **The location** – there is a preference to use studies that are located in Australia, followed by those with similar models of delivery of early childhood programs and similar social and economic contexts (Canada, New Zealand and the UK are the most relevant comparators). However, the majority of the research is from the United States. Studies on the impact of early childhood education from the US are still highly relevant to Australia, as the teaching approaches and delivery models are relatively consistent. It is the longer-term impacts that cannot be directly translated to an Australian context, because of fundamentally different patterns of disadvantage; different approaches to the provision of schooling, social welfare and health services; and different income and taxation arrangements.
- **How recent the study was** – there is a preference to use studies from the last 10 years, as these are more likely to reflect the experiences of children attending early childhood education in Australia today.

- **Whether the study focused on universal provision of early childhood education** – many studies internationally focus only on early childhood education provided to children experiencing social and economic disadvantage, for whom early childhood education has a much larger impact. It would be inaccurate to infer these impacts can be achieved for the whole population. Australian preschool and kindergartens are universal, so it is important that the studies we draw on are similarly available to the whole community and reflect the likely population-level impacts of a universal program.
- **Whether the study measured school achievement** – our analysis is dependent on linking the early childhood education experience of children with a standardised measure of achievement at school – because NAPLAN is the only education data Australia routinely collects and publishes, and is necessary for us to connect early school achievement with later outcomes. We needed studies with impacts on standardised test schools in early primary school (~Year 3) to be able to accurately translate those impacts into an Australian context – other measures of cognitive impact (i.e. assessment tools researchers use to measure literacy, for example) cannot easily predict later outcomes in an Australian context.

Table 23 summarises the studies assessed as part of the analysis. These studies were not as assessed as part of a meta-analysis so we have not evaluated the underlying methodology of these studies.

Table 23: Summary of studies assessed as part of cost-benefit analysis

Study	Australian	Recent study	Universal preschool	Measures educational achievement	Impact size for Year 3 education outcomes
The economic effects of pre-school education and quality (UK)	x	x	✓	✓	8.4%*
Cost-Benefit Analysis of Universal Preschool Education in Spain (Spain)	x	x	✓	✓	0.15
Early Bird Catches the Worm (Australia)	✓	✓	✓	✓	0.14 – 0.17
Introduction of the National Quality Framework (Australia)	✓	✓	✓	✓	0.14
Positive Educational Gains in Kindergarten for Full-Day Children (Australia)	✓	x	x	✓	4.8%†
Introduction of an additional Prep Year in Queensland (Australia)	✓	x	✓	✓	0.33
Head Start Impact Study (US)	x	x	✓	✓	NS
Tulsa's CAP Head Start Program (US)	x	x	x	✓	0.10
Abbott Preschool Program - APPLES (US)	x	x	x	✓	8 – 10%†
Early Childhood Longitudinal Study-Kindergarten (US)	x	x	✓	✓	0.06
Washington State's Early Childhood Education and Assistance Program (US)	x	✓	x	✓	0.16
North Carolina Preschool Programs (US)	x	✓	x	✓	0.11
The Opportunity Project Early Learning Centers (US)	x	✓	x	✓	18%†
Norwegian universal child care programs	x	x	✓	✓	NS
Universal preschool in the UK and Sweden	x	✓	✓	✓	0.3*

Note: Impact sizes that are not represented as a percentage are effect sizes for Year 3 or equivalent (NS = not significant)

* Value not translated to effect size due to differences in cohort chosen and structure of study.

Sources (in order): (Cattan, Crawford, & Dearden, 2014) (Van Huizen, Dumhs, & Plantenga, 2016) (Warren & Haisken-DeNew, 2013), (Centre for Education Statistics and Evaluation, 2017) (Boardman, 2005), (Goss & Sonnemann, 2016), (Puma et al, 2012) (Phillips, Gormley, & Anderson, 2016) (Barnett, Jung, Youn, & Frede, 2013) (Magnuson, Ruhm, & Waldfogel, 2007) (Washington State Institute for Public Policy, 2018) (Muschkin, Ladd, & Dodge, 2015) (Bakken, Brown, & Downing, 2017) (Havnes & Mogstad, 2011) (Mostafa & Green, 2012)

Chosen effect size

To choose an effect size for our analysis we prioritised Australia-sourced effect sizes of universal early childhood education programs. However, there were some issues associated with Australian-sourced studies noted in Table 23. Some of these sources were published as a stand-alone report that did not include a great deal of information on the type of analysis completed or provide sufficiently granular data, in particular *Introduction of the National Quality Framework* and *Introduction of an additional Prep Year in Queensland*. Other studies were conducted prior to the introduction of the National Quality Framework and *Positive Educational Gains in Kindergarten for Full-Day Children* produced results that were not translatable for the purposes of our analysis.

Numerous meta-analyses (a statistical analyses that combines the results of multiple scientific studies) have examined studies identifying the impact of early childhood education on children's cognitive and achievement outcomes. One such study looked at the impact on cognitive or achievement-related outcomes for 84 programs, measured at the end of each program, which is typically when the children are commencing primary school (Magnuson & Duncan, 2013). This meta-analysis found that the simple average effect sizes for early childhood education on cognitive and achievement scores was a 0.35 standard deviation.

Based on the three key Australian studies and the results of the international studies and meta-analyses, we chose an estimated effect size of 0.17 standard deviations. This is the estimated average impact for all children attending early childhood education programs.

We believe this is a reasonable estimation, reflecting the expected average impact of moderate to high quality universal early childhood education. It is consistent with available Australian evidence and the much more extensive international evidence base. We note that an effect size of 0.17 standard deviations is much less than international estimates of the impact, which can be as large as 0.35 standard deviations. However, many of these studies are focused on programs targeted at disadvantage cohorts, where larger impacts are generally seen

The effect size is used to determine the link between Year 3 standardised test scores and year-before-school early childhood education. The estimated increase in NAPLAN Year 3 scores were calculated to be around 14 NAPLAN points for Reading and Numeracy.¹⁵

¹⁵ In our analysis, we were required to quantify educational achievement in order to determine the potential scale of the economic benefits from early childhood education. We note the limitations of NAPLAN as measure of educational performance at an individual level. By nature, aggregate measures simplify a complex economy to a singular criterion and can hide nuances around the performance of the States and Territories, rural and metropolitan areas and individuals from different socioeconomic backgrounds. However, it is the only available source in Australia that tracks educational achievement at a holistic level.

Model analysis details

Further details on the modelling methodology is contained in this chapter. This chapter includes our approach to quantifying the costs and benefits of early childhood education, particularly the value of:

- Higher workforce participation by parents and carers
- Societal benefits and costs avoided.

Higher workforce participation by parents and carers

There is a substantial level of Australian and international evidence to suggest that workforce participation by parents and carers is dependent on the availability of affordable early childhood education and care.

In international studies, the magnitude of the impact that the cost of childhood education and care has on workforce participation varies. However, studies generally show that the more expensive early childhood education is, the less parents and carers will work (Anderson & Levine, 2001). The same results have been found in Australia, where a negative relationship between child care costs and female labour force participation has been established (Doiron & Kalb, 2005) (Gong & Breunig, 2012) (Rammohan & Whelan, 2007).

In Australia, the Commonwealth and State and Territory governments make an additional investment in year-before-school early childhood education, over and above child care subsidies for children aged 0-5, either by contributing funding to services or delivering services directly. This investment creates substantial additional subsidies for year-before-school early childhood education for parents and carers in the form of a reduction in out-of-pocket costs – including free provision for some families. Without government investment in year-before-school early childhood education, either through direct funding or delivering services, the cost for parents would be substantially higher.

This study has focussed on determining the amount of additional hours parents of carers work due to government investment in year-before-school early childhood education. This is the impact of the reduced cost of early childhood education on workforce participation of parents and carers. The value of these additional hours to parents and carers is additional income. The additional income also results in increases to income taxation, with the Commonwealth Government the beneficiary.

In addition, we know that time spent out of the workforce caring for young children can have a longer lasting impact on the earnings of parents and carers. The analysis includes an estimate of the increase in earnings for parents and carers as a result of being able to maintain an ongoing role in the workforce.

The impact of government investment in early childhood education on workforce participation

To quantify the change in workforce participation, we have estimated the number of parents who are either participating in the workforce or who work more hours due to government contributions to early childhood education. To do this, we need to estimate the elasticity of labour supply due to early childhood education subsidies. This elasticity can be interpreted as:

The additional hours that a parent or carer will work for a one per cent decrease in net childcare costs.

The analysis draws on the findings of two previous studies by Breunig & Gong, 2012 and Doiron & Kalb, 2005. These studies were also used in the Productivity Commission's 2015 *Inquiry into Childcare and Early Childhood Learning* to model the effects of proposed changes to childcare policies, which were a pre-cursor study to the introduction of the Child Care Subsidy (CCS) (Productivity Commission, 2014).

The Breunig and Gong (2012) study focused on a cohort of partnered mothers (either married or in a de facto relationship) of working age (younger than 65) with at least one young child (zero to five years old who is not yet at school). It found that the net price elasticity of hours of work for mothers with preschool children is -0.10. Or that a one per cent increase in the net childcare price will lead to a 0.10 per cent decrease in the hours of work of partnered mothers with a child aged zero to five years. The same paper found that the net child care price elasticities of employment for partnered women with young children is 0.06 per cent.

Doiron and Kalb considered sole parents and partnered parents in their research. This study showed that a 10 per cent increase in the net cost of child care for lone parent families with children aged less than five years old leads to a 2.8 per cent decline in expected hours of labour supply, an elasticity of -0.28 (Doiron & Kalb, 2005).

Our analysis applies the elasticities from these studies, assuming that the elasticities have not changed substantially over time and that there is a linear relationship in the elasticities – i.e. every one per cent decrease in the net price of child care causes the same magnitude of change in hours supplied.

Table 24: Elasticities used to estimate increased labour supply

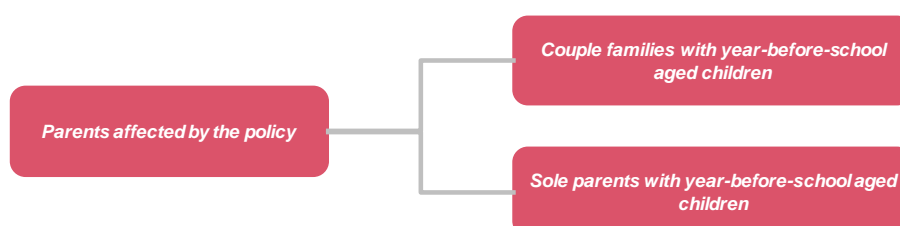
Description of cohort	Elasticity result	Source
Couple parents' net child care price elasticity on hours worked	0.10 per cent	Gong and Breunig (2012)
Couple parents' net child care price elasticity on employment	0.06 per cent	Gong and Breunig (2012)
Sole parents' net child care price elasticity on hours worked	0.28 per cent	Doiron and Kalb (2005)

Source: Doiron & Kalb, 2005 and Breunig and Gong, 2012

Estimating the level of workforce participation due to early childhood education

The model uses the elasticities above to estimate the number of parents and carers who are participating in the workforce or are working more hours due to government subsidies for early childhood education. The analysis considers two categories of parents or carers who receive subsidies for their children's participation in early childhood education (see Figure 21). We assume that the elasticities calculated for the workforce characteristics of mothers reflects those for primary carers.

Figure 21: Types of households impacted by changes to the cost of early childhood education



Source: PwC analysis

Our analysis determined that there were around 190,000 couple households and over 60,000 one parent families with year-before-school aged children in 2017 (Australian Bureau of Statistics, 2016). Our analysis has been limited to the number of primary carers within a partnered couple and sole parents who may join the workforce. We estimated the average number of hours worked by a primary carer with children zero to five as we were unable to get more detailed data on hours worked by parents with children in their year-before-school through 2016 ABS Census data (Australian Bureau of Statistics, 2016). Therefore, we were required to assume that the workforce characteristics of primary carers with children aged zero to five is consistent with primary carers with children aged in their year-before-school.

As noted in Section 6.1, the difference between household out-of-pocket costs and total cost for year-before-school early childhood education is required to calculate the impact to workforce participation. The average total cost per child enrolled in year-before-school early childhood education across Australia was calculated at around \$12.40 per hour, with the median out-of-pocket cost calculated around \$2.60 per hour. These numbers were used to calculate the change in the price of year-before-school early childhood education.

Using the elasticities and the change in the price of early childhood education, it was possible to determine the impact on hours supplied to the workforce. Figure 22 highlights this approach to determining the impact to workforce participation.

Figure 22: Approach to calculating number of additional hours supplied to the labour force



Source: PwC analysis

The increase in the number of hours supplied to the workforce, comes from both the increase in hours worked and the additional primary carers joining the workforce. The increase in hours worked by primary carers already in the workforce equates to 18,169,540 and the increase in hours from primary carers joining the workforce is equal to 14,769,072. By assuming an hourly rate of \$42.43, this change in labour supply is estimated to increase total earnings by \$1.4 billion. This hourly rate was sourced from the 2016 ABS Census data, by calculating the weekly wage of primary carers with children zero to five (Australian Bureau of Statistics, 2016).

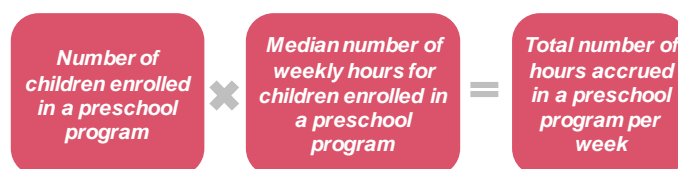
The taxation increases were estimated using 2017 taxation rates and is estimated to equal over \$292 million. This benefit is expected to only occur when children are attending year-before-school preschool; this is 2017 in our analysis.

Early childhood education hours

Private expenditure or out-of-pocket expenditure on early childhood education is reported in the Productivity Commission's Report on Government Services (ROGS) on a per-hour basis, but doesn't identify the total level of expenditure by households, in relation to provision of year-before-school early childhood education (Productivity Commission, 2019). Similarly, the Commonwealth Government's total expenditure on the CCB and CCR (in future the CCS) is reported in the Commonwealth Government's Budget Paper Statement 6: Expenses and Net Capital Investment but it doesn't identify how much of this expenditure relates to the 15 hours of year-before-school early childhood education – the focus of this study.

In order to estimate the overall level of CCB and CCR for year-before-school early childhood education, as compared to CCB/CCR funding for all early childhood education and care, it is necessary to estimate attendance levels. We decided to identify the hours of attendance related to the provision of year-before-school early childhood education. The approach to this estimation is summarised below.

Figure 23: Approach to calculating the number of children enrolled in a year-before-school preschool program



Source: PwC analysis

Overall attendance figures used in our analysis have been taken from ROGS (Productivity Commission, 2019). We assumed that the total number of hours per week of attendance for year-before-school preschool was 15. This is much lower than the general average number of hours per week of attendance for long day care, which is around 28 (Productivity Commission, 2019).

Table 25: Long day care attendance, 2017

State / territory	Number of children attending Year-before-school preschool through long day care service	Total number of children attending long day care service
New South Wales	58,545	238,014
Victoria	31,111	163,524
Queensland	39,272	166,567
Western Australia	692	56,909
South Australia	4,587	42,241
Tasmania	296	11,857
Australian Capital Territory	1,426	15,912
Northern Territory	426	5,580
Total (Australia)	136,355	700,604

Source: PwC analysis, ROGS 2019 – Table 3A.25 and Table 3A.18

These attendance figures were used to calculate the total annual hours of attendance for children enrolled in year-before-school preschool through long day care services. For more information see Section 5.2.2.

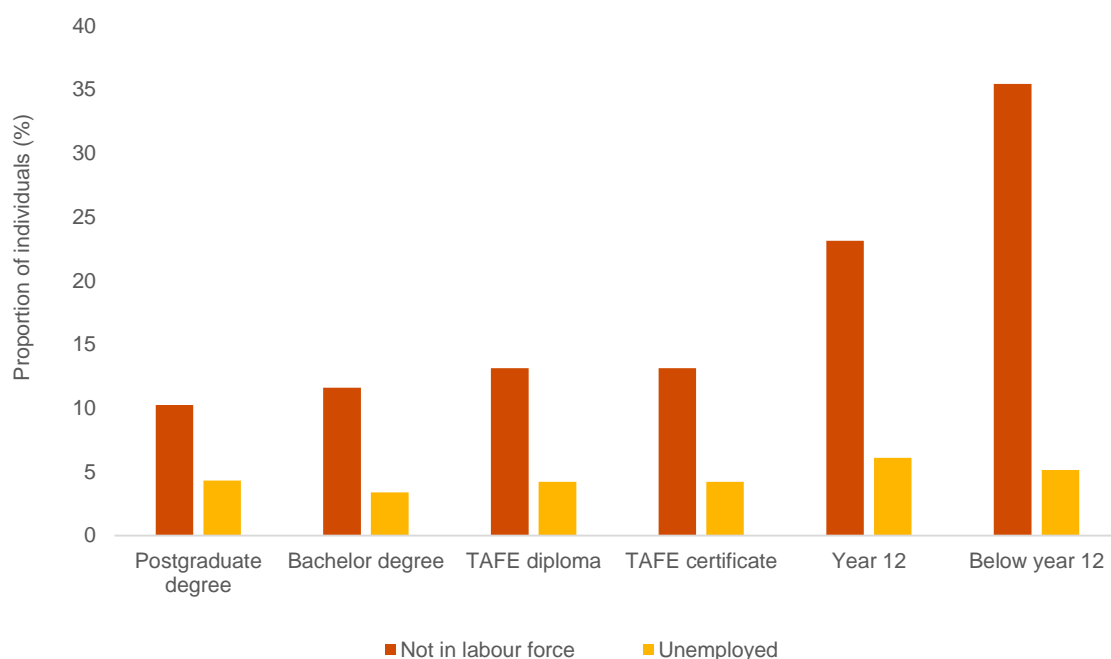
Welfare benefits

Various studies suggest a significant community-wide benefit of early childhood education stems from reduction in long-term unemployment and reliance on welfare support (Australian Institute of Health and Welfare, 2015). Our analysis incorporates the reduction in the number of individuals unemployed and those not-in-labour-force. The ABS defined persons not in labour force as people who are neither employed nor unemployed, with this category also representing individuals who are not actively looking for work or not available for work. A component of these individuals not available for work are engaged in education.

Typically, each age bracket has a certain proportion of individuals who are not in the labour force, so by looking at highest education level for a specific age bracket, we aim to identify the

relationship between education level and labour force status. We analysed 2016 ABS Census data for 25 to 65 year olds to determine labour force status by highest education level, see Figure 24 (Australian Bureau of Statistics, 2016).

Figure 24: Labour force status of individuals aged 30 to 50 by highest education level



Source: PwC analysis, ABS Census 2016.

The results represented in Figure 24 and was used to determine the increase in the number of individuals unemployed or not in the labour force. To monetise these benefits, we obtained fortnightly payments for Austudy and Newstart Allowance from the Department of Human Services (Department of Human Services, 2019). These benefits were estimated to be around \$524.28 for a weighted average of all household situations – single no children, single with children, couple no children, couple with children.

Table 26: Summary of modelling outputs – increase in lifetime earnings for children attending early childhood education

Description of output	Change in number of individuals unemployed or not in labour force	Annual welfare payments (\$)	Value of change in labour force status (\$)
Below year 12	-544		
Year 12	-31		
Vocational education and training diploma	-24		
Bachelor degree	183		
Master degree	78		
Total	-338	13,631	4,606,078

Source: PwC analysis, Department of Human Services, 2019.

These welfare benefits valued at \$4.6 million annually. The benefits were assumed to occur between 2033 and 2078, when individuals are aged 20 to 65.

Societal benefits and costs avoided

Reduction in health-related costs for early school leavers

Section 6.4.1 states the relationship between early school leavers and long-term health issues. Around 42 per cent of male and female early leavers in the working age population have a long-term health condition, as compared with 25.9 per cent of the general working age population (Lamb & Huo, 2017).

The modelled decrease in early school leavers enabled us to calculate the subsequent reduction in health related costs from early childhood education attendance. The benefit was calculated as the difference between the propensity for long-term health conditions for early school leavers and the general population, scaled by the reduction in the number of early school leavers.

In order to monetise the benefit, we used calculations of the estimated additional costs per person on Emergency Department admissions and extended admissions to public hospitals. The total annual reduction in health-related costs due to the increase in the number of children graduating high school was calculated at \$420,000. These benefits are expected to start in 2048, when the cohort is aged 35, till 2094.

Decreased rates of crime

Children who have higher participation in early childhood education are less likely to commit crimes either as a juvenile or adult. As noted in Section 6.4.4, the Head Start study from the U.S. found that early childhood education reduced the probability that an individual will commit a crime by 8.6 per cent. As the U.S. has a difference economic structure to Australia, in order to determine the impact of early childhood education on Australian children, we reduced the size of this expected benefit by 50 per cent.

The likelihood that an individual commits a crime changes with age, therefore, the methodology for incorporating this benefit must take into consideration that the probability of committing a crime is significantly greater for younger individuals than older individuals. Please note that due to data availability, the propensity for committing a crime at different age groups was calculated using NSW statistics from the Bureau of Crime Statistics and Research (Bureau of Crime Statistics and Research, 2018).

The key inputs into this calculation include:

- the probabilities of committing a crime for each age bracket - calculated using the total number of offenders and offender rates per 100,000 for the Australian population (Australian Bureau of Statistics, 2016-17)
- crime rates for the general population was calculated as the product of Australian population by age, corresponding offender rates and the total crimes (Bureau of Crime Statistics and Research, 2018).

To monetise the benefit, we determined the following costs into the model:

- reduced social costs to the community from reduced rates of crime
- reduced policing costs to government, with less need to respond to reported crimes
- reduced court costs to government from reduced rates of offending
- reduced prison costs to government from reduced rates of offending resulting in prison.

Benefit calculations across these categories varied with the per crime cost of the crime in terms of social costs, policing costs, prison costs and court costs. As the number of total crimes was sourced from NSW Bureau of Crime Statistics and Research, per crime cost was calculated for NSW. Our analysis assumes these cost figures represent the per person cost in Australia. The inputs into these calculations are summarised in Table 27.

Table 27: Inputs for the calculation of benefits from decreased rates of crime

Variable	Value	Note
Per crime societal costs to victims (\$2016-17)	\$29,705	Total societal costs were 17.1m (\$2016-17), excluding costs from lost output (Smith et al, 2011). This was divided by the total number of crimes in Australia (574,846).
Per crime policing costs (\$2016-17)	\$7,091	Total real recurrent expenditure (including user cost of capital less revenue from own sources and payroll tax) on police services in 2014-15 for NSW at \$3,359m (Productivity Commission, 2018). It is assumed that the NSW Police Force (2012) estimated that almost 80 per cent of time was spent either responding to incidents, criminal investigations or giving judicial support (Smith et al, 2011).
Per crime court costs (\$2015-16)	\$809	Real net recurrent expenditure for criminal and civil courts (excluding payroll tax) was \$316m in NSW (\$2016-17) (Productivity Commission, 2018).
Per crime prison (\$2015-16)	\$9,659	Total real net operating expenditure on prisons was \$812m (\$2015-16) and \$159m (\$2015-16) on community corrections (Productivity Commission, 2018).

Source: PwC analysis and in-text.

As the probabilities of committing a crime differs for each age bracket, when individuals are 40 years olds the total annual reduction in criminal costs due to early childhood education of around \$19 million for individuals aged 35 to 39. These benefits are assumed to start in 2033, when the cohort is aged 20 till 2078, when the cohort is aged 65.

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