Australian Government
Productivity Commission

The Demand Driven University System: A Mixed Report Card

Productivity Commission Research Paper

June 2019

ISBN 978-1-74037-677-8 (PDF)
ISBN 978-1-74037-676-1 (Print)

An appropriate reference for this publication is:

Productivity Commission 2019, *The Demand Driven University System: A Mixed Report Card*, Commission Research Paper, Canberra.

Publications enquiries

Media, Publications and Web, phone: (03) 9653 2244 or email: mpw@pc.gov.au

The Productivity Commission

The Productivity Commission is the Australian Government's independent research and advisory body on a range of economic, social and environmental issues affecting the welfare of Australians. Its role, expressed most simply, is to help governments make better policies, in the long term interest of the Australian community.

The Commission's independence is underpinned by an Act of Parliament. Its processes and outputs are open to public scrutiny and are driven by concern for the wellbeing of the community as a whole.

Further information on the Productivity Commission can be obtained from the Commission's website (www.pc.gov.au).

Contents

Acknowledgments

The Commission is grateful to all those who have given their time to share their experiences and expertise in support of this research paper.

The Commission wishes to particularly thank our external referee Professor Robert Breunig (Crawford School of Public policy, Australian National University) and Somayeh Parvazian and Ronnie Semo (National Centre for Vocation Education and Research) for their helpful feedback. The Commission also wishes to thank Dom English, Robert Latta, Andrew Taylor, Drew Menzies-Mcvey (Department of Education and Training), Andrew Norton and Ittima Cherastidtham (Grattan Institute), Tue Gorgens (Australian National University) and Chris Ryan (Melbourne Institute of Applied Economic and Social Research) for their advice and input into the project. Within the Commission, the team wishes to thank Ralph Lattimore, Philip Harslett, Henry McMillan and Danielle Venn for their advice, internal checks and guidance.

This paper was produced by Ben Dolman, Marco Hatt, Ishita Acharyya and Max Gillespie. The study was overseen by Chair Michael Brennan.

This paper uses survey data from the Longitudinal Survey of Australian Youth (LSAY). LSAY is managed and funded by the Australian Government Department of Education and Training (DET), with support from state and territory governments. The National Centre for Vocational Education Research (NCVER) provides analytical, reporting and publishing services for LSAY. Between 1995 and 2007, these services were provided by the Australian Council for Educational Research (ACER). The findings and views reported in this paper, however, are those of the Commission and should not be attributed to either DET or the NCVER.

Abbreviations

ABS	Australian Bureau of Statistics
ANZSCO	Australian and New Zealand Standard Classifications of Occupations
ASGS	Australian Statistical Geography Standard
ATAR	Australian Tertiary Admission Rank
ATN	Australian Technology Network of Universities
CGS	Commonwealth Grants Scheme
DDS	Demand Driven System
DEEWR	Department of Education, Employment and Workplace Relations
DET	Department of Education and Training
GCA	Graduate Careers Australia
Go8	Group of Eight Universities
HECS	Higher Education Contribution Scheme
HECS-HELP	Higher Education Contribution Scheme – Higher Education Loan Programme
HEPPP	Higher Education Participation and Partnerships Program
HESP	Higher Education Standards Panel
IRU	Innovative Research Universities
ISCED	International Standard Classification of Education
ISEI	International Socio-Economic Index of Occupation Status
IT	Information Technology
LSAY	Longitudinal Surveys of Australian Youth
MAR	Missing At Random
MCEETYA	The Ministerial Council on Education, Employment, Training and Youth Affairs
MICE	Multiple Imputation through Chained Equations
MOOCs	Massive Open Online Courses
MYEFO	Mid-Year Economic and Fiscal Outlook
NCVER	The National Centre for Vocational Education Research
NESB	Non-English Speaking Background
OECD	Organisation for Economic Co-operation and Development

PC	Productivity Commission
PISA	Programme of International Student Assessment
PMM	Predictive Means Matching
QILT	Quality Indicators for Learning and Teaching
RRMA	Rural, Remote and Metropolitan Areas
RUN	Regional Universities Network
SEIFA	Socio-Economic Index For Areas
SES	Socioeconomic Status
TAC	Tertiary Admissions Centre
TAFE	Technical and Further Education
VET	Vocational Education and Training

OVERVIEW

Key points

- University education can be transformative. It is also costly in terms of forgone earnings, student debt and Commonwealth outlays, so it is important that students, taxpayers and the broader community benefit from the investment.
- The 'demand driven system' in place between 2010 and 2017 was intended to increase domestic student numbers and give under-represented groups greater access. The results were mixed.
- It was certainly effective in increasing numbers: the share of young people that attended university by age 22 years increased from 53 per cent in 2010 to an estimated 60 per cent in 2016, based on data from the Longitudinal Surveys of Australian Youth.
- Multivariate regression analysis shows that the 'additional students' — those whose attendance can be ascribed to the expansion of the system — were drawn from many backgrounds. However, compared with other students, they typically had lower literacy and numeracy and a lower Australian Tertiary Admission Rank (most had an ATAR less than 70).
- Many of the additional students succeeded. About half of the additional students graduated by age 23 years (with many still studying). About half of those graduates entered managerial or professional occupations, outcomes that are similar to those of other graduates.
- However, people that enter university with lower literacy and numeracy and a lower ATAR drop out at higher rates. By age 23 years, 21 per cent of the additional students had left university without receiving a qualification compared with 12 per cent of other students.
- University participation increased within some under-represented 'equity groups', but not others.
  - School students from a low socioeconomic background and 'first in family' students were more likely to participate in higher education following the expansion in university places.
  - However, the participation 'gaps' (compared to those not in the equity group) remain for Indigenous people and for people from regional or remote areas, and may have widened.
- Despite the expansion, the level of participation among all these groups remains far lower than for people who do not come from disadvantaged backgrounds — a reflection of poorer *average* school performance and a range of cultural and environmental factors. In the latter respect, an equity group student with a given level of academic ability is still significantly less likely to attend university than their non-equity equivalents.
- Overall, the demand driven system succeeded in increasing the number of students and made progress in improving equity of access. However, many are entering university ill-prepared and struggling academically. This study suggests some areas for further policy consideration:
  - The school system has arguably not adapted to the role needed of it to prepare more young people to succeed at university, or more broadly to meet the growing demand in the Australian economy for complex and adaptable skills. Average literacy and numeracy of school children needs to rise to fill this role, reversing the sharp falls since 2003.
  - Children growing up in regional or remote areas with the same academic ability as their metropolitan peers continue to be much less likely to attend university.
  - The growing risk of students dropping out of university requires attention. On average, the additional students need greater academic support to succeed. While universities had strong incentives to expand student numbers, the incentives for remedial support are weak.
  - University will not be the best option for many. Viable alternatives in employment and vocational education and training will ensure more young people succeed.

University can be transformative. Most university students succeed academically and go on to rewarding careers. On average, they earn higher wages and are less likely to be unemployed — which means higher taxes and lower social security benefits — and they make the economy more innovative and adaptive.

A well-functioning higher education system should provide students with opportunities and empower them to make the choice of whether or not to study. It should match students with suitable study opportunities and meet the needs of the labour market. It should be open to people regardless of their background. It should also encourage those who will benefit most from the many years spent acquiring a qualification and support students to succeed while at university, recognising that university education is costly to students and the public more generally.

The Australian university system has evolved to meet these goals. Funding, pricing and institutional changes have slowly shifted the university system from the province of a small group of universities servicing a small, mainly male, share of the population in the 1950s and 1960s, to a key pillar of the skills formation system. It now involves a large share of school graduates and, after Dawkins' reforms, dozens of universities.

The most recent significant expansion of university participation was due to the implementation of the 'demand driven system' from 2010 to 2017 (the result of recommendations made by the Bradley *Review of Higher Education*).[1] Fiscal constraints were no longer part of the rationing mechanism. The Australian Government removed caps on its support for most domestic undergraduate students. Everyone could attend university, limited only by the students' willingness to invest their time and incur (concessional) debt, and universities' admission requirements. The policy aimed to expand undergraduate education for domestic students and improve the equity of access for disadvantaged groups. The policy was underpinned by the view that investment in higher education was falling behind the growing need for university-educated workers in the Australian economy.

An uncapped system has the virtue of letting students — who generally know their capabilities and lifetime aspirations better than government or universities — make choices about whether investing in university makes sense for them. It recognises that universities and governments are unable to accurately predict students' future university outcomes. The most prominent basis for entry — the Australian Tertiary Admission Rank (ATAR) — is an imprecise indicator. A system that conservatively screens out students who would benefit from university attendance means that many with good prospects will be denied access under capped systems. The demand driven system also gave students a greater chance to try some university study and learn whether it suited their skills and aspirations.

On the other hand, students only bear a share of the costs of university attendance and may have imperfect information about their likely success. So uncapped systems — where universities are funded based on how many students they enrol, rather than a fixed sum of money — face the risk of encouraging attendance by people who will not ultimately benefit,

[1] A funding cap was re-introduced for the 2018 and 2019 academic years, maintaining the 2017 funding level, amid concern about the fiscal cost of a burgeoning university system.

accompanied by student debt, diversion from superior educational options, forgone earnings from jobs that do not need a university qualification, and costs to taxpayers.

This study explores some of the costs and benefits of moving to a demand driven system by comparing access and student outcomes before and after the policy change.

The Commission's approach

This is a descriptive study. The study explores what happened to young Australians during the demand driven system using administrative, population and longitudinal data.

The study addresses two research questions:

1. Who are the 'additional students' who enrolled in university under the demand driven system who would not have had the opportunity in earlier periods, and what are the academic and labour market outcomes they achieved?
2. To what extent was the demand driven system more accessible to people from under-represented 'equity groups' (figure 1)? And what factors predict the under-representation of these groups?

The study draws on a range of data, such as the Census of Population and Housing, administrative data sourced from the Department of Education and Training, and the Quality Indicators of Learning and Teaching dataset. The centrepiece of this study is an analysis of the Longitudinal Surveys of Australian Youth (LSAY). The LSAY provides remarkably rich data on adolescents' lives as they grow and enter adulthood, beginning at around age 15 years and tracking through to age 25 years. This includes objective measures of school achievement. Since 2003, the LSAY participants have sat the OECD Program of International Student Assessment (PISA) in literacy and numeracy. While the previously mentioned data sets provide population benchmarks, the detail in the LSAY provides the best estimates available about young Australians' education decisions and the barriers they face to university access and success.

Unlike many previous studies using the LSAY, this study draws comparisons *across* cohorts. The focus is on the cohorts that enter the surveys at age 15 years in 2003, 2006 and 2009. The study considers determinants of their university participation by age 22 years — at the commencement of the demand driven system in 2010, and then in 2013 and 2016 respectively. It then follows students over time to assess their graduation rates and labour market transitions.

The relatively abrupt change in the mechanism for determining university access provides a natural experiment. In some ways, this study is a simple before and after analysis. The mechanism for determining university access before 2010 allowed fewer people access; beginning in 2010, more people were given access to a university education. This study uses statistical analysis to identify, in a probabilistic way, the additional students and considers their academic and labour market outcomes.

This study is not a policy evaluation of the demand driven system. It has made no attempt to weigh the benefits in terms of greater opportunity against the resource costs of expanding the system. Moreover, while the demand driven system contributed to a large change in the supply of domestic university places, other factors such as the youth labour market, technological change, problems in the vocational education and training system, skilled migration, and many other social and economic factors also affect who took up these places and the outcomes they achieved. Nevertheless, this study seeks to make a contribution by identifying who the additional students were under the demand driven system, without which it would be difficult (if not impossible) to make a rigorous assessment of the policy. It also highlights the connection between university success and school achievement (measured by literacy and numeracy at age 15 years) and the role that this achievement plays in explaining the persistent under-representation of equity groups.

Figure 1 **What is an 'equity group'?**

Equity groups considered in this study

Low SES	People in the lowest quartile in terms of socioeconomic status (SES).
First in family	People whose parents did not attend university.
Regional or remote	People who grew up in a regional or remote area.
Indigenous	People who identify as Aboriginal or Torres Strait Islander.

New opportunities for many, though some 'additional students' fared poorly

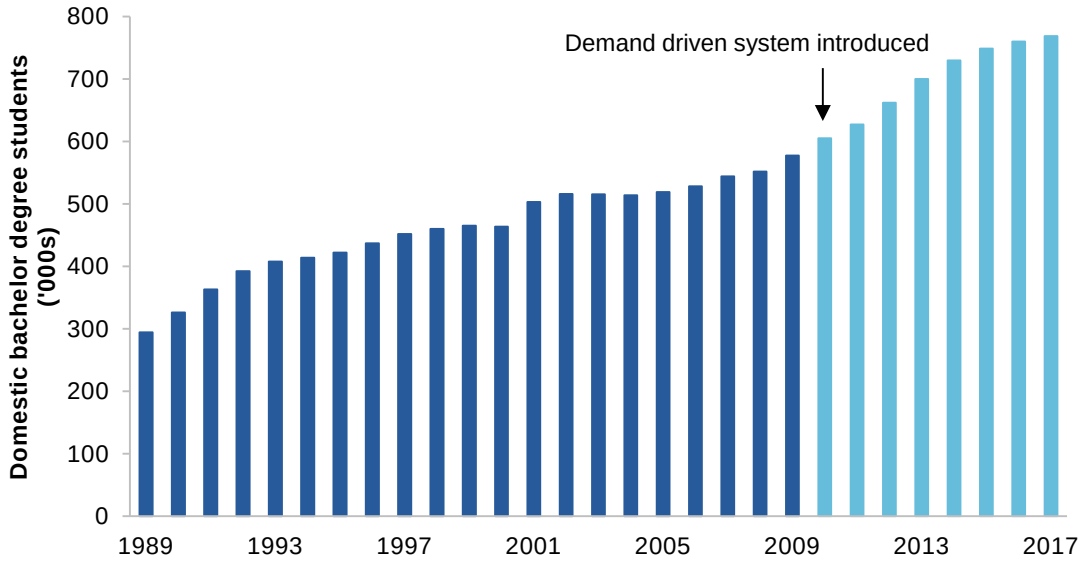
The demand driven system had pronounced effects on Australians' access to higher education. The transition to a demand driven system saw a progressive increase in the cap on Australian Government-supported domestic undergraduate places by 5 per cent in each of 2010 and 2011, followed by uncapped funding from 2012 for almost all fields of study.

Overall, between 2009 and 2017, the number of domestic bachelor degree students increased by one third (figure 2). The proportion of young people who enrolled in university has increased and a clear majority of Australians now attend university at some point by the age of 22 years. In step with the increase in enrolments, Australian Government expenditure

(including deferred student contributions) increased in real terms from $6.4 billion in 2009 to $9.3 billion in 2017.[2]

Figure 2 **Enrolments grew during the demand driven system**

Domestic bachelor degree students



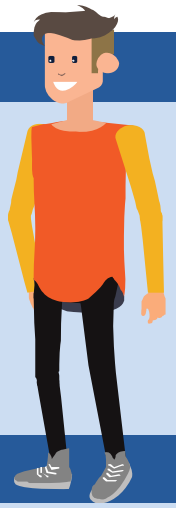
The expansion in the number of Australian Government-supported university places meant additional students had an opportunity to attend university during the demand driven system that they would not have had in earlier periods. These additional students come from a wide range of backgrounds, but are more likely to have certain traits than 'other students' (i.e. those that were not additional students). For example, the additional students are more likely to come from low socioeconomic families, study at public schools and grow up in metropolitan areas (figure 3).

2 Total expenditure estimates are Commonwealth Grant Scheme (CGS) and HELP special appropriations for 2008-09 (revised budget estimate from the Department of Education, Employment and Workplace Relations Portfolio Budget Statement, 2009-10) and 2016-17 (estimated actual from the Department of Education and Training Portfolio Budget Statement, 2017-18) adjusted to 2017 dollars. Undergraduate versus postgraduate CGS and HECS-HELP appropriations are not reported separately. Estimates do not include student contributions when paid up front. The increase in Australian Government expenditure reflects both an increase in student numbers and change in the mix and funding levels of courses taken.

Figure 3 **Who are the additional students and how do they fare?**

Characteristics and outcomes

Additional Students



- Students who **would not** have attended university before the demand driven system was introduced

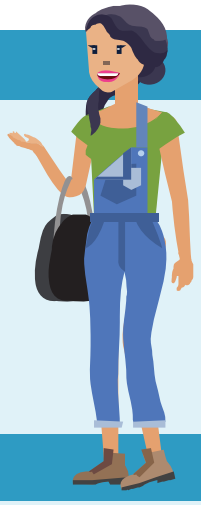
Characteristics

- **73 per cent** have an ATAR below 70 (or received no ATAR)
- **32 per cent** are from the bottom SES quartile
- **65 per cent** are first in family students
- **18 per cent** are from regional or remote areas
- **60 per cent** are from government schools
- **11 per cent** attended a Group of Eight university
- **30 per cent** take some vocational education and training prior to university
- More likely to study education, information technology or management and commerce courses than other students

Outcomes (age 25)

- **68 per cent** have graduated
- **22 per cent** have dropped out
- **59 per cent** of graduates are employed in managerial or professional occupations
- **75 per cent** of graduates are employed full time
- Average weekly pay is **$1,036**

Other Students



- Students who **would** have attended university before the demand driven system was introduced

Characteristics

- **28 per cent** have an ATAR below 70 (or received no ATAR)
- **15 per cent** are from the bottom SES quartile
- **45 per cent** are first in family students
- **25 per cent** are from regional or remote areas
- **47 per cent** are from government schools
- **29 per cent** attended a Group of Eight university
- **10 per cent** take some vocational education and training prior to university
- More likely to study engineering or natural and physical science courses than additional students

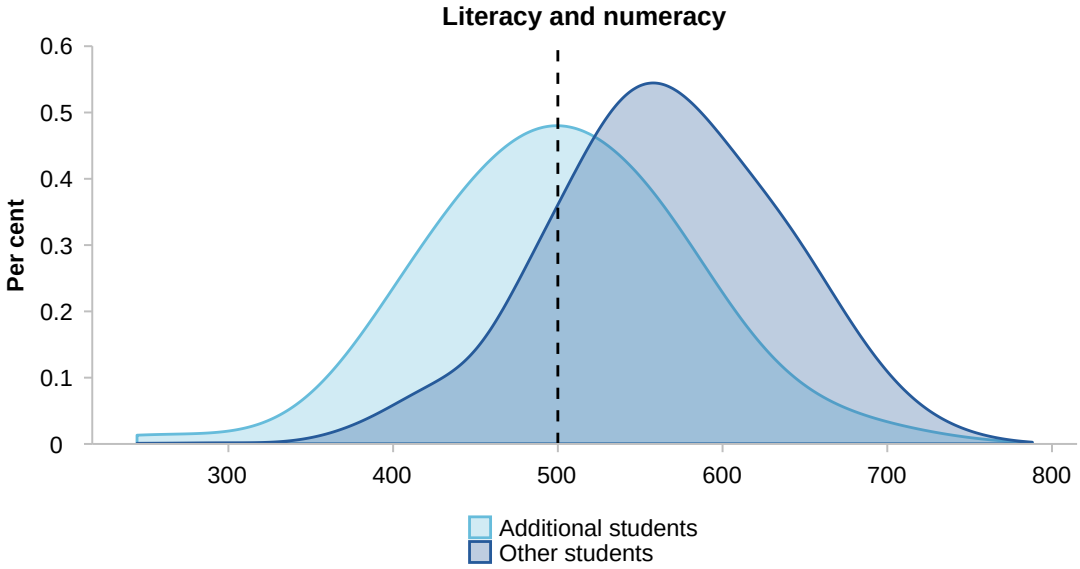
Outcomes (age 25)

- **80 per cent** have graduated
- **12 per cent** have dropped out
- **64 per cent** of graduates are employed in managerial or professional occupations
- **75 per cent** of graduates are employed full time
- Average weekly pay is **$1,153**

The most distinct feature of this group of additional students, compared with other university students, is that their school achievement was weaker. Prior to the demand driven system, ATAR scores were a primary mechanism for rationing places. While they remain important for entry by year 12 students and for many courses offered by Group of Eight universities, the most rapid growth in the system came from enrolments by students who had been out of school for a period into courses at non-Group of Eight universities. Around two thirds of additional students have an ATAR below 70 or received no ATAR at all. These students also have poorer foundational skills of literacy and numeracy, as measured by PISA scores at age 15 years, which weakens their capacity to engage and succeed at university (figure 4).

Figure 4 **More students are entering university poorly prepared[a]**

Distribution of those who participate in university by age 22 years in 2016

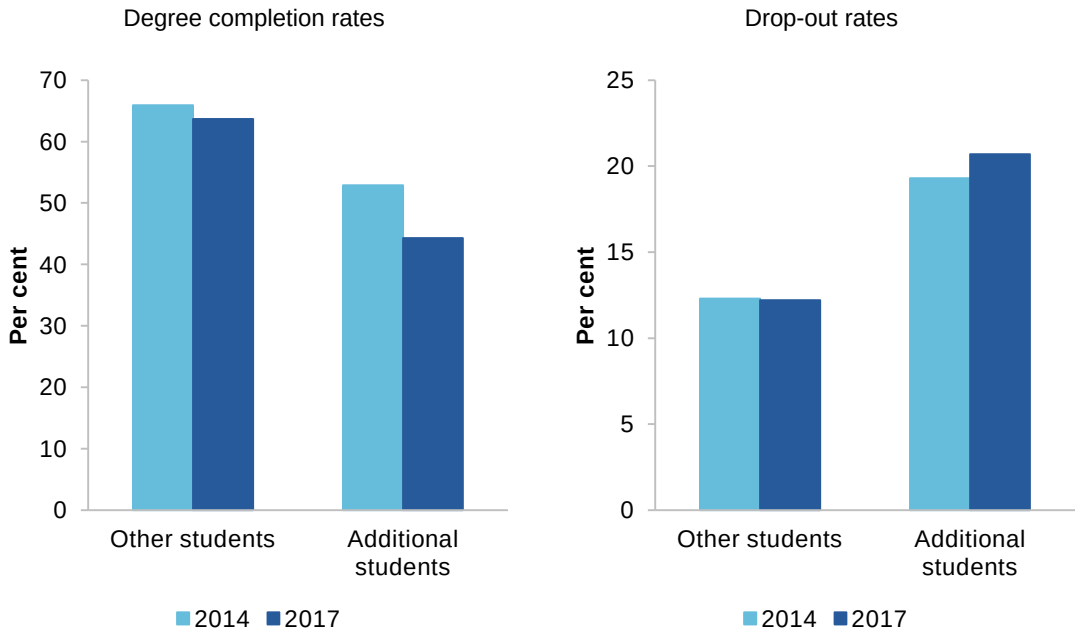


[a] PISA scores are scaled so that the OECD average is 500 and the standard deviation is 100 across all students tested in 32 countries when introduced in 2000.

Additional students are less likely than other students to succeed academically. About 21 per cent of additional students drop out by age 23 years compared with about 12 per cent of other students, rates that for other students have been trending down over time (figure 5). While most students that drop out do so within two years of enrolment, there is a tail of students who attend for longer prior to dropping out. Additional students that dropped out had an opportunity to experience university that would not have previously been available to them, and to take an informed decision on whether they are well suited to benefit from the experience. Nevertheless, it is an opportunity that came with costs, not least to the student. Students who drop out incur fee costs of $12 000 on average (Norton and Cherastidtham 2018), with the costs in terms of forgone earnings likely to be much greater.

Figure 5 **Additional students are more likely to drop out**

Completion and drop-out rates by age 23 years



For those who succeed academically, a university education remains a good investment. Around half of the additional students are in managerial or professional occupations by age 25 years, roles that generally would have been unavailable to them prior to the demand driven system. Nevertheless, additional students who graduate face slightly less smooth labour market transitions. They are less likely to be in full-time employment and have lower average weekly pay than other graduates or those who never attended university at age 23 years. However, the outcomes for graduates converge over time as they grow older and spend more time in the labour market. By age 25 years the remaining differences between these two groups are small. While average wages are similar for all groups in their early twenties, Census data show average earnings of graduates through their late twenties and thirties grows faster than those with trade qualifications or without post-school qualifications, implying a significant lifetime earnings premium (albeit lower than during earlier decades).

FINDING 1

The demand driven system significantly expanded access to university. The 'additional students' — those whose attendance can be ascribed to the expansion of the system — entered university with weaker literacy and numeracy than other students and were more likely to drop out. However, additional students that did graduate transitioned fairly well into the labour market.

There was some progress in improving equity

Improving access is valuable in its own right. Few would argue for excluding young people from opportunities based on disadvantage or hardship due to circumstances beyond their control. That said, policy should aim to ensure access also leads to success. A goal in providing access to under-represented groups is to set young people onto a career path they could not otherwise have pursued, thereby helping to overcome the disadvantage they were exposed to during their youth. A useful heuristic is to consider three hurdles: gaining access; degree completion; and labour market transitions.

Access

Young Australians from disadvantaged backgrounds have long been under-represented at university. In the two decades prior to the demand driven system, progress on lifting enrolments of students from equity groups had been modest at best.

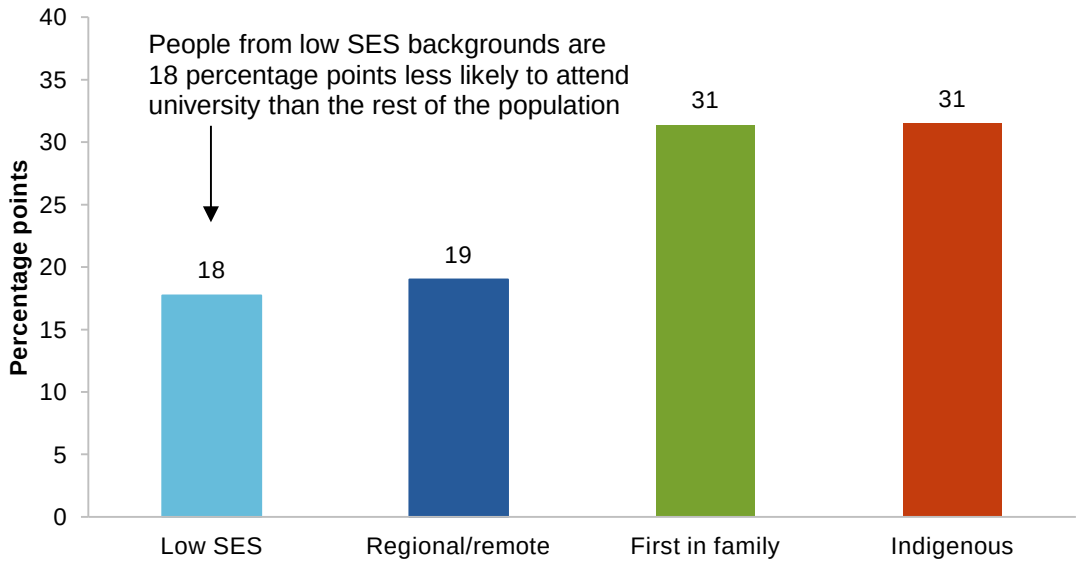
The demand driven system lifted enrolments of some equity groups more than others. In comparison with the general student population, additional students were more likely to come from low socioeconomic backgrounds and from families where the parents had not attended university. For example, in 2016, around one third of additional students were from a low socioeconomic background compared with around 15 per cent of other students. This inflow of additional students changed the overall composition of the student body, but only to a limited degree because the additional students comprised a modest share of all university students.

In contrast, the demand driven system did not stimulate increased participation rates for young people from regional or remote areas or for Indigenous people, though the latter finding does not take into account that Indigenous people often undertake university study at ages that are outside the scope of the dataset used in this study. For example, more than one third of Indigenous university students are aged over 30 years, compared with one quarter of non-Indigenous students.

Some of these trends may have been expected, while others need to be unpacked. For example, the different outcomes for those growing up in regional or remote areas may reflect the substantial relocation costs they face and the relative ease of access for young people growing up in metropolitan areas near large university campuses (figure 6). The demand driven system, of itself, did not address these underlying barriers.

Figure 6 **Equity groups remain under-represented at university**

Difference in university attendance rate by age 22 years (compared to non-equity groups) in 2016



FINDING 2

University enrolment and participation rates of people whose parents did not attend university and those from low SES backgrounds increased strongly under the demand driven system. In contrast, while there has been some increase in enrolments for people from Indigenous or regional or remote backgrounds, overall participation rates for these groups do not appear to have improved, at least until age 22 years.

Despite the increase in enrolments by some equity groups, all remain significantly under-represented at university. This study maps the effects of people's various characteristics at age 15 years on university attendance by age 22 years and how that affects equity group participation. It shows that there are two different reasons that explain why gaps in attendance persist: school achievement; and a range of cultural and environmental factors effects that are difficult to identify individually.

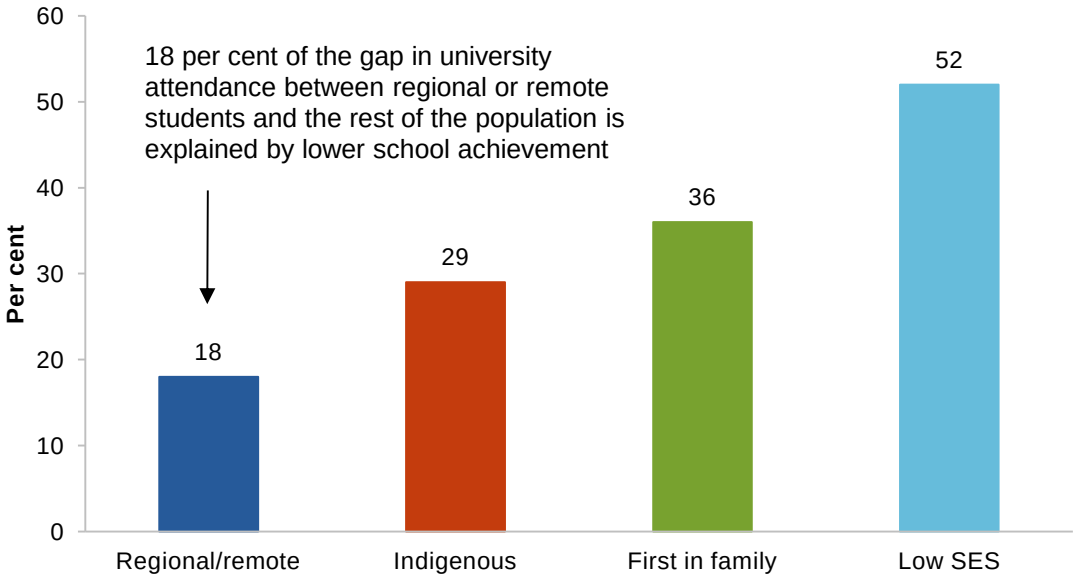
Proficiency in literacy and numeracy at age 15 years is the strongest predictor of whether an individual will attend university and a major explanation for the under-representation of children from low socioeconomic backgrounds or from families with parents who did not attend university (figure 7).[3] Literacy and numeracy are also relevant factors in explaining why Indigenous and regional or remote children are less likely to attend university. As such,

3 As measured by the OECD's Programme for International Student Assessment — PISA.

recent large declines in literacy and numeracy scores among regional or remote school children are of particular concern.

Figure 7 **Improving literacy and numeracy may reduce under-representation of equity groups at university**

Share of participation gap explained by variations in PISA scores[a]



a The gap is between equity group and non-equity group participation rates.

Put differently, strong foundational skills in literacy and numeracy are a powerful protective factor for children growing up in equity groups or from disadvantaged backgrounds. Those children that succeed in school and attain literacy and numeracy in the top quartile attend university at fairly similar rates regardless of their background. By contrast, children from equity groups with literacy and numeracy in the bottom quartile are about half as likely to attend university as equivalently capable children from more privileged backgrounds.

FINDING 3

All equity groups remain heavily under-represented at universities. Poorer average literacy and numeracy within these groups, when compared with the broader population, is one important source of this under-representation. Conversely, for people growing up in disadvantage, strong development of these foundational skills greatly increases their likelihood of university attendance.

Outcomes

Students from equity groups also face challenges when they attend university, as they:

- enter university with poorer literacy and numeracy on average than students from more advantaged backgrounds
- commence university at an older age on average (having spent some time working after completing school)
- are more likely to study part time and work while they study.

All of these factors are correlated with higher non-completion rates, which explains why equity groups tend to have higher drop-out and lower completion rates than students from non-equity groups.

Moreover, students from equity groups whose participation can be ascribed to the demand driven system have fared more poorly in terms of drop-out rates and completions than students from equity groups who would have gone to university in the absence of the demand driven system. For example, in 2017, drop-out rates for an additional student who was a member of at least one equity group were around 21 per cent compared with around 15 per cent for their equity group peers who would have gone to university in the absence of the demand driven system. Relative completion rates were even more starkly different — at 42 and 60 per cent respectively — reflecting that additional students from equity groups had entered university when older and had not yet completed their studies by age 23 years. Accordingly while the demand driven system increased access to students from some equity groups, it has so far led to relatively modest increases in the number of completions by such students.

There is insufficient information to gauge the labour market outcomes of additional students from equity groups, but the evidence for *all* students from equity groups is that those that graduate tend to have outcomes that are on par with graduates from non-equity groups. For example, nearly 60 per cent of low SES students who complete university are employed in managerial and professional occupations.

FINDING 4

While university access for people from low SES backgrounds improved during the demand driven system, some of the gains were given up due to higher drop-out rates and lower completion rates.

Implications for policy

Governments have many policy levers that affect higher education access and outcomes. They can:

- use their substantial control over the school sector to attempt to improve school achievement, particularly literacy and numeracy, noting this has proved difficult to achieve in the past
- try to address the range of environmental and cultural factors that cultivate a learning environment at school and affect aspiration to attend university
- expand (or reduce) access by relaxing (or tightening) caps on government-supported places
- require, or provide incentives for universities to provide greater support to students while at university.

The move to a demand driven system focussed on the third of these. This was supplemented by additional funding through the Higher Education Participation and Partnerships Program (HEPPP) for universities to raise the aspiration of disadvantaged children and to provide additional support services.

The demand driven system had several advantages over previous policies that severely rationed access. A series of reviews prior to its introduction indicated that pre-determining the number of university places allowed insufficient flexibility to meet the changing needs of the economy.

Overall, this study shows the demand driven system delivered substantial benefits in improving equity of access to some groups. It made higher education accessible to some students from disadvantaged backgrounds and it allowed the number of places to flex in response to changes in demand. More than 40 per cent of additional students attracted through the demand driven system had graduated by age 23 years, and these graduates eventually transitioned into managerial and professional careers at rates similar to other students.

This assessment of the success of the system needs to be tempered, though, by noting that many of the additional students did not succeed academically. And despite growth in the system, equity groups remain substantially under-represented.

Designing tertiary entrance arrangements is a vexed policy problem given the difficulties in identifying those most likely to benefit from a university education. Government can open the net wide for entry by allowing demand to lead the system. This approach maximises access, but increases fiscal costs and, for students ill-suited to higher education, can waste their time, build up debt and cause them to forgo alternative job or education options. Alternatively, government can make the net narrow by constraining the supply of places. However, the most readily available filtering techniques for universities to use are imprecise (school achievement measured by ATAR) and this study shows that in the past that approach has denied a higher education to people who would have benefited greatly from it

(particularly disadvantaged groups, who may have fewer university-educated role models in their family or neighbourhood).

The current freeze on university funding may provide the Australian Government some fiscal breathing room. However, the long-run pressure will be to continue to increase the size of the sector given that the historical shift towards jobs requiring complex cognitive skills is unlikely to abate. Australian Government policy foreshadows, from 2020, a return to growth in the number of university students, with funding levels subject to universities meeting performance targets. In a system that continues to expand, some of the lessons from eight years under the demand driven system may be of value to future policy design. This study points to a range of areas in which policy settings should be considered.

Improving foundational skills of students

Many of the additional students at university are arriving academically ill-prepared. This suggests that the Australian school system has insufficiently adapted to the role needed of it to prepare larger numbers of young people to succeed at university. While the entire distribution of achievement on literacy and numeracy at school is declining,[4] an overall trend that should be of concern, this study suggests that the university prospects of children from equity groups may be particularly affected.

Improving the preparation of university students requires raising the skills of school students. While governments have some capacity to influence the factors outside the school environment that affect literacy and numeracy, they have multiple levers affecting the functioning of schools. For example, teacher quality is a key driver of student outcomes and is influenced by policy decisions about accreditation of university teaching courses, recruitment practices for teachers, professional standards, teacher support, performance assessment, requirements to teach in field and for professional development, and teacher salary structures among other factors. The evidence base for policy decisions to improve schools is still piecemeal, as is its use for making such decisions (PC 2016), and experts often have divergent views about the best approaches. Nevertheless, some answers to the problems look promising (PC 2017).

Along with the benefits that would arise from having better prepared university students, improved schooling outcomes would have wider benefits. There is widespread acknowledgement that acquiring sound foundational skills in literacy and numeracy is essential to developing the skilled workforce the Australian economy will need.

4 OECD PISA scores show that, in comparison to OECD averages, the portion of students who are high performers has fallen, while at the other end of the spectrum the share who perform poorly has risen. The results show declines in the public system, in the Catholic system and in the independent system. They show that numeracy is falling faster than literacy. Though there are many other surveys and measures, previous studies suggest that over long periods of time the school achievement of Australian students has not improved and has probably deteriorated (Leigh and Ryan 2011).

The continuing access issues for regional or remote students

Children growing up in regional or remote areas with the same academic ability as their metropolitan peers continue to be much less likely to attend university. While the current study has not investigated the reasons in detail, it seems likely the high cost (both monetary and non-monetary) of moving to the cities where major university campuses are located is a significant, and perhaps increasing, barrier. The Commission (PC 2017) has previously noted that cost-effective and flexible ways of delivering education may bring benefits, such as massive open online courses (MOOCs) if accompanied with appropriate accreditation.

Retention rates for additional students

Declining retention rates require attention. There are two elements of this: admissions processes and remedial support. Admitting a larger group of students inevitably makes it more difficult to assess ahead of time which students will flourish academically. During the demand-led period, this challenge became more acute for some universities than for others. For example, the Group of Eight universities expanded domestic enrolments less than other universities and, to the extent they did, were able to do so in part by enrolling students that otherwise would have attended and succeeded at other universities. Higher drop-out rates outside the Group of Eight, and some variation across the sector, should have been expected. Nevertheless, the Higher Education Standards Panel (2016b) noted that particularly severe problems emerged for three universities (Swinburne, Federation and Tasmania), while conversely the University of Notre Dame used effective admissions processes that led to low subsequent drop-out rates.

The other challenge is remedial support for students that enter with weak or incomplete foundational skills. The current structure of the HEPPP provides additional funding to universities in proportion to the number of students they enrol from equity groups, in part to meet the cost of additional support needed to allow some students to succeed. The policy most likely further encourages enrolments, though whether it delivers higher quality and more appropriate support services for these students is difficult to know with the limited evidence base available on the scheme.

The incentives for universities to manage drop-out risks are weak. By and large, universities' incentives are to enrol more students. In many courses (particularly those without a laboratory component), the incremental costs of enrolling an additional student are low compared with the per-student revenue. The surplus is typically used to cross-subsidise research, which is often seen within universities as their preeminent and high-status purpose. This imperative for growth has not necessarily aligned with the needs of the student, nor the needs of Australian society and the economy.

There are many ways in which universities could be required to have more 'skin in the game' (PC 2017). The Australian Government (2018) is currently consulting on performance metrics to be tied to university funding, which may include measures of student outcomes (such as student satisfaction, full-time employment four months after graduation, and

employer satisfaction), course completion, equity, and student repayment of higher education loans. Any performance metrics tied to funding would need to be designed carefully to reward universities for 'adding value' to their students. They would need to avoid unintended incentives in favour of passing students regardless of their performance or against accepting students from disadvantaged backgrounds (who this study shows may be less likely to complete despite having similar capability).

Another way to improve university incentives would be to help students make well-informed choices and 'vote with their feet'. The Commission (PC 2017) previously recommended establishing a single portal for students to access comprehensive and up-to-date information about the areas of skills needed, educational requirements of careers, the range of education institutions providing relevant qualifications, and measures of their performance including student experiences and outcomes. Well-informed consumers who can vote with their feet would contribute to aligning better university incentives with the needs of the Australian economy.

Consideration should also be given to strengthening course counselling for students that encourages them to 'fail fast, fail cheap'. While a benefit of the demand driven system was that more students could try university and see whether they were well suited for it, early exit of those that prove ill-suited, despite remedial support, will mitigate the 'debt and regret' problem (Norton and Cherastidtham 2018).

Providing young people a range of options

Finally, university education is never going to be the best option for everyone. An economy that presents young people with a range of viable alternative options is likely to produce more consistently good outcomes. The other major alternatives to university — a job or vocational training — have been undermined by relative weakness in the youth labour market and deep-seated challenges in the vocational education and training sector (VET). In a different environment, more of those for whom university may not have been the best option may have pursued these alternatives. The policy imperative is to ensure a well-functioning youth labour market and VET sector.

The above remarks do not only apply to the additional students attracted by the demand driven system. Foundational skills have been falling across the board. Even prior to the demand driven system, full-time employment rates were falling for graduates and unemployment rates were rising. Policy initiatives to remedy the deficiencies in the education system — school, VET and university — have benefits that flow well beyond those that were the target of the demand driven system. This study points to a range of areas in which, regardless of the university funding model, policy settings may be able to improve the effectiveness of the system.

POLICY CHALLENGES

There are many policy challenges that emerge from the experiences during the demand driven system.

- Governments need to address the generally declining levels of proficiency of students, and particularly the growing share of school students who perform poorly. However, beyond some obvious initiatives, the question is what detailed package of policy measures would be most likely to be effective in reversing the decline.
- University enrolment practices and student support can help student retention without relinquishing standards, but universities have relatively weak incentives to change their practices. Prescriptive government requirements for entry and student support would discourage innovation and ignore the variations in the groups going to different universities. On the other hand, while rewards for universities to increase their retention rates overcome the problems of prescription, they may inadvertently lower standards or discriminate against groups with higher average likelihoods of dropping out. Devising a workable incentive regime entails difficult design issues, and better measures of outcomes for students beyond retention alone.
- Improving access to university by remote or regional students has proved resistant to policy, and may require more innovative models for their involvement.
- The university system is not a desirable destination for all people, but weaknesses in the youth labour market and the vocational education and training system have made the alternatives less attractive.

1 Introduction

1.1 Why this study?

Higher education is a pathway for many to rewarding careers and delivers broader benefits to the community. Graduates have higher labour force participation, employment rates and earnings — which for government also means that they pay more taxes and receive fewer social welfare payments on average. They are more adaptable as an economy changes and increase the productivity of those they work with (Becker 1962; Glaeser and Saiz 2003; OECD 2008). The broad benefits of tertiary study and the difficulties students (particularly from less well-off families) face in funding their education have long been recognised as justifying a government role in funding and provision.

Young people also have limited information about study opportunities and the careers they may lead to. Some grow up with fewer university-educated role models, which may discourage aspiration for higher education. Though not all people benefit from going to university, there is a role for government to help them make well-informed study decisions (PC 2017).

The introduction of the demand driven system was the most fundamental change in the Australian higher education system in two decades. Beginning with a step up in government-funded places in 2010 and 2011, from 2012 the demand driven system saw the government extend financial support — in the form of partial payment of course costs and income contingent loans to meet the remainder — to every domestic undergraduate student that universities chose to enrol.

The demand driven system ceased at the end of 2017. The Australian Government has limited funding for 2018 and 2019 to the 2017 level. From 2020, the Australian Government intends to link future growth in nominal funding to performance targets for individual universities, with a maximum rate in line with growth in the 15-64 year old population (Australian Government 2017b, 2017a).

This study documents what happened during the demand driven system. It is largely a descriptive analysis, drawing on administrative and population data. The study also explores the extent to which the previous system gave access to various student groups, and considers some of the costs and benefits of moving to a demand driven system.

The study seeks to address two research questions:

1. Who are the additional students who enrolled in university under the demand driven system who would not have had the opportunity in earlier periods, and what are the academic and labour market outcomes they achieved?

2. To what extent was the demand driven system more accessible to people from under-represented groups? And what factors explain why people from these 'equity groups' — Indigenous people, those from low socioeconomic backgrounds or whose parents did not attend university, and those from regional or remote areas — remain under-represented?

1.2 Setting the scene — the evolution of Australian higher education policy

The Australian higher education system has expanded in phases, with each phase marked by different rules or rationing mechanisms — some highly restrictive, some permissive — that determined who can participate (figure 1.1). Each change in rules has shifted the balance between capability (as measured by relative performance at school, currently through the Australian Tertiary Admission Rank or ATAR) and funding as the basis for rationing places. In the 1950s and 1960s, the ability to pay tuition fees up front (often by students' parents) was a large part of the rationing mechanism. Tuition fees were abolished in 1974 and by the mid-1980s student demand far outpaced the supply of places. Rising school completion rates and an increase in the number of 17-19 year olds intensified pressure on the system.

These pressures led to sweeping reforms, guided by the Dawkins white paper (Dawkins 1987). The aim of the white paper was to enhance the 'quality, diversity and equity of access' to education while improving the 'international competitiveness' of Australian universities. To balance the fiscal burden of growing student numbers while maintaining access, Dawkins recommended introducing the Higher Education Contribution Scheme (HECS), an income-contingent government loan at a concessional interest rate.

Dawkins also identified six under-represented populations, termed 'equity' groups (Dawkins 1990) — whose participation the Australian Government still tracks as partial metrics of the success of the university system. These were people:

(a) who identify as Indigenous

(b) from low SES (socioeconomic status) backgrounds

(c) from regional or remote areas

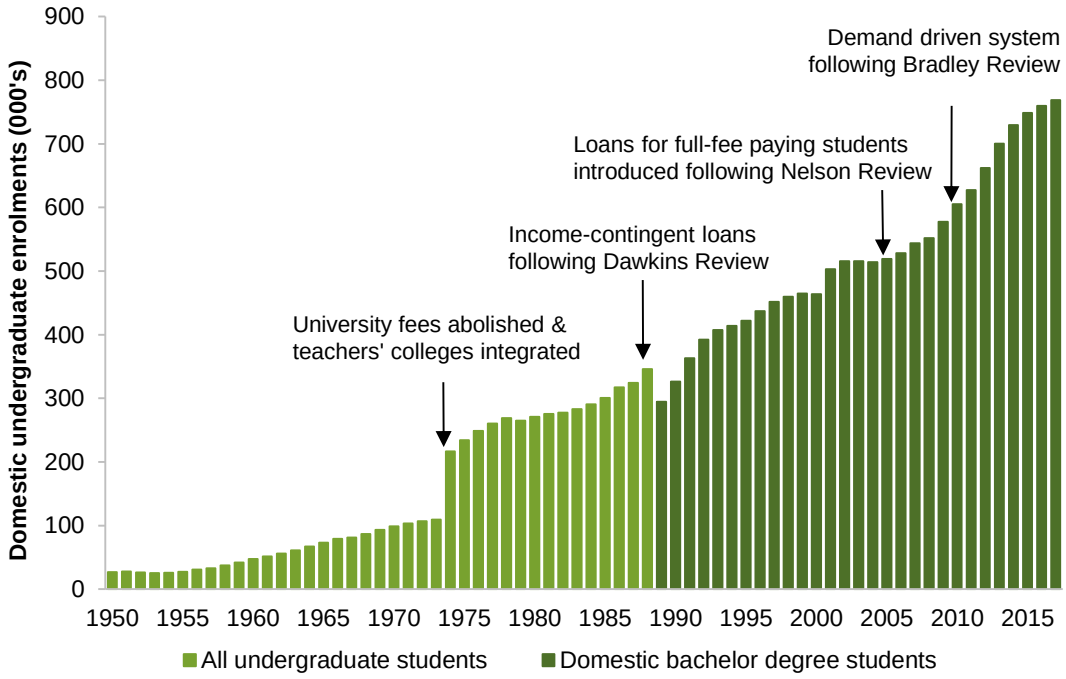
(d) from non-English speaking backgrounds (NESB)

(e) with a disability

(f) who are women in non-traditional areas of study.[5]

[5] Women in non-traditional areas of study are those enrolled in the Natural and Physical Sciences; Information Technology; Engineering and Related Technologies; Architecture and Building; Agriculture, Environmental and Related Studies; Management and Commerce; and Education (Economics and Econometrics).

Figure 1.1 **The demand driven system saw student numbers rise …**
Domestic undergraduate enrolments[a]



[a] Data from 1950 to 1988 include students enrolled in sub-bachelor degrees and international students; data from 1989 are for domestic bachelor degree students. The increase in 1974 reflects the integration of teachers' colleges into the higher education system and the elimination of university fees.

Sources: DET (2008, 2018b).

The reforms placed the onus of improving equity of access largely on the universities themselves (Dawkins 1990). This study considers the first three of these groups, as well as 'first in family' students whose parents did not attend university.[6]

Following the Dawkins reforms, the total number of government-supported places grew at a rate determined by the Australian Government, with quotas allocated to each university. Universities received capped funding amounts according to the quotas, which specified the distribution of government-supported places between field of study 'funding clusters', which the government defines.

While participation by most equity groups rose, the gap with non-equity groups did not close meaningfully. This was observed in both the 'West Review' (West 1998) and the 'Nelson Review' (Nelson 2002), and motivated their recommendations. Further, it became clear that the system did not align well the supply of places with the demand for skilled workers in the

6 The choice of groups reflects the study design and data availability: the design of the Longitudinal Survey of Australian Youth (LSAY) excludes many people with a disability at age 15 years; preliminary analysis of the LSAY showed people from non-English speaking backgrounds are not under-represented at university; analysis of fields of study is outside the scope of the research design.

economy. Instead of flexing with the demand of capable potential students, supply tended to respond with a lag, evident in a volatile offer rate from year to year (figure 1.2).

The Nelson Review also gave prominence to greater access to university, including an emphasis on an expansion of full-fee-paying places (Nelson 2002). Following the review, the Australian Government made loans available to full-fee-paying students and allowed universities to enrol larger numbers of them, while also raising the contributions paid by government-supported students. The changes did not appreciably raise equity of access and played only a limited role in meeting demand, with full-fee-paying places never accounting for more than 3 per cent of domestic undergraduate enrolments in public universities.

Figure 1.2 **… and saw supply adjust in step with demand**

Applications and offers, 2001-2018[a]

[a] Offer rate is the proportion of applications to bachelor degrees that resulted in an offer.

Sources: DET (2013c, 2014a, 2018d).

Higher education since the Bradley Review

It was against this history of substantial, but patchy, policy success that the Australian Government commissioned the 2008 *Review of Australian Higher Education* (the 'Bradley Review'), with a terms of reference that allowed it to consider nearly all aspects of the system.

The Bradley Review contended that non-government funding sources (including full-fee-paying students) were inadequate to maintain a quality system and meet projected shortages of university-educated people (Access Economics 2008).

The Review's most important recommendation was to uncap the number of government-supported places to increase total student numbers and support greater equity

of access. It recommended long-term targets on overall participation and equity. The goals were that:

- 40 per cent of 25 to 34 year old Australians should hold a bachelor's degree by 2025, from a base of about 30 per cent in 2008
- 20 per cent of higher education places should be held by people in the lowest SES quartile by 2020, compared to participation shares that have long hovered around 15 per cent.

The Australian Government largely implemented these recommendations. Following a phase-in period in 2010 and 2011, government-supported undergraduate student places in most courses were uncapped.[7] The demand driven system saw university access expand substantially. The number of domestic bachelor degree students rose from 577 000 in 2009 to 769 000 in 2017. To put this in context, this increase of 191 000 students during this period compares with an increase of only 74 000 during the preceding 8 year period.

Improved equity of access was an important goal of the demand driven system. Uncapping of undergraduate places was supported by other policies specifically targeting equity of access. Such measures included financial incentives for universities to enrol and retain disadvantaged groups, funding for support or equipment (for example, for disability), information to university staff on inclusive practices, scholarships targeted at disadvantaged groups, 'regional study hubs' to facilitate distance education, and annual mission-based compacts between each university and the Australian Government. The largest additional program was the Higher Education Participation and Partnerships Program (HEPPP) (box 1.1).

There have been few comprehensive reviews of higher education policy following the introduction of the demand driven system. The most wide-ranging review, undertaken in 2014 by David Kemp and Andrew Norton (2014), found that the system had allowed a substantial increase in the number of students, including those from equity groups. On the other hand, they found that more students were entering poorly prepared and at considerable risk of not completing their courses, and that attrition rates were high for students entering with low ATARs.

7 Government-supported places in medicine, postgraduate programs and sub-bachelor courses (diploma, advanced diploma, associate degree) were still allocated centrally. For places that were part of the demand driven system, the phase in period involved a 5 per cent increase above the baseline number of places funded in 2010 and a 10 per cent increase in 2011.

Box 1.1 Higher Education Participation and Partnerships Program

The Higher Education Participation and Partnerships Program (HEPPP), established in 2010, aims to ensure that Australians from low SES backgrounds who have the ability to study at university have the opportunity to do so (Acil Allen Consulting 2017). The HEPPP consists of three components, each with differing objectives and funding arrangements.

1. The *Participation component* aims to increase the participation of current and prospective domestic students from low SES backgrounds in accredited undergraduate qualifications, and support the retention and success of those students.
2. The *Partnerships component* aims to increase the aspirations and capacity of people from low SES backgrounds to participate in higher education through effective outreach and partnerships with primary and secondary schools, vocational education and training providers, other universities, state and territory governments and other external stakeholder groups.
3. The *National Priorities Pool* aims to increase the effectiveness of the implementation of the HEPPP nationally and at an institutional level.

Between 2010 and 2015, there were 2679 projects undertaken across 37 universities. Most of the HEPPP funding pool (about $800 million) was allocated to the participation and partnership components. More than 40 per cent of funds were targeted at assisting low SES students transition into, engage with and progress at university. About 40 per cent of projects involved outreach and work with external partners, usually schools, focused on raising students' aspirations and academic preparation (Acil Allen Consulting 2017). Since 2013, funding allocations per university have been allotted based on the share of low SES students enrolled at each university. Prior to 2013, about a quarter of total HEPPP funding was allocated through grants processes.

While there has been some improvement in equity of access over this period, there has been little evaluation of the HEPPP projects, so it is difficult to untangle the effect of the program from that of the demand driven system and other policy changes. Inadequate data is the obstacle:

> The data that would allow the separation of the impact of the HEPPP on these trends from the impact due to the co-introduction of the demand driven system, or from the impact due to other government programs and societal changes, are not available. As such, while it is likely that the HEPPP is contributing to the increase in applications and enrolments, the extent of this impact is not able to be quantified. (Acil Allen Consulting 2017, p. xvi)

It is also hard from the available evidence to know whether aspiration to attend university should be a target of policy. It is clear that school students that aspire to university at age 15 years are more likely to attend at later ages (Homel and Ryan 2014; Johnston et al. 2014). Whether aspiration is the main barrier to equity group participation is less clear. Large scale surveys (prior to the introduction of the HEPPP) show that aspirations to attend university among students from low socioeconomic and regional areas substantially exceeded participation rates (Bowden and Doughney 2012; Gale and Parker 2013). And, again, there is not yet good evidence whether HEPPP activities raise aspiration of school students that are well-suited to university study and who go on to succeed academically.

The untied nature of funding to universities that enrol more students from low SES backgrounds is also an unusual feature of the HEPPP. While it provides universities an incentive to enrol more of these students, again there has been no high quality evaluation of whether and how this funding is being spent to support these students and the effect on their academic success. Indeed, the current study illustrates high drop-out rates for these additional students (chapter 2).

Other assessments have focused on specific groups. One such review emphasised early intervention in order to, over time, eliminate the under-representation of Indigenous students at university (Behrendt 2012). It recommended that HEPPP projects aimed at Indigenous people should strengthen academic skills in mathematics and science in primary and early secondary school — a policy approach that is in line with the findings of this study. It also recommended a funding model that would support students undertaking enabling courses prior to university study, and once at university, an onus on faculties to provide tutoring, mentoring and connections with the professional world.

For many students in regional, rural and remote areas, 'university in place' is widely seen as an unattainable option and, accordingly, policy has tried to make moving to universities easier. A recent review (Halsey 2018) argued that existing government policies were not sufficient to meet the additional costs of relocation for students in these areas and that it will also be necessary to raise school achievement. More subtly, the review concluded that advice and information available about professional careers was 'thin' in regional and remote areas, which may hamper the development of an aspiration to attend university.

1.3 What this study does

This study describes the available data on higher education access and outcomes during the demand driven system and compares it with the previous period to shed some light on the impacts of the system. It draws on aggregate data from the ABS Census of Population and Housing and Department of Education and Training administrative data collections. However, the centrepiece of the analysis is based on the Longitudinal Surveys of Australian Youth (LSAY). Analytically, the paper makes two main contributions.

First, the study identifies the characteristics of people at age 15 years that explain whether, or not, they attend university. The focus is on four 'equity groups': Indigenous students, those from low socioeconomic backgrounds, those from regional and remote areas, and those that are 'first in family' students (those whose parents did not complete university). These results improve on administrative estimates of participation because they trace an individual back to the age of 15 years and assess the socioeconomic and geographic position they grew up in. The analysis then disaggregates differences between equity group and non-equity group participation rates into average contributions of a range of factors including an individual's literacy and numeracy at age 15 years, and characteristics of their family, school and local region, as described in table 1.1.

Second, the study uses this analysis to identify the types of students who were most responsive to the demand driven system — those who went to university after the system changed who would not have gone otherwise. We call these the 'additional' students. This was achieved by identifying those for whom the probability of attending university *increased* the most after 2010 (chapter 2).

There was no presumption that they were the lowest qualified university students in the group. Nevertheless, we find that most of the additional students either finished school with an ATAR less than 70 or did not receive an ATAR. We then track their outcomes including degree completion, progression to post-graduate study, full-time employment after graduation, employment in managerial or professional occupations (which are typically considered to be those for which a university education is necessary), and unemployment. The study also considers whether graduates say they are satisfied with their careers and whether their jobs use their skills.

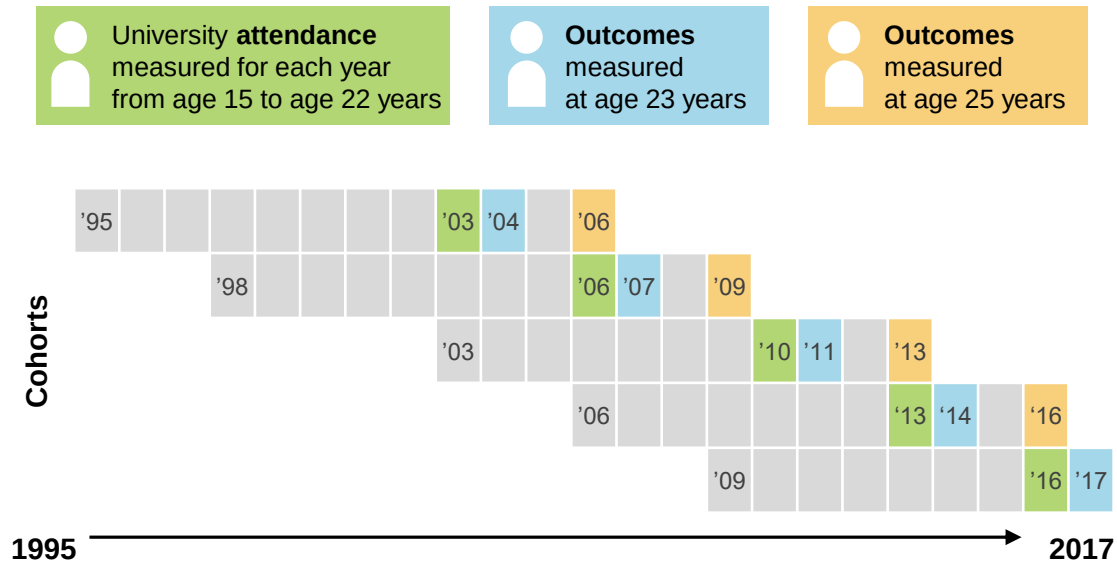
Table 1.1 **Explanators of university attendance used in this study**

Grouping	*Variables*
School achievement	Reading and numeracy tests (at age 15 years in 1995 and 1998) OECD Program for International Student Assessment (PISA) score on literacy and numeracy (at age 15 years in 2003, 2006, 2009)
Family characteristics	Parental occupation Parental education Non-English speaking background
School characteristics	School sector Parental occupation of classmates
Neighbourhood characteristics	Socio-Economic Indexes for Areas (SEIFA) index of Education and Occupation (at the postcode level)
Geographic characteristics	Regional and remote status
Other	Indigenous status State or Territory School attendance in year 12 Hours worked in year 12 Number of books in the home Gender

1.4 Terminology

This study presents results from analysis of five cohorts of the LSAY. Each cohort includes 10-15 000 young Australians. They commence in the survey at an age of about 15 years by sitting tests of literacy and numeracy and answering questions about their background and experiences at school. This study considers whether they attend university by age 22 years and then considers academic and labour market outcomes at the ages of 23 and 25 years. Figure 1.3 sets out each step in this timeline. Results in this paper are labelled by the year in which the data are observed, rather than by the year the cohort commenced in the survey.

Figure 1.3 **LSAY Cohorts, waves and years[a]**



[a] Each LSAY cohort consists of a sample of young Australians and follows them annually from when they are 15 years old (or in Year 9 as was the case for 1995 and 1998 cohorts) for the next 10 years.

While much of the analysis is set out in a descriptive way, presenting our best estimates of who attended university and what explains the under-representation of equity groups, the analysis of graduation rates and labour market outcomes in chapter 2 seeks to be more precise by presenting confidence intervals around key outcomes. In chapter 2, we use the term 'significant' to indicate that the differences in outcomes achieved by different groups are statistically significant, in the sense that there is less than a 5 per cent chance of obtaining similar results by chance. On the other hand, we use the term 'somewhat' in cases where the results tell a story about outcomes based on the weight of the best evidence available, but the difference may still be due to chance.

1.5 Caveats to the findings

The quality of any analysis depends upon the underlying data and the analytical techniques used (appendix B).

While the LSAY is a rich dataset for policy analysis, it also has limitations. Foremost among these is attrition from the sample: each successive year, students fail to respond to follow ups and leave the sample, such that by age 25 years about three quarters of the sample has been lost. Attrition rates are higher for some groups of interest to this study (such as Indigenous people and those from low SES backgrounds) and those remaining in the sample need to be given greater weight to produce average university participation rates and other statistics that are representative of the population as a whole.

After weighting, the university participation rates for equity groups calculated from LSAY were found to be broadly consistent with the aggregate data. Nonetheless, results for Indigenous students are less reliable than other groups because of high non-response to key questions and very high sample attrition rates.

A further concern is that attrition from the LSAY sample may be correlated with university participation and labour market outcomes in a manner unrelated to these demographic characteristics, and so may bias the results in an unknown direction. For example, the LSAY sample may reflect a higher (or indeed lower) university attendance rate for equity groups on average than what is observed in the population even after controlling for the observable characteristics.

Another limitation of this study is that, due to the design of the LSAY, it only considers young people. The students considered in this study are tracked only to age 23 years in the most recently available LSAY data (LSAY will follow them to age 25 years). At this age, most university students have only recently graduated, many are still studying and not all of the lifetime benefits and opportunity costs have materialised. As such, the analysis in this paper discusses labour market transitions only in early adulthood and makes no assertions about returns to education over the full course of a working life. Further, members of equity groups, particularly Indigenous people (box 1.2), attend university at a later age on average than the rest of the population, and this study was unable to assess changes in university participation at later ages.

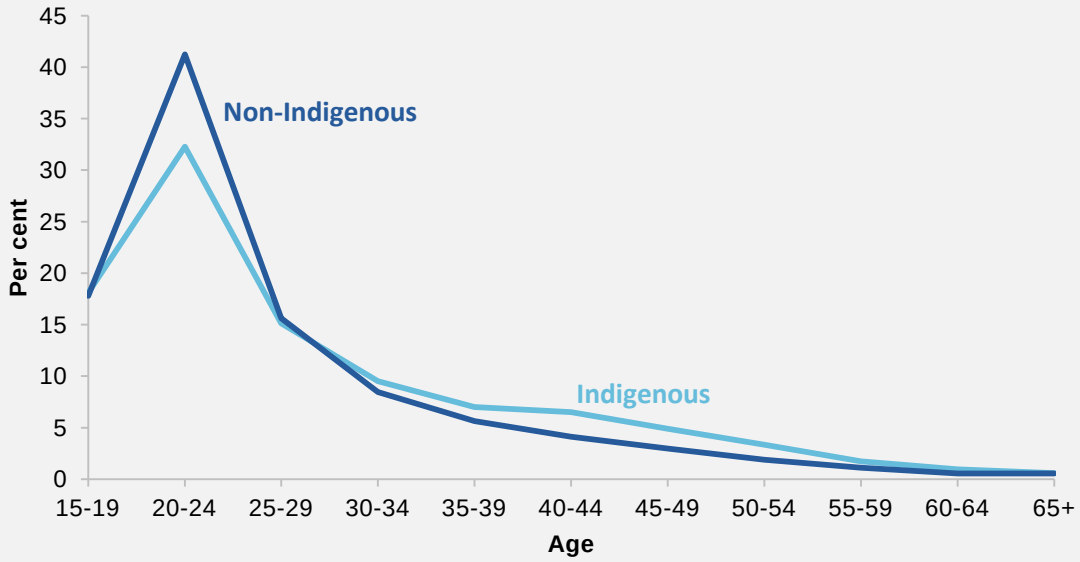
In terms of the analytical technique, much of the quantitative analysis is based on multivariate regression and associated decomposition methods. As with any statistical analysis, different models produce slightly different results. The robustness of key results to alternative model specifications is set out in appendix B.

A final, and important, caveat is that this study is not a cost-benefit analysis of the demand driven system. The study does not estimate the costs of the system, enumerate its value for additional students and society as a whole, or fully control for other factors apart from the demand driven system that affected the demand and take-up of university places. In the latter case, the demand driven system contributed to a large change in the supply of university place. But other factors such as macroeconomic conditions affecting the youth labour market, technological change and skilled migration also affected who took up these places and the outcomes they achieved.

Box 1.2 Indigenous people attain degrees at older ages

Indigenous university students are older, on average, than non-Indigenous students (figure below). More than one third of Indigenous university students are aged over 30 years, compared with one quarter of non-Indigenous students (Venn and Crawford 2016). Among other reasons, this reflects a higher proportion of students following vocational pathways to university and greater caring responsibilities at younger ages, particularly for women (Crawford and Biddle 2015; Venn and Crawford 2016). The analysis of the LSAY data in this study only considers equity group university access and participation up to age 22 years. As a result, it does not reflect the relatively higher Indigenous access and attendance rates at older ages that the age-adjusted aggregate data show (appendix A).

Figure: Age profiles of Indigenous and non-Indigenous students attending university, 2016



Source: Venn and Crawford (2016)

2 Growth in the higher education system

Key points

- Under the expanded higher education system, caps on government support for most domestic undergraduate students were removed and universities adapted their admissions processes. These changes facilitated an inflow of students who were previously restricted based on their Australian Tertiary Admission Rank (ATAR).
- To understand the effects of these changes, it is necessary to focus on those 'additional students' that would not have attended university prior to the demand driven system.
- While the additional students come from all walks of life, they typically perform more poorly in terms of literacy and numeracy (based on testing at age 15 years) and have lower ATAR scores (most less than 70) than other students.
  - They are also somewhat more likely to study management and commerce, information technology and teaching degrees than other students.
- Additional students underperform academically relative to other students. They drop out at rates 57 to 70 per cent higher than other students (drop-out rates for other students have been trending down over time).
- Those additional students that do graduate face less smooth labour market transitions. At age 23 years, they are less likely to be in full-time employment (especially in professional or managerial occupations) and have lower average weekly pay than other gradates or those that did not attend university.
  - However, these gaps in employment and earnings tend to narrow as additional students grow older and spend more time in the labour market, and largely vanish by age 25 years.
- Neither students, university administrators nor bureaucrats can be certain who will benefit from higher education. Some student attrition is unavoidable as people learn whether they are well suited to university education. Nevertheless, there is a cost to students in terms of forgone earnings, accumulated debt and out-of-pocket expenses, as well as a cost to the public due to the government subsidy. This suggests a role for greater support for students to either build the skills required to succeed or exit early.

2.1 Evolving admissions processes under the demand driven system

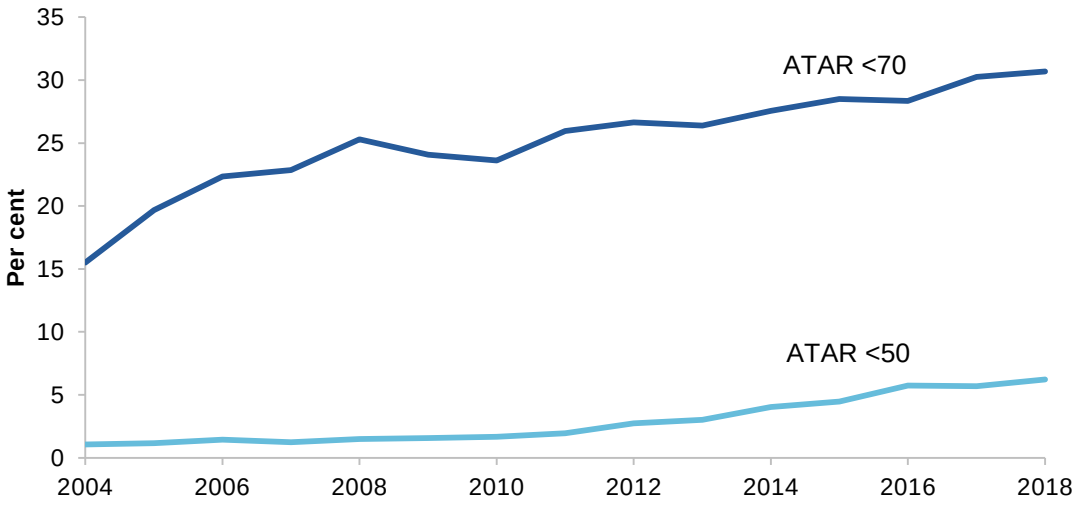
Universities have adapted their admissions practices over time to facilitate an increase in student numbers. Overall, cut-off scores for year 12 applicants have tended to decline over time and all universities have taken steps to broaden the information and experiences they consider. Direct applicants to university, the vast majority of whom are not current year 12

students, more than doubled between 2009 and 2017, while applicants via tertiary admissions centres (the traditional route of year 12 admission) grew by 17 per cent over the same period. These changes, designed to increase overall student numbers and support greater equity, are largely in step with the intent of the Australian Government at the time the demand driven system was introduced (Australian Government 2009).

ATAR remains important for year 12 applicants and for entry into the most selective courses. While applicants with low ATAR scores are more likely to be admitted than they were prior to the demand driven system, universities still make relatively few offers to students with very low ATARs. In 2017, about 30 per cent of accepted offers by school leavers were to students with an ATAR of 70 or less and only about 6 per cent of accepted offers to school leavers were to students with an ATAR of 50 or less (figure 2.1). Thus, school achievement remains an important determinant of school leavers' prospects of getting into university.

Figure 2.1 **School students with high ATARs still dominate year 12 acceptances**

Share of accepted offers by ATAR band[a]



[a] ATAR data presented here are only for students applying for undergraduate study at university directly after year 12. Other applicants may have obtained an ATAR, but the data are not published by the Department of Education and Training.

Sources: DET (2013d, 2013f, 2013h, 2013j, 2013l, 2013n, 2014b, 2015c, 2016e, 2017b, 2018f).

Admissions based on ATAR are relatively simple and transparent. On the other hand, many have criticised ATAR as a good indicator of likely university success. While high ATAR students, on average, achieve higher academic outcomes and lower drop-out rates than lower ATAR students, there is substantial variance around these average outcomes, especially so for low-ATAR students (discussed later). Low ATAR scores may particularly act as a barrier to university entry for students with academic promise who come from disadvantaged backgrounds or experienced hardship during their schooling because of circumstances beyond their control (Cardak and Ryan 2009).

While criteria used vary from university to university and course to course, all universities have broadened the basis on which they admit students to better recognise experience in addition to, or instead of, school completion (box 2.1). Applications based on vocational education qualifications or experience grew over the period from 2010 to 2014 before subsiding in line with the declining enrolments in the Vocational Education and Training (VET) sector. More students are also moving between courses and universities, with admission on the basis of previous higher education study (Pilcher and Torii 2018). There are also some indications that the rising complexity of entry pathways means that prospective students face increasing difficulties in understanding the full range of study options and opportunities available (DET 2016b).

Box 2.1 Some examples of changes in admissions processes

While every university has made changes to admissions processes, a handful of examples are:

- Curtin, Edith Cowan and Murdoch Universities and the University of Western Australia all offer short-term preparation courses for undergraduate degrees requiring ATARs of about 70
- Australian Catholic University and Notre Dame University typically recognise church and community involvement as well as academic pre-requisites
- Monash University provides entry into select courses based on completing a Diploma of Tertiary Studies and participating in access programs
- University of Technology Sydney recognises work experience for select courses and, similar to other universities, also provides preparation courses as well as ongoing academic support
- University of Wollongong provides a free, one year university preparation program to students who experienced hardship during their secondary school education and either did not receive an ATAR or did not get the ATAR score they hoped for. All students who successfully complete the program are guaranteed entry into a University of Wollongong bachelor degree.
- Melbourne University provides entry into select courses for those with no relevant school qualifications based on completing a Diploma in General Studies or Technical and Further Education (TAFE) courses along with other tertiary aptitude tests.

The University of Notre Dame's admissions processes are sometimes presented as an example of good practice (DET 2016b; PC 2017). It only accepts direct applicants and considers features of a prospective student's performance beyond their ATAR, including a student's personal statement on why they want to study at the University. Taking account of differences in the student body, the University has student attrition rates comparable to the Group of Eight (DET 2016b, p. 38) and, across all Australian universities, the second highest student assessment of the quality of the entire educational experience (Social Research Centre 2019b).

2.2 Who are the additional students?

The overall increase in domestic enrolments has meant that some young people have attended university in recent years who would not have had the opportunity during the previous decade. Identifying these 'additional students' is not straightforward. The approach in this study is to rely on the probabilities of attending university predicted based on

observable student characteristics. Those who attended university during the demand driven system are split, probabilistically, into two groups — 'additional students' and 'other students'. Those whose probabilities of attending increased the most since the demand driven system was introduced are more heavily represented in the 'additional students' group (box 2.2 provides greater detail).

Box 2.2 Estimating additional students

Additional students are identified by comparing predicted probabilities of university participation at two points in time (during the demand driven system, compared with a counterfactual at the start of the demand driven system).

Every person in the dataset has different characteristics, like school achievement and family background. The introduction of the demand driven system and other social and economic changes mean that the importance of these different characteristics for predicting university participation changed over time. For example, a high ATAR became a less important predictor of university attendance.

Multivariate regressions are used to predict each person's likelihood of university attendance based on their characteristics and LSAY cohort. Then, by applying the model coefficients from those aged 22 years in 2010, the counterfactual predicted probability is calculated for each person in the later groups aged 22 years in 2013 and 2016. These probabilities are then used to calculate the probability that a person who attended university was an 'additional student' or an 'other student'. The calculation used is shown in the table below.

To understand how the calculation works, consider someone who attended university by age 22 years in 2016 and whose estimated probability of attendance is the same or smaller using the 2016 model coefficients compared with the 2010 coefficients. This suggests that the demand driven system did not increase their probability of attendance and they are assigned a zero probability of being an additional student. In contrast, a university student in the 2016 cohort whose probability of attending university is higher than the counterfactual probability may well be an additional student. Those whose probability of attending increased the most are considered more likely to be additional students.

That is, university students in the 2013 and 2016 datasets are assigned a weight that they were additional students and a weight that they were other students. Robustness of results to alternative assumptions is presented in appendix B.

Calculation of additional students

Example: 2016 university attendance compared with a 2010 counterfactual

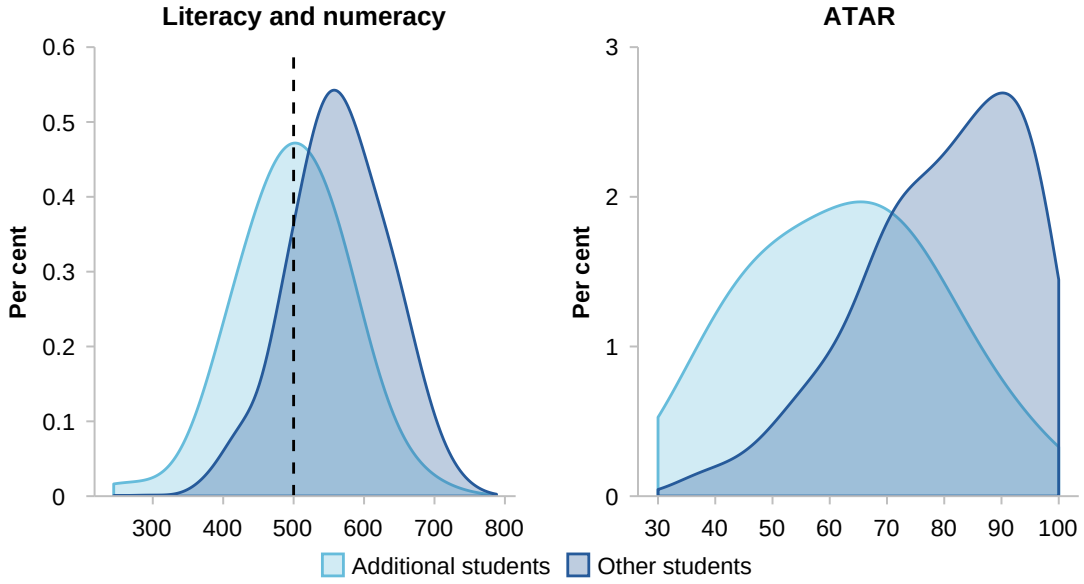
Observed status	*Propensity score*	*Additional students*	*Other students*	*Not attend*
Attended university in 2016	$P_{2016} < P_{2010}$	0	1	0
	$P_{2016} \geq P_{2010}$	$(P_{2016} - P_{2010})/P_{2016}$	P_{2010}/P_{2016}	0
Did not attend university in 2016	n.a.	0	0	1

Additional students differ from other students in a number of ways — for example they are more likely to have attended a government school — and come from a diverse set of backgrounds (discussed in more detail in chapter 3). Perhaps the clearest difference is that additional students have lower ATAR scores on average (figure 2.2). About two thirds of

additional students had an ATAR below 70 or received no ATAR at all, compared with about 30 per cent of other students (in both 2013 and 2016). Additional students commenced university at somewhat older ages on average and about 30 per cent of additional students took some vocational education and training prior to commencement (about three times the share of other students). These patterns are not surprising because admissions processes have become less focused on students' tertiary entrance rankings.

Figure 2.2 **Additional students have lower school achievement than other students, though distributions overlap considerably[a]**

Per cent of total students



a Literacy and numeracy (PISA) scores are scaled so that the OECD average is 500 and the standard deviation is 100 across all students tested in 32 countries when introduced in 2000. Students that did not receive an ATAR score are not shown in the ATAR distribution. Queensland Overall Position (OP) scores are converted to equivalent ATAR values. The average ATAR score for all year 12 students is usually about 70. If all students who enrolled in secondary education were to complete ATAR assessments, then the average ATAR would be 50 (Talent 100 2018; UAC 2019). The lowest reported ATAR is 30.

Source: Productivity Commission estimates based on LSAY.

Low ATAR scores also affect the university that additional students attend and the courses that they take. Almost all (89 per cent) additional students attended non-Group of Eight Universities (box 2.3). Additional students are also somewhat more likely to undertake education, information technology or management and commerce courses, and are less likely to undertake engineering or natural and physical sciences courses.

Another important difference between these groups is that the additional students have, on average, weaker foundational skills in literacy and numeracy. While there is substantial overlap between the distributions, about 81 per cent of additional students had literacy and numeracy below the average level of other students at age 15 years. Together with the

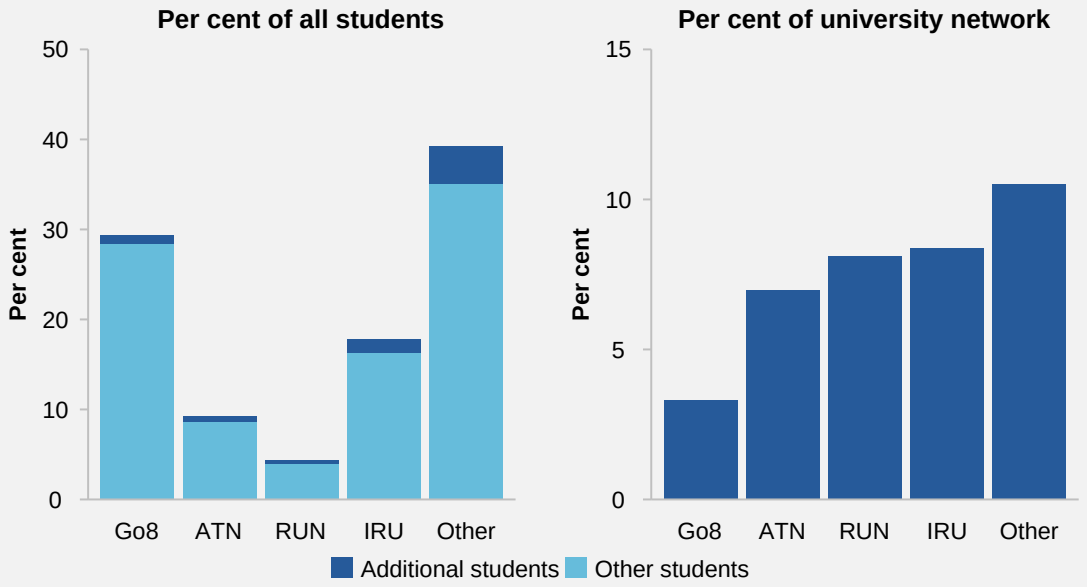
long-term decline in literacy and numeracy of Australian school students, this means that far more students are entering university ill-prepared than was the case prior to the demand driven system.

Box 2.3 Few of the additional students attended the Group of Eight

While some universities took on more additional students as a proportion of their total student numbers, only 4 per cent of the students who commenced their studies at Group of Eight (Go8) universities in 2016 were additional students. What appears to have occurred is that during the demand driven system the Go8 expanded their enrolments more slowly overall than some other universities and were able to take some of the best students that otherwise would have enrolled elsewhere in the system. As such, most of the adjustment in the system — adapting admissions processes and student support services to suit an intake from more varied backgrounds — occurred in universities outside the Go8.

Additional student commencements by university network[a]

Per cent of total student commencements by age 22 years in 2016



[a] ATN is Australian Technology Network, RUN is Regional Universities Network, IRU is Innovative Research Universities, Other is all other universities (appendix B). Growth in domestic undergraduate commencements increased by about 43 per cent and 12 percent for non-Group of Eight and Group of Eight universities respectively over the period 2009–2017.

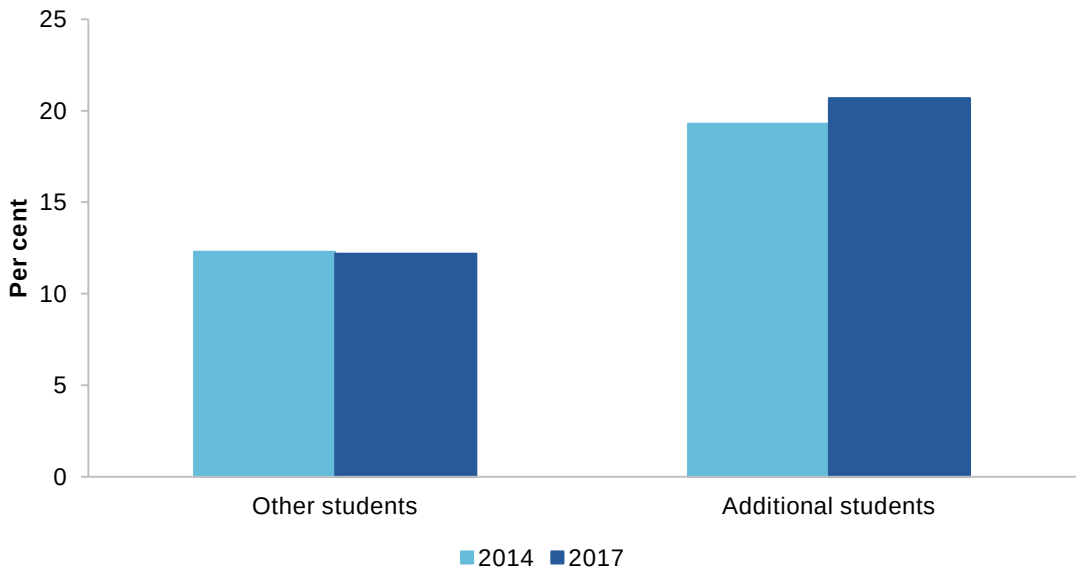
Source: Productivity Commission estimates based on LSAY.

2.3 How do the additional students perform at university and in the labour market?

Additional students are more likely to drop out

The clearest trend in the data is that additional students are dropping out of university at rates higher than other students, with this differential increasing over the course of the demand driven system (figure 2.3). By age 23 years, additional students in 2014 were 7 percentage points more likely to drop out of their degree than other students (a 57 per cent higher rate), with this gap widening to 8.5 percentage points in 2017 (a 70 per cent higher rate).

Figure 2.3 **Additional students are more likely to drop out**
Drop-out rate by age 23 years[a]



[a] Ratio of students who dropped out by age 23 years to students enrolled by age 22 years.

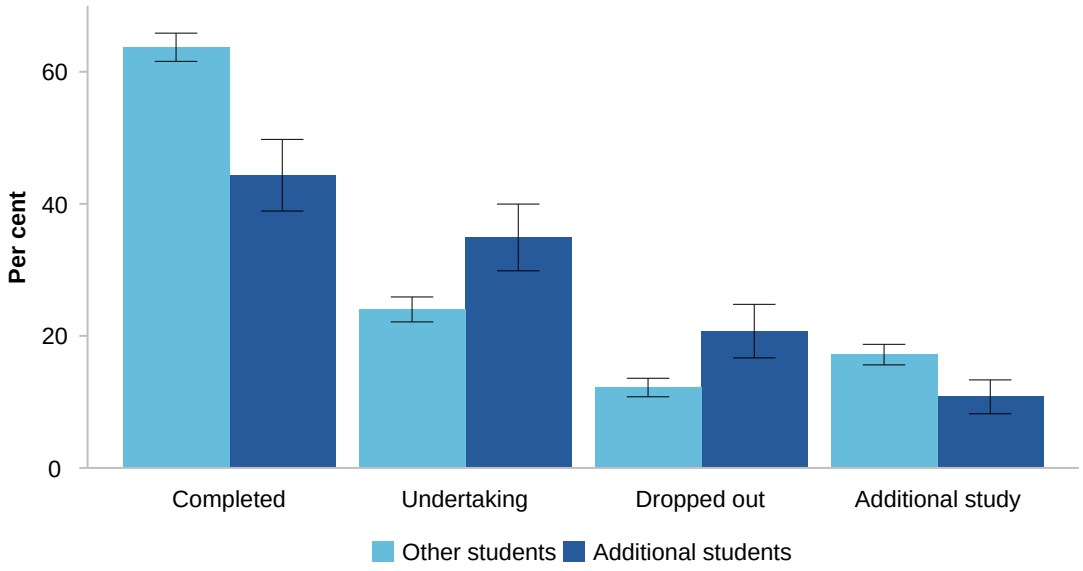
Source: Productivity Commission estimates based on LSAY.

The gap in degree completion rates by age 23 years between additional students and other students is larger still. This is because, on average, additional students commence at older ages and are more likely to study part time, which means many are still studying at age 23 years. Of those who do complete their bachelor degree, additional students are approximately 3 percentage points less likely than other students to undertake additional university study (figure 2.4).

While dropping out of university is not always a bad outcome — students who drop out often report learning useful skills and developing lasting friendships and connections (Norton and Cherastidtham 2018) — time spent at university is costly in terms of forgone wages and both private and public tuition costs (box 2.4). These costs can be minimised by dropping out quickly. The data show that most students drop out in less than 2 years, though there is a tail that spend longer enrolled before dropping out (figure 2.5).[8]

Figure 2.4 **Additional students are less likely to complete university and undertake further study[a]**

Academic outcomes at age 23 years in 2017



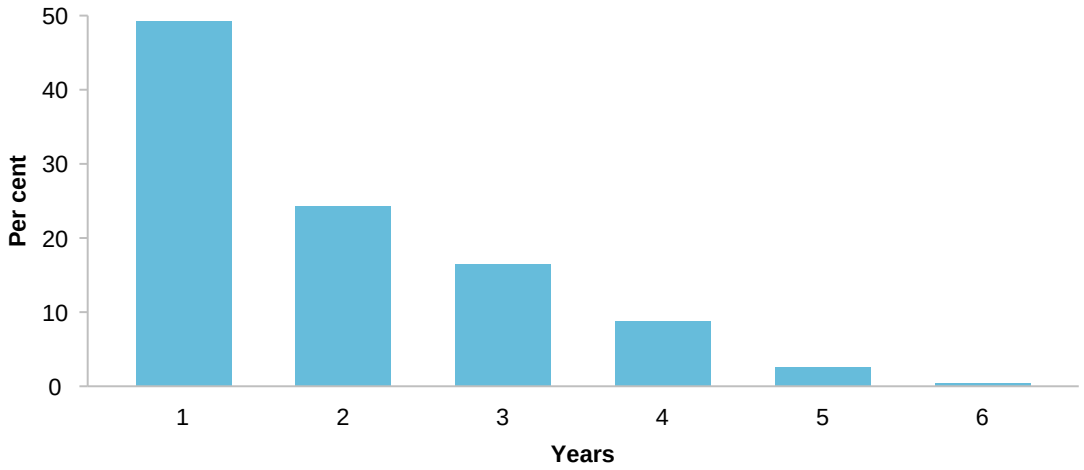
a Black bars reflect 95 per cent confidence intervals. Additional study captures people who completed a bachelor level degree, and at any point prior to 2017 commenced another degree at a bachelor level or higher.

Source: Productivity Commission estimates based on LSAY.

8 Administrative data that documents the number of units students take before dropping out are largely consistent with LSAY. Of students who commenced university before age 20 years and dropped out, about 40 per cent did so having taken up to one year of equivalent full-time study, another 25 per cent had taken between one and two years, and about 35 per cent had taken more than two years. Older students took fewer subjects before leaving. For example, almost 50 per cent of students who commenced between the ages of 31 and 40 years and dropped out did so having taken half a year of equivalent full-time study or less (Norton and Cherastidtham 2018).

Figure 2.5 **Most students who drop out do so within 2 years[a]**

Time at university for students who dropped out by age 23 years in 2017



a '1 year' refers to students that reported studying in at least one survey wave prior to dropping out. '2 years' refers to students that reported studying in two survey waves prior to dropping out etc. Time at university before dropping out is similar for additional students and other students.

Source: Productivity Commission estimates based on LSAY.

Box 2.4 Waste in the system?

Time spent at university is beneficial for some students who drop out. For example, about 45 per cent who do not complete their degree say that if they had their time over again, they would still begin their degree (Norton and Cherastidtham 2018). Nonetheless, on average, those that leave without obtaining a degree receive minimal financial benefits for the subjects they have completed. Rather, there is a 'jump' in additional lifetime earnings after the completion and accreditation of the degree — this is known as the 'sheepskin' effect (Herault and Zakirova 2013; Hungerford and Solon 1987; Jaeger and Page 1996).

Time spent at university is also costly, and many leave with 'debt and regret'. Research by the Grattan Institute (Norton and Cherastidtham 2018) shows that for students who drop out:

- almost 40 per cent would not begin their degree again knowing what they know now
- about one third believe they received no benefits from their course
- nearly two thirds believe they would have been better off if they had finished.

While most students who drop out pay or borrow less than $10 000 and exit the system swiftly, a significant minority (about 20 per cent) persist for longer durations and spend in excess of $20 000. On average, students who drop out incur costs of about $12 000. The value of their time in terms of forgone earnings is also substantial.

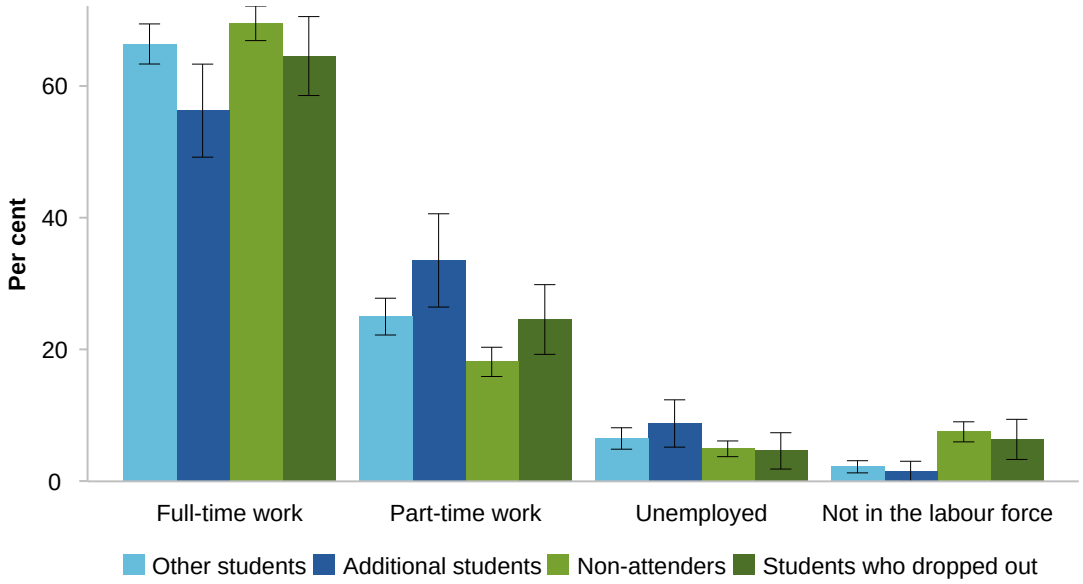
Together, these results present a mixed picture. On the one hand, some students who discover university is not for them and leave quickly can still obtain some benefits, while also reducing the costs of fees and the forgone opportunities in work or other more appropriate types of education (that is, alternatives to university). On the other hand, a large number of students say they regret their enrolment and accumulation of large debts.

Those who do graduate have less smooth initial labour market transitions …

Additional students who complete university are somewhat less likely to be employed full time at age 23 years and are more likely to be in part-time work than other graduates, people who dropped out or who did not attend university (figure 2.6). This last point appears counterintuitive because additional students generally have higher school achievement than those who did not attend, a characteristic normally correlated with success in the labour market. The likely reason — though conjectural — is that outcomes for full-time work reflect the shorter durations in the labour market of additional students compared with those who dropped out or did not attend university. More time allows people a better chance to find a full-time job that exploits their skills, a point that is consistent with the findings on outcomes at age 25 years for the various groups (see below).

Figure 2.6 **Additional students who complete university have somewhat poorer labour market transitions[a]**

Labour force status at age 23 years in 2017



[a] Labour market outcomes for other and additional students are presented only for those that graduate and are not undertaking additional study — and thus does not take into account the higher drop-out rates among additional students. The average delay between graduating and providing information about labour market outcomes was (at 1.5 years) the same for additional and other students. Students who dropped out may have been either additional or other students.

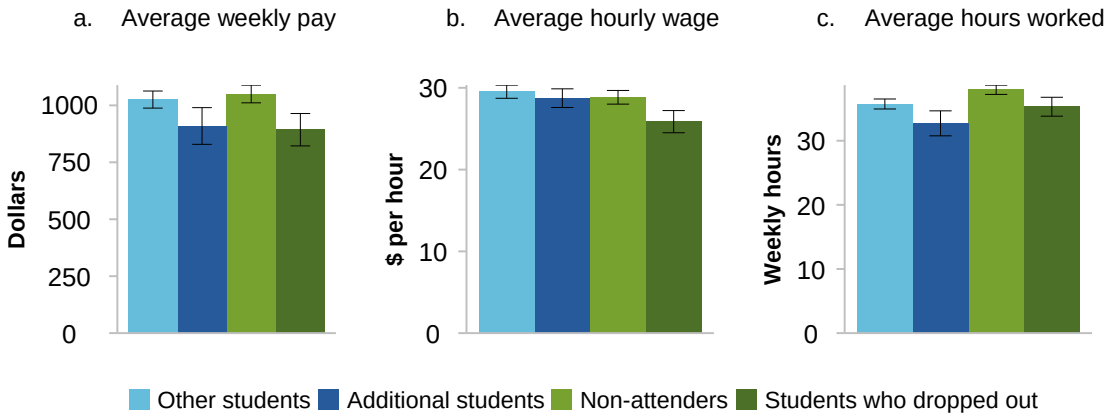
Source: Productivity Commission estimates based on LSAY.

The fact that additional students' *hourly* wage rate is equivalent to non-attenders (and higher than students who drop out), despite their shorter duration in the labour market, is also consistent with their generally greater levels of literacy and numeracy (figure 2.7). In that

case, their lower weekly wages is a symptom of temporary underemployment, rather than of failure in the higher education system.

Figure 2.7 **Additional students earn somewhat less than other graduates[a]**

Weekly pay and decomposition at age 23 years in 2017



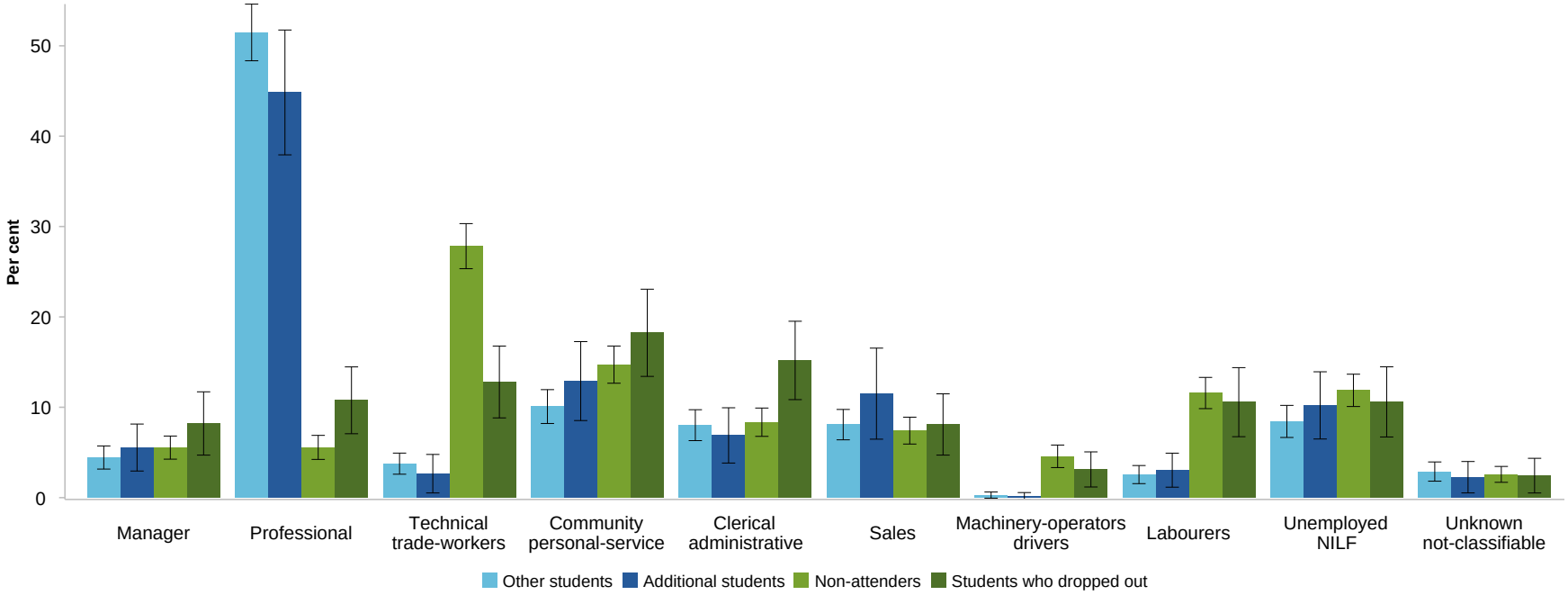
a Additional students and other students in this chart are those who completed their bachelor degree and are not undertaking additional study. Students who dropped out may have been either additional or other students. Average weekly pay and average hourly wage are often left unreported in the LSAY. In an attempt to account for non-random reporting of these variables a new set of attrition weights have been calculated and applied to our analysis (appendix B). Because of this adjustment, there are slight discrepancies between the average hourly wage derived by dividing average weekly pay by average hours worked and reported wages.

Source: Productivity Commission estimates based on LSAY.

Additional students are also somewhat less likely than other students to enter managerial or professional occupations after graduation and somewhat more likely to be dissatisfied with their employment outcomes. Overall, about 50 per cent of additional students were employed in managerial and professional occupations while about 56 per cent of other students were in these occupations (figure 2.8). In contrast, less than 20 per cent of students who drop out and 15 per cent of non-attenders are employed in these occupations — they are instead more likely to be in skilled trades or other occupations.

Figure 2.8 **Additional students are somewhat less likely to gain employment in a professional occupation than other graduates[a]**

Occupation at age 23 years in 2017



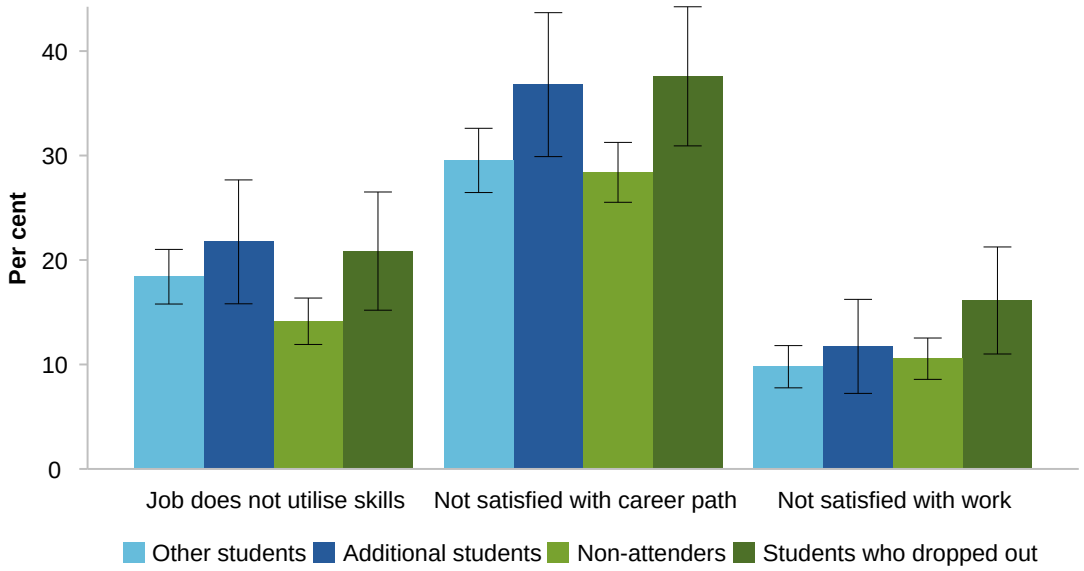
a Additional students and other students in this chart are those who completed their bachelor degree and are not undertaking additional study. Students who dropped out may have been either additional or other students. A professional or managerial occupation is described as requiring a bachelor level degree or higher (more than 5 years of relevant experience may be a substitute to the formal qualification). Of those listed as 'managers', the majority (in particular of students who dropped out) are working in managerial roles in retail and hospitality. This suggests that managerial occupations may not be the best indicator of degree utilisation for 23 year olds. A full description of occupation categories can be found on the Australian Bureau of Statistics (ABS) website under ANZSCO definitions.

Source: Productivity Commission estimates based on LSAY.

Given the degree of imprecision in the results, we cannot make robust claims about subjective aspects of post-education outcomes. However, the weight of evidence suggests that students who drop out fare worse because they have poorer outcomes across all three dimensions of subjective job quality (satisfaction, career prospects and utilisation of skills). Additional students who complete their degrees do better than those who drop out, but not by much (figure 2.9).

Figure 2.9 **Additional students are somewhat less satisfied with their career path than other graduates[a]**

Job quality at age 23 years in 2017



a Additional students and other students in this chart are those who completed their bachelor degree and are not undertaking additional study. Students who dropped out may have been either additional or other students. LSAY participants were asked to report on subjective measures of job satisfaction on a scale from zero to ten, where zero means very dissatisfied and ten means very satisfied. Students who reported a value lower than five are recorded as being not satisfied. A similar pattern emerges when using average scores as the key metric. Career path satisfaction was established from a 'yes/no' response.

Source: Productivity Commission estimates based on LSAY.

… by age 25 years, drop-out rates diverge further but graduate outcomes become more similar

While there is a larger share of additional students still studying at age 23 years and many of these ultimately drop out of university, those who graduate achieve similar labour market outcomes to other students as they settle further into their career. By age 25 years, there is no significant difference in full-time employment rates, and the share of graduates in managerial or professional roles is similar to other students (further results are presented in appendix B).[9]

However, it is notable that VET attendees also have very good, and sometimes better, labour market outcomes than university attendees — at least by age 25 years — suggesting that VET should not be overlooked as a career pathway (box 2.5).

Some risk factors are clear, though many are not

While many of the factors predicting university and labour market outcomes are unobservable, there are some common factors underpinning such outcomes, regardless of whether a student is additional or otherwise.

Students in the bottom half of the literacy and numeracy distribution (based on PISA scores) dropped out at rates about 50 per cent higher than students who ranked in the top quartile, while low ATAR students (with scores of 0-60) dropped out at rates about three times that of high ATAR students (80-100) (figure 2.10). High drop-out rates are also observed for students who study part time. A lower proportion of graduates from these groups transition into managerial or professional roles, a gap that has widened in recent years for low ATAR and part-time students. These results do not suggest that universities should restrict or limit entry for such students. Students that study part time, for example, often choose to do so based on external commitments to family or work. The results do, however, point to the need for universities to provide additional support and monitoring for such students.

9 A caveat is that these patterns reflect analysis of the early years of the demand driven system based on the LSAY cohort attending university by age 22 years in 2013, with the more recent cohort, which is the focus of most of the analysis, yet to reach 25 years of age.

Box 2.5 Matching VET students to university students

The comparative labour market outcomes for students of the VET system versus the university sector will reflect two factors — the causal impact of each sector on outcomes, and the impacts that arise from the differences in the traits of the people who choose to go to the different sectors. Failing to control for the latter can provide misleading indications of the 'value added' of each sector.

The technical problem is to find pairs of people with the same traits, but who have gone through the two different systems, and assess the differences in their outcomes. To address this problem, the following analysis implements propensity score matching. The characteristics of VET and university students before and after matching are presented in appendix B; table 10.

There are a number of limitations of propensity score matching. Not all students are able to be matched, so our analysis is not applicable to the full spectrum of VET or university students, but only students that had a reasonable probability of transitioning from year 12 to either university or VET. Those students who can be matched will still differ from their matched counterpart in terms of unobserved characteristics — such as social supports, personal drive or many other aspects that we cannot measure — which has the potential to bias the results.

With these caveats in mind, comparisons across the matched groups shows that, at age 25 years, a higher proportion of VET students were working full time and on average they earned more than their matched counterparts that attended university, with these gaps growing between 2013 and 2016. However, a likely explanation of the higher VET wage premium at age 25 years is that, on the one hand, VET graduates are more likely to have been working longer and progressed in their career, and on the other, university graduates have not yet been able to exploit the steeper wage returns from experience (appendix A, figure A.7).

Outcomes[a]

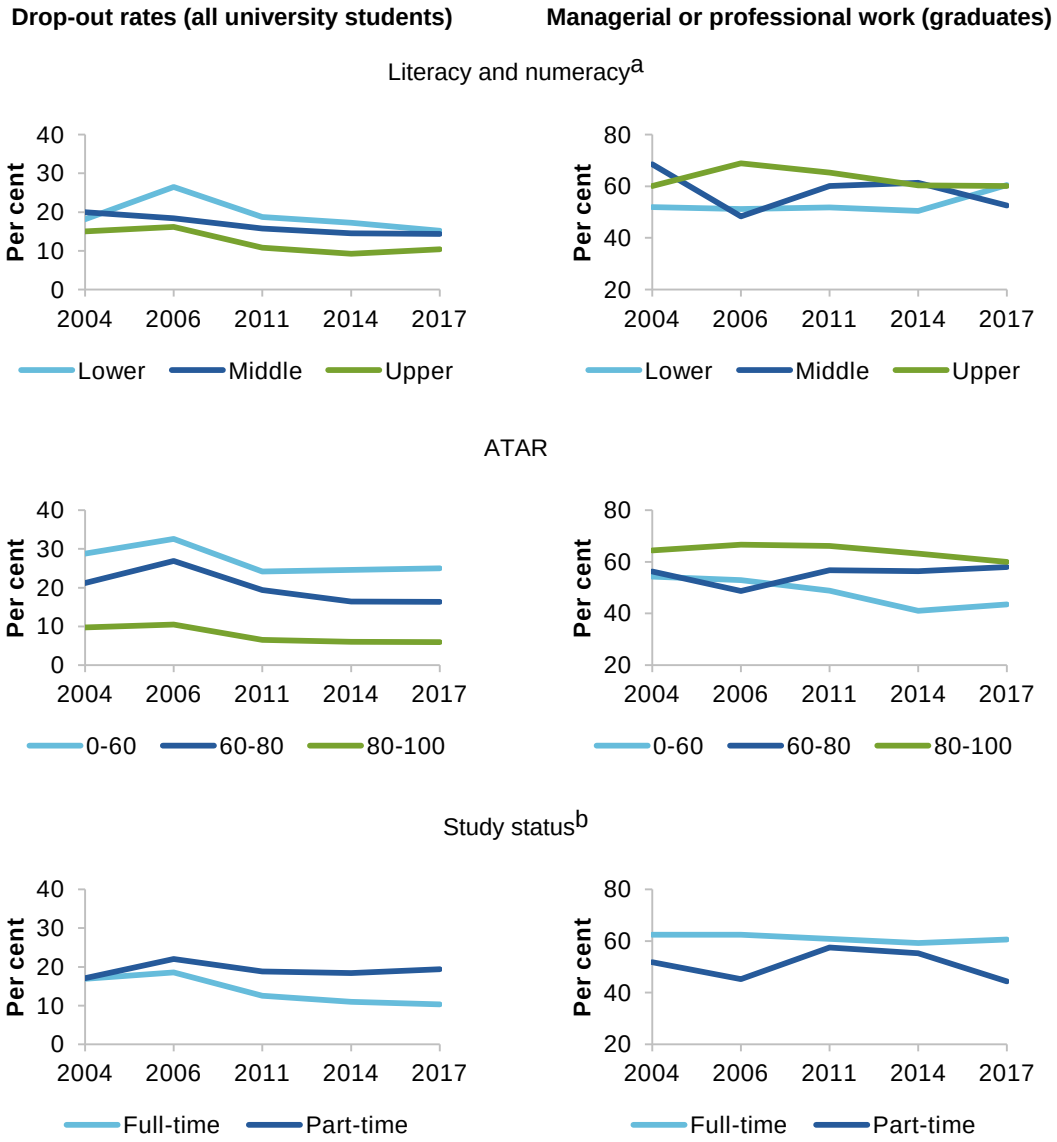
Outcomes Measure	*2013*		*2016*	
	VET	*University*	*VET*	*University*
Full-time work	81	77	82	72
Part-time work	15	19	14	25
Unemployed	3	2	2	2
Manager or professional	18	63	16	52
Technical or trade work	22	3	30	7
Average weekly earnings	$1168	$1085	$1310	$1108

a VET includes all sub bachelor level qualifications, including those provided by a university. The analysis excludes students who enrolled in both a VET course and university degree, those who are still undertaking study at age 25 years, and those who did not receive an ATAR.

Source: Productivity Commission estimates based on LSAY.

Figure 2.10 **Students with low school achievement or those who study part time have poorer outcomes**

Drop-out rates and employment in managerial or professional work at age 23 years



a Student achievement in terms of literacy and numeracy scores is based on testing in numeracy and literacy at age 15 years. 'Lower' refers to people in the bottom two quartiles, 'middle' refers to people in second top quartile, 'upper' refers to people in the top quartile. The bottom two achievement quartiles were combined due to the small number of students entering university from the bottom quartile. **b** 'Part-time' refers to students that enrol into part-time study at any point during their degree.

Source: Productivity Commission estimates based on LSAY.

2.4 Summing up

The demand driven system saw an influx of additional students who would not have had the opportunity to study in previous periods. The results show how difficult it is to design an admissions process, regardless of the university funding model. People do not have 'University is good for me' stamped on their foreheads. Neither aspiring students, university administrators, nor bureaucrats can be certain who will benefit from higher education. As such, it is not surprising that many additional students have achieved academic and labour market success. Nor is it surprising that more of the additional students have failed to graduate and fared poorly.

The expansion of the system has allowed a somewhat more diverse suite of students to aspire to attend university. In doing so, no doubt, it has made admissions processes more difficult for universities. Some universities have borne more of this challenge. Almost all of the additional students have attended universities outside of the Group of Eight. Of course, Group of Eight universities also expanded over this period, but at a slower rate and they had the advantage of enrolling students that otherwise would have attended other universities. The students whose futures were most difficult to judge in advance attended other universities, and as such it should be expected that the expansion of the system would disproportionately increase drop-out rates at these universities.

Nevertheless, a smaller proportion of additional students are completing university, and those who drop out face poorer outcomes than other students across multiple dimensions of job quality (satisfaction, career prospects and utilisation of skills). Although these outcomes could be reduced by tightening entry requirements again, other measures may be better targeted — including more guidance prior to university entry about whether the university system is a sensible destination for the person, improvement in pre-university foundational skills, and early support for students struggling with their university study. An efficient system should also assist those students who discover that university education is not useful to them to exit swiftly, mitigating the costs associated with university fees, forgone earnings in jobs not requiring a university qualification, and delayed options to acquire skills through other, more suitable forms of education and training.

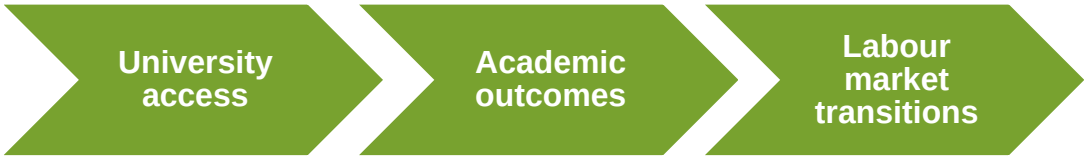
3 Equity of access and outcomes during the demand driven system

Key points

- While university attendance increased substantially under the demand driven system, growth among equity groups has been uneven.
  - Young people from a low socioeconomic status (SES) background and 'first in family' students were more likely to participate in higher education following the expansion.
  - However, there was little evidence of improved participation for young Indigenous people and people from a regional or remote location.
- These four equity groups remain heavily under-represented at university and this gap can be explained partly by low levels of foundational skills in literacy and numeracy.
  - Measured by OECD PISA scores, these are the most important predictor of the under-representation of low SES and 'first in family' students, and they play a role in the under-representation of regional or remote and Indigenous students.
  - Conversely, children who develop strong literacy and numeracy go on to attend university at high rates, regardless of whether they are part of an equity group.
- A range of other indicators of disadvantage also contribute to the gap, such as school and neighbourhood characteristics, though the effects can be difficult to identify individually.
  - Distance from a university campus remains a clear barrier for regional or remote students, who are less likely to attend than similarly capable metropolitan students.
- Improved access for low SES and first in family students would be somewhat hollow if not accompanied by academic and labour market success. Here, the results are mixed.
  - Students from equity groups are more likely to drop out of university than others, which likely reflects lower school achievement as well as part-time study.
  - Nonetheless, those who succeed at university and graduate — regardless of equity group membership — generally succeed in labour market transitions. Graduates from equity groups frequently transition into managerial and professional roles.
- These findings suggest three conclusions:
  - Development of strong literacy and numeracy not only provides economy-wide efficiency dividends, but are powerful equalisers for children growing up with disadvantage.
  - Those who grew up far away from a university campus benefited little from the expansion.
  - The high drop-out rate for young people from disadvantaged backgrounds suggests more should be done to support these students to succeed academically. There is a private and social benefit in doing so, as they will likely be set on a path to better economic prospects.

Though improving access is valuable in its own right, policy should aim to ensure access also leads to success. A useful heuristic is to consider three hurdles: gaining access; degree completion; and labour market transitions (figure 3.1).

Figure 3.1 **Equity groups face three hurdles to success**



3.1 University access

Improvements in equity group participation were uneven

More Australian school students have gone to university since the introduction of the demand driven system. Overall, the Longitudinal Surveys of Australian Youth (LSAY) data indicate that the proportion of young people attending university at some point by age 22 years increased from 53 per cent in 2010 to 60 per cent in 2016.

However, the story for the four equity groups examined in this study is nuanced (figure 3.2), and depends on the definition and age profile of equity groups examined (box 3.1).

Two of the four groups experienced an increase in university participation rates since 2010 — those from low SES backgrounds and first in family students (those whose parents do not have a degree). However, because participation rates also increased for the rest of the population, the extent of under-representation (the 'gap', in terms of percentage points) only narrowed for those from low SES backgrounds. University participation of young people from Indigenous and regional or remote backgrounds changed little over the 2010 to 2016 period. This implies greater under-representation at university for these three latter groups, given increased university participation by other young people.

Box 3.1 Equity groups and university participation in the Longitudinal Surveys of Australian Youth

While the centrepiece of this analysis is data from the LSAY, there are some important differences in definitions between it and other data sources.

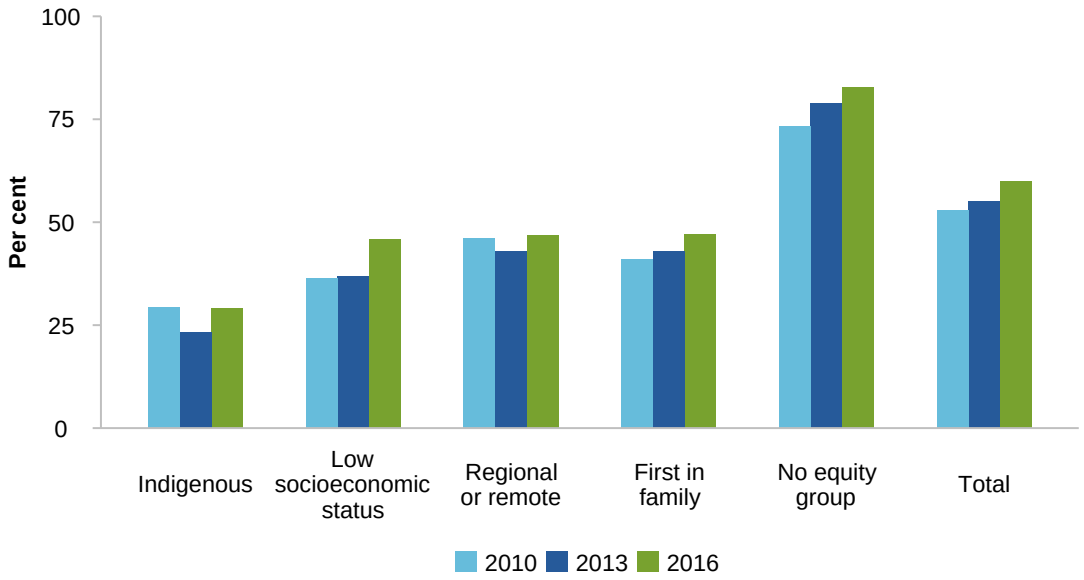
For example, the Australian Government Department of Education and Training (DET) publishes statistics on domestic student admissions and attendance. It also tracks participation by the six equity groups identified by Dawkins (1990) — students from a low socioeconomic background, regional or remote students, Indigenous students, students from a non-English speaking background, students with a disability, and women in non-traditional areas of study. Those statistics are based on administrative data reported by higher education institutions. The data available from the LSAY used in this study are generally closely aligned with the statistics reported by DET, but have the advantage that it is possible to follow each student through time (its longitudinal aspect). The two data sets are compared in the table below.

Attribute	DET statistics	This study's use of the LSAY survey
Sample size	Census of enrolments.	Survey of approximately 14 000 students each cohort.
Source	University enrolment data.	Self-completed questionnaires.
Student type scope	'Domestic' university students defined mainly by citizenship or permanent residency.	All students in Australian schools at age 15 years are assumed to be eligible to be treated as domestic university students.
Student age scope	University attendance is for a single year of age.	University attendance for cohorts of people at any point between the ages 15 and 22 years.
Location	Regional or remote status coded based on permanent (i.e. out of semester) address.	Regional or remote status coded based on place of residence at age 15 years.
Socioeconomic status	Coded based on permanent address linked to the Australian Bureau of Statistics Socio-Economic Indexes for Areas Index of Education and Occupation.	Coded based on the highest ranking parental occupation (using ANU3 score in 1995 and 1998 and International Standard Classification of Occupations score in 2003, 2006 and 2009).
First in family	First in family not included.	First in family coded based on whether or not either parent has a university degree.

Inevitably, there are some differences in university participation rates across the two data sets though these differences are quite modest. For example, the number of university students from ages 18 to 22 years in the 2009 LSAY cohort (after applying population weights) were between 3 and 14 per cent higher than the corresponding single year of age student numbers based on administrative data. These higher student numbers may reflect the LSAY sample design (for example, differences over what constitutes a domestic student) or attrition (as students with the lowest literacy and numeracy generally attrit, an effect that is not completely addressed through reweighting of the sample).

Figure 3.2 **University participation by age 22 years**

Participation rates by equity group[a]



a The 'no equity group' category consists of those individuals who are non-Indigenous, from a metropolitan location, from the top three SES quartiles and who are not first in family. **b** Participation is defined as the share of school students from that equity group who responded that they were studying a bachelor degree at any point up to the 8th wave of the cohort, which is up to approximately age 22 years.

Source: Productivity Commission estimates based on LSAY.

These trends flowed through to modest changes in the overall composition of university students as a group (table 3.1). There were increases in the share of students from some equity groups (low SES, first in family, Indigenous), but a decline in the share of students from regional or remote areas. Overall, the proportion of students from any of these four equity groups declined slightly over the period. These patterns reflect changes in both participation rates and the size of these groups in the population.[10]

10 The patterns are somewhat different in the Department of Education and Training's administrative data (discussed in more detail in Appendix A). For example, they show an increase in the share of students from low SES regions of 1.4 percentage points between 2010 and 2016, compared with 0.4 percentage points in LSAY data. Among other differences, those data are for students at all ages, whereas the current study only tracks participation to age 22 years (box 3.1).

Table 3.1 **The equity group composition of university students**
Share of those who attended university by age 22 years[a]

Equity group	*All students 2010*	*Additional students 2016*	*All students 2016*
	%	%	%
First in family	45.7	64.6	46.9
Regional or remote	27.2	17.7	24.4
Low socioeconomic status	15.6	32.3	16.0
Indigenous	1.0	1.6	1.2
No equity group	39.0	27.0	40.3

a Students may be members of more than one equity group. Data reflect both changes in shares of these groups in the population and changes in participation rates. Additional students are those students who attended as a result of the expansion in university places following the introduction of the demand driven system.

Source: Productivity Commission estimates based on LSAY.

3.2 What explains the remaining gaps in equity group access?

The decision to attend university is affected by a range of characteristics such as a student's achievement at school, the norms of the local community, family and peers, proximity to a campus, and financial considerations. In turn, differences in the typical characteristics of equity groups affect their university participation rates and may contribute to their relative under-representation.

Here, we explain the under-representation of the equity groups compared with the rest of the population by decomposing the gaps in participation into portions explained by various student characteristics.

Understanding our decompositions

To compare across the cohorts easily, decompositions are displayed as stacked bar charts (figures 3.4 and 3.8), while further detail is provided in appendix B (tables B.6 to B.9). To aid with their interpretation, consider the decomposition results for students from low SES backgrounds in 2010 (figure 3.3).

- The leftmost bar (light blue) shows the actual university participation rate (37 per cent) for people from a low SES background (referred to as the equity group participation rate in subsequent charts).
- The rightmost bar (multi-coloured) shows the participation rate (58 per cent) for people not from a low SES background.
- The other coloured bars show the contribution of a variety of factors (for example the characteristics of a student's school) that explain the under-representation of low SES

people at university. Together, the contribution of these factors sum to the 21 percentage point gap between the participation rate of people from low SES backgrounds compared with the rest of the population.

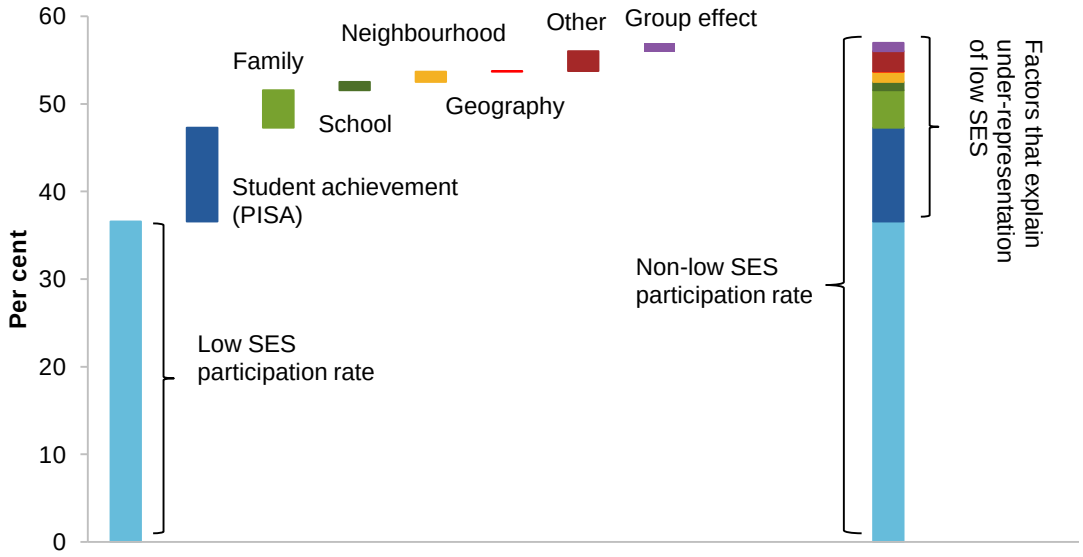
- The component labelled 'group effect' is the contribution to the gap made solely by being a member of the equity group after controlling for all of the other observable differences between groups in individual, family, school, neighbourhood and geographic characteristics. For example, the group effect for low SES includes any unobserved factors associated with being low SES, which could include discrimination, lower family pressures to go to university, or the role of income constraints on the affordability of university participation.[11]
- The component labelled 'other' includes contributions from characteristics such as gender, state and hours worked while attending school.
- A negative value in a decomposition means that the component contributes toward *closing* the participation gap for that group. For example, the negative value for the group effect in 2016 for people from a low SES background (figure 3.4) implies that, after controlling for their other characteristics, such people are *more* likely to go to university than the rest of the population.

Poor literacy and numeracy, measured by PISA scores, is the single most important characteristic associated with lower university participation by equity groups (figure 3.4). The education level of students' parents, where students go to school and the neighbourhood they live in are important too, but to a lesser degree.

Membership of an equity group after controlling for all of these other factors — identified in the charts as 'group' contributions — remains a substantial barrier to participation in some cases. Having parents who did not attend university remains a barrier, while growing up in a regional or remote area or being Indigenous may present an increasing barrier. These patterns are discussed in more detail below.

[11] In analysing the decomposition for the regional or remote group, the factor 'geography' is not included as a separate explanator for the gap in participation for this group because the measure of geography is whether a person comes from a regional or remote area, which is already captured by the group effect.

Figure 3.3 **How to interpret the decomposition charts**



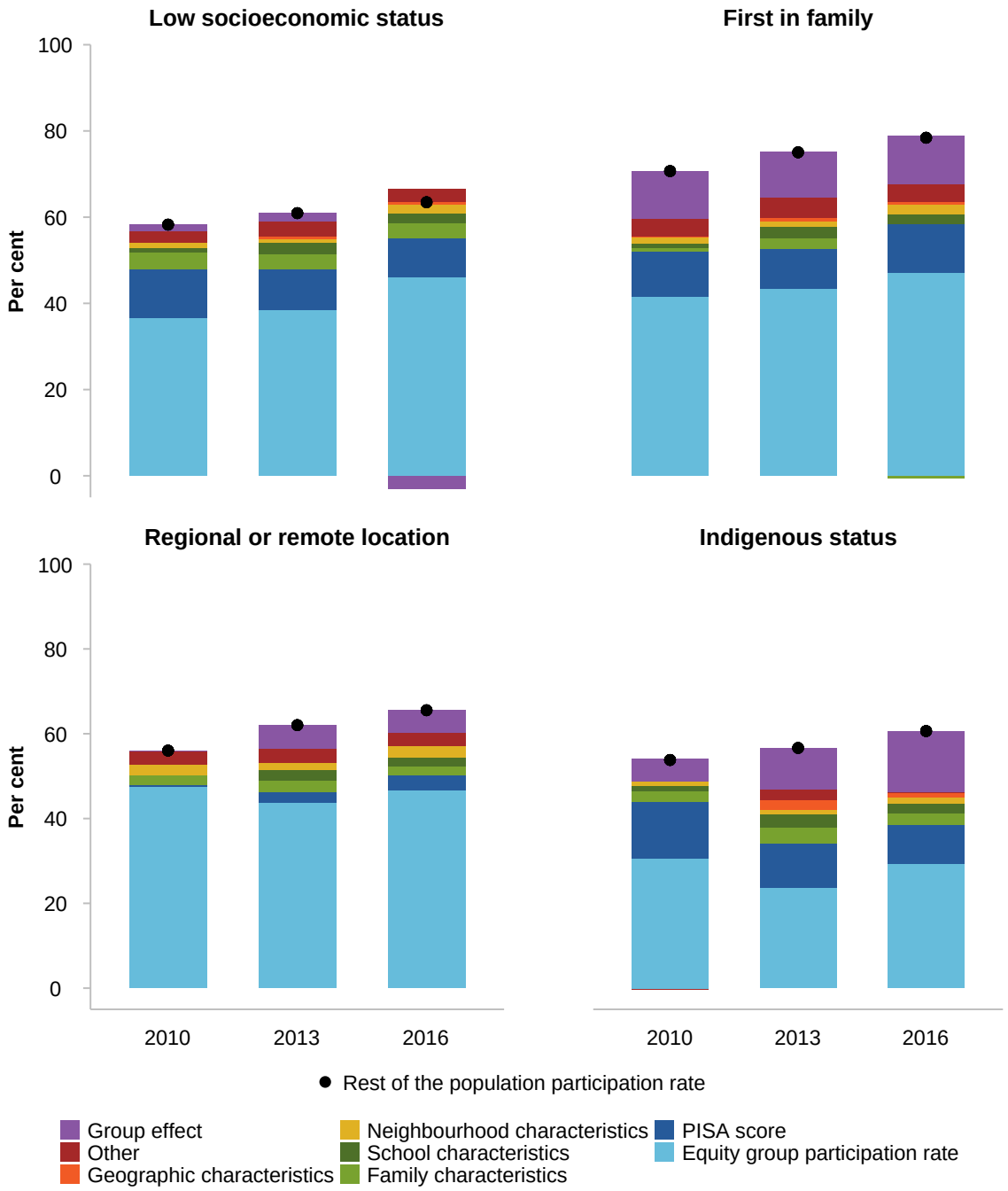
Poor school achievement explains part of the equity group participation gap

Literacy and numeracy at age 15 years, measured by PISA scores, explain half of the under-representation of low SES students, about one third of the under-representation for first in family and Indigenous students, and about 20 per cent of the under-representation of regional or remote students in 2016 (figure 3.4).

Overall, Australian students' literacy and numeracy declined between 2003 and 2015, but the rate of decline has been more rapid for some equity groups, particularly regional or remote school students (figure 3.5). Declining literacy and numeracy scores explain some of the growing gap in university participation between equity and non-equity groups, and is partly why regional or remote students have not made gains in university participation since the introduction of the demand driven system.

Figure 3.4 **Decomposition of differences in university attendance by equity group[a]**

Group average participation rates

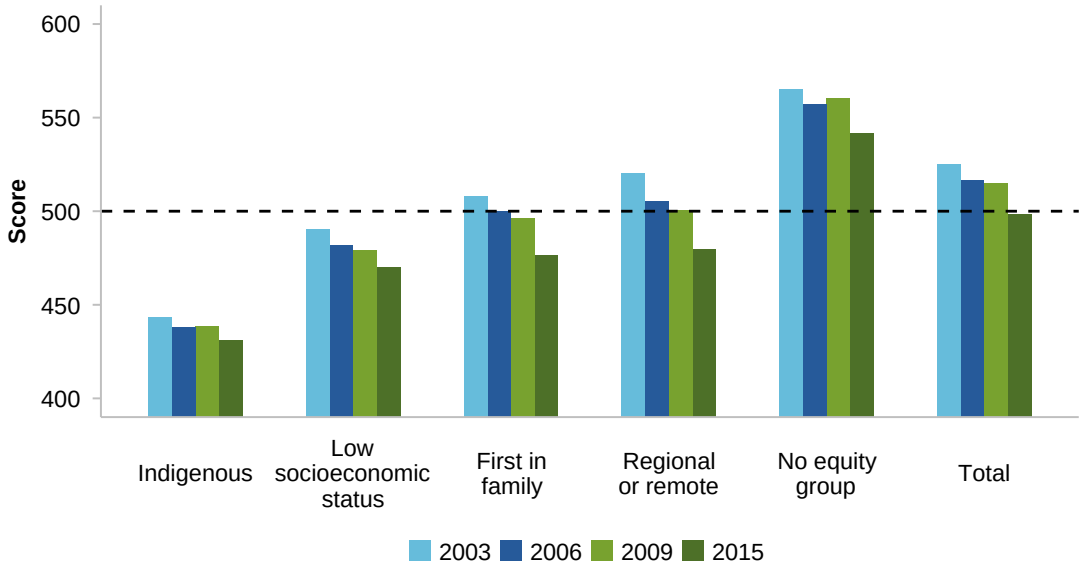


[a] Family characteristics comprise educational attainment and occupation; school characteristics comprise school sector and the SES of the school; geographic characteristics are based on ABS classifications for 'regionality' or remoteness; neighbourhood characteristics are based on the ABS Socio-economic Indexes for Areas Index of Education and Occupation (more detail in appendix B). The rest of the population participation rate is for the population not in that equity group.

Source: Productivity Commission estimates based on LSAY.

Figure 3.5 **Literacy and numeracy of school students is falling**

Average of PISA score for reading and mathematics[a]

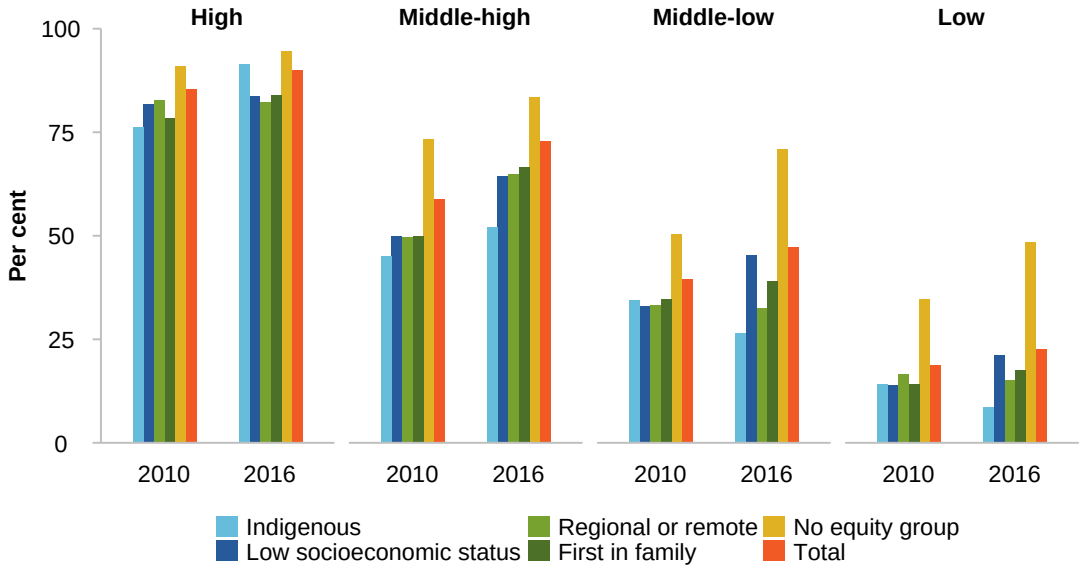


[a] A PISA score of 500 corresponds to the average score across OECD member countries in 2000, the first year the test was conducted.

Source: Productivity Commission estimates based on LSAY.

Figure 3.6 **University attendance by literacy and numeracy quartile**

Attendance by age 22 years[a]



[a] High achievers are those students in the top quartile for literacy and numeracy based on their PISA scores and low achievers are those in the bottom quartile. Note that group representation in these quartiles varies. For example, there are relatively few students from equity groups in the highest quartile and relatively few students that are not from equity groups in the lowest quartile. The Indigenous group in particular is based on a small sample and therefore results for that group should be treated with caution.

Source: Productivity Commission estimates based on LSAY.

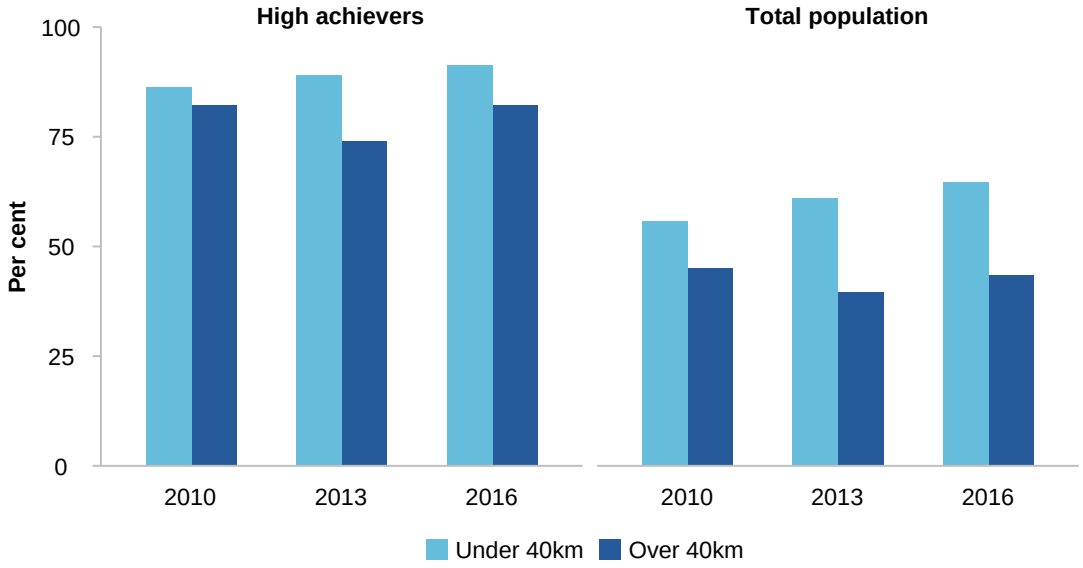
The 'tyranny of distance' is also a barrier for regional or remote students

School students who live in regional or remote areas are much less likely to attend university than students who grow up in metropolitan areas. Some of this difference is explained by lower school achievement and by peer effects. However, these characteristics only partly explain the lower participation rates of regional or remote school students. Moreover, there is a growing gap between students of the same background and capability based solely on whether they grew up in a regional or remote area or in a metropolitan area (bottom left panel of figure 3.4).

Distance from a campus — with the concomitant costs of relocation and forgone opportunity to live with family (box 3.2) — appears to explain some of the under-representation of this group. School students who live more than 40 kilometres from a university campus are considerably less likely to go to university than school students who live in closer proximity; and this gap widened since the introduction of the demand driven system, even for high achieving students (figure 3.7).

Figure 3.7 **Attendance rates at university by distance to a university campus[a]**

By age 22 years



[a] Geodesic distance from a major university campus in the last year of school, estimated from postcode level data. High achievers are those students in the top quartile for literacy and numeracy based on PISA scores. Data are for attendance by age 22 years in 2010 (2003 cohort), 2013 (2006 cohort) and 2016 (2009 cohort).

Source: Productivity Commission estimates based on LSAY.

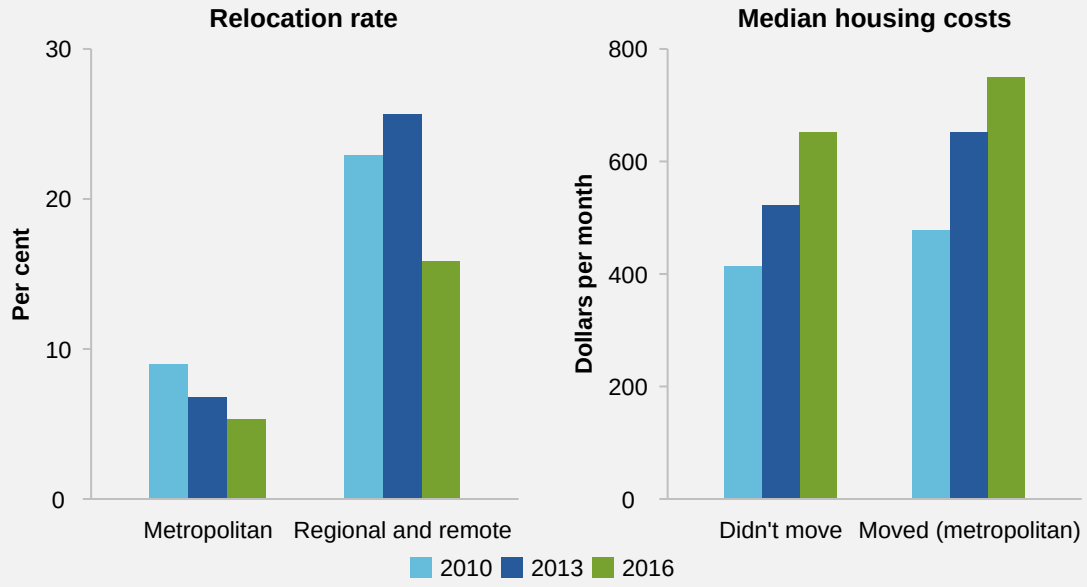
Box 3.2 The financial burden facing regional or remote students

The cost of relocating may be a growing factor in regional or remote students' decisions to attend university. Regional or remote school students who attend university are more likely to move after finishing school and before commencing university, and those that do move end up further away from their support networks than their metropolitan counterparts. For university students from a regional or remote location, between 16 and 26 per cent (across the three cohorts) reported they changed postcodes between their last year of school and their first year of university, compared with 5 to 9 per cent of university students from metropolitan locations. On average, regional or remote students who moved were 80 to 130 kilometres away from where they lived in year 12, compared with 13 to 20 kilometres for metropolitan school students. This means that they may be a long distance from family and support networks.

Moving for university also comes with additional financial burdens. First-year university students who remain in the same postcode (including those who live with or board with their parents) face lower accommodation costs than those who move. Accommodation costs for first-year university students have also risen in recent years. In 2016, students who moved from regional or remote to metropolitan areas typically paid $749 per month (median payment) for accommodation, compared with $478 in 2010 — an increase of 55 per cent.

Movements and costs faced by first year university students

Domestic students who had attended university by age 22 years[a]



[a] Whether or not someone moved (between their last year of school and their first year of university) is approximated by whether their postcode changed, as data on their exact address were not available. Housing costs refer to board, rent or mortgage repayments.

Source: Productivity Commission estimates based on LSAY.

School, neighbourhood and geographic characteristics matter, but to a lesser extent

The importance of school, neighbourhood and geographic characteristics may reflect the influence of peers or differences in the quality of education. School characteristics explain between 7 and 13 per cent of equity groups' under-representation in 2016, while neighbourhood characteristics explain between 5 and 15 per cent and geographic characteristics explain between 2 and 5 per cent. Of the school characteristics, both the average SES of the peer group and the school sector (public, Catholic, independent) affect students' attendance at university, although the school sector appears to be slightly more significant.

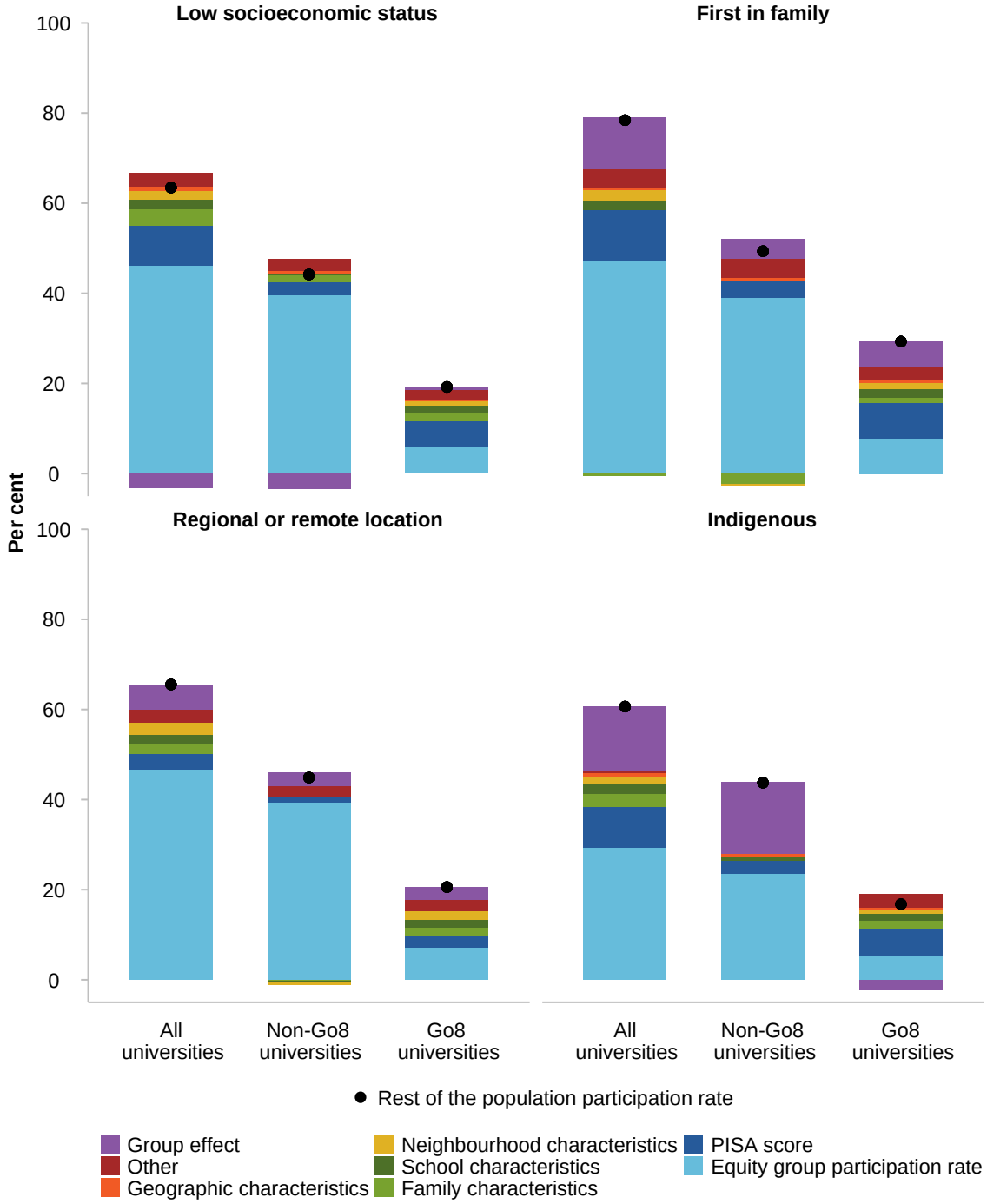
The other characteristics identified in this study explain the remaining under-representation of equity groups. Not attempting year 12 or working longer hours while in year 12 (part of 'other' characteristics) are important for some equity groups — particularly for first in family but also for those from a low SES background.

Equity groups are more under-represented at Group of Eight universities

The under-representation of the low SES, regional or remote and first in family equity groups is most pronounced at Group of Eight (Go8) universities. Figure 3.8 shows the gap in attendance and the factors that explain the under-representation of equity groups at Go8 and non-Go8 universities. The Go8 disproportionately enrol students with high literacy and numeracy, through selection that often requires high ATAR scores. The consequence is that people from low SES backgrounds, first in family students and regional or remote students are under-represented in the university system almost entirely because they are under-represented at Go8 universities. Indigenous students, on the other hand, are under-represented at both Go8 and other universities.

Figure 3.8 **Decomposition of differences in university participation rates by equity group and type of university**

Attendance by age 22 years in 2016



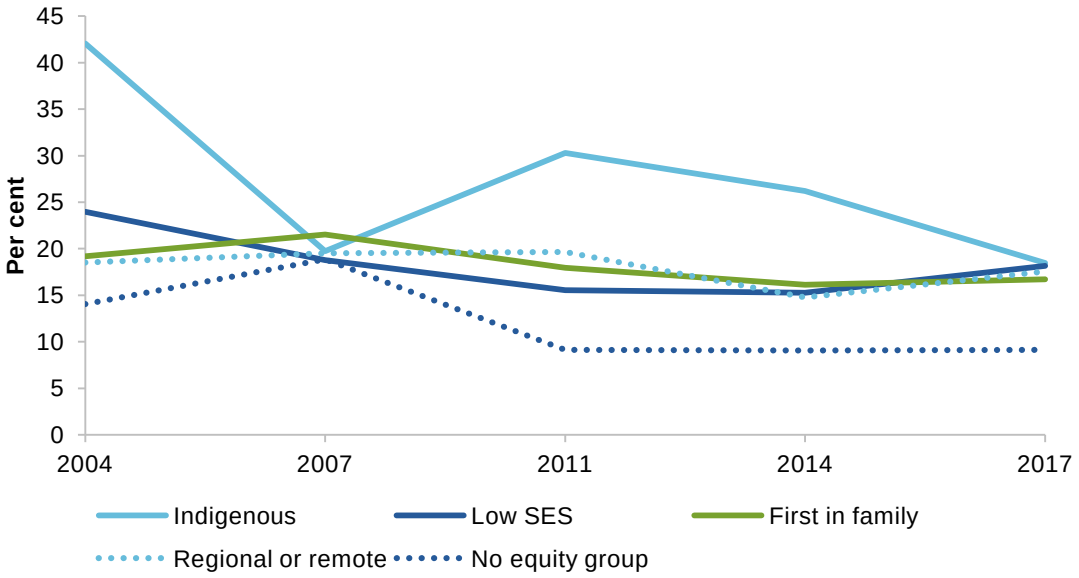
Source: Productivity Commission estimates based on LSAY.

3.3 Academic outcomes

University can be a difficult place to succeed for people entering with weaker foundational skills and school achievement, or with little prior experience or exposure through peers and family members. It can also be difficult while juggling work and family commitments. As observed in figure 2.10, part-time study, low literacy and numeracy, and low ATAR scores are strong predictors of higher drop-out rates compared with other students.

These challenges confront students from equity groups more often than those not from equity groups. Students from equity groups were 36 per cent more likely to study part time in their commencing year, have lower levels of literacy and numeracy on average, and were more likely not to have an ATAR score than students from non-equity groups. In part due to these factors, students from equity groups have lower degree completion rates than non-equity students (figure 3.9).

Figure 3.9 **Drop-out rates are higher for students from equity groups**
Share of people attending university by age 22 years[a]



[a] Drop-out rates measured at age 23 years. Estimates for Indigenous people are variable due to small sample size.

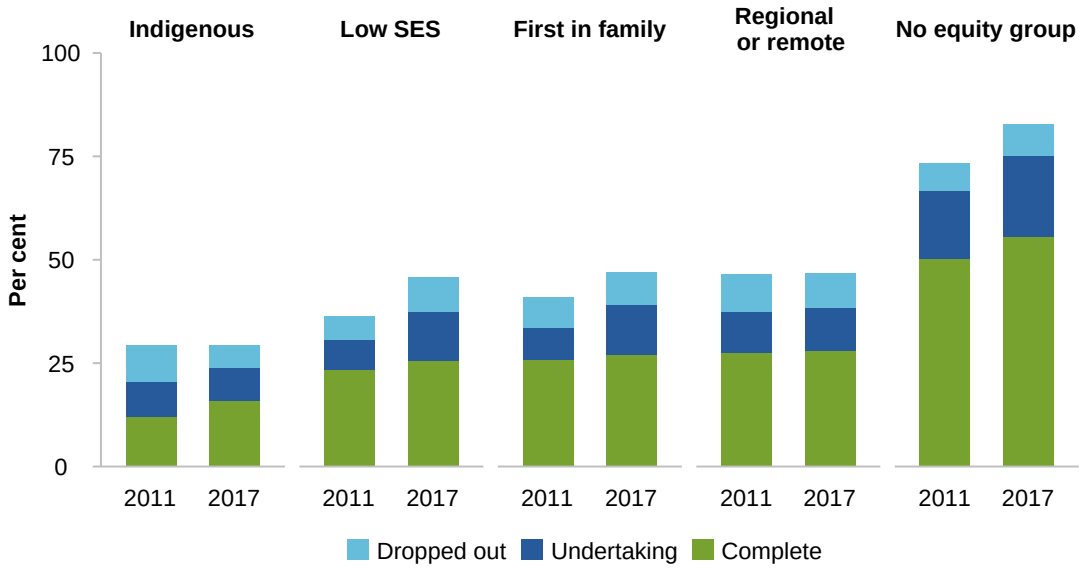
Source: Productivity Commission estimates based on LSAY.

Taking the trends in degree completion into account, there has only been a modest overall increase in degree attainment of people of low SES background by age 23 years (figure 3.10). This is despite the strong increase in their university participation. However, it is difficult to draw strong conclusions. Young people are taking longer to complete a bachelor degree and this is reflected in the increased percentage of people still undertaking study at age 23 years in 2017 (the most recent data available). Many of these students will

go on to graduate, although data tracking earlier cohorts through to age 25 years suggests that many will also ultimately drop out.

Figure 3.10 **Bachelor degree attainment by equity group[a,b]**

Per cent of equity group population at age 23 years[c]



[a] The sum of the three components shown — dropped out, undertaking and complete — is equal to the university participation rates at age 22 years (figure 3.2). [b] Due to small sample sizes and high rates of survey attrition, the Indigenous figures should be treated with caution. [c] University participation is measured at age 22 years (reflecting whether they ever attended by that age). Outcomes are measured at age 23 years.

Source: Productivity Commission estimates based on LSAY.

The difficulties faced by people from equity groups were compounded if they were also additional students (table 3.2). Additional students from equity groups have even lower school achievement and are more likely to study part time than other students from these equity groups. In particular, 36 per cent of additional students from an equity group have no ATAR score at all, compared with 20 per cent of additional students who are not part of any equity group.

However, drop-out rates are similar for additional students, regardless of equity group membership. This might reflect differences in fields of study chosen by these groups. It could also change as additional students progress in their studies (a third of them were still studying at age 23 years).

Table 3.2 **Student attributes and outcomes, by equity group status**[a]

By age 23 years in 2017 (shares of student groups)

Variable	*Equity group*	*Additional students* %	*Other students* %
Student attributes			
No ATAR score	Low SES	42	11
	First in family	35	9
	Regional or remote	34	7
	Any equity group	36	8
	No equity group	20	3
Part-time student in first year of university	Low SES	24	8
	First in family	12	5
	Regional or remote	15	5
	Any equity group	13	5
	No equity group	6	3
Worked in first year of university	Low SES	60	57
	First in family	70	70
	Regional or remote	63	59
	Any equity group	69	67
	No equity group	68	68
Outcomes			
Completion rate	Low SES	42	58
	First in family	42	60
	Regional or remote	41	61
	Any equity group	42	60
	No equity group	51	68
Drop-out rate	Low SES	19	18
	First in family	23	16
	Regional or remote	25	17
	Any equity group	21	15
	No equity group	20	8
Still undertaking	Low SES	39	24
	First in family	35	25
	Regional or remote	34	22
	Any equity group	37	25
	No equity group	29	24

a The Indigenous equity group is not separately shown due to small sample sizes and unreliability of estimates. Indigenous students are included in the 'any equity group' category.

Source: Productivity Commission estimates based on LSAY.

3.4 Labour market transitions

One measure of a successful labour market transition is commencement in a managerial or professional occupation. These are generally considered to be roles in which a university education (or equivalent experience) is needed.

Equity groups are less represented in these occupations than non-equity groups (the top panel of figure 3.11). Moreover, this pattern is persistent. From 2011 to 2017, the relative importance of these occupations among the population of 23 year olds was generally stable for *all* groups, including non-equity groups.[12]

The prime reason for the under-representation of equity groups in managerial and professional occupations is that there has been little progress in degree completion, compared to the rest of the population not in that equity group. The reasons for this lack of progress varied between equity groups.

For some, it was the first hurdle: access. This study finds little improvement in access for young Indigenous or regional or remote students.

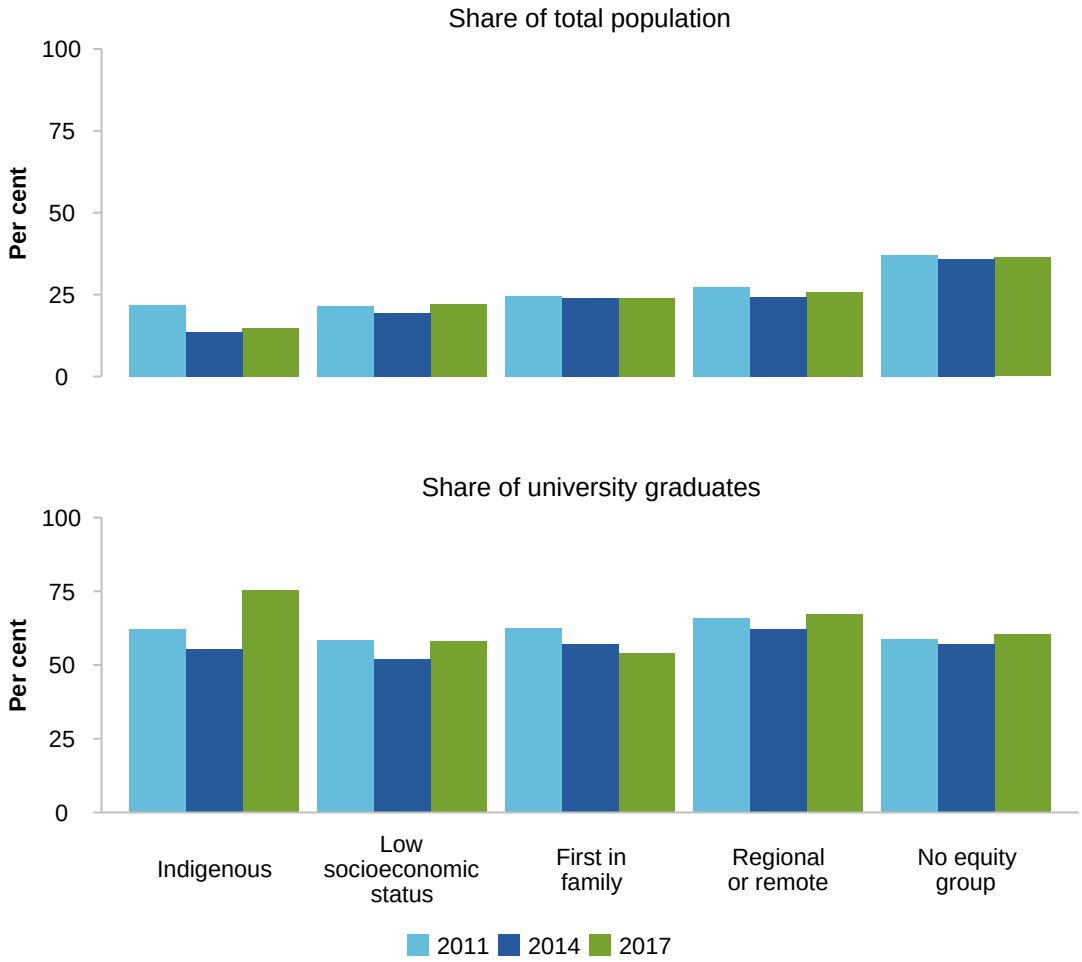
For others, it was the second hurdle: academic outcomes. For example, while the rate of university participation of people from low SES backgrounds increased sharply, this has yet to flow through to degree completion to a material extent. To visualise this, consider 100 young people from low SES backgrounds (table 3.3). In 2010, 36 of them attended university by age 22 years, whereas in 2016, 46 of them attended by age 22 years. But of these ten extra students, only two had graduated by age 23 years — three had dropped out of university, while five were still studying and so their outcomes are yet to be determined. Notwithstanding that some were still studying, the rising drop-out rate for people from low SES backgrounds offset some of the gain in access.

There is little evidence, however, that equity groups struggle at the third hurdle: labour market transitions. Graduates from all equity groups achieve high rates of transition into managerial and professional roles by age 23 years (the bottom panel of figure 3.10).

[12] On face value, this seems perplexing as the opposite might be expected when a greater share of Australians are attending university. Indeed, ABS data is in line with expectations, as managerial and professionals employment is increasing as a share of all occupations for 15-24 and 25-34 year olds (ABS 2019, *Labour Force, Australia, Detailed, Quarterly, Feb 2019*, datacube EQ07a, Cat. no. 6291.0.55.003). The two results can be reconciled if the time taken to obtain professional or managerial employment increasing after graduation — which is supported by other evidence.

Figure 3.11 **Among graduates, there are far smaller differences in occupational outcomes**

Prevalence rates of working in managerial and professional occupations at age 23 years[a]



[a] The data relate to all survey participants at age 23 years. A professional and managerial occupation is described as requiring a bachelor level degree or higher (more than 5 years of relevant experience may be a substitute to the formal qualification). A full description of occupation categories can be found on the ABS website under ANZSCO definitions. Results for Indigenous people should be interpreted carefully due to the small sample size.

Source: Productivity Commission estimates based on LSAY.

Table 3.3 **University participation, completion and outcomes[a]**

Share of group

Year	*Stage*	*Result*	*Low SES*	*First in family*	*Indigenous*	*Regional or remote*	*No equity group*
			%	%	%	%	%
2010	University participation	Attended university	36	41	29	47	73
2011	Academic outcomes	Completed degree	24	26	12	28	50
		Still undertaking	7	8	8	10	16
		Dropped out	6	7	9	9	7
2011	Labour market transitions	Manager or professional	13	15	7	17	27
2016	University participation	Attended university	46	47	29	47	83
2017	University outcome	Completed degree	26	27	16	28	56
		Still undertaking	12	12	8	11	20
		Dropped out	8	8	5	8	8
2017	Labour market transitions	Manager or professional	13	14	11	17	30

a Data are for two cohorts who were aged 22 years in 2010 or 2016, and 23 years in 2011 or 2017. Labour market outcomes shown are only for those individuals who have completed a bachelor degree. Some of those individuals may be undertaking postgraduate studies. Components may not sum to totals due to rounding. Survey attrition weights in wave 8 (age 22 years) have been applied for internal consistency within the table. The university outcomes and labour market transitions data in this table may differ slightly from those reported in figures 3.11 and 3.12 which use wave 9 (age 23 years) survey attrition weights.

Source: Productivity Commission estimates based on LSAY.

3.5 Summing up

During the demand driven system, there was strong growth in participation by young people from low SES backgrounds and first in family students, with less evidence of improvement in participation by people from Indigenous backgrounds or regional or remote backgrounds.

Yet, even for the first two groups, the policy success has been limited in two ways: they remain heavily under-represented at university; and they are less likely to complete their degrees by age 23 years.

The under-representation of equity groups at university reflects many factors. Among these, lower school achievement is one of the most important explanations, although the extent of its importance varies across the equity groups.

This is good news. Foundational skills like literacy and numeracy through childhood and adolescence can be improved by education policy (PC 2017). This study shows that raising literacy and numeracy is not only important for aggregate labour market outcomes, but it is also critical for the equality of opportunity across Australians growing up in different circumstances.

On the other hand, it is clear that there are also barriers to higher education associated with individual, family, school, region and neighbourhood characteristics. In particular, people who are Indigenous, do not have a university educated parent, or have grown up in a regional or remote location are less likely to attend university for any given level of literacy and numeracy.

These barriers to participation may prove harder to lower. But here, too, education is a great equaliser. Students from equity groups with high literacy and numeracy attend university at rates similar to peers of equal capability from more advantaged backgrounds. Similarly, students from equity groups that graduate successfully from university do as well as students not from equity groups in terms of labour market outcomes to age 23 years. This highlights the critical importance of developing sound foundational skills at school, and support to succeed at university.

University completion also remains a hurdle for people from equity groups and one which in some cases appears to have gotten higher, not lower, during the demand driven system. For example, despite the substantial increase in university attendance among people from a low SES background, changes in degree completion have been relatively modest (figure 3.12). The evidence suggests that some are performing poorly academically and — though conjectural — this may be because they are more likely to enter university ill-prepared and are more likely to study part time. Universities are well placed to assist students to overcome these challenges.

Yet, while universities faced strong incentives to increase enrolments in the demand driven system, the incentives to support students to achieve academic outcomes are weaker. The Higher Education Participation and Partnerships Program provides additional funding to

universities that take students from low SES backgrounds for the purpose of supporting their development. Universities choose how to deploy these funds and in practice it supports a myriad of different programs. Their efficacy has not been evaluated at a program level. This study at a system level at least suggests two hypotheses: that the additional funding has been used ineffectively; or that it has proved insufficient to meet the needs of students from disadvantaged backgrounds. Possibly both hypotheses are true.

Figure 3.12 **How high are the hurdles?**

… for people from a low SES background

Attendance	Completion	Professional work
• **46 per cent** of students from low SES backgrounds now attend university (up from about **36 per cent** in 2010). • Despite the increase, low SES students remain substantially under-represented at university.	• Some of the gain in low SES participation has been given up by rising drop-out rates.	• Of those who complete university, **58 per cent** of low SES students transition into managerial and professional work.

Source: Productivity Commission estimates based on LSAY.

A A snapshot from aggregate data

Information based on administrative data collected by the Department of Education and Training, the ABS and other surveys provide a useful context for the longitudinal data analysis elsewhere in this report and act as an independent check on the reliability of some of the key patterns identified by the LSAY. However, the administrative data tell a less rich story than information from LSAY. This is because these data are not longitudinal and contain less information about students' characteristics, which are important for uncovering the reasons for student participation and outcomes.

A.1 What do aggregate data tell us about access?

Growth in access has been uneven and gaps remain

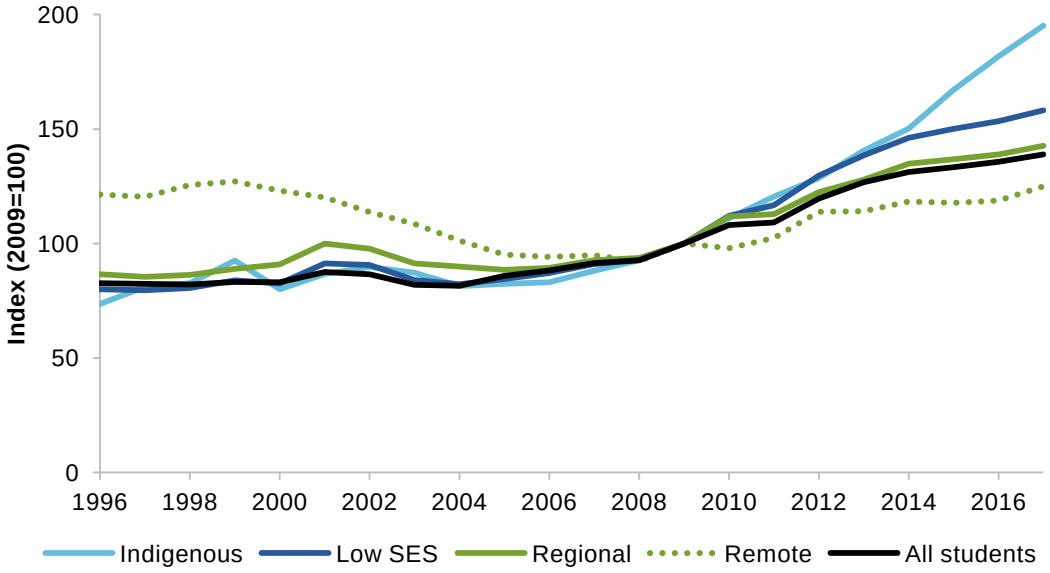
The substantial expansion of the system saw the number of commencements from all equity groups rise from 2009 to 2017 (figure A.1). However, the growth in commencements across equity groups has been uneven, with Indigenous and low-SES experiencing the highest rate of growth and students from remote areas experiencing the lowest rate of growth.

These growth rates do not take account of different rates of population growth among the each group. Moreover, a crude participation rate based on the number of commencements as a share of the relevant group population can be misleading because university participation varies by age. For example, it would be possible for one equity group to have the same participation rates for each age, but for the crude participation rate to be different because one group had an older age structure than the other. Adjusting crude rates for differences in age structures avoids this problem (as explained in appendix B) and shows that while around 1.2 per cent of the Australian population enrol in an undergraduate degree each year, the rate among equity groups is much lower (figure A.2). Indigenous people enrol at around one half this rate while, remote students are even less likely to enrol.

This suggests there remains room for progress in equity groups' access despite the overall growth in the system. Such groups have an inherent capability similar to others, but are held back by factors amenable to policy influence — like schooling, aspiration, isolation and discrimination.

Figure A.1 **Commencements grew for all groups[a]**

Domestic undergraduate commencements, 1996–2017 (2009 =100)

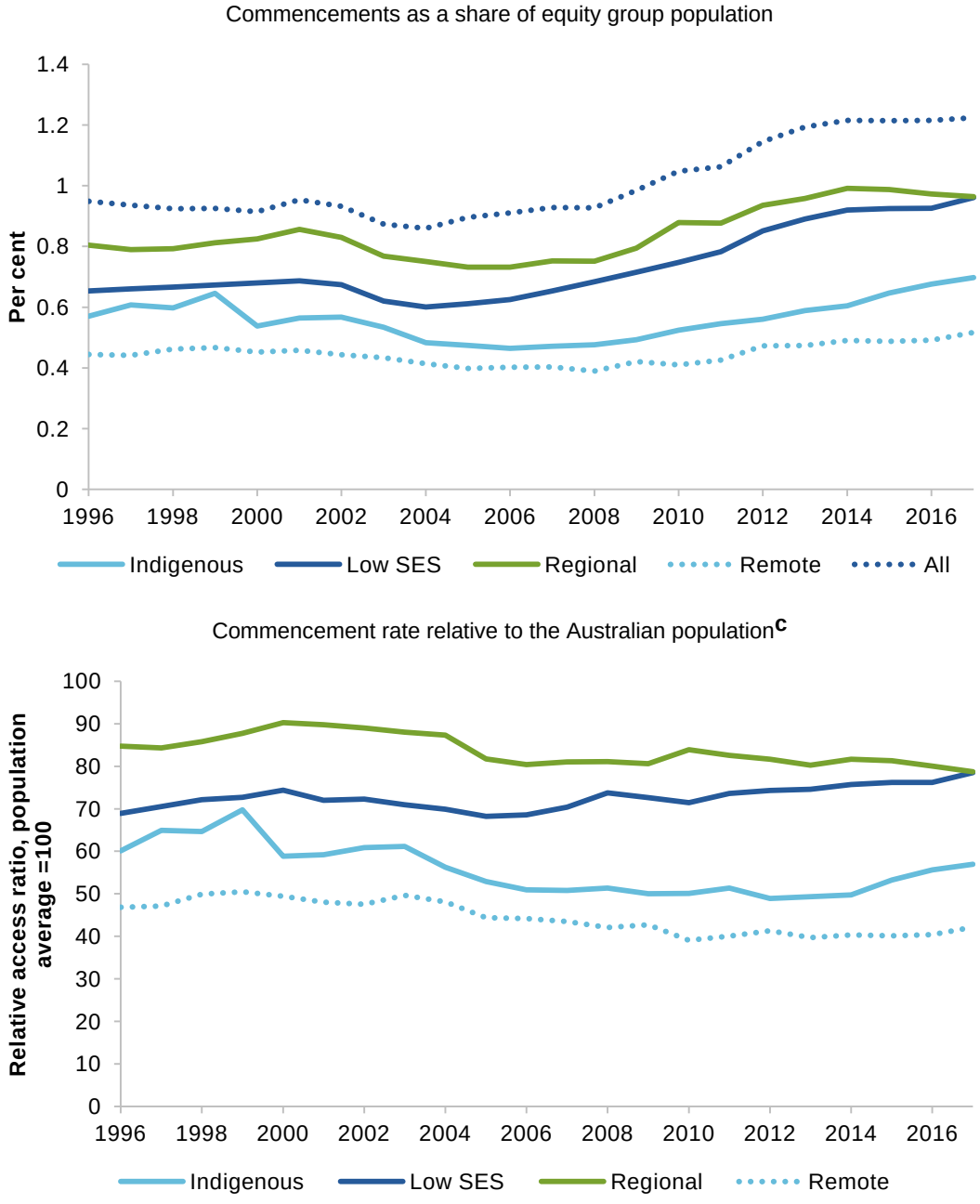


a Low SES measure based on 2006, 2011 and 2016 SEIFA postcode measure. Regional & remote measure uses 2011 ASGS and 2016 ASGS bases, with MCEETYA growth rates applied 2001 to 2006, and RRMA growth rates applied 1996 to 2000. 'Domestic undergraduate' includes courses that lead to the award of a diploma, advanced diploma, associate degree or a bachelor degree (pass, honours or graduate entry).

Sources: DET (2013b, 2015a, 2018c, 2019).

Figure A.2 **But equity groups remain heavily under-represented[a,b]**

Age-adjusted rates, 1996-2017



a Data are the number of commencing domestic undergraduate students adjusted to take account of the different age distributions of the groups. 'Domestic undergraduate' includes courses that lead to the award of a diploma, advanced diploma, associate degree or a bachelor degree. **b** Age adjustments apply proxy measures for international students by equity group. Details on the age adjustment methodology are at appendix B, section B.9.**c** Relative access ratios show commencements as a share of age-adjusted equity group populations measured relative to commencements as a share in the general population. A ratio of 100 means that the group has an equal opportunity for access as Australians as a whole.

Sources: DET (2013b, 2013a, 2015a, 2016a, 2016c, 2018c, 2019), ABS (2006b, 2011b, 2016g, 2016c, 2016b).

Universities have changed admissions practices, but ATAR remains important for year 12 applicants

A more diverse pool of applicants

The growth in higher education access has also been accompanied by shifts in admission practices over time and expansion of the pool of potential applicants for courses. Though ATAR remains important for school leavers, more students are being admitted now through direct applications to universities, rather than through centralised tertiary admissions centres, and the criteria used vary from university to university and course to course.

The characteristics of university entrants have also changed significantly (table A.1). The number of applications based on experience in work or other forms of education in addition to, or instead of, school completion has grown rapidly. Direct applicants to university, the vast majority of whom are not current year 12 students, more than doubled between 2009 and 2017. In contrast, year 12 applicants via Tertiary Admissions Centres (the traditional route of year 12 admission) grew by only 17 per cent over the same period.

A.2 How are students faring at university?

Academic outcomes vary by group and time

University drop-out and completion rates vary considerably across different groups. Members of equity groups, including students that are Indigenous, or grew up in regional and remote areas or from low SES backgrounds have much lower completion rates and higher drop-out rates.[13]

However, the results for equity students need to be interpreted carefully because the same student can be classified into more than one group (for example, low SES and remote). Accordingly, causally attributing a higher drop-out rate to one classification (say remoteness) may really reflect some other student trait (such as SES status). For example, there is some evidence that once other factors that can increase the risk of dropping out have been controlled for, there is little difference in completion risks between students from major cities and regional or remote areas (Norton and Cherastidtham 2018).

There has been a sustained downward trend in degree completions for most student groups (figure A.3). Drop-out rates also generally rose after commencement of the demand driven system in 2010, though the degree to which this has occurred may be exaggerated because drop-out rates prior to 2010 may have been artificially low due to poor alternative labour market prospects for young people in the aftermath of the global financial crisis.

[13] Data from Quality Indicators for Learning and Teaching (Social Research Centre 2019b), which is based on the Student Experience Survey, also shows higher drop-out rates for students from equity groups. It indicates that the average share of undergraduate students considering early departure was 19 per cent in 2018. It was 30 per cent for Indigenous students, 21 per cent for 'first in family' students and 22 per cent for low SES students.

The trends above partly reflect the increase in the number of students entering with a lower ATAR and those studying part time. Students with an ATAR below 60 are about half as likely to complete an undergraduate degree within four years as those with an ATAR of 90 or more (figure A.4). Completion rates have also been falling for groups entering with an ATAR of between 60 and 90 and for non-year-12 entrants. Studying part time is also a strong predictor of dropping out, which some have argued is due to students' responsibilities at work and home (Norton and Cherastidtham 2018).[14]

Table A.1 **A more diverse pool of applicants**

Applicants by admissions pathway and prior education experience ('000s)[a]

		2010	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*
		'000	'000	'000	'000	'000	'000	'000	'000
TAC	Year 12 applicants	137.5	142.3	147.6	151.0	151.6	140.9	156.0	155.6
	Non-year-12 applicants	129.5	124.9	125.6	124.4	123.8	115.3	118.2	112.3
Direct	Total direct	60.7	68.9	76.8	82.9	89.7	103.3	120.6	131.6
Of non-year-12 TAC and direct app's	Complete postgraduate	4.3	4.3	5.0	5.7	6.4	6.9	7.0	7.1
	Complete bachelor	19.8	19.9	22.6	24.7	25.4	27.6	27.3	26.9
	Complete sub-degree	7.1	6.4	7.1	7.5	8.1	7.6	7.5	7.3
	Incomplete higher education	18.4	62.8	65.5	67.8	75.3	73.8	61.4	59.9
	Complete VET	21.7	22.9	23.4	24.8	22.5	22.9	23.5	25.5
	Incomplete VET	5.4	4.9	4.6	4.5	3.5	3.4	3.7	3.4
	Complete secondary Education	43.3	55.5	53.9	54.2	53.0	53.1	49.8	47.5
	Other qual - complete or incomplete	14.1	7.8	9.4	9.2	9.7	9.7	8.4	12.4

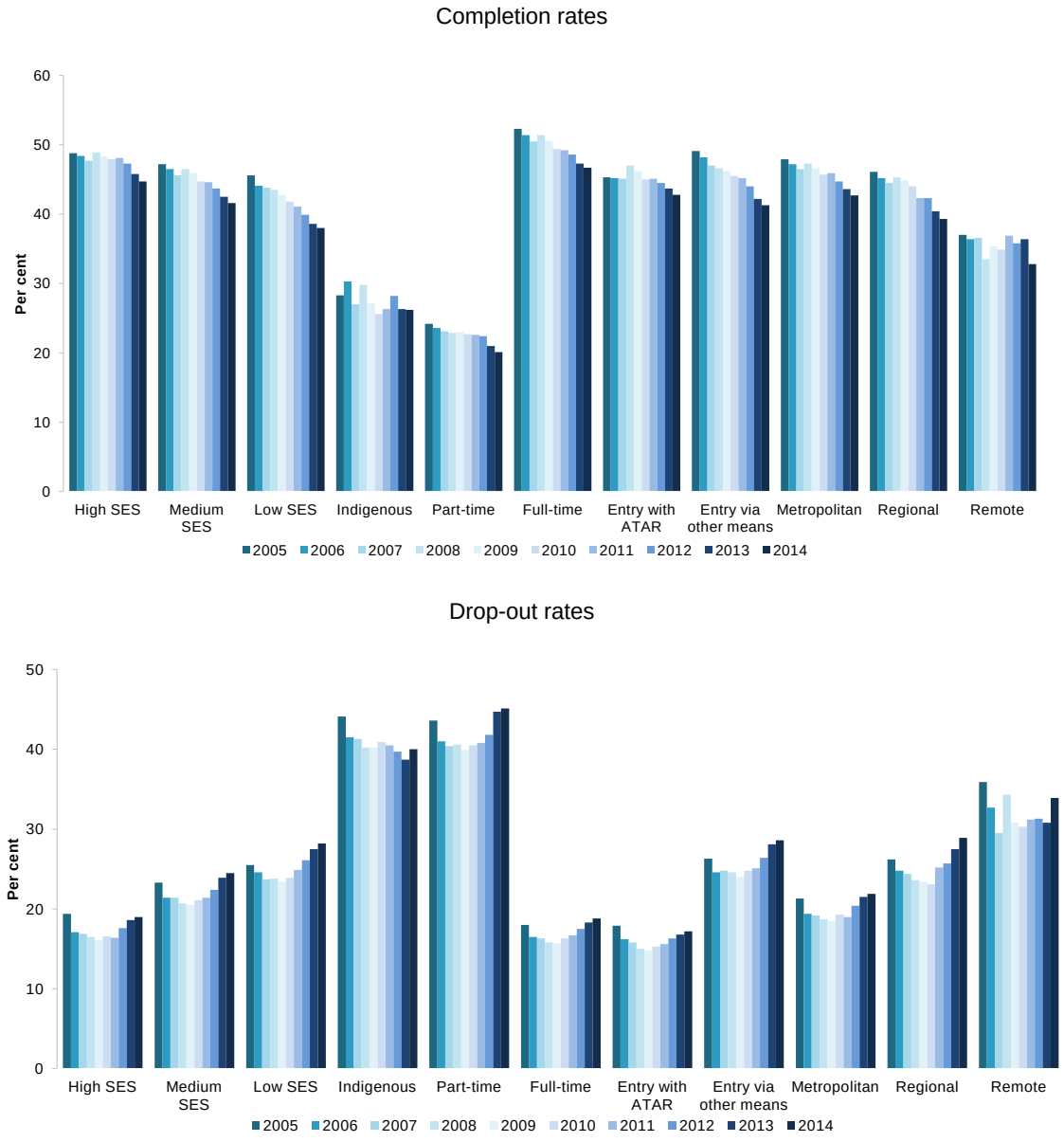
a Year 12 applicants are those who seek admission into undergraduate study at university directly after completing year 12. 'Direct' covers unique applicants only. All applications for the University of Tasmania are included in the Tertiary Admissions Centre (TAC) count. Totals include applicants who did not report prior education experience. **b** From 2009 onwards, the department implemented a new national unit record data collection. National data collection for 2009 includes only TAC data.* indicates prior university experience, prior VET experience and completed secondary school respectively, as reported in the department's 2009 Offers and Acceptances annual publication.

Sources: DET (2013e, 2013g, 2013i, 2013k, 2013m, 2014a, 2015b, 2016d, 2017a, 2018e).

14 These trends are consistent when considering completion and either four-year or six-year drop-out rates.

Figure A.3 **Degree completion rates have declined across all equity groups**

By commencement year and selected characteristics[a]

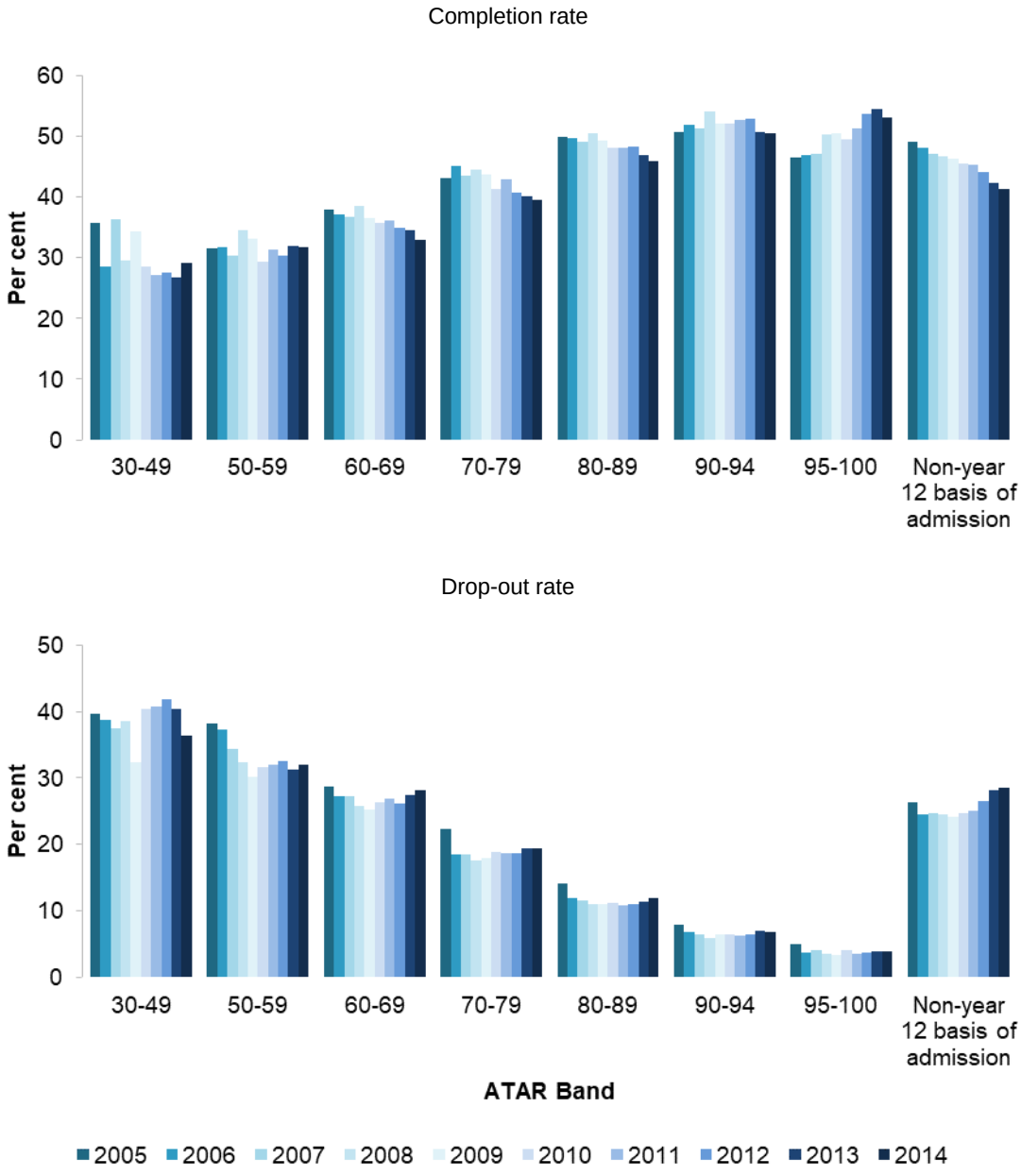


[a] Completion and drop-out rates are numbers of completions and drop outs over a 4 year period for students who commenced a bachelor degree in a given year. Drop outs include those who did not continue after the first year and those who disenrolled thereafter. SES is reported based on the students' postcode of permanent home residence linked with the ABS Socio-Economic Indexes for Areas (SEIFA) Education and Occupation Index. High, medium and low SES refer to the top, middle two and bottom quartiles, respectively. Regional classification is reported on a student's postcode of permanent home residence. Metropolitan, regional and remote categories are derived from the Ministerial Council on Education, Employment, Training and Youth Affairs classification (MCEETYA) until 2010. From 2011, regional classification is based on the Australian Statistical Geography Standard (ASGS). The 2011 version of ASGS is used from 2011 to 2015.

Source: DET (2018a).

Figure A.4 **Lower ATARs are associated with lower completion and higher drop-out rates**

Four-year completion and drop-out rates by year of commencement[a]



[a] Completion and drop-out rates are numbers of completions and drop-outs over a 4 year period for students who commenced a bachelor degree in any given year. Drop-out rates include those who did not continue after the first year and those who disenrolled thereafter.

Source: DET (2018a).

A.3 How are graduates faring?

More varied and overall less positive labour market transitions

The labour market outlook for graduates has weakened materially since the global financial crisis. This appears to be particularly pronounced for new graduates, with many having difficulty establishing their careers. The full-time employment rate four months after graduation steadily declined from 85.2 per cent in 2008 to 70.9 per cent in 2016 (among those available for work, and not undertaking further full-time study) (GCA 2016, 2018), before recovering somewhat in the past couple of years. Full-time employment rates have fallen and unemployment rates have risen for graduates of all ages, with the largest deteriorations for graduates aged less than 30 years (figure A.5).

However, some graduates take time to secure full-time work and outcomes are better after more time post graduation. For example, while in 2015, 67.1 per cent of undergraduates had a full-time job four months after graduating, 89.2 per cent of the same group of graduates had secured such employment three years later.[15]

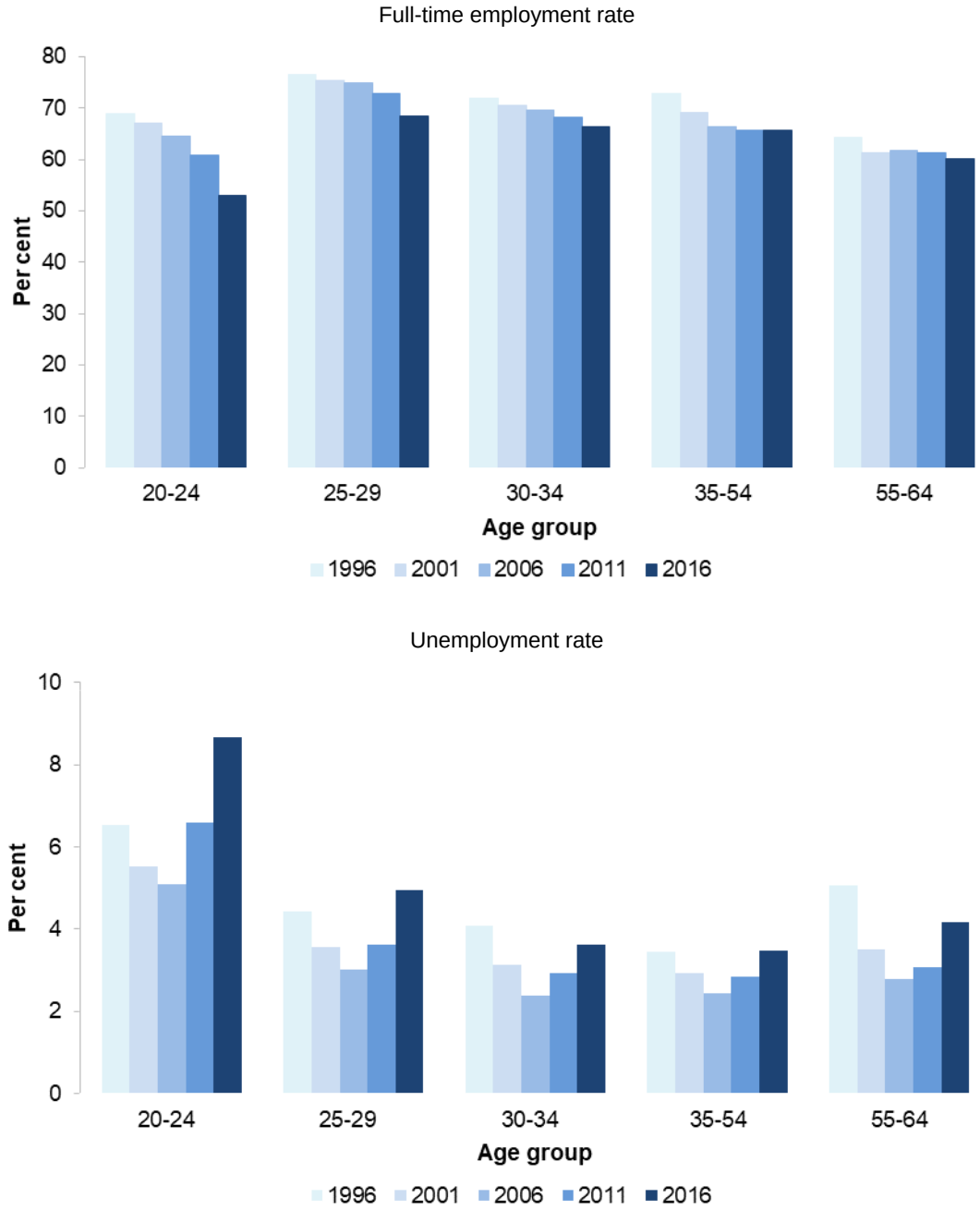
Growth by field of study may not match labour market demand

Under the demand driven system, universities were able to determine overall domestic undergraduate student numbers and the number of offers they made for each course. As such, trends in enrolments by fields of study reflect both student demand and university decisions. The fastest growth in enrolments by discipline since 2009 was in health-related courses (excluding medicine, for which places remain government-controlled), natural and physical sciences, information technology, and 'society and culture'. Graduates from some of the high-growth fields, such as health, face strong labour market demand, while others, such as information technology and natural and physical sciences, fare poorly. Overall, there is no correlation between growth by field of study and labour market demand (at the outset of the demand driven system) measured by unemployment rates of graduates (figure A.6).

15 Overall outcomes have still weakened. For the 2007 cohort, the short-term full-time employment rate was 83.6 per cent and the three-year rate was 92.6 per cent (Social Research Centre 2018).

Figure A.5 **Graduate labour market outcomes have weakened**

Employment and unemployment rates for bachelor-degree-qualified individuals by age group[a]



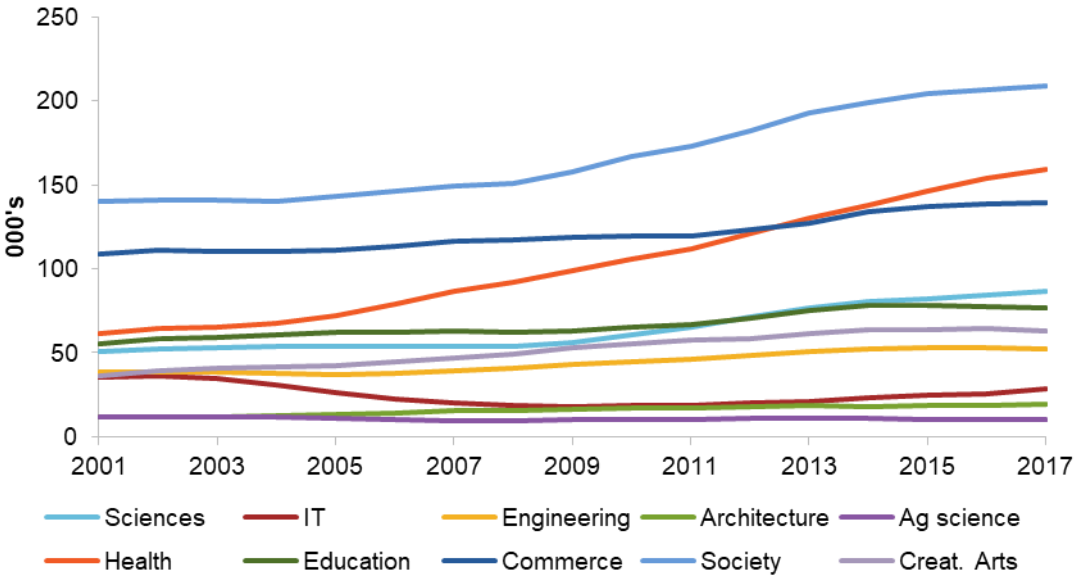
[a] Full-time employment and unemployment rates where highest level of qualification is a bachelor degree.

Sources: ABS (2006a, 2011a, 2016f, 2019a, 2019b).

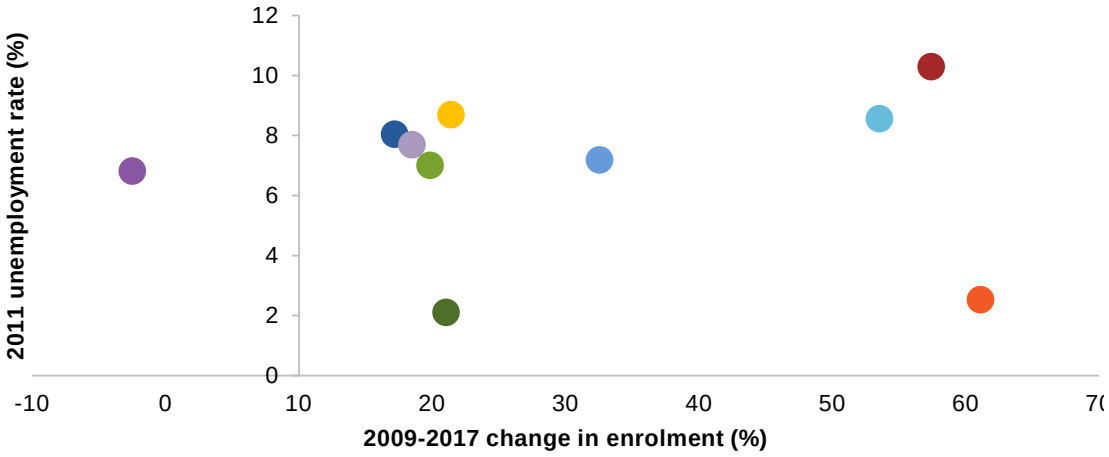
Figure A.6 **Enrolments by field of study**

Domestic bachelor degree enrolments, 2001-2017

Enrolments have grown in most fields …



… but there is no correlation between enrolment growth and 2011 unemployment rates (20-24 year olds)



Sources: DET (2019); ABS (2016f).

Lower graduate wage premiums?

University participation has increased and employment rates have fallen, but have the private returns to education declined?

There is a range of methods and data sources that can be used to estimate the private returns to education over a person's lifetime. Estimates vary depending on the datasets, assumptions

and methodologies applied.[16] While it is difficult to predict the lifetime earnings of graduates, the age-earnings profile (figure A.7) has often been used as a guide (Wei 2010). By this measure, at most ages over the past decade, average earnings of those with no post-school qualification have grown faster than average earnings of those with a bachelor degree. As a result, the average earnings premium of those with an bachelor degree has fallen over the past decade, for those aged 30 years or over. These changes reflect falls in the relative earnings of graduates in almost all fields of study, with the earnings premium for graduates of engineering, IT and management and commerce degrees falling the most.

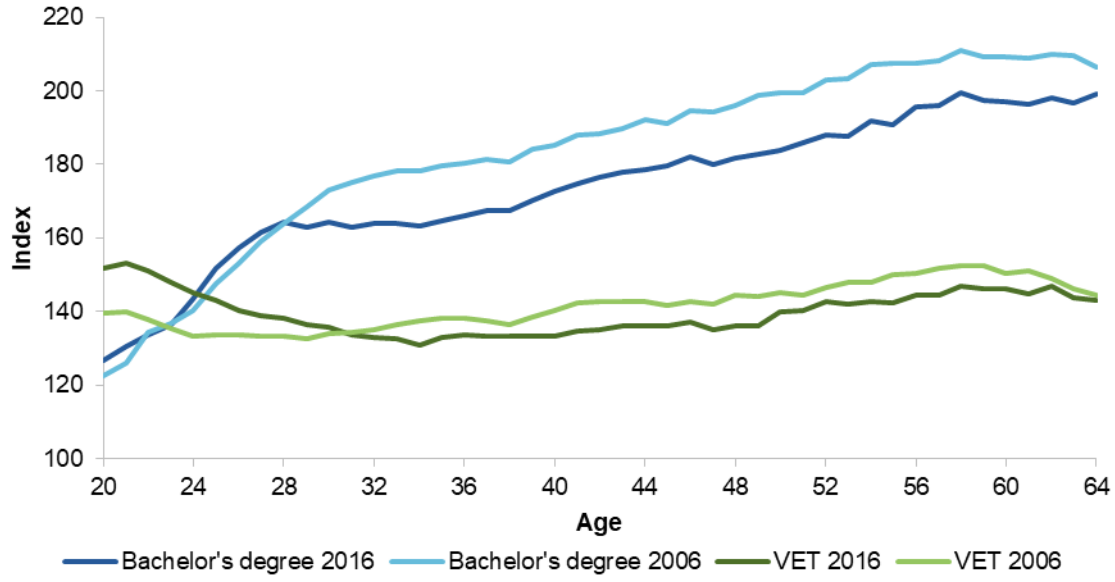
However, while the private benefits of a higher education may have decreased, the costs have likely decreased — so, it is not clear that the private rate of return to investing in higher education has fallen. The labour market for young people had deteriorated markedly over this period (relative to average adult earnings) so that the opportunity cost of the years spent studying (in terms of forgone wages, in addition to the financial outlays on fees and study materials) may have fallen as fast as or perhaps faster than the graduate wage premium.[17] Indeed, the wage premium for a VET education has also fallen and remains lower than that of bachelor degree graduates. Of course, social returns may be higher or lower than private rates of return (due to positive spillovers of an education to other workers, or negative consequences if education is merely a signal of underlying ability) and have not been estimated in this study.

16 For example, NATSEM estimated somewhat smaller changes in *earnings* premiums between 2006 and 2016 than the estimates presented in Figure A.7, applying a Mincer Equation to HILDA data (Gong and Tanton 2018). Accounting for hours worked, NATSEM finds almost no change in *wage* premiums. In contrast, the OECD compared *earnings* of bachelor and postgraduate degree graduates combined against those with no post-school qualification. It found the relative earnings advantage of a tertiary education was higher in 2015 than in 2005, but that pattern was a result of comparing two different ABS surveys (OECD 2006, 2017), which makes the results difficult to compare with other studies.

17 Forgone wages are one important opportunity cost of study, and there is some evidence these costs may have declined over time. Real average weekly earnings (from all sources) of non-graduates aged 18 to 24 years fell by 3 per cent over the decade to 2006, and by a further 8 per cent over the decade to 2016 (ABS 2016e, 2016d, 2016a).

Figure A.7 **Lower undergraduate (and VET) earnings**

Average weekly income from all sources, no post-school qualifications = 100[a]



[a] VET includes diploma & advanced diploma, associate degree and certificate III & IV graduates

Sources: ABS (2016e, 2016d).

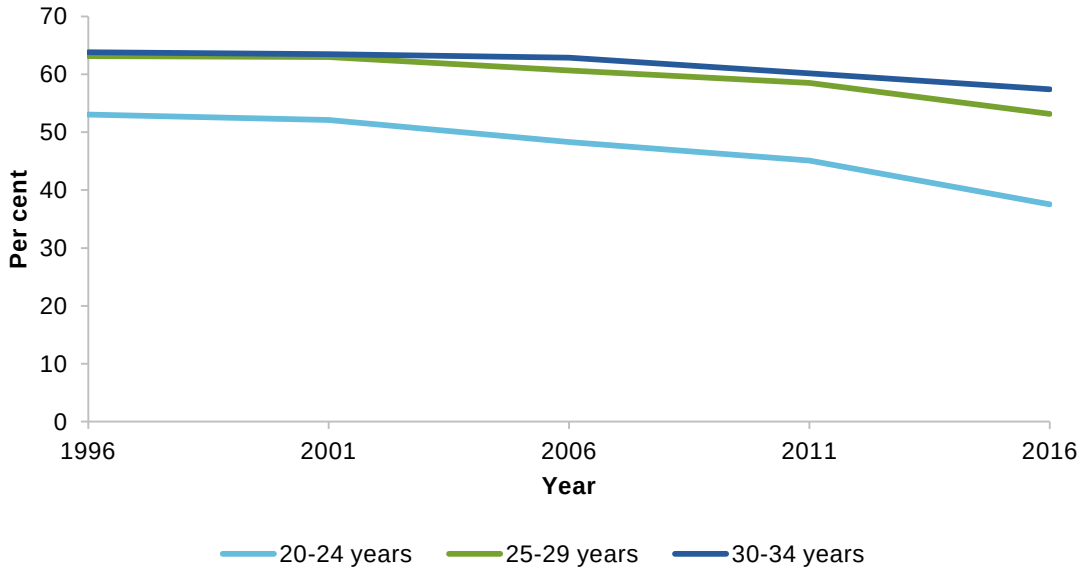
Some evidence of a skills mismatch

There is also some evidence that graduates are less likely to be using their skills. Graduates have become less likely to be employed in managerial or professional occupations than before (figure A.9), which are broadly considered to be those occupations typically requiring a university education.[18] The proportion of 20 to 24 year old graduates in these occupations fell by 15 percentage points over the two decades to 2016. However, there are differences across fields of study and, in particular, employment in these occupations rose for graduates of health and education degrees during the demand driven system.

[18] Transition into these occupations is also is also used as an indicator in the QILT data and other research. A caveat is that not all 'managerial' jobs genuinely need a degree to be performed well (ABS 2019c).

Figure A.8 **Fewer graduates are entering occupations that require their skills**

Percentage of graduates in managerial and professional occupations



Sources: ABS (2006b, 2011b, 2016b, 2016c, 2016g).

Graduates' subjective experience in the labour market is also suggestive of some skill mismatch. Notwithstanding the variability of data from the Quality Indicators for Learning and Teaching, nearly a third of recent graduates employed full time in 2018 did not consider that their qualification was 'important' to their job (Social Research Centre 2019a). About a quarter of graduates employed overall did not feel that their qualification prepared them well for current employment. Graduates with more 'vocationally focused' degrees report higher rates of skill utilisation at work, while by contrast over 40 per cent of science and maths bachelor degree graduates' skills were not fully utilised at work (Social Research Centre 2019a).

B Data and methodology

This study uses probit regressions to predict university attendance for Australian school students and to decompose the determinants of the under-representation of equity groups at Australian universities. The dependent variable in each regression model is a binary outcome of whether or not the student ever attended university by a particular wave in each of the Longitudinal Surveys of Australian Youth (LSAY) cohorts.

In the first stage, we infer determinants of university attendance within each cohort in a similar manner to previous literature (Cardak et al. 2017; Miller and Le 2004). Participation at university (by age 22 years, unless otherwise indicated) is regressed on a broad set of individual, family, school and regional characteristics. The regression results are then used to understand the determinants of differences between equity group and non-equity group participation rates using a method developed by Schwiebert (2015).

In the second stage, we take a similar approach to predicting university attendance. The regression analysis is repeated with additional data to improve the overall predictive ability of the model, including on students' Australian Tertiary Admission Rank (ATAR) and including a measure of the distance to the university from a student's residence in their final year of school to improve the overall predictive ability of the model. Missing ATAR data are imputed in order to maintain sample size.

The same regression specifications are used for the 2003, 2006 and 2009 cohorts (for participation by age 22 years in 2010, 2013 and 2016 respectively). We estimate the probability that each student attends university in the 2006 and 2009 cohorts then, applying the 2003 regression specifications, we predict counterfactual probabilities that students in the 2006 and 2009 cohorts would have attended if part of the 2003 cohort. This approach implicitly assumes that unobservable characteristics affect university attendance in the same manner in each cohort.

This appendix sets out key issues with the data and variables we use and the technical approaches taken to:

- addressing sample attrition in the LSAY (section B.2)
- decomposing differences in group mean participation rates (section B.4)
- imputing missing ATAR values (section B.6)
- bootstrapping confidence intervals around key outcome variables (section B.7).

Regression results are presented in tables B.15 and B.16. All regressions use population and attrition weights with Huber-White robust standard errors.[19] R code used to produce these estimates is published on the Productivity Commission website together with this research report.

This appendix also contains detail of the calculations of age-adjusted commencement rates by equity group presented in appendix A.

B.1 The Longitudinal Surveys of Australian Youth

The primary data for this paper are drawn from the LSAY. The LSAY tracks children in middle high school years and their progression through study and labour market transitions until the age of 25 years. The LSAY cohorts commenced in 1995, 1998, 2003, 2006, 2009 and 2015. The first two cohorts entered in Year 9 at school. The last three cohorts entered at age 15 years on average (table B.1). Most of the students sampled in the last three cohorts are in Year 10 at school (figure B.1).

Table B.1 **LSAY sample summary**

Cohort	*Sampling unit*	*Survey period*	*Average age when first surveyed*	*Year when aged 22 years*	*No. of waves*	*No. of schools*	*Commencing sample size*
1995	Year 9 in 1995	1995-2006	14.5 years	2003	12	300	13,613
1998	Year 9 in 1998	1998-2009	14.5 years	2006	12	300	14,117
2003	Age 15 in 2003	2003-2013	15.7 years	2010	11	355	10,370
2006	Age 15 in 2006	2006-2016	15.7 years	2013	11	356	14,170
2009	Age 15 in 2009	2009-2019	15.7 years	2016	11	353	14,251

Source: National Centre for Vocational Education Research LSAY User Guides (2018).

[19] Adjusting standard errors for clustering by school in our design of the LSAY data sample was found to make no material difference to the results

Figure B.1 **LSAY sample by school year level and state**
2006 cohort

Source: Productivity Commission estimates based on LSAY.

All students entering the sample undertake tests of literacy and numeracy. Since 2003, this test has been the OECD Program for International Student Assessment (PISA) test. The assessment involves written tests of mathematical, reading and scientific literacy. Participants also complete a background questionnaire about their families, school, peers, learning strategies, experiences in the classroom, out-of-school activities, post-school study plans and work experience.

The sample is designed to be representative of students across Australia, using state/territory, school sector and region (metropolitan, regional or remote) as strata. Students from smaller states are over-sampled so that reliable PISA results can be reported for each jurisdiction. Participants are drawn from approximately 350 schools with about 50 students selected at random from each school. Smaller jurisdictions and Indigenous students were oversampled to ensure that reliable results for these groups. The National Centre for Vocational Education Research (NCVER) supply sample weights with the LSAY data so that oversampled groups can be weighted down for the purposes for reporting descriptive statistics.

All LSAY statistics reported in this study incorporate sample and survey attrition weights, which means reported statistics should be representative of the Australian population. We use the sample weights supplied with the LSAY data, but take our own approach to calculating attrition weights. Ideally, after applying the weights, baseline characteristics should be the same across all waves of the survey. However, as can be seen in table B.2, there are some small differences between the results reported at age 15 years and age 22 years. Section B.2 describes our method for estimating the attrition weights.

Table B.2 **Descriptive statistics of LSAY data**

2003, 2006 and 2009 cohorts[a]

	Age 15 years (Baseline Characteristics)			*Age 22 years (Sample used in predictive model)*		
	2003 Cohort	*2006 Cohort*	*2009 Cohort*	*2003 Cohort*	*2006 Cohort*	*2009 Cohort*
Socioeconomic status[b]	55.4	54.5	53.2	54.7	54.3	53.8
PISA score[c]	525.2	516.4	514.6	534	523	524
Parent attend university	60%	61%	59%	60%	61%	59%
Non-English speaking background	3%	3%	2%	4%	3%	2%
Regional or Remote	31%	31%	27%	30%	32%	27%
Gender female	49%	49%	51%	51%	49%	51%
Indigenous	2%	3%	3%	2%	3%	3%
University <20 km	60%	60%	61%	61%	60%	59%
University 20-200 km	34%	34%	32%	33%	34%	35%
University >200 km	6%	7%	6%	6%	6%	6%
Independent school	17%	16%	18%	17%	16%	20%
Catholic school	21%	22%	22%	22%	23%	23%

a The sample at age 15 years contains all people included in the LSAY surveys (LSAY provided sampling weights have been applied). The sample at age 22 is restricted to people included in the predictive modelling used to identify additional student (our new set of weights have been applied across all cohorts. **b** Highest ranking parental occupation, using International Socioeconomic Index (ISEI) of occupational status. The index ranges from 16 (agricultural assistants, cleaning staff) to 90 (judge). **c** Average for mathematics and reading.

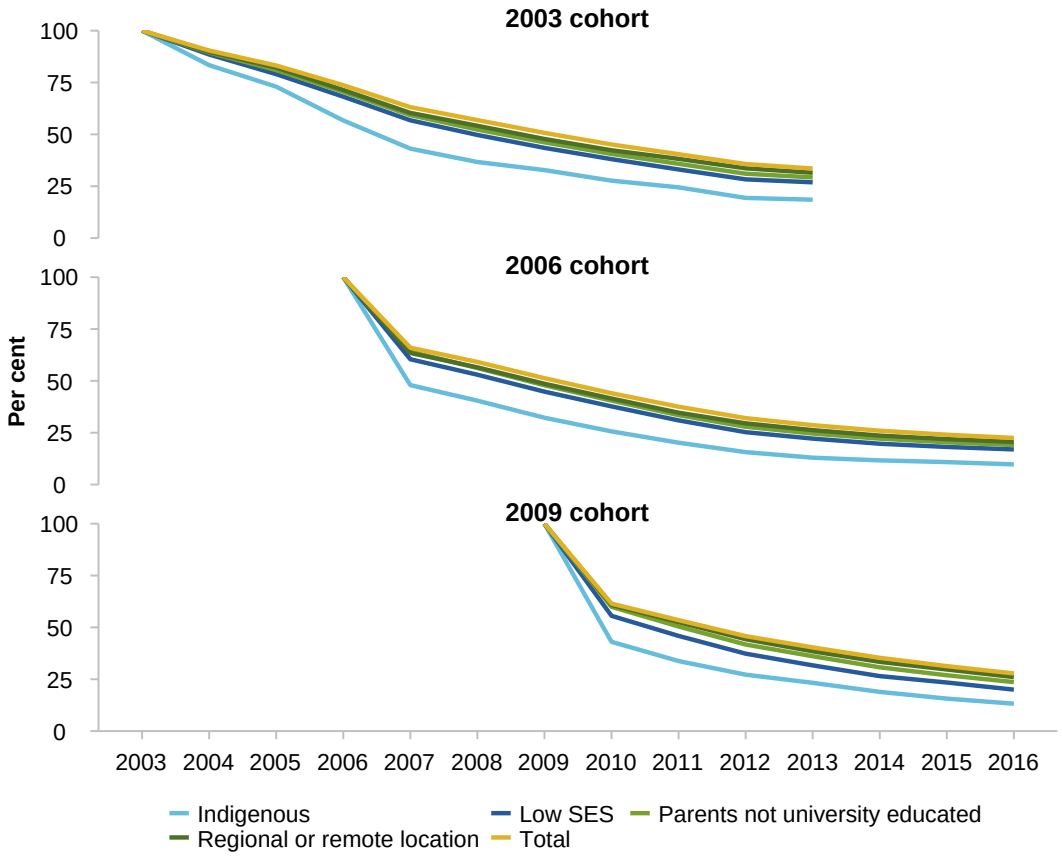
Source: Commission estimates based on LSAY.

B.2 Sample attrition in the LSAY

The greatest challenge in using LSAY data is addressing sample attrition. Attrition occurs when respondents did not complete follow up surveys, or cannot be contacted. It is a feature of all longitudinal surveys, but is more substantial for the LSAY and other surveys involving young people (Watson and Wooden 2009). Item non-response may also occur, as with all surveys.

In the LSAY, substantial attrition occurs between the initial wave and the first follow up survey and cumulates over time. By the final wave of the survey, at age 25 years, around 25 to 30 per cent of the original sample remains (figure B.2). The 2003 survey design was different from other years because the PISA tests of school achievement were administered separately from the LSAY questionnaire, with some additional sample loss between these events. Attrition rates are generally higher for men, people from low SES backgrounds, those from regional or remote areas and, particularly, Indigenous students.

Figure B.2 **Sample attrition by equity group**
Share of initial sample remaining



Source: Productivity Commission estimates based on LSAY

The gradual loss of sample leads to less precise estimates of parameters and, to the extent that the sample become unrepresentative of the Australian population, may bias estimates of group means relevant to this study (such as university participation rates and drop-out rates).

This paper addresses potential attrition bias using an approach similar to that recommended by NCVER (Lim 2011). Inverse probability weights are constructed from a logit regression of attrition on a range of demographic characteristics (table B.3). The weights used in this paper differ in two ways from those provided by NCVER. First, we use a consistent set of weighting variables across all three cohorts. Second, weights are calculated separately every time a statistic is generated to correct for effective loss of sample due to item non-response.

Table B.3 **Weighting variables[a]**

Variable	*Description*
State	State of school attending
School sector	Sector of school
School ID	Dummy variable for each unique school
Gender	Female or male
Grade	Student year level, relative to modal school year
Indigenous [b]	Indigenous status
Parents education	Highest educational level of parents
Parents occupation	Occupational status of parents
Immigration status	Immigration status
Geographic location	Geographic location based on home address
School achievement in maths	Mathematics achievement quartile (age 15)
School achievement in science	Science achievement quartile (age 15)
School achievement in reading	Reading achievement quartile (age 15)

a School achievement used in the 1995 and 1998 cohorts was not based on PISA. **b** Indigenous status in the 2003 cohort was only asked of LSAY participants (and not recorded for the full set of students in the PISA sample which LSAY was pulled from). As such the Indigenous sample in the 2003 cohort may not be representative of the Australian population.

Source: NCVER.

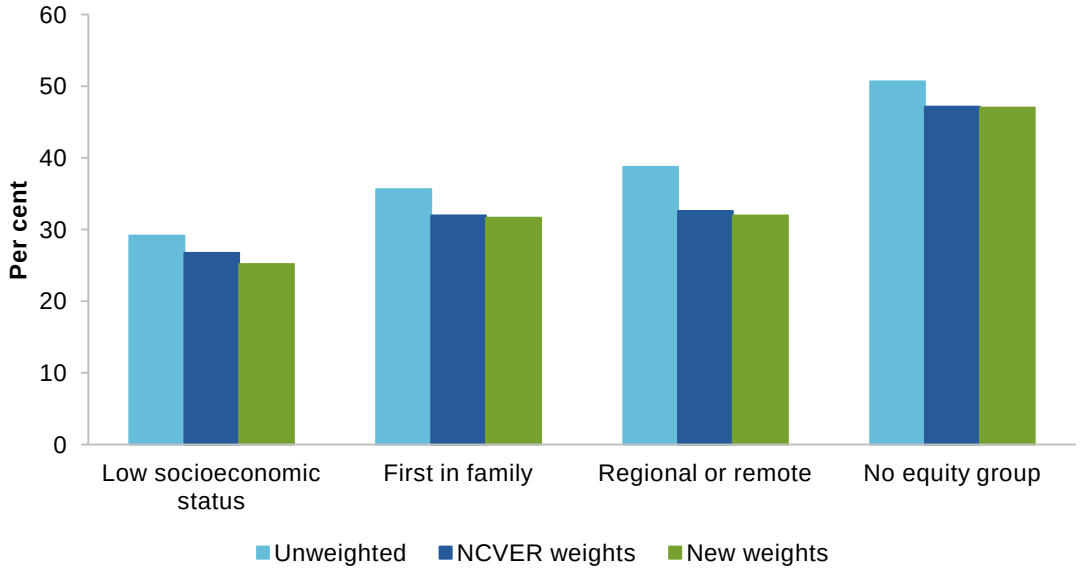
To illustrate the impact, and importance, of applying weights when using LSAY, figure B.3, shows the proportion of students employed in managerial or professional occupations (measured at age 25 years) across four distinct equity groups. Unweighted point estimates are presented alongside means using NCVER provided weights, and our set of newly constructed weights.

- The proportion of graduates employed in managerial or professional occupations is artificially high when no weights are applied.
- When NCVER weights are applied, the average falls relative to the unweighted means.
- When the Commission weights are applied the average falls even further. This suggests, that of the sample that remains (after accounting for attrition) those who actually *report*

their occupation are over-represented by individuals with characteristics associated with a higher likelihood of employment in a managerial or professional occupation.

Figure B.3 **Example: the impact of weights**

Share of group in managerial or professional work, age 25 years (2006 cohort)



Source: Productivity Commission estimates based on LSAY.

B.3 Regression modelling and variables

Probit regressions are estimated separately for each cohort using two model specifications. In the first model, the goal is to describe the patterns of university attendance based on individual, family, school and regional characteristics. This model excludes the ATAR variable to allow a reduced-form interpretation of the parameters of interest (such as the effect of literacy and numeracy at age 15 on university attendance). In the second model, the goal is to predict accurately who would or would not attend university. In this model, the ATAR variable is included to improve prediction performance. Estimated distance between a student's home address in the last year of school and the nearest university campus is also added in place of a 'regional or remote location' indicator, as this improves goodness of fit in some cohorts.

Variable selection

The study makes comparisons across LSAY cohorts. For this reason, a consistent set of explanatory variables is used in each regression to the extent possible (table B.4). One exception is that the measure of school achievement in the 1995 and 1998 cohorts is different from that used in the 2003, 2006 and 2009 cohorts, which limits comparability of later results with those from the earlier cohorts.

Aspiration at age 15 years to attend university is not included as an explanatory variable in this study for two reasons, despite previous studies linking aspiration to observed university attendance at older ages (Homel and Ryan 2014; Johnston et al. 2014). First, the LSAY does not contain a consistent measure of aspiration across the 2003, 2006 and 2009 cohorts (table B.5). Second, aspiration may be endogenous with attendance: the intent to take an act presumably is affected by similar unobserved factors as the act itself, such as perceived opportunity to attend, for example (Homel and Ryan 2014). As such, including aspiration may bias the estimates of additional students. Were aspiration included as a regressor, the increase in aspiration following the introduction of the demand driven system would appear to explain part of the increase in student numbers when in fact it is a result of an endogenous change in students perceived opportunities and other factors.

Table B.4 **Regression variables**

Variable	*Model*[a]	*Data type*	*Wave*	*Description*
University attendance by age 22 years	1 & 2	Binary	1-8	Whether or not they ever responded that they were studying a bachelor degree
University attendance by age 19 years	1 & 2	Binary	1-5	Whether or not they ever responded that they were studying a bachelor degree
University attendance by age 22 : Group of Eight universities	1 & 2	Binary	1-8	Whether or not they ever responded that they were studying a bachelor degree at a Group of Eight university
Gender	1 & 2	Binary	1	Gender response
State	1 & 2		1	State of school attended
Indigenous status	1 & 2	Binary	1	Whether or not Indigenous response
Socioeconomic status	1 & 2	Quartile	1	Highest ranking parental occupation, using International Socioeconomic Index (ISEI).
PISA score	1 & 2	Quartile		Average PISA score based on standardised testing in numeracy and literacy at age 15
Parental education	1 & 2	Binary	1	Reported at least one parent has a university degree (ISCED score of 5A or 6)
School sector	1 & 2	Categorical	1	Government, catholic or independent school
School SES	1 & 2	Quartile	1	Average socioeconomic status of students at the school
Location	1	Binary	1	Regional or remote or metropolitan location. Based on reported residential postcodes concorded to the Australian Statistical Geography Standard (ASGS)
Distance to closest university (log)	2	Numeric	End of school	Geodesic distance from reported postcode of residence in last year of school to the closest university campus
Non-English speaking background	1 & 2	Binary	1	Arrived in Australia less than 5 years prior to the first wave of the cohort and live in a home where a language other than English is spoken
Index of education and occupation	1 & 2	Quartile	1	Matched residential postcode to the Australian Bureau of Statistics (ABS) Socio-Economic Indexes for Areas Index of Education and Occupation
Attend year 12	1 & 2	Binary	All	If they ever reported they were in year 12 or completed year 12
Hours worked in year 12	1 & 2	Numeric	Year 12	Average weekly hours worked in the year they reported they were in year 12. If they never reported they were in year 12, but they completed year 12, the hours worked in the preceding year are used If they never completed or reported they were in year 12, the hours worked in year of wave 12 minus reported year level in wave 1 are used
Interaction between hours worked and year 12 attendance	1 & 2	Numeric	Year 12	If attended year 12, then 0, otherwise equal to hours worked in year 12
Books	1	Ordinal	1	Reported number of books in the home: 0-100, 101-500, or greater than 500
Grade	2	Ordinal	1	School year level

a Model 1 is model used in the decompositions; model 2 is the model used in estimating additional students.

Table B.5 **Measurements of aspiration in the LSAY**
2003, 2006 and 2009 cohorts[a]

Cohort (variable)	*Question*	*Possible responses 2003*	*Possible responses 2006*	*Possible responses 2009*
2003 (ST23Q06) & 2009 (EC05Q01F)	Which of the following do you expect to complete	Tick box (yes or no)	NA	Tick box (yes or no)
2003 (LAA005), 2006 (ST48N01) & 2009 (ST65N01)	In the year immediately after you leave school what do you plan to do?	• Go to university • Get an apprenticeship • Get a traineeship • Go to a TAFE college • Do some other study or training • Look for work/get a job • Defence forces • Travel • Other • Don't Know	1. Go to university 2. Get an apprenticeship 3. Get a traineeship 4. Go to a TAFE/VET college 5. Do some other study/training 6. Look for work/get a job 7. Gap year/Time off/Travel 8. Other 9. Don't know	1. Go to University 2. Get an apprenticeship 3. Get a traineeship 4. Go to a TAFE or VET (vocational) college 5. Do some other study or training 6. Look for work/get a job 7. Gap year / time off 8. Don't know 9. Something else 10. Travel 11. Self-development in sports or performing arts 12. Defence force
2003 (LAA009), 2006 (ST49N01) & 2009 (ST66N01)	Do you plan to do any further study at any other time after you leave school?	1. University 2. Apprenticeship 3. Traineeship 4. TAFE college 5. Defence forces 6. Other 7. Don't Know	1. No - no further study plans 2. Yes - university course 3. Yes - apprenticeship 4. Yes - traineeship 5. Yes - other TAFE/VET course 6. Yes - some other study/training 7. Other 8. Don't know	1. No 2. Yes, university course 3. Yes, apprenticeship 4. Yes, traineeship 5. Yes, other TAFE or VET course 6. Other 7. Don't know 8. Defence force 9. Performing / Creative arts training 10. Professional sports

a All questions are from the first wave of the cohort.

Derived variables

While some variables were taken directly from the LSAY dataset, several were derived either from the LSAY data or by matching LSAY data with other data.

Hours worked in year 12

Anlezark and Lim (2011), using LSAY data, found that combining school and work has a modest negative impact on school and post-school study outcomes when the hours are long (in excess of 15-20 hours a week). To account for this effect, this study's modelling of outcomes includes reported hours worked of school students in year 12. As this study includes school students who did not attend year 12, an interaction term was added to isolate the effect of hours worked for only those students who go on to attend year 12.

Neighbourhood socioeconomic status

The socioeconomic status of the neighbourhood in which one grows up can affect the likelihood of university participation in a number of ways. For example, more affluent areas may more readily provide university-educated role models that help develop aspiration to attend university during childhood. To capture these neighbourhood effects, data from the Census of Population and Housing were merged into the LSAY based on the postcode of the student in the first wave of the sample. The study uses the ABS Socio-Economic Index for Areas (SEIFA) 'index of education and occupation' as a measure of socio-economic status of the region, with annual data constructed by linear interpolation between census years. This index had better explanatory power in the models than alternatives tested including the ABS 'index of relative socio-economic disadvantage', the 'index of economic resources', and local area unemployment and youth unemployment rates.

Distance

Many students attending university remain in their parent's dwelling given the cost of independent living. In 2017, the cost of living for a university student in the family home was estimated to be just under $11 000 annually, while the most likely alternative (shared renting) was more than 140 per cent more costly (ASG 2017). Staying in the family home is not an option for students when they do not live in close proximity to a university campus — and these students may not be able to access family and other support networks. The consequence is that the effective cost of university participation will often be much higher for students originating from places distant from a campus. This is likely to partly explain the lower university participation rates of young people from regional areas (Cooper, Baglin and Strathdee 2017). To assess the importance of this effect, geodesic distance was measured to the nearest university campus from a centroid of the postal area in which the student resides during the last wave that they reported they were in school.

Campus addresses were obtained from university websites and specialist campuses were excluded (defined as campuses that only offer bachelor degrees one field of study). We determined the longitude and latitude of each student's postcode, using the statistical software package R to access location data from Google maps, then calculated the minimum distance between each student postcode and campus address.

There is limited evidence on what is a reasonable distance to commute to university. In an Australian context, Urbis (2018) used a 60 km threshold as the distance beyond which commuting was a tenable option, but this was based on assumption rather than empirical evidence. Frenette (2007) considered attendance of students growing up more than 80 km from a university campus, 40 km to 80 km and less than 40 km is within commuting distance for most people. This study uses a log transformation of distance measured as a continuous variable. It provided the highest predictive power for the data used in this study, based on various transformations of the distance variable, including an ordinal distance variable with cut-offs at 40 km and 80 km.

While the above approach to variable definition is tractable, it is likely to downplay the importance of distance because the quality and diversity of courses at the closest university may not match the preferences of students.

Books

Cultural capital — the social assets of a person (education, social networks, the nature of familial conversations, access to diverse experiences) — provides an avenue for social mobility, including academic achievement and access to university (Bourdieu and Passeron 1990; Noble and Davies 2009). Having books in the home is one aspect of this capital, with evidence from LSAY that found that having more than 100 books is a major driver of academic achievement (in school) and university aspirations — exceeding the effects of parental education and occupation (Johnston et al. 2014).

Defining equity groups in the LSAY

No single dataset is ideal for the examination of the impact of equity group background and tertiary education outcomes. In contrast with administrative data from the Department of Education and Training, LSAY tracks children from school age and contains richer information on child and family traits than DET administrative data. On the other hand, the limited sample size of the LSAY and challenges of survey attrition mean that group mean participation rates may be less accurate than those derived from administrative data sets. The LSAY dataset also only relates to young people, aged 15 to 25 years, whereas published figures on equity group participation rates from administrative data are based on all years of age.

Some of the most important differences between equity groups as defined in this study and from DET administrative data are:

- This study defines someone as a ‘first in family’ student if neither parent holds a university degree. This is coded based on attainment of International Standard Classification of Education (ISCED) level 5A or 6 qualifications. Administrative data collections do not report first in family students.
- This study defines regional and remote status based on a student’s postcode at age 15 years (concorded to the ASGS classification). These data were available in a restricted

access LSAY dataset. Administrative data collections rely on the permanent address provided at the time they enrol in university and is less likely to capture a student's regional origin.

- This study defines socioeconomic status based on the student's family. It uses parental occupation when the student is 15 years old at the four digit International Standard of Occupation level mapped to the International Socio-Economic Index of occupational status index. This is a more accurate measure of the relative advantage of a child's upbringing than the administrative measure, which is based on the ABS Socio-Economic Index for Areas of a student's permanent (out of semester) address provided at the time they enrol in university.
- This study defines non-English speaking background (NESB) as a student who migrated to Australia at or before the age of ten and who speaks a language other than English at home. This is similar to administrative data in which the definition of NESB is based on whether a student migrated to Australia at most ten years before enrolling at university and speaks a language other than English at home. [20]
- This study excludes disability as an equity group because some people with disabilities are out of scope of the LSAY survey.

B.4 Decomposing differences in group means

Factors that affect individual decisions to attend university also contribute to differences in participation between groups. In a linear regression model, it is common (following Oaxaca (1973) and Blinder (1973)) to decompose differences between groups into contributions from group membership alone (e.g. being from the lowest SES quartile) and contributions from differences in group characteristics (for example, that members of the lowest SES quartile may have lower school achievement, more commonly attend public schools, and so forth). The difference in group predictions between a 'Group 1' and 'Group 2' with characteristics X_1 and X_2 is given by the difference in the group means multiplied by the estimated coefficients $\hat{\beta}$. That is, the average difference between the predicted outcomes for the two groups is $(\bar{X}_1 - \bar{X}_2)'\hat{\beta}$. It is natural to define the contribution of a particular characteristic k to the average group difference as:

$$c_k = \frac{(\bar{X}_{1,k} - \bar{X}_{2,k})\widehat{\beta_k}.}{(\bar{X}_1 - \bar{X}_2)'\hat{\beta}.}$$

In non-linear models, like the probit models used in this paper, there is no longer a natural decomposition. A range of alternative approaches have been developed that involve different

[20] The reason why the age of 10 years was chosen (instead of 10 years before university enrolment) was to allow calculation of the size of the population that did not attend university in a consistent manner (which is required to estimate the university participation rate). Participation rates based on administrative data rely on ABS Census data to estimate the population that did not attend university.

ways of comparing members of each group and different ways to linearise the predicted probabilities (for example, Fairlie (2005); Yun (2004)). The Oaxaca-Blinder decomposition is then applied to the linearised probabilities and averaged across the comparisons.

The current paper applies an approach developed by Schwiebert (2015). The approach has two advantages compared with alternative methods. First, it is not dependent on a choice of which members of Group 1 are compared with which members of Group 2. Rather, *every* pairwise comparison is made and the results are averaged. Second, it is not dependent on a choice of whether to linearise predicted probabilities at the observation from Group 1 or at the observation from Group 2. Rather, the predicted probabilities are linearised based on the average slope between the observations. That is, if Group 1 has n_1 members indexed by $i \in I_1$ and Group 2 has n_2 members indexed by $j \in I_2$ then the contribution of a particular characteristic k to the average group difference is given by:

$$c_k = \frac{1}{n_1 n_2} \sum_{i \in I_1} \sum_{j \in I_2} \frac{\left(\Phi\left(-X_i'\hat{\beta}\right) - \Phi\left(-X_j'\hat{\beta}\right)\right)(X_{i,k} - X_{j,k})\widehat{\beta_k}}{(X_i - X_j)'\hat{\beta}}$$

Detailed results

The tables presented in this section report in more detail on the decomposition results illustrated in chapter 3 of the report. They consider the gap in university participation rates between equity groups and the rest of the population. Results are calculated separately for each of the four different equity groups and for each of the 2003, 2006 and 2009 LSAY cohorts.

Contributions to the gap in university participation depend upon differences in the typical characteristics of the equity and non-equity groups and the importance of those characteristics in the probit regressions. For example, the differences in university participation rates between 'first in family' and 'non-first in family' groups that can be attributed to the school sector they attended depend on the differences in the proportions of those groups in each school sector and the overall effect of school sector on university attendance (holding all else constant).

Similarly, changes in contributions to the gap over time can occur because the two groups are becoming more different or similar in that characteristic or because the importance of that characteristic is changing. For example, if the school sector is becoming less important over time for low socioeconomic students, it may be because either (or both) lower socioeconomic students are (relative to other students) becoming less likely to go to government schools or the effect of the school sector on university attendance is becoming less important over time.

Table B.6 **Indigenous status**

Contributions to gap in university participation

	2010	*2013*	*2016*
	% pts	*% pts*	*% pts*
Indigenous participation rate	30	24	29
Non-Indigenous participation rate	54	56	61
Gap in university attendance	24	33	32
Per cent of the gap explained by:	*%*	*%*	*%*
Literacy and numeracy	58	32	29
Family characteristics	10	13	8
Books	*0*	*0*	*0*
English speaking background	*2*	*2*	*2*
First in family	*8*	*6*	*8*
Low socioeconomic status	*0*	*4*	*-1*
School	6	7	8
Sector	*10*	*3*	*5*
School socioeconomic status	*-4*	*6*	*2*
Neighbourhood	5	4	5
Geographic	0	6	3
Other characteristics	-1	8	1
Gender (male)	*-7*	*0*	*-7*
Worked 10 or more hours	*0*	*2*	*1*
Attended year 12	*5*	*1*	*14*
*Interaction term (hours * attend year 12)*	*0*	*0*	*-3*
State	*1*	*4*	*-4*
Specific to being Indigenous	23	29	46

Source: Productivity Commission estimates based on LSAY.

Table B.7 **Regional or remote location**

Contributions to gap in university participation

	2010	*2013*	*2016*
	% pts	*% pts*	*% pts*
Regional/remote participation rate	47	44	47
Metropolitan participation rate	56	62	66
Gap in university attendance	9	18	19
Per cent of the gap explained by:	%	%	%
Literacy and numeracy	6	13	18
Family characteristics	26	15	12
Books	*0*	*0*	*0*
English speaking background	*11*	*4*	*4*
First in family	*14*	*8*	*9*
Low socioeconomic status	*2*	*3*	*-2*
School	1	15	11
Sector	*16*	*2*	*6*
School socioeconomic status	*-14*	*13*	*5*
Neighbourhood	28	9	15
Other characteristics	37	18	16
Gender (male)	*-3*	*3*	*0*
Worked 10 or more hours	*15*	*6*	*6*
Attended year 12	*27*	*7*	*9*
*Interaction term (hours * attend year 12)*	*-3*	*1*	*-3*
State	*-1*	*-1*	*3*
Indigenous status	*1*	*2*	*2*
Specific to being from a regional or remote location	2	30	29

Source: Productivity Commission estimates based on LSAY.

Table B.8 **Low socioeconomic status**

Contributions to gap in university participation

	2010	*2013*	*2016*
	% pts	% pts	% pts
Low socioeconomic status participation rate	36	38	46
Not low socioeconomic participation rate	58	61	64
Gap in university attendance	22	23	17
Percentage of the gap explained by:	%	%	%
Literacy and numeracy	52	42	52
Family characteristics	18	16	21
Books	*0*	*0*	*-1*
English speaking background	*-1*	*-1*	*-2*
First in family	*19*	*16*	*23*
School	4	11	13
Sector	*10*	*3*	*10*
School socioeconomic status	*-6*	*8*	*3*
Neighbourhood	6	4	11
Geographic	0	2	5
Other characteristics	11	16	17
Gender (male)	-3	-1	-3
Worked 10 or more hours	4	2	8
Attended year 12	12	13	14
*Interaction term (hours * attend year 12)*	-1	2	-5
State	0	-1	1
Indigenous status	0	1	1
Specific to being low socioeconomic status	7	8	-18

Source: Productivity Commission estimates based on LSAY.

Table B.9 **First in family**

Contributions to gap in university participation

	2010	*2013*	*2016*
	% pts	% pts	% pts
First in family participation rate	41	43	47
Not first in family participation rate	71	75	79
Gap in university attendance	29	32	32
Percentage of the gap explained by:	% pts	% pts	% pts
Literacy and numeracy	36	29	36
Family characteristics	3	8	-2
Books	*0*	*0*	*-1*
English speaking background	*1*	*2*	*2*
Low socioeconomic status	*2*	*6*	*-3*
School	3	9	7
Sector	*8*	*1*	*5*
School socioeconomic status	*-5*	*7*	*2*
Neighbourhood	6	4	7
Geographic	0	2	2
Other characteristics	14	15	13
Gender	*-2*	*0*	*0*
Worked 10 or more hours	*6*	*4*	*8*
Attended year 12	*11*	*9*	*9*
*Interaction term (hours * attend year 12)*	*-1*	*1*	*-5*
State	*0*	*0*	*0*
Indigenous status	*0*	*1*	*1*
Specific to first in family	38	33	36

Source: Productivity Commission estimates based on LSAY.

Table B.10 **Population composition of equity groups and total**

Per cent of group

Equity group and total	*Group composition*	*2003*	*2006*	*2009*
		%	%	%
Indigenous	First in family	77	80	82
Indigenous	Government school	81	86	74
Indigenous	Low neighbourhood SES	39	48	41
Indigenous	Low PISA	51	43	35
Indigenous	Low school SES	37	35	43
Indigenous	Not attend year 12	19	11	22
Regional or remote	First in family	68	73	70
Regional or remote	Government school	69	69	65
Regional or remote	Low neighbourhood SES	43	39	44
Regional or remote	Low PISA	21	27	26
Regional or remote	Low school SES	43	38	40
Regional or remote	Not attend year 12	19	17	13
Low SES	First in family	88	88	87
Low SES	Government school	75	76	72
Low SES	Low neighbourhood SES	36	36	40
Low SES	Low PISA	35	38	34
Low SES	Low school SES	45	42	47
Low SES	Not attend year 12	20	21	15
First in family	Government school	69	68	64
First in family	Low neighbourhood SES	32	31	34
First in family	Low PISA	28	30	29
First in family	Low school SES	32	31	33
First in family	Not attend year 12	18	18	13
Total population	First in family	60	61	59
Total population	Government school	61	61	57
Total population	Low neighbourhood SES	25	24	25
Total population	Low PISA	22	23	22
Total population	Low school SES	24	24	24
Total population	Not attend year 12	14	14	10

B.5 Identifying additional students

The demand driven system allowed people to enter university who would not previously have had the opportunity (or perhaps inclination). This paper seeks to identify the characteristics of these additional students. To do so, we estimate the probability that a school student in the 2009 cohort would have attend university by age 22 years. This is compared with a counterfactual, which is the probabilities they would have attended if they were part of the 2003 cohort. If a school student did not go on to attend university in the 2009 cohort, their predicted probability of attending is assumed to be zero.

Maintaining the assumptions of the probit model and considering only those people in the 2009 sample, then the unconditional probability that they would have attended in the 2003 and 2009 sample is given by the following:

$$Prob\left(Attend_{2003,i}\right) = Prob(X_i{'}\beta_{2003} + u_i > 0)$$

$$Prob\left(Attend_{2009,i}\right) = Prob(X_i{'}\beta_{2009} + e_i > 0)$$

Estimates from probit regressions allow us to predict the unconditional probabilities of those people in the 2009 sample attending in 2003 and 2009 by the following:

$$\widehat{Prob}\left(Attend_{2003,i}\right) = Prob\left(X_i{'}\hat{\beta}_{2003} + u_i > 0\right) = \Phi(X_i{'}\hat{\beta}_{2003})$$

$$\widehat{Prob}\left(Attend_{2009,i}\right) = Prob\left(X_i{'}\hat{\beta}_{2009} + e_i > 0\right) = \Phi(X_i{'}\hat{\beta}_{2009})$$

What we know with certainty is whether they attended as part of the 2009 cohort. We use this condition and the structure above to predict the probability of any person in the 2009 cohort being in one of three categories. For those students that attended university as part of the 2009 cohort, we distribute their weight across two categories: the 'other students' that were predicted to attend were they part of the 2003 cohort (given our estimates of $\hat{\beta}_{2003}$) and the 'additional students' that were predicted not to attend as part of the 2003 cohort. Those observed to be 'non-attenders' as part of the 2009 cohort form a third category.

$$Prob\left(Other\ student_{2009,i}\right) = \Phi_2(X_i{'}\hat{\beta}_{2009}, X_i{'}\hat{\beta}_{2003}, \rho)/\ \Phi(X_i{'}\hat{\beta}_{2009})$$

$$Prob\left(Additional\ student_{2009,i}\right) = 1 - \Phi_2(X_i{'}\hat{\beta}_{2009}, X_i{'}\hat{\beta}_{2003}, \rho)/\ \Phi(X_i{'}\hat{\beta}_{2009})$$

In general, the unobserved characteristics of a person captured in the error terms — such as ambition, diligence and resilience — may have had a different effect on university attendance at different times. As we do not observe the counterfactual scenario, it is not possible to estimate the correlation in errors compared with those in the factual scenario and it is necessary to make an assumption. For the results shown in chapter 2, we assume these unobserved characteristics would have had the same effect in both periods, so that $e_i=u_i$ and $\rho=1$. Under this assumption, among the sample that attends university in the 2009 cohort we obtain conditional probabilities given by:

$$Prob\left(Other\ student_{2009,i}\right) = 1\ if\ X_i'\hat{\beta}_{2003} > X_i'\hat{\beta}_{2009}$$

$$\Phi(X_i'\hat{\beta}_{2003})/\ \Phi(X_i'\hat{\beta}_{2009}) \text{ otherwise}$$

$$Prob\left(Additional\ student_{2009,i}\right) = 0\ if\ X_i'\hat{\beta}_{2003} > X_i'\hat{\beta}_{2009}$$

$$1 - \Phi(X_i'\hat{\beta}_{2003})/\ \Phi(X_i'\hat{\beta}_{2009}) \text{ otherwise}$$

The same approach is taken to identify additional students in the 2006 cohort compared with the 2003 cohort.

Choi (2015) undertakes a somewhat similar examination of the effects of expanding university access for young Koreans by comparing age cohorts within a household survey undertaken between 1998 and 2009. Two observations may help compare that analysis with the current study. First, Choi (2015) relies on comparisons across age cohorts within a single cross-sectional data set, which means older cohorts had the opportunity for mature entry to university that younger cohorts have not yet had. This paper compares cohorts at the same age. Second, Choi (2015) implicitly assumes that there is zero correlation between the effect that unobserved characteristics had and the effect they would have had were a person counterfactually part of an earlier cohort.

Summary statistics of the additional students and other students are displayed in table B.11 and figures B.4 and B.5, from two different perspectives. Table B.11 shows where the additional and other students come from, which provides an indication of how the composition of university participants has changed since the introduction of the demand driven system. For example, the composition of university participants has shifted toward more first in family students.

Figures B.4 and B.5 show the participation rates of various groups of young people in 2013 and 2016, respectively. These stacked bar charts provide an indication of the changes in the university participation rates brought about by the additional students. The other students component is the participation rate without the additional students. The combined two components is the participation rate with both the other and additional students.

Table B.11 **Who are the additional students?**

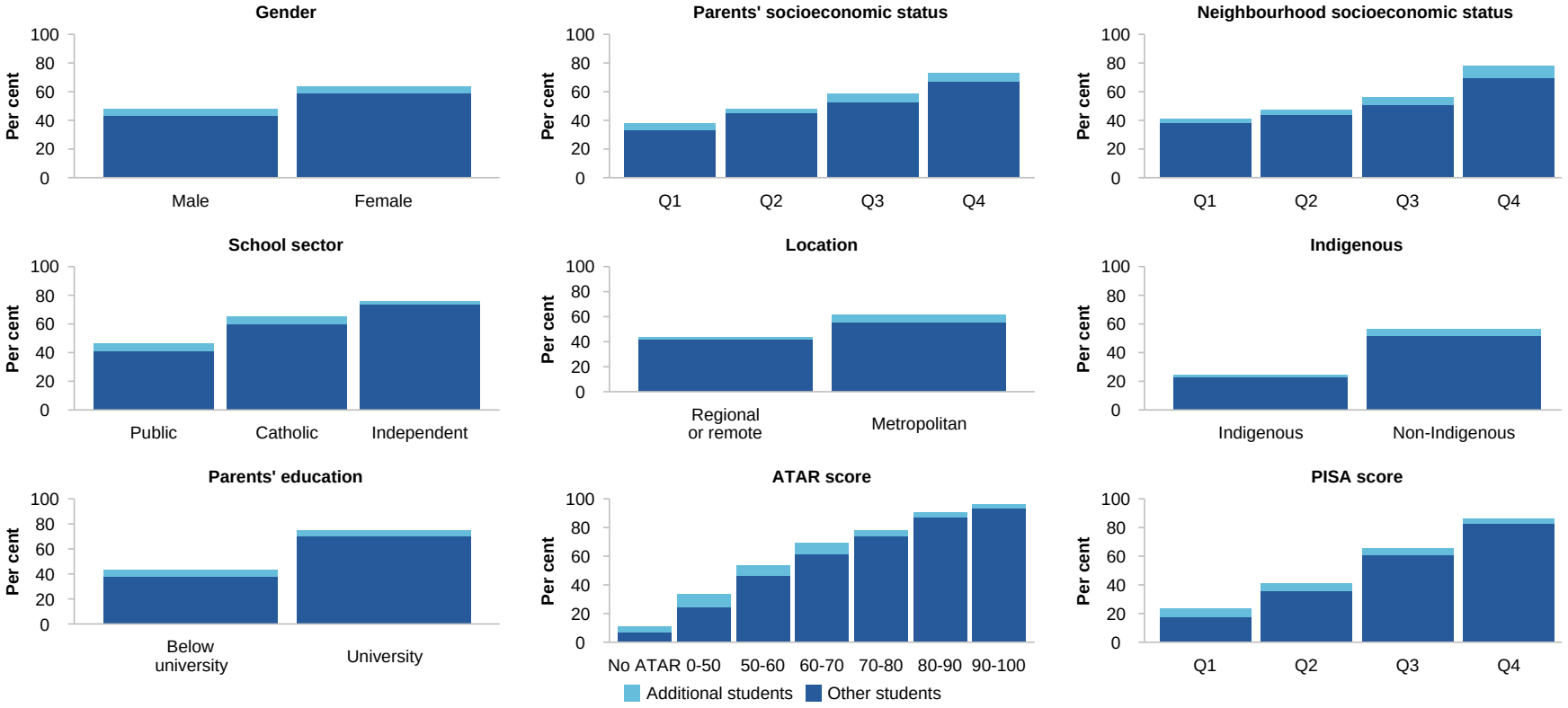
Per cent by age 22 years in 2016[a]

Category	*Group*	*Additional students*	*Other students*	*Not attended*	*Total*
Socioeconomic status	Quartile 4	22.4	35.0	17.6	27.3
	Quartile 3	26.9	26.0	24.5	25.5
	Quartile 2	18.4	24.5	29.9	26.3
	Quartile 1	32.3	14.5	28.0	20.9
First in family	First in family	35.4	55.0	21.6	40.5
	Not first in family	64.6	45.0	78.4	59.5
Indigenous status	Not indigenous	98.4	98.8	95.6	97.5
	Indigenous	1.6	1.2	4.4	2.5
Location at age 15	Metropolitan	82.3	74.9	58.5	68.7
	Regional or remote	17.7	25.1	41.5	31.3
Equity group	Not disadvantaged	27.0	41.7	12.3	29.1
	Disadvantaged	73.0	58.3	87.7	70.9
Neighbourhood socioeconomic status	Quartile 4	35.4	34.2	11.6	25.2
	Quartile 3	21.8	24.9	22.1	23.6
	Quartile 2	18.8	23.1	30.2	25.7
	Quartile 1	24.0	17.8	36.0	25.5
Institution network	Group of Eight	11.3	28.5	0	26.9
	Australian Technology Network	7.4	8.6	0	8.6
	Innovative Research Universities	14.9	16.2	0	16.1
	Other universities	42.4	34.5	0	35.2
	Regional Universities Network	4.3	4.8	0	4.8
	Not reported	19.7	7.4	0	8.5
School sector	Independent	14.8	26.4	10.9	19.5
	Catholic	25.7	26.6	18.8	23.4
	Government	59.5	47.0	70.3	57.0
Gender	Male	51.4	41.0	58.6	48.6
	Female	48.6	59.0	41.4	51.4
ATAR score	90-100	5.8	27.1	1.2	15.6
	80-90	6.8	24.1	4.0	15.1
	70-80	14.7	20.0	5.6	14.0
	60-70	16.9	13.8	10.8	12.7
	50-60	11.5	7.0	10.8	8.8
	0-50	19.9	4.2	13.2	8.6
	No ATAR	24.4	3.8	54.3	25.2

a Quartile 4 denotes the top quartile (top 25 per cent) **b** The totals for each of the quartiles differ from 25 per cent due to the effect of survey attrition (survey attrition may also affect the other values).

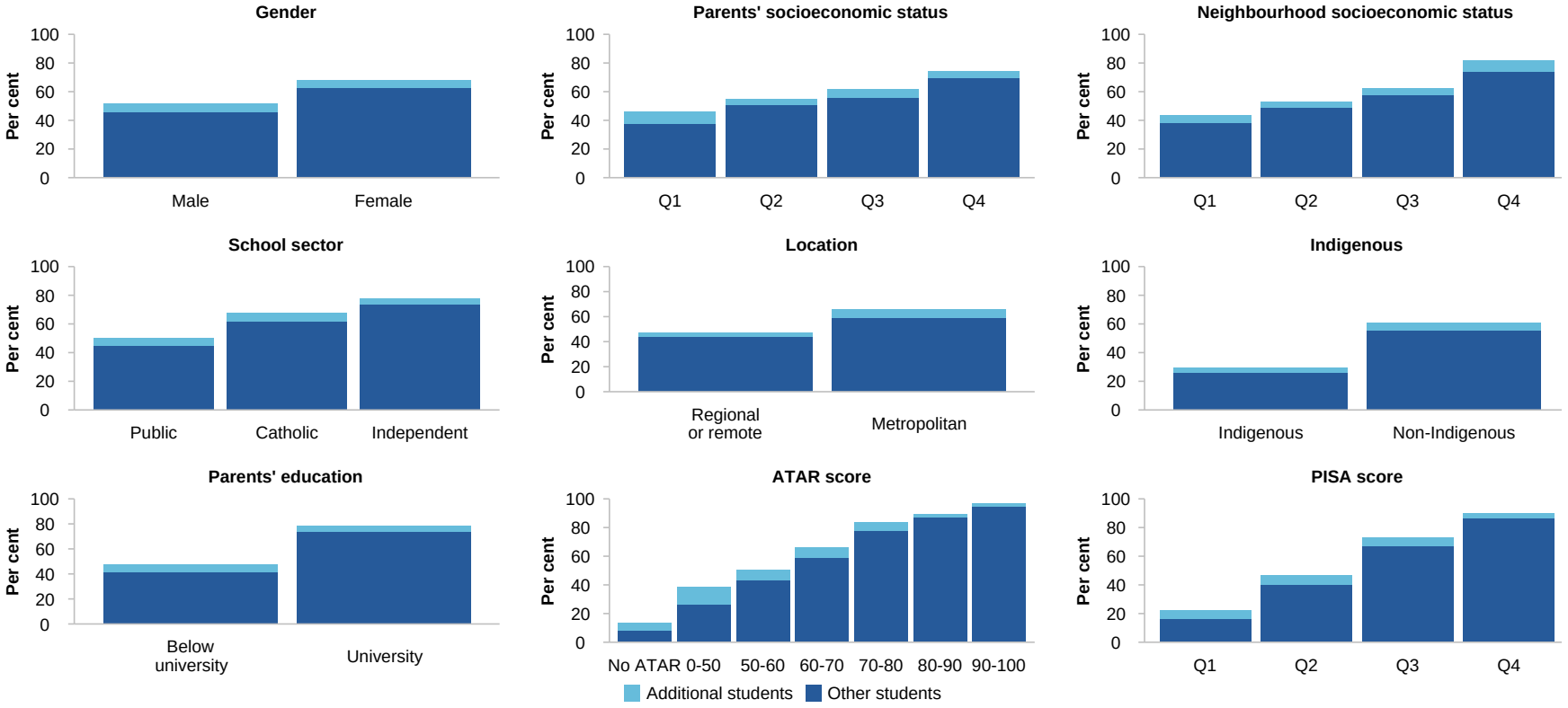
Source: Productivity Commission estimates based on LSAY.

Figure B.4 **University attendance by age 22 years in 2013: additional students and other students**



Source: Productivity Commission estimates based on LSAY.

Figure B.5 **University attendance by age 22 years in 2016: additional students and other students**



Source: Productivity Commission estimates based on LSAY.

B.6 Imputing ATAR scores

The study imputes missing ATAR values where survey respondents report that they received an ATAR but do not report what it was, or where they provided no information about whether they received an ATAR. Depending on the cohort, between 18 and 27 per cent of survey respondents fall into one of these two categories. Where survey respondents report they did not receive an ATAR, this information is coded as a categorical variable and no ATAR score is imputed.

The imputation here uses multivariate imputation by chained equations (MICE) with predictive mean matching (PMM). The technique involves regression analysis to construct an index of ATAR predicted values based on a range of demographic data such as PISA scores, year 12 completion and individual, family, school and region characteristics. These predicted values are then used to match observations with missing ATAR information to similar observations in the data set. The ATAR information of the comparable observation is then used to replace the original observation.

The chained equations approach can handle different types of variables (for example, continuous or binary) as well as complexities such as bounds or survey skip patterns, all simultaneously (Azur et al. 2011). An advantage of MICE with PMM is that it produces imputed values that (1) reflect any inherent skewness in the original variable, (2) are automatically bounded consistent with the original data and (3) are automatically discrete or continuous depending on the underlying data (Carpenter and Kenward 2013). Imputation is undertaken both of (1) whether a respondent received an ATAR and (2) if they did receive an ATAR, what their score would have been. Where the imputation concluded that the respondent did not receive an ATAR the hypothetical ATAR score is overridden with a 'no ATAR' response.

The approach assumes that the missing ATAR values that are 'missing at random' meaning that the probability of data being missing is, after controlling for observable variables, distributed randomly. While difficult to test this assumption directly, analysis showed that the observable student characteristics do a good job of predicting ATAR scores and the predicted distribution of ATARs reconciles with administrative data published by the DET data. The main results on completion and labour market outcomes of additional and other students are robust to alternative treatment of the ATAR, including dropping missing ATAR values or including dummy variables for missing values instead of imputing.

Table B.12 **Variables used for ATAR imputation**

Variables	*Description*
Completed year 12	Whether or not student complete year 12
State	State of school student attended
PISA scores	Based on standardised testing in numeracy and literacy at age 15 years
School SES	Average socioeconomic status of students at the school
School sector	Government, Catholic, independent
Socioeconomic status	Highest ranking parental occupation using ISEI score
Parental education	Reported at least one parent has a university degree (ISCED score 5A of 6
Gender	Male or female
Location	Region or remote or metropolitan (based on reported residential postcodes)
NESB	Student is from a non-English speaking background (see table 4)

B.7 Bootstrapping confidence intervals

Confidence intervals are estimated for the key outcome variables such as university completion rates and labour market transitions (chapter 2) to assess whether differences in group means reflect chance or not. Uncertainty in group means comes from two sources: sampling variation in the data; and uncertainty around predicted probabilities that students are in one or the other of the two groups. These group means are non-linear in the estimated parameters from the university participation equations (as described in B.7 above) and, as such, a computational approach is taken to estimating confidence intervals.

Bootstrapping assigns measures of accuracy to estimated statistics by taking repeated random samples from the original sample with replacement to generate many more random samples. The statistic of interest is calculated from each of these new random samples, and a distribution of possible results is generated from each of these new statistics. This distribution is used to infer the uncertainty around the statistic calculated from the original sample.

The bootstrapping approach used sample weights for the probabilities of drawing each observation from the original sample and drew 5000 samples in this way. The outcome variables were estimated from each of the new samples, to generate a distribution of possible results. A 95 per cent confidence interval is estimated from the 5000 bootstrapped statistics by calculating the standard error of the computed statistics and applying it to the original mean.

The bootstrap standard error is the standard deviation of the individual bootstrap estimates and is calculated as follows. Let $\hat{\theta}$ denote the statistic estimated from the original sample. Then let $\hat{\theta}_b$, b =1,..B denote the B estimates of θ from the bootstrap samples. The bootstrap standard error for $\hat{\theta}$ is then given by:

$$SE(\hat{\theta}) = \sqrt{\frac{1}{B-1}\sum_{b=1}^{B}\left(\hat{\theta}_b - \bar{\theta}\right)^2}$$

From this, the confidence interval of the statistic is estimated by:

$$\hat{\theta} \pm Z_{\alpha/2} \times SE(\hat{\theta})$$

B.8 Propensity score matching

Propensity score matching was used to examine the labour market transitions of students that enrol in vocational and education training courses (VET) relative to students, with otherwise similar characteristics, that attend university. Relative to people that enrol in VET courses, students that attend university are more likely to have a parent that is university educated and have higher school achievement and socioeconomic status. A comprehensive list of baseline characteristics among VET and university students is presented in appendix table B.13.

Propensity scores were calculated using logistic regressions. Enrolment in a VET qualification was chosen as the dependant variable due to smaller number of students that enrol into VET compared with university. Variables included in the regression are those shown in table B.13 as well as dummy variables for the student's grade level when they entered LSAY and their state of residence.

'Neighbourhood matching' of university graduates to students with VET qualifications was undertaken using the Matchit package in R. The method finds pairs of observations that have similar propensity scores (predicted probabilities of attending VET), but that differ in their treatment status (university versus VET). At each matching step, the algorithm chooses the control unit (in our case, a university student) that is not yet matched but is closest to the propensity score of the treated unit (VET student). Due to a limited area of common support (overlap in the propensity scores for VET and university students) a number of observations were discarded. In this sense our analysis is only applicable to students that had a reasonable probability of transitioning from year 12 to either university or VET.

Loess smoother curves were used to estimate the mean of each covariate, by treatment status, at each value of the propensity score. We obtained nearly identical means of each covariate at each value of the propensity score, suggesting that we have a high degree of balance across variables included in our model. Differences in means after matching are shown in table B.13.

Table B.13 **Covariate balance before and after matching[a]**

People aged 25 years in 2016 — excluding students still studying

Variable	*VET (before)*	*University (before)*	*VET (after)*	*University (after)*
Socioeconomic status (parents occupation)	50.0***	60.1***	52.7	50.9
School socioeconomic status	50.9***	56.3***	52.9	52.7
SEIFA (socioeconomic status of postcode)	972.1***	1 030.8***	989.8	992.5
Hours worked in year 12	14.4***	5.2***	6.5	7.4
Parent attended university	28%***	63%***	38%	42%
ATAR	59.9***	83.5***	65.6	67.2
PISA	508.7***	587.8***	546.9	549.4
Male	57%***	45%***	50%	52%
Attended government school	71%***	47%***	57%	56%
Indigenous	5%***	1%***	2%	2%
Regional or remote	47%***	29%***	41%	43%

a VET includes all sub bachelor level qualifications, including those provided by a university. Students that enrolled into both a VET course and university degree, students that are still undertaking study at age 25 years and students that did not receive an ATAR have been excluded from analysis. ***, **, * indicate statistical significance at 1%, 5% and 10% respectively.

Source: Productivity Commission estimates based on LSAY.

B.9 Calculation for age adjusted university access rates

Administrative data from DET on university commencement for different equity groups do not account for the different population growth rates or population age profiles of each group. In assessing university access, these demographic differences are important because university participation varies markedly by age.

For this reason, Appendix A, figure A.2 presents university age-adjusted measures of university access for each equity group. Two measures are used:

- The 'access rate' is the percentage of a relevant population that commenced undergraduate university studies in any given year as a share of the relevant age-adjusted population.
- The 'relative access ratio' is calculated by dividing an equity group's age-adjusted access rate by the access rate of the Australian population as a whole.

A relative access ratio of 100 means that the group has — given its age structure — an equal opportunity for access as Australians as a whole, while a relative access ratio of 50 means members of that group are only half as likely to attend.

The method for age adjustment is based on the direct age standardisation with external weights methodology applied by the Australian Institute of Health and Welfare (2011). The data used in these calculations are commencements from published and unpublished administrative data from the Department of Education and Training and age profiles of the relevant populations from the ABS Census of Population and Housing.

The relative access ratio is calculated as follows. For any given equity group (e) and age (a) the crude access rates and age-adjusted access rates are given by:

$$CrudeAccessRate_e = \frac{UniCommence_e}{POP_e}$$

where $UniCommence_e$ is the number of commencing domestic undergraduate students by equity group, as published by the Department of Education and Training:

$$EquityAgeWeight_{e,a} = \frac{POP_{e,a}}{POP_a}$$

$$POPStudyWeight_a = \frac{POPStudying_a}{\sum_a POPstudying_a}$$

where $POPStudying_a$ is the Australian population recorded as currently studying at a university or tertiary institution by year of age in the Census.

$$AdjAccessWeight_e = \sum_a (EquityAgeWeight_{e,a} \times POPStudyWeight_{a)}\ for\ each\ equity\ group$$

$$AdjPOP_e = AdjAccessWeight_e \times \sum_a POP_a$$

$$AdjAccessRate_e = \frac{UniCommence_{e,a}}{AdjPOP_e}$$

The population access rate to universities is:

$$POPAccessRate = \frac{\sum_a UniCommence_a}{\sum_a POP_a}$$

So for each access group, the relative access rate is:

$$RelativeAccessRatio_e = \frac{AdjAccessRate_e}{POPAccessRate}$$

These access ratios are calculated using domestic commencements. For consistency, an estimate of the number of international students is subtracted from each equity group population. Estimates for age profile of international students were calculated based on

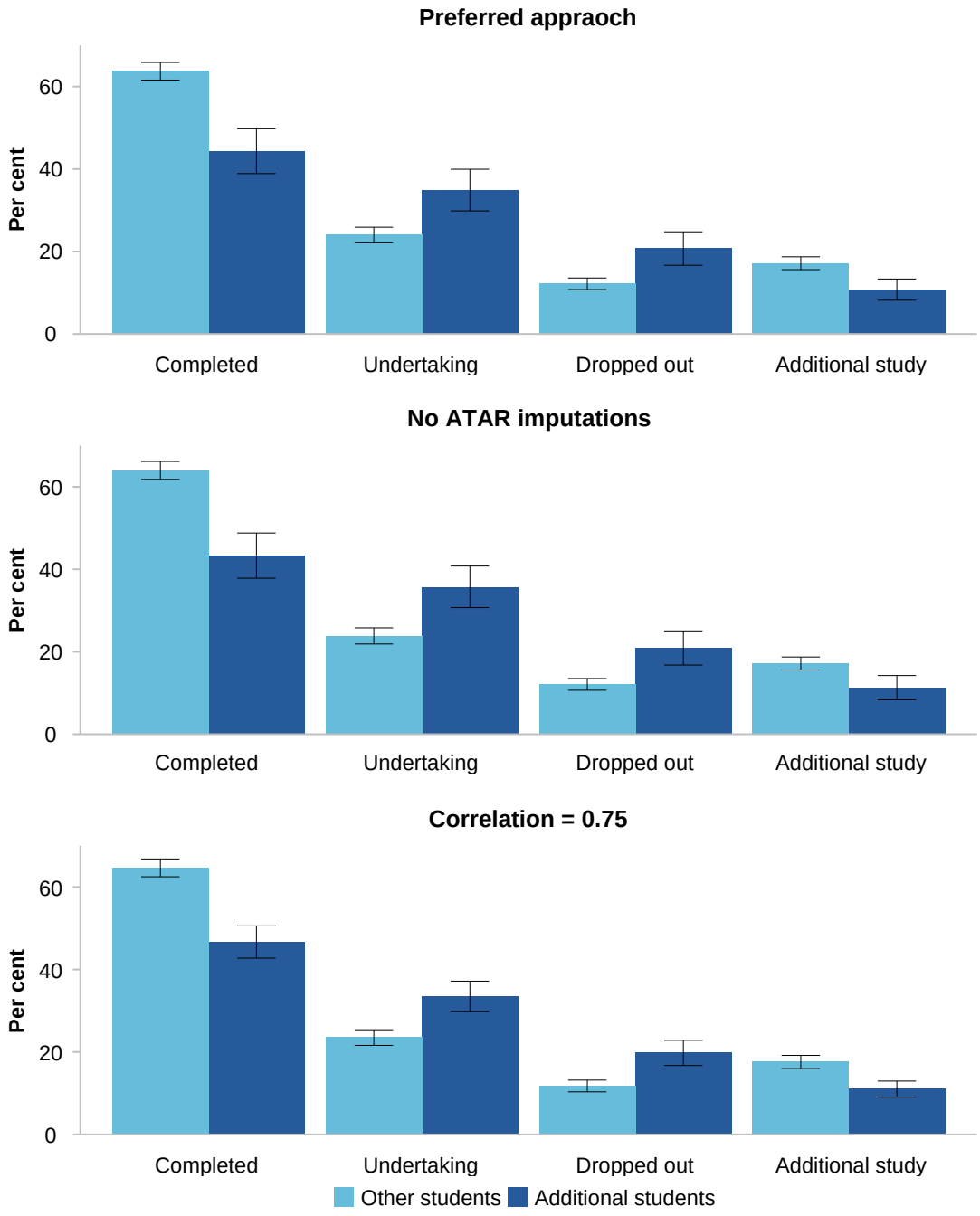
Census data on arrivals in the past two years and applied to the total number of international students from administrative data.

B.10 Robustness checks

To ensure robustness of results, checks have been conducted that address (1) our approach to imputing students' ATAR scores and (2) assumptions regarding the correlation in unobservable characteristics between different points in time. Figures B.6 and B.7 show students' academic and labour market outcomes at age 25 years for our preferred specification (chapter 2), a specification that excludes imputed ATAR scores (which instead includes a dummy variable for missing values) and a specification that assumes imperfect correlation (0.75) regarding the impact of unobservable characteristics on university attendance across time. Main results are robust across these alternative specifications.

Figure B.6 **Robustness checks: academic outcomes**

Age 23 years in 2017

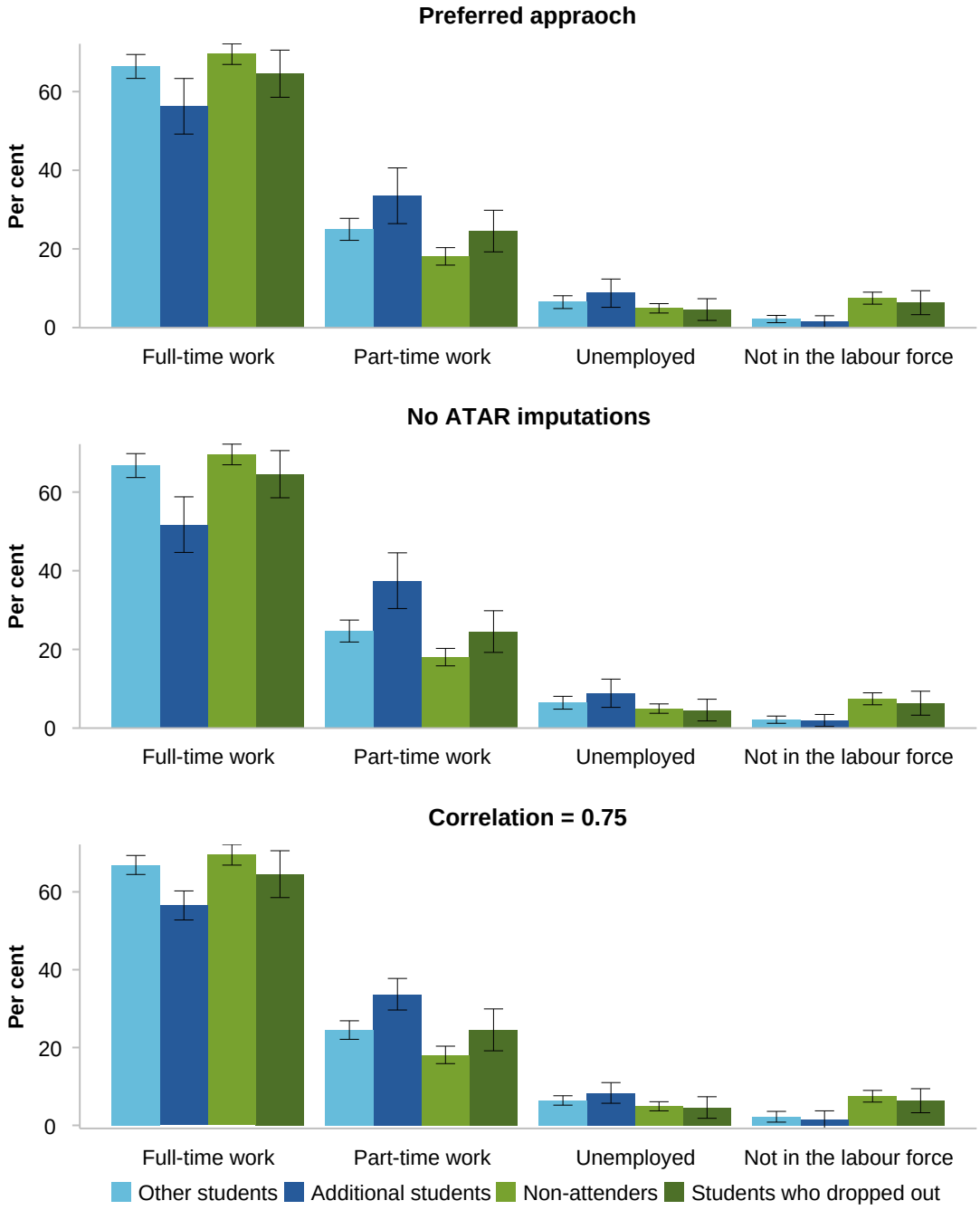


a Black bars reflect 95 per cent confidence intervals. Additional study captures people who completed a bachelor, and at any point prior to 2017 commenced another degree at a bachelor level or higher

Source: Productivity Commission estimates based on LSAY.

Figure B.7 **Robustness checks: labour market outcomes**

Age 23 years in 2017



a Labour market outcomes for other and additional students are presented only for those that graduate — and thus does not take into account the higher drop-out rates among additional student.

Source: Productivity Commission estimates based on LSAY

B.13 **Some convergence of outcomes by age 25 years**

Table B.14 **2006 cohort[a]**

Academic and labour market outcomes

Outcome measure	*Student type*	*Mean*	*95 % confidence interval: upper*	*95 % confidence interval: lower*
2014 (age 23 years)				
Completed	Other student	65.9	68.0	63.8
	Additional student	52.9	58.4	47.4
Dropped out	Other student	12.2	13.6	10.8
	Additional student	19.3	23.6	15.0
Full-time work	Other student	68.1	71.0	65.2
	Additional student	59.0	64.8	53.2
	Non-attenders	69.4	71.7	67.0
	Dropped out	57.4	63.5	51.3
Managerial or professional occupation	Other student	56.7	59.7	53.7
	Additional student	44.1	50.2	33.7
	Non-attenders	11.8	12.9	10.7
	Dropped out	17.5	20.5	14.5
Average weekly pay (2014 dollar terms)	Other students	976.9	1 012.3	941.5
	Additional students	862.2	940.6	783.9
	Non-attenders	1 061.4	1 116.5	1 006.2
	Dropped out	897.0	982.6	811.5
2016 (age 25 years)				
Completed	Other student	79.9	81.8	78.1
	Additional student	68.2	73.2	63.1
Dropped out	Other student	11.9	13.4	10.4
	Additional student	22.2	26.5	17.8
Full-time work	Other student	75.3	77.8	72.8
	Additional student	74.8	81.2	70.7
	Non-attenders	71.1	73.7	68.5
	Dropped out	71.3	77.2	65.3
Managerial or professional occupation	Other student	64.4	67.3	61.5
	Additional student	59.4	65.1	53.7
	Non-attenders	13.7	14.9	12.5
	Dropped out	26	30	22
Average weekly pay (2016 dollar terms)	Other students	1,153.4	1,191.5	1,115.3
	Additional students	1,035.6	1,108.0	963.1
	Non-attenders	1,128.6	1,179.1	1,078.0
	Dropped out	1,012.1	1,103.0	921.2

a Full-time work, employment in a managerial or professional occupation and average weekly pay excludes dropouts and students that are undertaking study.

Source: Productivity Commission estimates based on LSAY.

Table B.15 **Regression results: Attendance at a Group of Eight university by age 22 years[a]**

	2003		*2006*		*2010*		*2013*		*2016*	
	(i)	(ii)	(i)	(ii)	(i)	(ii)	(i)	(ii)	(i)	(ii)
Gender: Female	0.200**	0.202**	0.513	0.526	-0.045	0.069	-0.009	0.120	-0.061	0.062
	(0.096)	(0.097)	(2.556)	(2.520)	(0.099)	(0.096)	(0.125)	(0.125)	(0.117)	(0.110)
Indigenous	0.693	0.697	-0.184	-0.280	0.010	-0.132	-0.053	-0.149	0.493	0.212
	(0.647)	(0.667)	(2.047)	(2.197)	(0.253)	(0.180)	(0.247)	(0.229)	(1.047)	(0.437)
Achievement	0.128***	0.128***	0.147	0.147						
	(0.031)	(0.031)	(0.183)	(0.204)						
PISA					0.002	0.006***	0.002	0.008**	0.005**	0.008***
					(0.001)	(0.001)	(0.004)	(0.004)	(0.002)	(0.002)
ATAR group imputed: 80-90					-0.502***		-0.554***		-0.388**	
					(0.096)		(0.145)		(0.188)	
ATAR group imputed: 70-80					-0.953***		-1.028***		-1.013***	
					(0.118)		(0.123)		(0.250)	
ATAR group imputed: 60-70					-1.352***		-1.552***		-1.436**	
					(0.189)		(0.348)		(0.558)	
ATAR group imputed: 50-60					-1.714***		-1.989***		-1.781***	
					(0.287)		(0.529)		(0.370)	
ATAR group imputed: 0-50					-1.690***		-1.998**		-2.020***	
					(0.427)		(0.870)		(0.438)	
ATAR group imputed: No ATAR					-2.113***		-1.908***		-1.315***	
					(0.343)		(0.677)		(0.381)	
Hours worked in year 12	-0.022***	-0.022***	-0.005	-0.007	-0.021	-0.027	-0.013	-0.018	-0.021	-0.029
	(0.008)	(0.008)	(0.166)	(0.211)	(0.014)	(0.017)	(0.014)	(0.025)	(0.018)	(0.020)
Whether attended year 12: Not attended	-3.843***	-3.871***	-0.294	-0.329	-1.350***	-1.562***	0.282	-0.298	-5.169***	-5.212***
	(0.444)	(0.441)	(4.050)	(5.012)	(0.356)	(0.152)	(0.714)	(0.587)	(0.287)	(0.132)

(continued next page)

Table B.15 (continued)

	2003		2006		2010		2013		2013	
	(i)	(ii)	(i)	(ii)	(i)	(ii)	(i)	(ii)	(i)	(ii)
Interaction of hours worked with year 12 attendance	0.069***	0.069***	-0.030	-0.029	0.028*	0.030*	-0.034	-0.032	0.035	0.044**
	(0.009)	(0.009)	(0.228)	(0.284)	(0.016)	(0.017)	(0.029)	(0.032)	(0.024)	(0.018)
Ethnic background: Non-English	1.082***	1.078***	-3.472	-3.389	0.398	0.519**	0.505*	0.544*	0.587	0.786
	(0.294)	(0.297)	(2.948)	(2.965)	(0.250)	(0.234)	(0.283)	(0.302)	(0.650)	(1.473)
Books: 101-500		0.007		-0.142		0.036		-0.229**		0.081
		(0.085)		(2.327)		(0.089)		(0.091)		(0.140)
Books: 0-100		-0.051		0.009		-0.004		-0.069		0.073
		(0.124)		(3.073)		(0.120)		(0.111)		(0.150)
Parent's occupation: Q3	0.025	0.025	-0.439	-0.439	0.047	-0.024	-0.261*	-0.227*	-0.202	-0.234
	(0.098)	(0.099)	(3.155)	(3.047)	(0.120)	(0.110)	(0.146)	(0.137)	(0.233)	(0.147)
Parent's occupation: Q2	-0.091	-0.091	-0.382	-0.347	0.065	-0.008	-0.279*	-0.275*	-0.074	-0.153
	(0.113)	(0.112)	(3.861)	(3.493)	(0.129)	(0.122)	(0.154)	(0.149)	(0.185)	(0.150)
Parent's occupation: Q1	-0.233	-0.233	-0.388	-0.400	0.124	0.046	-0.268	-0.262	-0.044	-0.153
	(0.179)	(0.185)	(4.324)	(3.920)	(0.189)	(0.173)	(0.424)	(0.361)	(0.323)	(0.198)
Parent's education: Below university	-0.313***	-0.312***	-0.321	-0.353	-0.228***	-0.317***	-0.026	-0.153	-0.283	-0.347***
	(0.085)	(0.088)	(3.258)	(3.355)	(0.088)	(0.088)	(0.147)	(0.144)	(0.259)	(0.125)
SES of the school: Q3	-0.441***	-0.440***	0.125	0.158	-0.122	-0.117	-0.293**	-0.326**	-0.101	-0.194
	(0.132)	(0.128)	(3.247)	(3.576)	(0.106)	(0.118)	(0.117)	(0.145)	(0.214)	(0.179)
SES of the school: Q2	-0.448**	-0.427**	-0.283	-0.259	-0.071	-0.074	-0.369	-0.466*	-0.229	-0.350
	(0.189)	(0.188)	(4.082)	(4.500)	(0.147)	(0.130)	(0.249)	(0.257)	(0.420)	(0.251)
SES of the school: Q1	-0.458*	-0.444*	0.210	0.185	-0.233	-0.200	-0.551	-0.569*	-0.325	-0.392
	(0.258)	(0.265)	(4.339)	(4.621)	(0.206)	(0.203)	(0.349)	(0.309)	(0.389)	(0.277)

(continued next page)

Table B.15 (continued)

	2003		2006		2010		2013		2016	
	(i)	(ii)	(i)	(ii)	(i)	(ii)	(i)	(ii)	(i)	(ii)
Sector: Catholic	0.078	0.091	-0.794	-0.807	-0.139	-0.188	0.109	0.133	0.057	0.025
	(0.136)	(0.137)	(0.931)	(1.213)	(0.160)	(0.145)	(0.147)	(0.131)	(0.313)	(0.198)
Sector: Public	-0.183	-0.180	-0.521	-0.526	-0.142	-0.311**	0.132	0.053	0.147	0.006
	(0.147)	(0.148)	(3.264)	(3.558)	(0.129)	(0.127)	(0.203)	(0.183)	(0.410)	(0.243)
Neighbourhood SES: Q3	0.059	0.051	0.005	0.066	-0.225**	-0.234**	-0.009	0.019	-0.203	-0.264
	(0.129)	(0.128)	(1.822)	(1.959)	(0.110)	(0.107)	(0.179)	(0.201)	(0.218)	(0.163)
Neighbourhood SES: Q2	0.228	0.230	-0.049	0.041	-0.376***	-0.351***	-0.255	-0.266*	-0.213	-0.280
	(0.165)	(0.165)	(1.440)	(1.776)	(0.121)	(0.110)	(0.219)	(0.144)	(0.300)	(0.216)
Neighbourhood SES: Q1	0.177	0.168	-0.432	-0.366	-0.227	-0.119	0.079	0.040	-0.270	-0.363*
	(0.214)	(0.219)	(2.182)	(2.604)	(0.149)	(0.154)	(0.210)	(0.191)	(0.285)	(0.195)
Distance	-0.024		-0.050		0.051		-0.033		-0.047	
	(0.035)		(0.223)		(0.046)		(0.035)		(0.048)	
Location: Regional or remote		-0.086		-0.340		-0.078		-0.277*		-0.229
		(0.106)		(0.311)		(0.158)		(0.143)		(0.178)
State: VIC	0.548***	0.531***	0.580	0.576	0.088	0.157	0.037	0.054	0.524**	0.488**
	(0.179)	(0.185)	(0.727)	(0.936)	(0.128)	(0.116)	(0.153)	(0.138)	(0.266)	(0.217)
State: QLD	0.130	0.128	0.357	0.402	0.171	-0.049	-0.132	-0.056	0.068	0.106
	(0.216)	(0.214)	(1.091)	(1.349)	(0.198)	(0.147)	(0.355)	(0.422)	(0.274)	(0.141)
State: SA	0.126	0.112	0.542	0.545	-0.024	0.028	0.206	0.243*	0.639*	0.720***
	(0.167)	(0.172)	(0.733)	(1.064)	(0.250)	(0.201)	(0.157)	(0.137)	(0.353)	(0.196)
State: WA	0.339*	0.322*	0.576*	0.593*	-0.174	-0.206*	-0.107	-0.120	0.245	0.118
	(0.184)	(0.187)	(0.306)	(0.319)	(0.149)	(0.116)	(0.222)	(0.163)	(0.294)	(0.124)
State: TAS	-0.588***	-0.559***	-0.396	-0.121	-1.280***	-0.870***	-1.569***	-1.251***	-0.274	0.022
	(0.204)	(0.206)	(0.731)	(0.626)	(0.130)	(0.174)	(0.149)	(0.256)	(0.262)	(0.264)
State: NT	-0.477***	-0.450***	-0.603	-0.404	-0.209*	-0.120	-0.212	0.026	-0.237	0.072
	(0.160)	(0.167)	(0.778)	(1.220)	(0.127)	(0.154)	(0.197)	(0.150)	(0.373)	(0.220)
State: ACT	0.495***	0.453***	0.073	0.062	0.248**	0.220**	0.079	-0.029	0.346	0.246
	(0.139)	(0.151)	(2.914)	(3.105)	(0.097)	(0.088)	(0.132)	(0.127)	(0.244)	(0.151)

(continued next page)

Table B.15 (continued)

	2003		2006		2010		2013		2016	
	(i)	(ii)	(i)	(ii)	(i)	(ii)	(i)	(ii)	(i)	(ii)
Grade					-0.108		-0.006		-0.139	
					(0.095)		(0.150)		(0.191)	
Constant					-0.299		-0.346		-0.477	
					(0.216)		(0.476)		(0.525)	
ATAR missing dummy: Missing	-2.126***	-2.316***	-2.330	-2.698	-0.765	-3.864***	-0.552	-4.506**	-2.061	-5.102***
	(0.691)	(0.607)	(3.445)	(6.667)	(0.787)	(0.838)	(2.583)	(2.016)	(1.467)	(1.079)
Observations	3,551	3,537	1,272	1,271	4,354	4,351	3,788	3,846	3,620	3,616

a ***, **, * indicate significant at 1%, 5% and 10% respectively, standard errors are in parentheses

Source: Productivity Commission estimates based on LSAY

Table B.16 **Regression results: Attendance at any university by age 22 years[a]**

	2003		*2006*		*2010*		*2013*		*2016*	
	(i)	(ii)	(i)	(ii)	(i)	(ii)	(i)	(ii)	(i)	(ii)
Gender: Female	0.275***	0.286***	0.599	0.603	0.319***	0.384***	0.296*	0.382***	0.325	0.429**
	(0.091)	(0.090)	(0.477)	(0.443)	(0.095)	(0.086)	(0.151)	(0.129)	(0.259)	(0.181)
Indigenous	0.370	0.340	0.445	0.439	-0.179	-0.183	-0.280	-0.354*	-0.439	-0.488*
	(0.506)	(0.437)	(0.939)	(1.083)	(0.182)	(0.173)	(0.218)	(0.187)	(0.513)	(0.269)
Achievement	0.142***	0.138***	0.128*	0.126						
	(0.022)	(0.023)	(0.075)	(0.077)						
PISA					0.003***	0.008***	0.002	0.008***	0.003	0.008***
					(0.001)	(0.001)	(0.002)	(0.002)	(0.003)	(0.002)
ATAR group imputed: 80-90					-0.297**		-0.321		-0.136	
					(0.119)		(0.246)		(0.261)	
ATAR group imputed: 70-80					-0.636***		-0.504**		-0.332	
					(0.124)		(0.253)		(0.251)	
ATAR group imputed: 60-70					-0.963***		-0.803***		-0.763**	
					(0.139)		(0.297)		(0.316)	
ATAR group imputed: 50-60					-1.299***		-1.135***		-0.953	
					(0.160)		(0.374)		(0.730)	
ATAR group imputed: 0-50					-1.622***		-1.643***		-1.174**	
					(0.224)		(0.398)		(0.526)	
ATAR group imputed: No ATAR					-2.386***		-2.330***		-2.046***	
					(0.166)		(0.296)		(0.287)	
Hours worked in year 12	-0.012**	-0.012**	-0.026	-0.028	-0.008**	-0.015***	-0.005	-0.014	-0.020*	-0.025***
	(0.006)	(0.006)	(0.039)	(0.035)	(0.004)	(0.004)	(0.022)	(0.013)	(0.010)	(0.009)
Whether attended year 12: Not attended	-1.811***	-1.813***	-1.163	-1.188	-0.533	-1.226**	-0.388	-1.189*	-0.638	-1.425
	(0.427)	(0.445)	(3.037)	(3.184)	(0.622)	(0.602)	(0.860)	(0.636)	(1.828)	(1.237)

(continued next page)

Table B.16 (continued)

	2003		2006		2010		2013		2016	
	(i)	(ii)	(i)	(ii)	(i)	(ii)	(i)	(ii)	(i)	(ii)
Interaction of hours worked with year 12 attendance	0.014	0.014	0.006	0.007	-0.002	0.004	-0.010	-0.006	0.016	0.024
	(0.014)	(0.014)	(0.071)	(0.074)	(0.023)	(0.019)	(0.040)	(0.025)	(0.058)	(0.039)
Ethnic background: Non-English	0.818	0.850	1.475	1.573	0.573**	0.776***	0.850*	1.018***	0.976*	1.258**
	(0.507)	(0.585)	(2.071)	(2.288)	(0.234)	(0.223)	(0.438)	(0.305)	(0.526)	(0.564)
Books: 101-500		0.066		-0.198		0.001		0.019		0.063
		(0.096)		(0.507)		(0.086)		(0.264)		(0.174)
Books: 0-100		-0.101		-0.332		-0.004		-0.002		0.059
		(0.119)		(0.727)		(0.110)		(0.280)		(0.209)
Parent's occupation: Q3	-0.017	-0.012	-0.454	-0.462	-0.006	-0.055	-0.028	-0.077	0.122	0.038
	(0.110)	(0.107)	(0.714)	(0.668)	(0.111)	(0.103)	(0.224)	(0.165)	(0.323)	(0.233)
Parent's occupation: Q2	-0.222**	-0.209**	-0.459	-0.441	0.028	0.012	-0.181	-0.217	0.102	0.034
	(0.104)	(0.104)	(0.659)	(0.603)	(0.110)	(0.113)	(0.168)	(0.176)	(0.478)	(0.321)
Parent's occupation: Q1	-0.171	-0.143	-0.605	-0.557	-0.023	-0.068	-0.075	-0.157	0.266	0.130
	(0.153)	(0.157)	(0.913)	(0.904)	(0.139)	(0.143)	(0.242)	(0.238)	(0.468)	(0.309)
Parent's education: Below university	-0.329***	-0.331***	-0.184	-0.155	-0.311***	-0.369***	-0.226	-0.370**	-0.304	-0.406**
	(0.099)	(0.101)	(0.512)	(0.493)	(0.093)	(0.092)	(0.160)	(0.153)	(0.299)	(0.202)
SES of the school: Q3	-0.290**	-0.300**	-0.117	-0.124	0.100	0.066	-0.063	-0.078	-0.039	-0.198
	(0.144)	(0.140)	(0.842)	(0.785)	(0.111)	(0.106)	(0.150)	(0.168)	(0.342)	(0.275)
SES of the school: Q2	-0.354**	-0.369**	-0.413	-0.395	0.201	0.164	-0.171	-0.317	-0.025	-0.233
	(0.161)	(0.162)	(0.858)	(0.921)	(0.144)	(0.127)	(0.323)	(0.405)	(0.358)	(0.310)
SES of the school: Q1	-0.271	-0.263	-0.376	-0.369	0.137	0.156	-0.181	-0.217	0.063	-0.097
	(0.180)	(0.180)	(1.008)	(1.019)	(0.170)	(0.145)	(0.268)	(0.332)	(0.481)	(0.398)
Sector: Catholic	0.016	0.052	0.406	0.421	-0.039	-0.094	0.209	0.201	0.033	-0.013
	(0.142)	(0.152)	(0.911)	(0.852)	(0.133)	(0.124)	(0.153)	(0.225)	(0.617)	(0.388)

(continued next page)

Table B.16 (continued)

	2003		2006		2010		2013		2016	
	(i)	(ii)	(i)	(ii)	(i)	(ii)	(i)	(ii)	(i)	(ii)
Sector: Public	-0.266**	-0.267**	-0.000	0.013	-0.253**	-0.449***	0.079	-0.068	-0.193	-0.331
	(0.131)	(0.134)	(1.036)	(0.942)	(0.115)	(0.110)	(0.172)	(0.296)	(0.560)	(0.352)
Neighbourhood SES: Q3	0.088	0.055	0.188	0.191	-0.064	-0.152	-0.123	-0.141	-0.083	-0.153
	(0.132)	(0.131)	(0.315)	(0.318)	(0.138)	(0.129)	(0.231)	(0.260)	(0.520)	(0.357)
Neighbourhood SES: Q2	0.357**	0.271*	0.217	0.196	0.005	-0.216	-0.162	-0.150	-0.142	-0.225
	(0.163)	(0.162)	(0.363)	(0.371)	(0.187)	(0.165)	(0.286)	(0.306)	(0.563)	(0.386)
Neighbourhood SES: Q1	0.281	0.189	0.047	0.037	-0.098	-0.247	-0.180	-0.207	-0.182	-0.340
	(0.175)	(0.172)	(0.380)	(0.394)	(0.199)	(0.178)	(0.323)	(0.323)	(0.560)	(0.404)
Distance	-0.066**		-0.053		-0.031		-0.062		-0.094	
	(0.029)		(0.130)		(0.035)		(0.040)		(0.065)	
Location: Regional or remote		-0.022		-0.116		-0.005		-0.193		-0.187
		(0.125)		(0.200)		(0.130)		(0.158)		(0.215)
State: VIC	0.324**	0.308*	0.258	0.231	-0.066	0.081	-0.060	0.103	-0.216	-0.159
	(0.155)	(0.158)	(0.273)	(0.279)	(0.124)	(0.126)	(0.204)	(0.221)	(0.503)	(0.345)
State: QLD	-0.019	-0.009	0.233	0.256	0.097	-0.096	-0.418**	-0.124	-0.280	-0.292
	(0.158)	(0.157)	(0.217)	(0.212)	(0.192)	(0.145)	(0.196)	(0.203)	(0.328)	(0.232)
State: SA	0.068	0.040	-0.059	-0.074	-0.057	-0.049	-0.058	-0.017	-0.135	-0.008
	(0.132)	(0.135)	(0.253)	(0.262)	(0.163)	(0.124)	(0.482)	(0.248)	(0.360)	(0.341)
State: WA	-0.087	-0.115	-0.023	-0.049	0.251	-0.123	0.091	-0.145	0.281	-0.069
	(0.154)	(0.152)	(0.209)	(0.224)	(0.182)	(0.111)	(0.287)	(0.191)	(0.426)	(0.290)
State: TAS	-0.137	-0.154	0.457*	0.467*	0.095	0.097	0.128	0.122	-0.097	0.046
	(0.174)	(0.215)	(0.243)	(0.267)	(0.158)	(0.169)	(0.256)	(0.161)	(0.321)	(0.283)
State: NT	0.403**	0.334	0.223	0.283	-0.012	-0.018	-0.155	-0.121	-0.107	0.075
	(0.174)	(0.214)	(0.477)	(0.537)	(0.143)	(0.189)	(0.305)	(0.283)	(0.260)	(0.267)
State: ACT	0.347	0.272	0.088	0.057	-0.033	-0.206	-0.265	-0.462***	0.034	-0.294
	(0.213)	(0.211)	(1.049)	(1.021)	(0.164)	(0.131)	(0.234)	(0.150)	(0.377)	(0.346)
Grade					-0.080		0.093		-0.044	
					(0.084)		(0.152)		(0.267)	

(continued next page)

Table B.16 (continued)

	2003		2006		2010		2013		2016	
	(i)	(ii)	(i)	(ii)	(i)	(ii)	(i)	(ii)	(i)	(ii)
Constant					-0.504***		-0.907**		-0.658	
					(0.182)		(0.460)		(0.415)	
ATAR missing dummy: Missing	-0.653	-1.199***	-0.508	-0.787	0.254	-3.607***	1.301	-3.109***	0.835	-2.852*
	(0.492)	(0.449)	(1.466)	(0.949)	(0.556)	(0.570)	(1.201)	(0.960)	(2.711)	(1.482)
Observations	3,796	3,782	2,198	2,197	4,603	4,602	3,986	4,047	3,833	3,828

a ***, **, * indicate significant at 1%, 5% and 10% respectively, standard errors are in parentheses

Source: Productivity Commission estimates based on LSAY

References

ABS (Australian Bureau of Statistics) 2006a, 2006 ABS Census of Population and Housing, 'Persons by place of usual residence, filtered by highest level of post-school qualification, by field of education, labour force status'.

—— 2006b, 2006 ABS Census of Population and Housing, 'Persons by place of usual residence, filtered by highest level of post-school qualification, by field of education, occupation division (ANZCO)'.

—— 2011a, 2011 ABS Census of Population and Housing, 'Persons by place of usual residence, filtered by highest level of post-school qualification, by field of education, labour force status'.

—— 2011b, 2011 ABS Census of Population and Housing, 'Persons by place of usual residence, filtered by highest level of post-school qualification, by field of education, occupation division (ANZCO)'.

—— 2016a, 1996 ABS Census of Population and Housing Customised data report, 'Persons by place of usual residence, filtered by highest level of post-school qualification, by field of education, individual income (gross weekly)'.

—— 2016b, 1996 ABS Census of Population and Housing Customised data report, 'Persons by place of usual residence, filtered by highest level of post-school qualification, by field of education, occupation division (ANZCO)'.

—— 2016c, 2001 ABS Census of Population and Housing Customised data report, 'Persons by place of usual residence, filtered by highest level of post-school qualification, by field of education, occupation division (ANZCO)'.

—— 2016d, 2006 ABS Census of Population and Housing, 'Persons by place of usual residence, filtered by highest level of post-school qualification, by field of education, individual income (gross weekly)'.

—— 2016e, 2016 ABS Census of Population and Housing, 'Persons by place of usual residence, filtered by highest level of post-school qualification, by field of education, individual income (gross weekly)'.

—— 2016f, 2016 ABS Census of Population and Housing, 'Persons by place of usual residence, filtered by highest level of post-school qualification, by field of education, labour force status'.

—— 2016g, 2016 ABS Census of Population and Housing, 'Persons by place of usual residence, filtered by highest level of post-school qualification, by field of education, occupation division (ANZCO)'.

—— 2019a, 1996 ABS Census of Population and Housing, Customised data report, 'Persons by place of usual residence, filtered by highest level of post-school qualification, by field of education, labour force status'.

—— 2019b, 2001 ABS Census of Population and Housing, Customised data report, 'Persons by place of usual residence, filtered by highest level of post-school qualification, by field of education, labour force status'.

—— 2019c, Labour Force, Australia, Detailed, Quarterly, Feb 2019, datacube EQ07a, Cat. no. 6291.0.55.003, April.

Access Economics 2008, Future Demand for Higher Education - Report for Department of Education, Employment and Workplace Relations, Department of Education, Employment and Workplace Relations, Canberra.

Acil Allen Consulting 2017, Evaluation of the HEPPP, Report to Department of Education and Training, Canberra.

Anlezark, A. and Lim, P. 2011, Does combining school and work affect school and post-school outcomes?, Research Paper, National Centre for Vocational Education Research.

Australian Government 2009, Transforming Australia's Higher Education Sector Policy Statement.

—— 2017a, MYEFO 2017-18, Canberra.

—— 2017b, Statement on Performance-Based Funding for the Commonwealth Grant Scheme.

—— 2018, Terms of Reference - Performance-Based Funding for the Commonwealth Grant Scheme, Department of Education and Training.

Australian Institute of Health and Welfare 2011, Principles on the use of direct age-standardisation in administrative data collections: for measuring the gap between Indigenous and non-Indigenous Australians, Cat. no. CSI 12.

Azur, M.J., Stuart, E., Frangakis, C. and Leaf, P. 2011, 'Multiple imputation by chained equations: what is it and how does it work?', International Journal of Methods in Psychiatric Research, vol. 20, no. 1, pp. 40–49.

Becker, G. 1962, 'Investment in Human Capital: A Theoretical Analysis', Journal of Political Economy, vol. LXX, no. 5.

Behrendt, L. 2012, Review of Higher Education Access and Outcomes for Aboriginal and Torres Strait Islander People, Department of Education and Training, Canberra.

Blinder, A. 1973, 'Wage discrimination: reduced form and structural estimates', Journal of Human Resources, vol. 8, no. 4, pp. 436–455.

Bourdieu, P. and Passeron, J.-C. 1990, Reproduction in Education, Society and Culture, SAGE Publications.

Bowden, M. and Doughney, J. 2012, The importance of cultural and economic influences behind the decision to attend higher education, vol 41.

Cardak, B., Brett, M., Barry, P., McAllister, R., Bowden, M., Bahtsevanoglu, J. and Vecci, J. 2017, Regional Student Participation and Migration Analysis of factors influencing regional student participation and internal migration in Australian higher education, National Centre for Student Equity in Higher Education, Curtin University.

Cardak, B.A. and Ryan, C. 2009, 'Participation in higher education in Australia: equity and access', Economic Record, vol. 85, no. 271, pp. 433–448.

Carpenter, J.R. and Kenward, M.G. 2013, Multiple Imputation and its Application, First, Wiley.

Choi, S. 2015, 'When everyone goes to college: the causal effect of college expansion on earnings', Social Science Research, vol. 50, pp. 229–245.

Cooper, G., Baglin, J. and Strathdee, R. 2017, Access to Higher Education: Does Distance Impact Students' Intentions to Attend University?, National Centre for Student Equity in Higher Education, Curtin University, Perth.

Crawford, H. and Biddle, N. 2015, Paper 17 Education Part 3: Tertiary education, CAEPR Indigenous Population Project 2011 Census Papers.

Dawkins, J. 1987, Higher education : a policy discussion paper, December, Australian Department of Employment, Education and Training, Canberra.

—— 1990, Higher Education: The Challenge Ahead. A working draft, Higher Education Council of the National Board of Employment, Education and Training, Canberra.

DET (Department of Education and Training) 2008, Selected Higher Education Statistics – Time Series Data, 1949-2000.

—— 2013a, 2011 Overseas students.

—— 2013b, Selected Higher Education Statistics – 2008 Student Data, Appendix 2 – Equity Groups.

—— 2013c, Selected Higher Education Statistics – Undergraduate Applications, Offers and Acceptances 2008 Appendix Table A1.

—— 2013d, Undergraduate Applications, Offers and Acceptances 2008- Appendix Table on Current Year 12 Applications, Offers and Acceptances by state by ATAR.

—— 2013e, Undergraduate Applications, Offers and Acceptances 2009.

—— 2013f, Undergraduate Applications, Offers and Acceptances 2009- Appendix Table on Current Year 12 Applications, Offers and Acceptances by state by ATAR.

—— 2013g, Undergraduate Applications, Offers and Acceptances 2010.

—— 2013h, Undergraduate Applications, Offers and Acceptances 2010- Appendix Table on Current Year 12 Applications, Offers and Acceptances by state by ATAR.

—— 2013i, Undergraduate Applications, Offers and Acceptances 2011.

—— 2013j, Undergraduate Applications, Offers and Acceptances 2011- Appendix Table on Current Year 12 Applications, Offers and Acceptances by state by ATAR.

—— 2013k, Undergraduate Applications, Offers and Acceptances 2012.

—— 2013l, Undergraduate Applications, Offers and Acceptances 2012- Appendix Table on Current Year 12 Applications, Offers and Acceptances by state by ATAR.

—— 2013m, Undergraduate Applications, Offers and Acceptances 2013.

—— 2013n, Undergraduate Applications, Offers and Acceptances 2013- Appendix Table on Current Year 12 Applications, Offers and Acceptances by state by ATAR.

—— 2014a, Undergraduate Applications, Offers and Acceptances 2014.

—— 2014b, Undergraduate Applications, Offers and Acceptances 2014- Appendix Table on Current Year 12 Applications, Offers and Acceptances by state by ATAR.

—— 2015a, Selected Higher Education Statistics – 2014 Student Data, Appendix 2 – Equity Groups.

—— 2015b, Undergraduate Applications, Offers and Acceptances 2015.

—— 2015c, Undergraduate Applications, Offers and Acceptances 2015- Appendix Table on Current Year 12 Applications, Offers and Acceptances by state by ATAR.

—— 2016a, 2016 Overseas students.

—— 2016b, Higher Education Standards Panel - Improving the transparency of higher education admissions.

—— 2016c, International student data 2006.

—— 2016d, Undergraduate Applications, Offers and Acceptances 2016.

—— 2016e, Undergraduate Applications, Offers and Acceptances 2016- Appendix Table on Current Year 12 Applications, Offers and Acceptances by state by ATAR.

—— 2017a, Undergraduate Applications, Offers and Acceptances 2017.

—— 2017b, Undergraduate Applications, Offers and Acceptances 2017- Appendix Table on Current Year 12 Applications, Offers and Acceptances by state by ATAR.

—— 2018a, Completion Rates of Higher Education Students - Cohort Analysis, 2005-2017, Tables 1, 2, 3.

—— 2018b, Selected Higher Education Statistics – 2017 Student data, Full Year Data, Enrolments Time Series.

—— 2018c, Selected Higher Education Statistics – 2017 Student Data, Section 11 – Equity Groups.

—— 2018d, Selected Higher Education Statistics – Undergraduate Applications, Offers and Acceptances 2018 Appendix Table A2.

—— 2018e, Undergraduate Applications, Offers and Acceptances 2018.

—— 2018f, Undergraduate Applications, Offers and Acceptances 2018 - Appendix Table on Current Year 12 Applications, Offers and Acceptances by state by ATAR.

—— 2019, Student Enrolments Time Series - Visual Analytics.

Fairlie, R. 2005, 'An extension of the Blinder-Oaxaca decomposition technique to logit and probit models', Journal of Economic and Social Measurement, vol. 30, no. 4, pp. 305–216.

Frenette, M. 2007, 'Too far to go on: distance to school and university participation', Education Economics, vol. 14, no. 3, pp. 31–58.

Gale, T. and Parker, S. 2013, Widening participation in Australian higher education - Report to the Higher Education Funding Council for England, CFE (Research and Consulting) Ltd and Edge Hill University.

GCA (Graduate Careers Australia) 2016, Graduate Destinations Report 2015.

—— 2018, Employment and salary outcomes of higher education graduates from 2017, February, p. 3.

Glaeser, E. and Saiz, A. 2003, The rise of the skilled city, NBER Working Paper no. 10191, December.

Gong, X. and Tanton, R. 2018, Returns to education in Australia 2006-2016, A study commissioned by KPMG, February, NATSEM, University of Canberra.

Halsey, J. 2018, Independent Review into Regional, Rural and Remote Education, Department of Education and Training, Canberra.

Herault, N. and Zakirova, R. 2013, 'Returns to education: accounting for enrolment and completion effects', Education Economics, vol. 23, no. 1, pp. 84–100.

Homel, J. and Ryan, C. 2014, Educational outcomes: the impact of aspirations and the role of student background characteristics, Research Report 65, National Centre for Vocational Education Research, Adelaide.

Hungerford, T. and Solon, G. 1987, 'Sheepskin Effects in the Returns to Education', The Review of Economics and Statistics, vol. 69, no. 1, pp. 175–177.

Jaeger, D. and Page, E. 1996, 'Degrees matter: new evidence on Sheepskin Effects in the Returns to Education', The Review of Economics and Statistics, vol. 78, no. 4, pp. 733–740.

Johnston, D., Shah, C., Shields, M. and Spinks, J. 2014, Are neighbourhood characteristics important in predicting the post-school destinations of young Australians?, Occasional Paper, National Centre for Vocational Education Research, Adelaide.

Kemp, D. and Norton, A. 2014, Report of the Review of the Demand Driven Funding System, Department of Education, Canberra.

Leigh, A. and Ryan, C. 2011, 'Long-run trends in school productivity: evidence from Australia', Education Finance and Policy, vol. 6, no. 1, pp. 105–135.

Lim, P. 2011, Weighting the LSAY Programme of International Student Assessment cohorts, Technical Report 61, National Centre for Vocational Education Research.

Miller, P. and Le, A. 2004, High School Graduation in Australia: Do Schools Matter?, vol 51.

NCVER (National Centre for Vocational Education Research) 2018, LSAY User Gudies.

Nelson, B. 2002, Higher education at the crossroads: an overview paper, Australian Department of Education, Science and Training, Canberra.

Noble, J. and Davies, P. 2009, 'Cultural capital as an explanation of variation in participation in higher education', British Journal of Sociology of Education, vol. 30, no. 5, pp. 591–605.

Norton, A. and Cherastidtham, I. 2018, Dropping out - the benefits and costs of trying university, 2018–07, Grattan Institute.

Oaxaca, R. 1973, 'Male-female wage differentials in urban labor markets', International Economic Review, vol. 14, no. 3, pp. 693–709.

OECD 2006, Education at a Glance 2006.

—— 2008, OECD Economic Outlook, Volume 2008, Issue 1.

—— 2017, Education at a Glance 2017.

PC (Productivity Commission) 2016, National Education Evidence Base, Report no. 80, Canberra.

—— 2017, Shifting the Dial: 5 Year Productivity Review, Report no. 84, Canberra.

Pilcher, S. and Torii, K. 2018, Crunching the number: Exploring the use and usefulness of the Australian Tertiary Admission Rank (ATAR), Mitchell Institute at Victoria University, Melbourne.

Schwiebert, J. 2015, 'A detailed decomposition for non-linear econometric models', Journal of Economic Inequality, vol. 13, no. 1, pp. 53–67.

Social Research Centre 2018, 2018 Graduate Outcomes Survey - Longitudinal (GOS-L) National Report, QILT, Quality Indicators for Leaning and Teaching, October, National Report, Social Research Centre.

—— 2019a, 2018 Graduate Outcomes Survey (GOS) National Report, QILT, Quality Indicators for Leaning and Teaching, January, National Report, Social Research Centre.

—— 2019b, 2018 Student Experience Survey National Report, QILT, Quality Indicators for Leaning and Teaching, April, National Report, Social Research Centre.

Talent 100 2018, How does HSC scaling work for Year 12 students?, Talent 100 - HSC Success. Simplified., 5 June.

UAC (Universities Admissions Centre) 2019, Australian Tertiary Admission Rank.

Venn, D. and Crawford, H. 2016, Post-school education, CAEPR Census Paper no. 11.

Watson, N. and Wooden, M. 2009, 'Identifying Factors Affecting Longitudinal Survey Response', Methodology of Longitudinal Surveys, John Wiley & Sons, pp. 157–181.

Wei, H. 2010, Measuring economic returns to post-school education in Australia: evidence from the 1981-2006 Australian Censuses, ABS Catalogue no. 1351.0.55.032.

West, R. 1998, Learning for Life: review of higher education financing and policy: final report, Australia. Department of Employment, Education, Training and Youth Affairs. Higher Education Financing and Policy Review Committee, Canberra.

Yun, M. 2004, 'Decomposing differences in the first moment', Economic Letters, vol. 82, no. 2, pp. 275–280.