

ARE LOW SES STUDENTS DISADVANTAGED IN THE UNIVERSITY APPLICATION PROCESS?

A 2014 Student Equity in Higher Education Research Grants Project

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Executive Summary

This report investigates the sources of inequalities in university participation by focusing on the university application and admission process. We build on the growing international evidence of differences between high and low socioeconomic status (SES) students in their understanding of the university application process.

The report is based on administrative university application data from the Victorian Tertiary Admissions Centre, in Victoria, Australia. Students can apply for up to 12 university programs as part of an application portfolio and this portfolio can be changed multiple times in the lead-up to final closure of applications. The data used in the analysis compares student application portfolios before and after they discover their Australian Tertiary Admission Rank (ATAR). The ATAR is based on final high school achievement and is the key means by which university places are allocated in Victoria. This data provides a unique opportunity to study how students respond to important new information about their admissions prospects.

An economic model is developed to understand student behaviour and decisions around university applications. A key feature of the model is that optimal application portfolios change because the realisation of high school achievement serves to remove an important dimension of uncertainty in the university application process. Having received their ATAR students revise their portfolio which requires the sourcing of new information. The model motivates our focus on student achievement (ATAR) and SES in application decisions.

The empirical analysis focuses on the number of changes made to application portfolios after students discover their ATAR. A critical finding is that high SES students make more changes to their application portfolios than low SES students. This is consistent with international evidence on university application behaviour where disadvantaged students struggle with the application process.

The empirical analysis is extended to measure the benefits to students of being able to modify their application portfolio after they discover their ATAR. Key themes that emerge from this analysis is that those students that make more changes to their application portfolio reap larger benefits from the opportunity to revise their application portfolios. As high SES students make more changes than low SES students, the former reap more benefit from receiving their ATAR. We also analyse some empirical claims about application portfolio aggressiveness, diversity and size by Chade and Smith (2006) along the dimension

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of student SES and achievement or admissions probability.

All of these results point to strong advantages to high SES students in terms of their understanding of the university application process and how they respond to new information in that process. Conversely, low SES students come from backgrounds where families have less experience and familiarity with higher education and the university application process, leaving them at a disadvantage when informed actions and decisions are required. An important implication of our findings is the timing of any possible intervention and support for low SES students. Disadvantaged students seem to respond poorly in the window between discovering their ATAR and finalising their application portfolio. Any policies that seek to bridge the gap in application sophistication between high and low SES students should operate at this final phase of the application window. In the longer term, such practices should be complemented with the enhancement of skills and competency around understanding university education and the application process which should ultimately reduce differences in the window that we have studied.

This research suggests that policy actions should be taken towards the end of high school to improve student understanding of university application processes and thereby outcomes for low SES students. However, this should be seen as complementary to, rather than a substitute for, long term efforts to improve high school achievement. Improving high school achievement and thereby university eligibility will make the implications of this research about information even more important as greater numbers of disadvantaged students qualify for and seek higher education opportunities.

Chapter 1: Introduction

It is well documented that students from lower SES backgrounds are less likely to participate in higher education; see Brennan and Osborne (2008), and Cardak and Ryan (2006). High SES students are almost three times as likely as low SES students to attend university in Australia; Cardak and Ryan (2009). It is also well established that higher education leads to higher earnings; Harmon *et al.* (2003). Thus, inequalities in educational participation reinforce and perpetuate inequalities across society, both within and across generations. According to the Australian Social Inclusion Board (2012), Australia has the ninth highest income inequality of 26 OECD countries. Since the mid-1990s, a time during which higher education has expanded dramatically in Australia, inequality has grown by 10% (as measured by the Gini coefficient). Understanding the drivers of inequality in educational participation is a fundamental step towards designing effective policies to address the consequent intergenerational inequality and social exclusion.

An explanation identified by Avery (2010) for the limited numbers of low income students at selective institutions in the US is that talented low SES students do not have the expertise or information required to navigate the college admissions process and enrol at the selective colleges that match their qualifications. Avery (2010) found that students offered counselling were 7.9 percentage points more likely to enrol in the “most competitive” colleges. This large effect suggests that better information and guidance around the application process can have a significant impact on the university participation of low SES students.

This report contributes to our understanding of the SES gradient in university participation by investigating university application decisions of recent high school graduates. The project builds on the work of Avery (2010), hypothesising that expertise in the university application process is an important factor determining university participation in Australia. Our study uses data on the population of 2011 Victorian Certificate of Education (VCE) students who applied for a university place through the Victorian Tertiary Admissions Centre (VTAC) in Victoria, Australia. This data provides information on university application portfolios before and after students discover their final high school results or Australian Tertiary Admission Rank (ATAR). As students can change their application portfolios after they discover important information about their achievement, this data and institutional setting provide an important opportunity to analyse the information processing differences between high and low SES students. The potential benefits of understanding different capacities to process higher education relevant information are significant as this will clarify the relevance and timing of potential information-based interventions that can enhance low SES university

participation, an important policy objective dating back at least to the abolition of tuition charges in the 1970s in Australia and reinforced at numerous points since.

The report develops a model based on economic theory to understand student behaviour and decisions around university applications. This model links back to the optimal portfolio construction problem initially investigated in Chade and Smith (2006). A key feature of the model is that optimal application portfolios change because the realisation of high school achievement serves to remove an important dimension of uncertainty in the university application process. The model is used to motivate our focus on student achievement (measured by ATAR) and SES in application decisions. Our key variable of interest is the number of changes students make after they discover their ATAR. The critical finding is that high SES students make more changes to their application portfolios than low SES students. Our results are consistent with, and extend, a range of existing evidence on university application behaviour. In particular our analysis is the first to study student application behaviour and the importance of information with the benefit of a large scale data base. Importantly the data consists of a population set rather than a sample. Further, the data allows a very focused analysis of the links between information and student behaviour due to the very short window between the time that students receive their ATAR and make final changes to their portfolio. That is, students change the application portfolio they submitted up to a month earlier after they discover their final high school results. As a consequence, the changes can be strongly attributed to the information content of their ATAR and the way in which students process this information.

The empirical analysis is extended to measure the benefits to students of being able to modify their application portfolio after they discover their ATAR. The key themes that emerge from this analysis are that high SES students and those that make more changes to their application portfolio reap larger benefits from the opportunity to revise their application portfolios than low SES students. We also analyse some empirical claims by Chade and Smith (2006) about application portfolio aggressiveness, portfolio diversity and size along the dimension of student SES and achievement or admissions probability. All of the results point to strong advantages to high SES students in terms of their understanding of the university application process and how they respond to new information in that process.

Our claim is that these advantages manifest themselves in the ability to understand and process information. Low SES students come from backgrounds where families have less experience and familiarity with higher education and the university application process.

Notwithstanding the prevalence of online information, these students are at a disadvantage when trying to understand the potentially complex task of preparing a university application portfolio. An important implication of our findings is the importance of the timing of any possible intervention and support for low SES students. Students seem to respond poorly in the window between discovering their ATAR and finalising their application portfolio. Any policies that seek to bridge the gap in application sophistication between high and low SES students should operate at this final phase of the application window. In the longer term, such practices should be complemented with the enhancement of skills and competency around understanding university education and the application process which should ultimately reduce differences in the window that we have studied.

The report proceeds with a discussion of higher education in Australia and the SES differences in university participation. We then provide a discussion of some of the alternative approaches to modelling and conceptualising student decision making around higher education participation. Chapters 2, 3 and 4 discuss the evidence around the role of information in explaining differences in university applications and participation. Chapters 5 and 6 explain (i) the institutional setting from which our data are drawn, and (ii) the key features of the data and summary statistics. An economic model of optimal university application portfolios, which incorporates uncertainty around high school achievement and centralised admissions, is developed in chapter 7. In chapter 8 we leverage our theoretical model to empirically test the importance of SES differences in the processing of information in the university application process. We also test models of the benefits of the institutional arrangement that allows students to change their application portfolio after they discover their ATAR and investigate differences across students in application portfolio aggressiveness, diversity and size. The final chapter of the report provides a discussion of the key findings around SES and high school attainment and suggests possible policy and practice implications with a particular focus on the timing of any possible interventions or support, based on the timing of the information arrival at the end of December.

Chapter 2: Socioeconomic Status, University Admissions and Information

This chapter examines the literature on the nature and extent of the problems encountered by low SES students in their journey from secondary school to higher education. We first examine the extent of low SES student representation in higher education. We then consider the extent of the differences in the information available to high and low SES students making choices about university attendance. Finally we consider the impact of any information differences in university choices and investigate whether students from different socioeconomic backgrounds process similar information in different ways.

The benefits of increasing access to university for low SES students

A key driver of the Australian Commonwealth Government's higher education policy since the 1980s has been the recognition that greater participation in higher education can drive competitiveness, economic growth and higher living standards. The primary impetus for the increasing demand for higher education has been major changes to industry and occupational and employment structures in the context of a globalised Australian economy facing intense competition for international and domestic markets; OECD (2003). At the same time, changing community expectations, and a growing appreciation by industry of the need for lifelong learning, has led to increasing pressure on higher education institutions to diversify student populations, widen participation, and increase the breadth and depth of courses offered; see OECD (2003) and Putnam and Gill (2011).

It has long been recognised that deepening participation in higher education by increasing access to universities for students from low socioeconomic backgrounds represents both a social and an economic policy imperative. In 1988, for example, a Policy Statement on Higher Education, Dawkins (1988), by the Federal Government noted that:

“The larger and more diverse is the pool from which we draw our skilled workforce, the greater is our capacity to take advantage of opportunities as they emerge. The current barriers to the participation of financially and other disadvantaged groups limit our capacity to develop the highest skilled workforce possible and are a source of economic inefficiency.”

The Bradley *et al.* (2008) review of higher education identified the need to widen and deepen participation in higher education.¹ To this end, the Bradley review recommended the Government set as national target that 40 per cent of 25 to 34-year olds attain at least a bachelor-level qualification by 2020. The review also recommended the Government set as target that 20 per cent of undergraduate enrolments in higher education should be students from disadvantaged groups and low socioeconomic backgrounds by 2020.

The Bradley review presents the need for widening university participation by increasing the number of low SES students attending university both on equity and efficiency grounds. The review notes that if Australia wants to compete in the knowledge economy and be successful in the global competition for skills, it must increase university participation by currently under-represented groups, reiterating the Dawkins claims of 20 years earlier. The review cites research suggesting that in the next decade the supply of people with undergraduate qualifications will fall short of demand. To increase university participation, the review argued that it is imperative that groups currently under-represented within the system, such as Indigenous Australians, people from regional and remote areas and others from low SES backgrounds be provided with greater opportunities to attend university; Bradley *et al.* (2008, p. xi).

Similar conclusions have been drawn internationally. In Canada, Berger (2008) argued that Canada's competitiveness depends on increasing the participation rate of students in higher education and that such an increase cannot be achieved without recruiting students from low SES backgrounds who traditionally have been less likely to go to university or college. In the US, Belfield and Levin (2007) noted that increased access to higher education by students from low SES backgrounds can increase economic growth and tax revenues and decrease the strain on public finances. They conclude that efforts to improve educational outcomes for at-risk populations should be viewed as public investments that are likely to yield benefits considerably in excess of investment costs.

Based on such arguments, Gale *et al.* (2010, p. 22) concluded that:

“It could be argued, therefore, that it is economic necessity rather than a commitment to social justice that is driving the renewed focus on student equity in higher education and the current focus on social inclusion.”

¹ As outlined above, widening participation leads to an increase in diversity of students (for example more students coming from low SES backgrounds). Deepening on the other hand is about increasing participation independent of student background.

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In response to the Bradley review, the Commonwealth Government announced structural reforms for the higher education sector focused on a demand driven funding system. The implication is that higher education institutions would no longer be constrained by Government quotas on Commonwealth supported places (CSPs) when making offers to undergraduate students, thereby leading university participation to be determined by demand rather than supply. The Commonwealth also set targets for both overall levels of higher qualification attainment and for the proportion of students from low SES backgrounds attaining university qualifications in order to achieve greater national productivity as well as improve social inclusion; Gillard (2009a, 2009b, 2009c).

Representation of low SES students in higher education

Studies by Dow *et al.* (2010), Wheelahan (2009a, 2009b, 2010), Universities Australia and University of Melbourne Centre for the Study of Higher Education (CSHE) (2008) and James (2002) examined whether institutional arrangements are achieving government objectives of improving access to university by disadvantaged students. The broad findings suggest some impact in widening participation by improving access for students from socioeconomic backgrounds already represented in higher education. However, there has been limited success in deepening participation by redressing socioeconomic disadvantage.

Wheelahan (2009a) found that current institutional arrangements provide access to universities, but not to the elite universities. These institutional arrangements and government policies are not a mechanism for redressing socioeconomic disadvantage in higher education more broadly because the socioeconomic profile of students entering university is very similar to that of students already in higher education and within individual universities.

Similar findings have been noted by several other studies over the past two decades. The Department of Education, Employment and Workplace Relations (DEEWR) and Roy Morgan Research (RMR) conducted the first national survey examining the factors influencing Year 12 students' post-school choices in 2009. They found that students from high SES backgrounds were more likely to express a preference to attend university. Using the Australian Bureau of Statistics (ABS) Socio-Economic Indexes for Areas (SEIFA) Index of Education and Occupation (IEO) as a measure of SES, 66% of students from high SEIFA-IEO areas expressed a preference to attend university in comparison with 47% of students from low SES-IEO areas.

South Australian data from more than a decade earlier indicated similar results. Moodie and Swift (1996) found that people from high SES backgrounds accounted for 42% of undergraduate places in South Australia, considerably above their representation in the total population of 25%. This was at the expense of those from low and middle SES backgrounds who accounted for 14% and 44% of places respectively, well below their actual shares of the population of 25% and 50% respectively.

Consistent with the South Australian data discussed above, recent studies suggest that the proportion of low SES students attending university has remained unchanged in the last two decades at around 14% to 16%, while this group comprises the bottom SES quartile of the broader Australian population; Commonwealth of Australia (2009) and Leach (2013). Recent analysis also indicates that the expansion of higher education has primarily benefitted higher SES students. Chesters and Watson (2012) found that in 2005, men with a university-educated father were almost three times more likely to have graduated from university than other men, while women with a university-educated father were almost four times more likely to have graduated from university than other women.

These findings are not exclusive to Australia. International evidence also shows that high SES students are over-represented in higher education relative to low SES students. In the US, a study by Cunha and Miller (2009) found that low income students were less likely to apply to attend college partly because low-income and minority students tended to place low value on academic success. Even when low income students did apply to attend college, they tended to apply to community and less selective colleges rather than highly selective institutions. In addition, a large number of high-achieving students from low-income families did not apply to selective colleges. This is in contrast to students with the same test scores and grades from high-income backgrounds who were extremely likely to apply to a college where the median student had similar achievements to their own; Hoxby and Avery (2012).

Similar conclusions were reached by Smith *et al.* (2013) who found that students from lower SES backgrounds under-match 49.6% of the time while higher SES students under-match 34% of the time. Under-matching occurs when a student could have enrolled in a college more selective than the college they actually chose to attend. SES differences in substantial under-matching are also significant, with 22.7% of lower SES students enrolling in a college that was two selectivity levels below the level they could have attended compared to 13.6% of higher SES students.

Usher (2005) found for Canada that lower income students were less likely to attend university because low-income families ascribed lower premiums (i.e. a lower value) to a university education than higher income families. Students from families with incomes under \$30,000 estimated median university graduate income at \$4,885 above that of high school graduates. This compares to a median estimate of \$6,962 above that of high school graduates by Canadian students from families with incomes of \$60,000 or more. Students from low-income families also tended to overestimate the cost of attending university by substantially greater amounts than other families.

This evidence suggests that increasing participation by low SES students is an extremely challenging undertaking because the factors that lead to under-representation are not clear but involve a range of interrelated issues; CSHE (2008). These include the lack of support structures which would encourage or enable higher education participation, lower levels of educational achievement in schools and the lack of aspiration; Dow *et al.* (2010).

Differences in information available to high SES and low SES students

This report examines the role of differences in the information available to students from different SES backgrounds in explaining the under-representation of lower SES students in higher education. The previous literature suggests that all students, irrespective of SES, would benefit from more information on the subject and course options available, the range of possibilities for further education, and their various work and career options.

James (2000) examined the student decision-making process around post-secondary education, using data from a survey conducted by the University of Melbourne Centre for the Study of Higher Education. A key finding is the perceived lack of information available to school leavers when making university and course selections. Students were asked about the main influences on their course and university selection and their perceived confidence in having good information and knowledge in relation to these influences. Students generally expressed great uncertainty about important information and outcomes, including the satisfaction of graduates and graduate employment rates.

However, the literature suggests both qualitative and quantitative differences in the information used by low and high SES students when making university application decisions. Gale *et al.* (2010) argued that students of different SES have different access to knowledge about higher education and what it has to offer, which in turn leads to differences in aspirations. This is particularly the case for student groups underrepresented at university. The authors distinguish between “cold information” which can be accessed from a careers

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expo, university open day or a dedicated website and “hot information” which is described as a type of “street savvy” that provides students higher resilience to rejections, allowing them to investigate alternative routes to their desired outcomes. It is argued that middle and upper class (higher SES) students have more cold and hot information compared to lower SES students.

Research by Krause *et al.* (2009) showed that students from low SES backgrounds receive little and poor guidance, information and support concerning post-school education and training options from schools. The information available to these students is limited in quantity in that few senior secondary students receive one or more guidance activities per month over their senior years, with most students only receiving one per year. It is also limited in quality and effectiveness. This is because there is little attention to actively building students’ decision-making knowledge and skills for informed choice, and that the most common type of career advice activity across Years 10, 11 and 12 is the distribution of written material and handouts. They also identify a scarcity of guidance around high school curriculum choices for low SES students that could improve post-secondary education and training opportunities or are appropriate to students’ aspirations and potential. They argue this is because of the widespread perception that low SES students are more likely to fail and are therefore either not encouraged or actively discouraged from pursuing higher education.

The evidence on the differences in information available to students from different SES groups has led to calls for governments to provide additional support and resources to schools from non-metropolitan and lower SES areas in order to improve student experiences and opportunities in relation to post-school options. There have also been calls for employer groups and universities to extend their information networks and recruitment activities to low SES schools that have limited access to high quality information; Atweh *et al.* (2006).

International evidence paints a similar picture in that low SES students face significant disadvantages in accessing high quality, relevant information to assist them in making university choices. In the context of the US education system, Venezia and Kirst (2005) concluded that there are significant inequalities in the areas of college counselling, college preparation course offerings and connections with local post-secondary institutions. There is also an unequal distribution of resources such as college centres on high school campuses, opportunities to make college visits and visits from college recruiters to high school

campuses. Research also shows that the students most likely to benefit from the assistance of school counsellors in their preparation for college are more likely to have trouble accessing counsellors; McKillip *et al.* (2012). This is despite the evidence that high achieving, low-income students who were offered counselling were nine percentage points more likely to enrol in “Most Competitive” colleges than otherwise similar students not offered counselling; Avery (2010).

All of this evidence points to strong support for the idea that information is a valuable commodity in the decision-making process around university attendance. It also points to the finding that information is not uniformly distributed or at least not uniformly understood across the SES distribution. Our contribution will be to investigate empirically how students respond to new information, in the form of discovering their ATAR, in the university application process. This can be interpreted as an indication of how the capacity to process new information differs across the SES distribution. We next turn to a brief discussion of some of the alternative approaches to modelling and conceptualising student decision making about higher education participation.

Chapter 3: How Students Make Choices

This chapter examines the approaches used by researchers to understand student choices of institution and area of study in higher education. The literature on student choice has taken three broad approaches which can be summarised as:

- (i) Economic approaches, based on the assumption that prospective students are rational participants in higher education, making decisions based on cost-benefit analyses;
- (ii) Sociological or status-attainment approaches which view socioeconomic background characteristics as the main influence on student decision making; and
- (iii) Information-processing approaches (also called combined models), which combine the ideas of the economic and sociological approaches. These incorporate the rationality assumptions of economic models and components of status attainment models.

Some examples of this literature include Obermeit (2012), Kusumawati *et al.* (2010), Wiese *et al.* (2010), Bergerson (2009), Smith and Flemming (2006) and Hossler *et al.* (1999). Each of these approaches is based on a different conceptual framework and leads to different findings and policy prescriptions which we explore in more detail below.

Economic models

Economic models of student choice are based on the principle of rationality and freedom of choice within the education market place. Students make decisions based on evaluations of the anticipated costs and benefits of the range of potential choices. The economic approach typically assumes students have sufficient accurate information about the options available and the possible outcomes. Students use this information as “inputs” to produce “outputs” which are student decisions on institution and course selection; Hossler *et al.* (1999).

Foskett and Hemsley-Brown (2001) summarise the economic approach to higher education choice as being based on the following principles:

- (i) students seek to maximise utility from their choices;
- (ii) students make choices that will be exclusively based on self-interest;
- (iii) choices are made after a process of intensive information collection; and

(iv) the process of considering alternatives and making choices will be rational.

A typical example of the economic model of student choice is proposed by Campbell and Siegel (1967). In their framework, students' decisions on university education can be viewed as either an investment or a consumption decision, with the two motivations not necessarily being mutually exclusive.

In considering university and course choice as an investment decision, students choose to undertake higher education if the present value of the expected stream of benefits, which include additional lifetime income and additional social and intellectual benefits, resulting from attaining an education exceeds the present value of any costs associated with higher education. These costs may include pecuniary costs such as tuition charges, opportunity costs such as income foregone while studying, and non-pecuniary costs such as pressures associated with study and the disutility of living away from home.

After considering costs and benefits, students compare the expected rate of return of higher education with an appropriate hurdle interest rate and pursue higher education if the expected rate of return exceeds some minimum expected rate of return. This framework has been expanded and augmented by numerous researchers who have calculated private rates of return on investments in higher education; Heller (1997), Leslie and Brinkman (1987). An implication of this framework is that changes in prices such as tuition fees or subsidies such as scholarships or subsidised loans alter the costs of higher education and lead students to reassess the returns on investment in higher education; Paulsen (1998).

Alternatively, treating university and course choice as a consumption decision requires education to be viewed as a consumer durable which provides a stream of future non-pecuniary benefits over a student's lifetime, as well as current consumption benefits including social and intellectual benefits arising from university attendance. A lower bound on the value of these consumption benefits can be approximated by the outlays made by students to receive a university education. Treating university education as a consumption good means it should satisfy the standard laws of demand, there should be a negative relationship between price and demand, and if it is a normal good, we should observe a positive relationship between income and demand – demand for university education should be greater among higher income households.

Building on this framework, researchers have examined how students with different characteristics (e.g. gender, ability and parental socioeconomic status) differ in the extent to

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which financial variables are deemed important in choosing higher education. Work by Paulsen (1998) has concluded that:

- (i) students are responsive to both prices and subsidies in enrolment decisions;
- (ii) students are more responsive to subsidies in the form of grants rather than loans;
- (iii) lower-income students are more responsive to prices and subsidies than students from middle- or upper-income groups; and
- (iv) students from marginalised ethnic and racial groups are more responsive to prices and subsidies than other students

The stylised models used in the economic approach can be extended to accommodate a range of concerns. Examples include public goods, externalities and social benefits of higher education; see Lochner (2011) and Haveman and Wilson (2005). Risk and uncertainty in university education, including dropout risk, are central in the work of Athreya and Eberly (2013), Hendricks and Leukhina (2013) and Akyol and Athreya (2005). Models can be extended to account for information asymmetry where students might not have full information about institutions and programs or conversely, institutions may not have full information about students; see Lane and Kivitsso (2008) and Dill and Soo (2004).

Sociological models

Sociological models, which attempt to explain university and course selection, focus on the impact of students' socioeconomic background and characteristics on their educational and occupational aspirations, and academic decisions; Terenzini *et al.* (2001).² These models predict that educational aspirations and higher education intentions are determined by demographic and socioeconomic characteristics as well as academic preparation and prior academic achievement.

The sociological approach examines how socialisation processes, family conditions, school environments and interactions with "significant others" including peers, teachers, counsellors and family members help shape student aspirations and determine student choices of higher education institutions and courses; Bowden and Doughney (2012), Perna (2006), Somers *et al.* (2002), Hearn (1988), Sewell and Shah (1978) and Sewell *et al.* (1969).

² Sociological models are also referred to as status attainment models in the literature.

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A key focus of sociological models is how cultural and social capital influence student choice. Cultural capital promotes educational success through providing students with knowledge, language and behavioural characteristics necessary for them to succeed in higher education; Jaeger (2011) and Bourdieu (1997). Cultural capital is often passed from parents to children, and students at university whose parents have also attended university have a distinct advantage in the accumulation of cultural capital over first generation students; Dumais and Ward (2010) and Walpole (2003).

According to Perna (2006) and Lamont and Lareau (1988), individuals who lack the required cultural capital may:

- (i) lower their educational aspirations or self-select out of particular higher education options because they are not aware of the particular cultural norms;
- (ii) over-perform to compensate for their less-valued cultural resources; or
- (iii) receive fewer rewards for their educational investment.

A companion concept to cultural capital is that of social capital which focuses on social networks and the means by which such networks are developed, sustained and expanded; Perna (2006), Morrow (1999).

Social capital is intrinsically based on relationships with others, which are acquired through membership in social networks and other social structures. Individuals use social capital to take advantage of information, institutional resources and support and to gain access to human and cultural capital which is available through social structures to which the individual belongs; Perna (2006), Portes (1998). Social capital is central in conveying the norms and social controls that individuals must understand and accept in order to succeed in higher education and the workplace; Coleman (1998). Researchers emphasise the relationship between parents and children and between parents and other adults who interact with their children, such as teachers and counsellors, as the key determinants of social capital; Coleman (1998) and Teachman *et al.* (1997).

Combined or information-processing models

Information-processing models combine aspects of sociological status attainment and economic models, providing models which describe the consecutive stages of the student decision-making process. The stages identified by various researchers are similar, although descriptions sometimes differ. These models examine the critical economic, social and

cultural determinants which influence students at each stage of the process of deciding to attend university and choosing an appropriate institution and course. Most combined models divide the student decision-making process into a number of phases involving aspirations development and alternative evaluation, options consideration, evaluation of the remaining options and final decision; Cabrera and LaNasa (2000), Hossler *et al.* (1999), Hossler and Gallagher (1987), Jackson (1982) and Chapman (1981).

The model by Hossler and Gallagher (1987) is representative of the combined approach to the examination of student decision making. It is one of the most widely cited and used process models of student decision making and is based on a synthesis of various literatures about higher education choice; Bergerson (2009). The key features of model are:

- (i) The first stage in the Hossler and Gallagher model is the Predisposition Stage. In this stage students develop their self-image, preferences and aspirations and the student decides whether or not to pursue post-secondary education. Individual and environmental background factors have the strongest influence at this stage. These include a student's background characteristics such as socioeconomic status, academic ability and the attitude of parents and peers. Organisational factors such as the quality of high school programs and exposure to higher education institutions also influence predisposition.
- (ii) The second stage of the model is the Search Stage. This involves the student gathering general information about higher education and specific information about institutions and courses. During this stage students search for post-school options based on various criteria such as career aspirations, interest in a field of study, access to information and contact with tertiary institutions. This stage results in a "choice set" of preferred options. The search phase is affected by students' values on higher education, the intensity of their search activities and university marketing activities.
- (iii) The final stage of the Hossler and Gallagher model is the Choice Stage. During this stage students and their families interpret the information they have collected within the context of their personal and social circumstances, resulting in decisions about whether to apply to university and which university and course they prefer to attend. These decisions are based on high school results, whether the right courses in a preferred field of study are available, educational and occupational aspirations and whether the perceived benefits of a particular course outweigh the costs.

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The Hossler and Gallagher model is used as the framework for the discussion presented in Chapter 4.

Chapter 4: Access to Information: High and Low SES Students

In this chapter we review the literature on the information available to students when making university choices. We focus on potential differences in the information available to high SES and low SES students. Previous research indicates there are several stages which students go through in the process of deciding to attend university and choosing an appropriate course, and that this process commences years before the student makes the final decision; Prosser *et al.* (2008). In terms of the work of Hossler and Gallagher (1987), the relevant stages are the predisposition, search and choice stages as discussed in the previous chapter.

Predisposition to higher education

This report focuses on the search and choice stages. However, it needs to be recognised that the Predisposition Stage is crucially important in shaping a student's preferences to attend university and that differences in personal, family, cultural and environmental conditions determine the extent to which students aspire to higher education. Research has shown that parents' educational attainment, encouragement from family and student ability are the strongest predictors of higher education aspirations and predisposition; Eidintas and Juceviciene (2014) and Bers and Galowich (2002).

Recent research reveals that although all students, regardless of socioeconomic background, have strong aspirations for post-secondary education, the aspirations of high school students are related to their socioeconomic status; St. Clair *et al.* (2013), Buddelmeyer *et al.* (2011), Kintrea *et al.* (2011) and Bowden and Doughney (2010, 2012). Bowden and Doughney find that high SES students are more likely to aspire to university attendance and less likely to aspire to lesser qualifications or work, while the reverse was generally true for students from lower SES backgrounds. Similarly, Buddelmeyer *et al.* (2011) find that one of the key factors for the school completion gap between high and low SES students in Australia is that low SES students and their parents have relatively lower educational aspirations compared to higher SES students and that lower student and parent aspirations account for 3 and 6 percentage points differences in school completion rates respectively.

Similar findings have been observed in previous research. CSHE (2008) concludes that a wide range of interrelated factors explain the persistent under-representation of lower SES students in higher education. These include lower levels of educational achievement in schools, lower educational aspirations and lower school completion rates. It has also been

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found that SES-based limits on career and educational aspirations become more entrenched as student's progress through high school; Somerville *et al.* (2013).

After reviewing a wide range of literature on socioeconomic status and aspirations, Dupriez *et al.* (2012, p. 506) conclude that:

“a statistically significant relationship is usually observed between family social background and the educational aspirations of young people. Where the phenomenon has been studied, it seems that the influence of the cultural capital of families has a twofold effect. An indirect effect corresponds to the influence of cultural capital on school career, which in turn has a strong impact on educational aspirations. The direct effect corresponds to the residual influence of cultural capital on educational aspirations after controlling for students' abilities.”

Previous data supports this conclusion and reveals that even though there are high levels of aspiration among all socioeconomic groups, students from low SES backgrounds have relatively lower educational aspirations than those from higher SES backgrounds; see the study by the Department of Education, Employment and Workplace Relations and Roy Morgan Research (2009); hereafter referred to as DEEWR and RMR (2009). These findings are not a result of different SES students' perceptions of their likely entrance scores. In examining the reasons for deciding not to go to university, the study found no substantial differences across SES groups in the proportion citing that their results would not be good enough to permit entrance to university. Instead a number of studies note that lower SES students tend to place lower value on academic success; Cunha and Miller (2009). Low SES students also have less information and support with respect to curriculum choices that are appropriate to student aspirations and maximise post-secondary education and training opportunities. These students face a widespread perception that they are more likely to fail and are as a consequence provided less encouragement to pursue higher education; Gale *et al.* (2010) and Krause *et al.* (2009).

Lower aspirations have also been shown to result from lower social and cultural resources available to disadvantaged students. This lower level of social and cultural capital is an impediment to aspiration formation and attainment; Sellar *et al.* (2011), Bok (2010) and Appadurai (2004). Researchers suggest these reduced aspirations can also lead to an acceptance of one's conditions and limit the ability to perceive a better future; Gale *et al.* (2013).

Other research has shown that given limited support and incorrect information, people from low income backgrounds do not perceive university education as a good investment. For example, Usher (2005) found that low-income families in Canada overestimate the costs and underestimate the benefits of university education.

Similar results have been observed in Australia where James (2002) finds that lower SES students are more reserved in their opinions on whether (i) “a university degree is a good investment in the future”; (ii) “university study allows you to explore interesting things”; and (iii) “life at university sounds exciting”. Lower SES students are also less likely to be positive about the potential future benefits of time spent at university. As a result, James (2002) shows that over 75% of higher SES students report a desire to undertake higher education compared with approximately 50% of lower SES students. According to Gale *et al.* (2013), this is due primarily to low SES students not having access to information about higher education which might inform their aspirations. It also results from lower expectations of schools and teachers with respect to disadvantaged students, this having a significant negative impact on the aspirations of such students.

Importantly, research has shown that given appropriate and correct information about the benefits and costs of attending higher education, low SES students can improve their predisposition towards higher education. Oreopoulos and Dunn (2013) report on a field experiment in Toronto, Canada, which provided students with some easily accessible information about the benefits of attending college. The study found that the provision of such information changed higher education decisions, especially for students who are initially uncertain about college enrolment. After the provision of information, these students were more likely to adjust their cost concerns downwards, and their own expected return from attending higher education upwards. As a result, this group expressed less uncertainty and more subsequent interest in completing a higher education degree.

The higher education search process

During the search stage students begin to develop a list of prospective institutions in which they are interested:

“...students (and parents) take an inventory of their needs, values, wants, and limitations and then attempt to match them to a large number of desirable institutions, thereby creating choice sets” (Smith and Fleming, 2006)

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Previous research shows that during the search stage students rely heavily on information obtained from their immediate social circle such as parents, relatives and friends. They also consult guidance or careers counsellors and, less often, teachers. Written materials such as brochures, university catalogues and guides produced by the state education authorities are consulted. Students also interact with the institutions themselves through open days and discussions with university representatives.

According to Brennan (2001), information collected during the search stage can be grouped into four categories:

- (i) Higher education experiences, including campus visits and observations. Such personal experience contributes significantly to a prospective student's decision to attend a particular institution.
- (ii) Informal interpersonal sources of information, such as family and friends. Informal sources of information are more easily accessed by prospective students and are therefore more heavily utilised in the decision-making process.
- (iii) Formal interpersonal sources of information such as independent third parties, experts, teachers and careers advisers. Formal sources of interpersonal information are less easily accessed.
- (iv) Commercial or independent non-interpersonal sources of information such as guide books, course information booklets and informative materials provided by others and independent internet information.

There has been some research in Australia examining the relative importance of these different types of information in student search processes. However, much of this information is in need of updating. For example, many of the Australian studies available date back to the 1990s or early 2000s, prior to the growing importance of the internet as a source of independent information and as a proxy for interpersonal information for young people. Nevertheless, the available studies indicate that all students, irrespective of SES, would benefit from more information on the range of further education possibilities, available subject and course options, and various work and career options.

Students applying for university in Victoria, Western Australia and New South Wales were studied in James (2000). A key finding related to information for school leavers making university and course selections. For example, only 30% to 36% of students surveyed

indicated that they believed that they had sufficient information to make appropriate course choices. Such information included confidence in the ability to meet the demands of the course, the reputation of the course among employers, the satisfaction of course graduates and the employment rates of course graduates. Similarly uncertainty prevailed with respect to choices between universities, such as the prestige of universities, employment rates for graduates from various universities and the opportunities for higher degree study. Only 30% to 46% of students indicated that they had reasonable or good knowledge of these important aspects of university choice.

The study found a wide range of factors that influence school leavers' choices of university courses, the most significant being experiential factors such as the possibility of optimising school results at a particular institution and perceived course quality. In particular, 46% of respondents indicated a desire to get the most from their high school examination results by picking a course which optimised these results. Between 38% and 57% of students regarded perceived course quality, expressed in terms of the reputation of the course among employers, the satisfaction and employment rates of graduates, and approaches to teaching and learning, as being a strong or very strong influence on course choice. Interpersonal formal and informal information such as advice from teachers and views of parents and friends were also found to be somewhat important, with 19% of students considering advice of teachers about a course having a strong or very strong influence on their choice, 15% of students considering family advice to be a strong influence and 8% of students considering the views of friends to play a strong or very strong role.

Experiential information was also found to be very important when students were developing their university choices, as opposed to course or degree choice. Students were concerned with emotional issues concerning "personal fit" at a particular university as well as perceived institutional characteristics and reputation which were strong considerations when choosing a university. For example, 51% of students considered that fitting in well at a particular university to be a strong or very strong influence in university choice. Other important factors affecting personal fit were university surroundings, the atmosphere of the campus, the cultural and social life of the university, sporting and recreational facilities, the kind of students who go to the university and the clubs and societies at the university. Surprisingly, only 7% of students indicated that their friend's university attendance plans were an important factor in their own choice of institution. In relation to institutional characteristics, students indicated that the prestige and image of the university, the international character of the university, the employment rates of the graduates of the university and the starting

salaries of graduates of the university were important factors in university selection with up to 46% of students considering at least one of these factors a strong or very strong influence.

Many Australian studies find that independent information is the primary source used by students at the search stage of the university selection process. Using data from a self-administered questionnaire of enrolled first year, first-time students at the University of South Australia, Martin (1996) found that the universities admission guide was mentioned by a majority of respondents as an important source of information. Only 50% of students mentioned their high school as an important source of information, while only 15% mentioned their high school counsellor. Consistent with other studies, Martin's study also found that informal information derived from a student's peer group remains an important influence with 48% of students indicating that the views of their peer group played some role as a source of information. The study notes that the role of parents was rated very low, being ranked last in the list of 13 factors. This is in contrast with studies in the United States which show that parents play a very important role in the search stage of the college selection process.

Other Australian studies, however, suggest that both informal interpersonal information, provided by parents, and formal interpersonal information, provided by school counsellors and teachers, are important sources of information for students. Using a structured questionnaire, Brennan and Marriot (1996) found that advice from career counsellors is an important influence on the decision-making process of students. According to the study, the career counsellor plays a key role in a student's choice of university with a mean importance rating of 4.10 out of 5 being second only to family members with a mean importance rating of 4.54. The opinion of career counsellors was rated as more valuable than that of their close friends who had a mean importance rating of 3.80. The opinion of family members was found to be significantly more important for students whose parents had attended university than for students whose parents had not. The opinion of career counsellors and school teachers was found to be significantly less important for students whose parents had previously attended a tertiary institution compared to those whose parents had not.

The DEEWR and RMR (2009) study discussed above adds to the body of knowledge on the higher education search process. It presents survey-based findings about the influences on Year 12 student choices after they finish high school. The most commonly used sources

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were formal interpersonal and independent non-interpersonal information. The study concluded that the main sources of university search information were:

- Tertiary Admissions Centre guides, 85%;
- Listening to a talk by an external speaker (e.g. university representative) at their school, 80%; and
- Visiting a website hosted by a university, 76%.

Overall, 61% of students indicated they had visited a university, whether independently or organised through their school. The implication is that accessibility of tertiary institutions affects information sources used by students, with remote students less likely to have access to university visits.

Advice from careers advisors and teachers were also found to be important influences on student choices of course and university. Parents' views and the plans of friends were considered relatively less important sources of information by students. Notwithstanding this, the report notes that there was significant overlap between what students planned to do and what they felt their parents wanted them to do in the year immediately after leaving school, with the post-school intentions of 69% of respondents aligning with parents' expectations. There were also strong links between students' intentions and those of their closest friends, with 52% of students making post-school choices which were similar to their friends' intentions.

These results are consistent with other studies which show that formal interpersonal and independent non-interpersonal information are very important in the search stage of the higher education decision-making process. Krause *et al.* (2009) find that institutional open days, institutional websites and university advisors are the key sources of information during the search stage with each of these sources of information receiving a mean score of 3.69, 3.65 and 3.05 respectively on a scale with 1 representing unimportant and 5 representing very important information. Informal interpersonal sources of information (mother, friends and father) also play an important role, with these sources of information receiving mean scores of 3.06, 2.83 and 2.77 respectively.

Information available to different student cohorts during the search stage

Turning to the information available to students from different SES groups, most internationally and Australian research indicates that students from low SES backgrounds

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receive little and poor guidance, information and support from schools on post-school education and training options during the search stage.

As noted above, Krause *et al.* (2009) find that low SES students receive limited career and post-school education guidance activities per month over their senior years, with most students only receiving one per year. What little guidance is provided is written material with little focus on actively building students' abilities to make informed decisions about post-school education. They also find that school-based guidance and advice is constrained by a perception, prevalent among teachers and careers counsellors, that low SES students are likely to fail and are therefore discouraged from pursuing higher education. This is compounded by counsellor and teacher perceptions of a lack of family interest and limited cultural capital. Another complicating factor is the limited support and resources for careers counsellors and teachers. The report discusses previous research which finds students form ideas regarding appropriate post-school choices early in their secondary school years. The report argues that counselling and guidance early in the search phase are crucial and can be central to increasing the number of low SES students attending university.

International research also identifies the significant disadvantages faced by low SES students in the search stage of the university selection process. A study by Venezia and Kirst (2005) finds that there are significant inequalities in the US education system in the areas of college counselling, college preparation information and connections with higher education institutions. There is also an unequal distribution of resources such as college centres on high school campuses, opportunities to make college visits, and visits from college recruiters on high school campuses.

The role of counsellors during the search and choice phases of the university choice process is a central theme arising from international research on the obstacles facing low SES students. Numerous international studies have shown that access to counsellors by low SES students increases the higher education choice set available to such students.

Avery (2010) examined the impact of providing individualised counselling to a random group of high-achieving low SES students in the states of Connecticut, Massachusetts, New York and Rhode Island, providing positive evidence of the value of college counselling. Avery found that counselling could have an important influence on the application patterns of these students. Even though more than 60% of the students in the study identified high profile Ivy League colleges and MIT as a first choice, these students were usually unaware of slightly less selective colleges that would be good matches for their interests and qualifications.

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They found students offered counselling submitted approximately 50% more applications to less selective colleges within the group of “Most Competitive” colleges than did students not offered counselling. As a result of this difference in application patterns, students offered counselling were approximately nine percentage points more likely to enrol in “Most Competitive” colleges than students not offered counselling.

Similar results were noted by Borghans *et al.* (2013) who found that counselling had a statistically significant impact on the quality of educational choice. A one standard deviation increase in counselling at a school is associated with a 9% decrease in the probability of students preferring a different field of education (based on retrospective information on the use of counselling at secondary school). The positive effects of counselling are strongest for males and for those whose parents have low levels of education.

Despite the evidence of the importance of counsellors in enhancing the choices available to low SES students during the search and choice stages, evidence suggests that low SES students are significantly disadvantaged when accessing appropriate counsellors and their advice. McKillip *et al.* (2012) show that low income students who most need the assistance of school counsellors, and could benefit most from such assistance in their preparation for college, are more likely to have trouble accessing counsellors. Hoxby and Avery (2012) conclude that high achieving low income students in the US have only a slight probability of meeting a teacher, high school counsellor, or schoolmate from an older cohort who attended a selective college, thereby limiting sources of information with personal experiences of such colleges.

The research presented above provides diverse international evidence that many low SES students restrict their higher education choice set and either enrol at less selective institutions than those that they could have attended or do not enrol in higher education at all. This is further supported by the finding of under-matching by low SES students in Smith *et al.* (2013) discussed above. For example, 22.7% of lower SES students substantially under-match by enrolling in a college that is two selectivity levels below the level they could have attended compared to 13.6% of higher SES students.

The choice stage

In the choice stage students use the information they have gathered during the search stage, supplementing it with further information about their academic achievement derived from high school results, to make application decisions about specific higher education courses. Previous research suggests that course suitability, academic reputation, job

prospects and teaching quality are important considerations when students are choosing a particular course and institution.

Soutar and Turner (2002) find that in the choice stage, Australian students place greatest emphasis on university characteristics such as a strong academic reputation, very good teaching quality and good campus atmosphere. They also focus on course suitability and job prospects after graduation. Using average utility scores to reflect the value of university and course attributes, they find course suitability (where the student found exactly what they were looking for) provided an average utility of 116, strong academic reputation 95, good job prospects 92, very good teaching quality 87 and great campus atmosphere 75. Students assigned lower average utilities to traditional universities compared to modern or technological institutions. Distance of the university from home, family opinion, whether the student can transfer between TAFE and university and whether friends attend the same university were all found to have the expected effects on utility. Similar results have been observed by numerous researchers; see Bergerson and Petersen (2009) for an example from the US.

A further aspect of the university and course choice process is that students are most likely to apply to institutions which they believe are likely to admit them. Thus, a student's expectations of the probability of admission are an important factor in determining university and course choice; Chapman (1986, 1981).

In this respect, previous research provides strong clues as to the disadvantages faced by low SES students during the higher education choice stage. Hoxby and Avery (2012) and Hoxby and Turner (2013a, b) find most high-achieving students from disadvantaged backgrounds in the US never apply to selective colleges and universities. This is despite having qualifications that make them likely to be admitted and succeed at such institutions. This (non)application pattern is argued to be driven by a lack of awareness of the available opportunities. In contrast, high-achieving students from high SES families are overwhelmingly likely to apply to selective institutions. A key reason for low SES students' behaviour according to this research is that high-achieving disadvantaged students are poorly informed about the application *strategies* used by their high SES counterparts which result in multiple admission offers from which they can choose. Low income students, for example, appear to lack information about their admissions probabilities at various institutions. These expectations allow high income students to develop strategies that maximise their chances of being admitted to selective institutions.

Hoxby and Turner (2013a) used field experiments to provide high achieving, disadvantaged students appropriate information on (i) how to apply to colleges; (ii) what the student would actually pay to attend various colleges; (iii) college graduation rates; and (iv) instructional resources. They found the treated group of high achieving, disadvantaged students applied to and were admitted to institutions with greater resources, higher graduation rates, and curricula more oriented to their abilities and interests.

Using data from a recent program targeting low SES students who were provided with a number of interventions including application guidance, information about graduation rates and application requirements for various colleges and a calculator which helped students determine the net costs of attending university, Hoxby and Turner (2013b) conclude that these interventions led students to submit 19% more applications and students were 27% more likely to submit at least five applications. The interventions also raised the probability of applying to a peer public university by 19%, a peer private university by 17%, and a peer liberal arts college by 15%; the term “peer” implies an institution where most of a student’s peers would be similarly prepared in terms of high school curriculum and achievement. Students were also more likely to apply to institutions in the range immediately below and above peer institutions, thereby reducing application discrepancies that might otherwise be observed.

Other field experiments with disadvantaged students in the US resulted in similar findings. Cunha and Miller (2009) show that low income students who were given information about how to apply to college increased college application rates by 4.1-6.5 percentage points. They conclude that there is strong evidence that providing relevant information about the college application process to disadvantaged students is an effective way to increase college application, acceptance and enrolment rates among lower SES students.

Given this wide ranging evidence on the importance of information in the university application process, we next outline the institutional setting in which students graduate from high school and apply to university in the jurisdiction under study, the state of Victoria, Australia. We then explain the key features of our data that enable us to investigate how information adds value to student decision making.

Chapter 5: Centralised Admissions in Victoria, Australia

In this chapter we describe the university application and admissions process in Victoria in order to highlight the key features that we focus on in our study. These key features include qualifying for university admission through final examinations and submitting applications through a centralised admissions authority, the Victorian Tertiary Admissions Centre (VTAC).

Students seeking admission to a university in Victoria typically undertake the Victorian Certificate of Education (VCE) in their final year of high school (Year 12).³ Students undertaking the VCE need to complete at least five VCE subjects. This is typically done in their final year with the possibility to take at least one VCE subject in the preceding two years of high school (Year 10 or 11).⁴ VCE subjects are assessed with both centrally moderated ongoing assessment and centrally administered final examinations. Student results for each subject are collated into a single index referred to as the Australian Tertiary Admission Rank (ATAR). The ATAR is the student's percentile rank in their VCE cohort and includes a range of adjustments that account for (i) the relative difficulty of different subjects, and (ii) individual student educational opportunity and disadvantage. A student's ATAR is a critical component of the university application and admissions process in Victoria and Australia more broadly because university places are rationed on merit which is typically assessed based on student ATAR.

³ The majority of students follow this path. Other potential paths for admission to university include undertaking the International Baccalaureate in the final year of study, mature age entry and applying after undertaking non-university post-secondary study. These alternative modes of admission are not considered in this study.

⁴ Many students take more than five VCE subjects but only the results of the best six subjects are taken into account when finalising VCE results.

Table 1: Important dates in the university application timeline.

Event		Fee ^a	Date ^a
Panel A: Course Applications			
Timely:	Open	\$25	1 August 2011
	Close		30 September 2011
Late:	Open	\$86	30 September 2011
	Close		11 November 2011
Very Late:	Open	\$111	11 November 2011
	Close		9 December 2011
Panel B: Change of Preference Windows			
First change of preference period:		No fee	1 August 2011
Open	Close		
Second change of preference period:		No fee	28 November 2011
Open	Close		
			28 October 2011 ^b
			21 December 2011
Panel C: Other Important Dates			
Students sit VCE written exams		No Fee	24 October – 23 November 2011
VCE results and ATAR		No Fee	16 December 2011
Round 1 offers		No Fee	16 January 2012

Notes:

^a These fees and dates were drawn from VTAC (2011) and the Victorian Curriculum and Assessment Authority (VCAA) Bulletins.

^b “Late” and “Very Late” applications submitted after the end of the first change of preference period cannot be changed until the second change of preference period begins.

The centralised university application process in Victoria is administered by VTAC. The application process involves a number of clearly defined milestones outlined for the 2011 academic year in Table 1, Panel A. The academic school year corresponds to the calendar year, running from late January to late November. The first application milestone is to submit a “timely application”. Timely applications were open from 1 August to 30 September, a period during which students could access and modify their application. A timely application in 2011 required an application fee (\$25), with the student free to submit a list of up to 12 different degree programs at different institutions. Students ranked these programs in order of preference which was taken into account when allocating them to the most preferred program they qualified for. Students who did not submit their application before the timely application deadline of 30 September were charged an additional late fee (\$86 in total) to submit a “late application” to the system. Students who missed the late application deadline of 11 November were able to submit a “very late application” by paying an even greater late fee (\$111 in total) until the final deadline of 9 December; see VTAC (2011) for more detail.

An important feature of the application process is that students can modify their applications at no cost during the first “Change of Preference” window which is open until the end of October, when the VCE examination period begins; exact dates are listed in Table 1, Panel B.⁵ VTAC locks down applications during the VCE final examination period, between the end of October and the end of November (Table 1, Panel C), possibly in order to reduce anxiety and distractions among VCE students undertaking final exams. After the VCE assessment process is completed, the second “Change of Preference” window opens. Students can access and change their VTAC application from late November through to late December when applications are finalised. The other critical feature of this second window is that students are informed of their VCE results and ATAR before this second application window closes (Table 1, Panel C), thus students are able to make application decisions with full information regarding their educational attainment as it pertains to university admissions.

Once applications are finalised, the details of each student’s application and ATAR are provided to all universities listed on their application. Universities ration places by merit, based on student ATAR. Each university listed informs VTAC if they are prepared to make an offer. VTAC operates as a clearing house and based on the ranking submitted by the student in the application, matches the student to the highest ranked program to which they

⁵ Notably, “late” and “very late” applications can be submitted after the first change of preference window closes. Students cannot change these late applications until the second change of preference period begins.

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have been admitted, providing the student with one formal offer to their highest ranked (most preferred) feasible program.

The ATAR threshold for admission to a program is referred to as “clearly in ATAR”. Institutions release the clearly in ATAR for their various degree programs from the previous year to provide guidance to students seeking university places. The actual clearly in ATAR for the current cohort is subject to demand for and supply of places in respective degree programs and thus may differ from the publicly announced clearly in ATAR from the previous year’s admissions; however, differences are typically small and the previous year’s clearly in ATAR provides a good guide of what is required for admission.

Chapter 6: Data and Descriptive Statistics

The data used in this study was obtained from VTAC by application and involves a confidentiality agreement.⁶ It comprises anonymised information on all 40,650 Victorian Year 12 students who completed the VCE in 2011 and applied for a university place through VTAC in the calendar year 2011. The data does not include students who applied directly to the universities. These applications were for admission to university in 2012. We also draw on the ABS 2011 Census data for postcode-based median income data which is matched to postcode data provided in the VTAC data files.

The core element of the dataset is each student's list of up to 12 degree programs applied for in order of preference. As outlined in Chapter 5, students have several opportunities to modify their application list, and our data records this list at four different points in time through the application process. The first snapshot was taken on 28 October, after the closure of the first change of preferences window; Table 1, Panel B. The second snapshot was taken on 11 November at the closure of the "late" applications. This is the last milestone date before students complete their VCE examinations and the second change of the preferences window opens. Importantly, the key differences between the first and second snapshot will only be the inclusion of late application data. The third snapshot was taken on 21 December at the end of the second change of the preferences window. It includes all applications (including very late applications) and reflects any changes made during the second change of the preferences window. Finally, a fourth snapshot was taken on 6 January which incorporates changes made by Victorian International Baccalaureate students and students applying from outside Victoria, along with the unchanged applications of VCE students. The data utilised in this analysis focuses on changes made between the second and third snapshots, as our focus is on applicants completing the VCE, the most common route to university for school leavers.

Students receive their VCE results and ATAR in mid-December. Any changes between the second and third snapshots of the application data will have been made after students have completed their examinations and are likely to have been finalised after receipt of critical ATAR information. This is an important feature of our data and we interpret differences between applications in snapshots two and three to reflect (i) new information contained in the final high school results; and (ii) the manner in which students process this new

⁶ The dataset was provided, under confidentiality agreements, to Mark Bowden and consisted of 9 csv files. The STATA files used to conduct our analysis can be provided upon request. We can provide the original data files obtained from VTAC, after the requesting applicant has successfully applied to VTAC for these files and signed the necessary confidentiality agreements.

information. We present a summary of the number of students making changes at snapshots two, three and four in Table 2 to illustrate that the vast bulk of the preference changing occurs between snapshots two and three. Only 156 (360) students changed their application portfolios between snapshots one and two (three and four) with an average number of changes of 0.028 (0.047). Virtually all changes are made between snapshots two and three, with a total of 23,441 students making an average of 4.501 changes.

Table 2: Average number of changes in student applications at snapshots two, three and four. Total number of students making changes given in parentheses.

	Average changes between snapshots (Number of students making changes)		
	Snapshots one to two	Snapshots two to three	Snapshots three to four
Low SES	0.027 (93)	4.377 (12679)	0.046 (197)
High SES	0.029 (63)	4.659 (10762)	0.048 (163)
Total	0.028 (156)	4.501 (23441)	0.047 (360)

The dataset also contains a range of academic, socioeconomic and demographic variables Tabspecific to each individual student. Academic variables include student ATAR and VCE results for each subject (study scores) and type of school attended.⁷ Demographic variables include gender, highest level of education attained by the student’s mother and father, the primary language spoken at home, and the population aged 15 – 64 in the student’s local area of residence (by postcode). Other admissions information available includes the final university offers made, whether a student accepted or rejected their offer and, if accepted, whether the student chose to study part-time, full-time or to defer studies.

We employ two measures of SES. The first is the Australian Bureau of Statistics, Socio-Economic Indexes for Areas (SEIFA) which is based on the 2011 Census, while the second is the parents’ highest level of education. The SEIFA is a postcode-based measure of SES, attributing a neighbourhood SES to individuals. Four SEIFA indexes are available from the 2011 Census and we use the Index of Education and Occupation (IEO) as it is most relevant to the educational issues under investigation. The SEIFA IEO combines a number of educational and occupational measures at the local postcode level. These include the education, employment and skill levels of occupations of residents within the postcode area. The SEIFA IEO is constructed to have a mean of 1000 and a standard deviation of 100, with

⁷ Victorian students can attend private schools (Independent or Catholic) or public schools. A small fraction of subjects attend adult schools. These provide qualifications specifically for adults intending to return to university study.

lower values reflecting greater levels of educational and occupational disadvantage, including a lack of jobs and/or qualifications, and higher levels of low skilled employment.⁸

The second measure of SES is based on the highest level of education attained by the student's parents. We define two groups. The high SES group comprises students who have at least one parent who has completed a bachelor's degree or higher. The low SES group comprises all other students. In the context of this paper, this second measure of SES sharply reflects differences in parental experience of higher education and the capacity for parents to provide information and advice on the higher education application process. We assume that parents who have attended university are more informed about both the application process and the benefits of higher education, and can therefore provide better guidance to their children. This second measure reflects individual characteristics, as opposed to the SEIFA IEO which is an average measure of socioeconomic status based on neighbourhood (postcode) characteristics. On this basis, it is a more reliable indicator of SES; see Bowden and Doughney (2010), James (2002) and McMillan and Western (2000).

The data also includes school specific characteristics such as school SES, based on the SEIFA IEO, the number of VCE students from the school applying to university through VTAC, average ATAR of these students and the population in the school local area aged between 15 and 64 years.

The data set also contains the clearly in ATAR thresholds for admission to courses in the previous year, for commencement in 2011. This is important as students use these ATAR thresholds to form their expectations about their chances of admission to preferred courses in 2012. We use these thresholds together with the second snapshot of each student's list of course preferences to estimate student expectations of their ATAR. We do this by taking the average of the previous year's clearly in ATAR thresholds for the top four degree programs each student applies for.⁹

Variables and summary statistics are provided in Table 3, with Panel A presenting student specific variables and Panel B presenting school level variables. The average ATAR of VTAC applicants is 68.58. Student SES, measured by the SEIFA IEO, has an average and standard deviation of 1015 and 90 respectively, with a minimum of 655 and maximum of

⁸ See <http://www.abs.gov.au/ausstats/abs@.nsf/Lookup/2033.0.55.001main+features42011> or ABS (2013) for more details.

⁹ We use the top four courses applied for as 85% of applicants are admitted to one of these courses. 53% were offered their first preference; 19% their second preference; 8.47% their third preference; 4.63% their fourth preference and 2.74% their fifth preference based on the students' January list.

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1213. We find that 47.3% of students have at least one parent who has completed a bachelor's degree or higher. Only a small fraction do not speak English at home (13%), less than half the sample are male (44.5%), while nearly half attended private schools (23.8% independent and 25.9% Catholic), with less than 1% attending adult schools and the remaining 49.3% attending public schools.

The next seven variables tell us about how students react to the information revealed by their final high school results and ATAR. Between snapshots 2 and 3, the average number of changes made to students' VTAC applications is 4.50, with a standard deviation of 4.48, while 37% of all applicants change their top ranked program after they have received their ATAR. The average rank of the offer received is 3.80, with a standard deviation of 4.48,

Table 3: Summary statistics of 2011 VTAC applications data for individuals in Panel A and by school in Panel B.

Variable	Mean / %	Std. Dev.
Panel A: Student specific variables		
ATAR (<i>n</i> = 39335)	68.58	20.05
Student SES (SEIFA) ABS (<i>n</i> = 39335)	1015	90
Student SES (at least one parent has a bachelor's degree) (<i>n</i> = 36793) ¹	47.3%	
Primary language English (<i>n</i> = 39335)	87%	
Male (<i>n</i> = 39335)	44.4%	
Attended independent school (<i>n</i> = 39335)	23.7%	
Attended Catholic school (<i>n</i> = 39335)	25.9%	
Attended adult school (<i>n</i> = 39335)	0.98%	
Average number of changes in application (November-December) (<i>n</i> = 39335)	4.50	4.48
Proportion changing 1st preference (November-December) (<i>n</i> = 39335)	37.2%	0.49
Average preference rank of course offered in January (<i>n</i> = 37280) ²	2.18	2.20
Average clearly in ATAR of top four courses applied for in November (Expected ATAR) (<i>n</i> = 35595) ³	75.00	12.64
Expected ATAR – ATAR (<i>n</i> = 35595) ^{3, 4}	7.66	15.51
Expected ATAR – ATAR (pessimistic) (<i>n</i> = 12390)	-7.47	6.26
Expected ATAR – ATAR (optimistic) (<i>n</i> = 23205) ⁵	15.74	12.66
Panel B: School Specific Variables		
School SES (SEIFA) (<i>n</i> = 39285)	1024	103
School average ATAR (<i>n</i> = 39335)	68.58	10.79
Within school variance in ATAR (<i>n</i> = 39329)	16.78	2.81

Notes:

1. The sample size for students' SES by parents' level of education is lower due to missing data.
2. The sample size for average preference rank of course offered is lower as it excludes all students who were not made an offer.
3. There were a small number of students for whom we did not have a clearly in for any or all of the top four preferences.
4. A student's expectation of their ATAR is measured as the average of clearly in of the student's first four preferences in October.
5. There were 3 students whose expected ATAR was equal to their ATAR and they were included as optimistic.

suggesting that students have a good sense of what programs are feasible though there is a lot of variability in this measure.

The last four variables in Panel A of Table 3 provide some sense of how well students predict their final ATAR. Our measure of the student's expected ATAR, given by the average of the clearly in ATAR of the top four programs applied for, is 77.67. This is considerably higher

than the average realised ATAR of 68.58. Since the number of observations available for Expected ATAR and ATAR are different, the difference is 7.66 (rather than 9.09), with the null of equality of these two means easily rejected at the 1% level of significance. This difference is broken up into two groups, those who underestimate their ATAR (pessimistic students) with an average underestimate of -7.47 and those who overestimate their ATAR (optimistic students) with an average overestimate of 15.74. The null of equality of these two means is easily rejected at the 1% level of significance.

These results suggest students are surprised by their ATAR, especially on the downside, implying that discovering their ATAR provides valuable information which they can use in improving their application strategy. We break this information down further in Table 4 to illustrate that (i) many more students are optimistic than pessimistic; and (ii) differences between low and high SES students are greater among the optimistic students.

Table 4: Summary statistics of differences between expected and actual ATAR for 2011 VTAC applications by SES. Optimistic and pessimistic students are defined to have respectively overestimated or underestimated their ATAR based on the average clearly in ATAR of the top four programs listed in their application.

SES (parental education)	Optimistic		Pessimistic	
	Expected ATAR		Expected ATAR	
	- ATAR	<i>n</i>	-- ATAR	<i>n</i>
High SES	13.03	9084	-7.28	7026
Low SES	17.49	14121	-7.72	5363
Overall	15.75	23205	-7.47	12389

Returning to Panel B of Table 3, where a number of school level summary statistics are presented, the average school SEFIA IEO is 1021 and SES based on parents with at least a bachelor's degree is 0.38. Average school ATAR is 68.23 and the average within school variance in the ATAR is 18.55, which is lower than the overall standard deviation of ATAR of 20.05, suggesting some school-based clustering of students with similar ATARs.

To further motivate our analysis, we present a number of summary statistics by SES in Table 5. As above, high SES students are those where at least one parent has completed a bachelor's degree or higher. Compared to high SES students, about 21% more low SES students received offers outside their top four degree choices, while 62% more low SES students rejected offers. On all the measures presented, low SES students are at a

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disadvantage. We are surprised by the fewer number of changes made by low SES students and this forms part of the basis of our study.

Table 5: Summary statistics for 2011 VTAC applications by SES.

SES (parental education)	Average changes¹	Average rank of offer¹	Offer outside top 4¹	Offer rejected	No offer received
Low SES (<i>n</i> = 18026)	4.48	2.19	10.30%	14.55%	7.61%
High SES (<i>n</i> = 16893)	4.75	2.11	8.50%	8.98%	3.00%
Overall (<i>n</i> = 34919)	4.61	2.16	9.40%	11.86%	5.37%

Notes: There are small discrepancies between the figure in this table and that presented in Table 3 as all students are included for the purposes of Table 3 while those students that did not report the parents' level of education, or were not made an offer, have been excluded from the statistics in this table.

Chapter 7: A Conceptual Model of Choice

We develop a stylised model of university application and admission in order to highlight a range of predictions around SES and the application procedure. The key features are the various distinct stages in the application process and the importance of differences in information at those stages.

Consider a population of students who wish to attend university. Define the full set of institutions and degrees that students can apply for as J . We assume that all universities enrol students through a central enrolment authority that serves as a clearing house for students and universities. To be admitted to university, student i must submit a list of programs to be considered for. This forms a subset $K_i \subseteq J$ with cardinality $|K_i| \leq k$ where k is the maximum number of applications permissible, and program j is the j th most preferred university program student i lists. These choices will be determined by (i) the student's demographic characteristics, including career and study interests of the student, denoted x_j ; (ii) the student's expectations of final high school results used to determine admission, denoted \hat{a}_i ; and (iii) expectations of how difficult it will be to gain entry to various degrees and institutions, determined by supply of and demand for places in program j , denoted respectively by \hat{d}_j and \hat{s}_j . Together with the supply of places and the student's final high school achievement, these lists represent demand and are used by universities and the central enrolment authority to allocate students to their most preferred feasible choice.

In the first stage of the application process, student i applies for $|K_i|$ programs by solving the following maximisation problem,

$$\max_{K_i \subseteq J} U_i = \sum_{j=1}^{|K_i|} U_{ij} \left(\hat{a}_i(x_i), I_{ij}(x_i), x_i \right) P_{ij} \left(\hat{a}_i(x_i), I_{ij}(x_i); \hat{d}_j, \hat{s}_j, h_j \right) \prod_{l=1}^{j-1} \left(1 - P_{il} \left(\hat{a}_i(x_i), I_{il}(x_i); \hat{d}_l, \hat{s}_l, h_l \right) \right),$$

(0)

where P_{ij} is student i 's expected probability of gaining a place in program j and U_{ij} is student i 's expected utility from attending program j . This optimal list of choices is referred to as a student's application portfolio, as in Chade and Smith (2006). Consistent with the empirical evidence discussed above, in forming this portfolio, students collect information and advice from a range of sources, including peers, parents, teachers, student advisors,

the central admissions authority and universities. Student i 's information set at the first stage is given by $I_{ij}(x_i)$. It depends on the student's demographic characteristics and affects both the student's expected utility and expected probability of admission to program j . Students also draw on historical admissions information, h_j , in assessing admissions probabilities, P_{ij} . Based on supply and demand for university places and the student's final high school results, this application portfolio is to be used by the central enrolment authority to allocate students to their most preferred feasible choice.

After the first round of applications is submitted, students undertake final high school examinations. This second stage of the application process involves final assessment and determines high school achievement used in admitting students to university. This resolves student uncertainty around achievement, replacing \hat{a}_i with a_i in both U_{ij} and P_{ij} .

In the third stage of the application process, students have the opportunity to revise their application portfolio. Using past admission thresholds, h_j , and actual achievement, a_i , student i updates expected probability of admission to the full set of available programs $\{J\}$. Discovering actual achievement also leads to updating in expected utility from the full set of programs, U_{ij} , as students now have a better idea of whether they have the academic aptitude for the various programs they might be considering. All of this updating involves the collection of advice and information from each student's respective networks, leading to a new information set for each program j , denoted $I'_{ij}(x_i): I_{ij}(x_i) \subseteq I'_{ij}(x_i)$. In submitting a revised list of program choices and orderings, students solve the portfolio choice problem in equation (0) with \hat{a}_i and $I_{ij}(x_i)$ replaced by a_i and $I'_{ij}(x_i)$ respectively.

$$\max_{K_i \subseteq J} U_i = \sum_{j=1}^{|K_i|} U_{ij} \left(a_i, I'_{ij}(x_i), x_i \right) P_{ij} \left(a_i, I'_{ij}(x_i); \hat{d}_j, \hat{s}_j, h_j \right) \prod_{l=1}^{j-1} \left(1 - P_{il} \left(a_i, I'_{il}(x_i); \hat{d}_l, \hat{s}_l, h_l \right) \right), \quad (0)$$

Information content of ATAR

The key to possible changes in programs and orderings is the difference between a_i and \hat{a}_i , reflecting the surprise or new information contained in the final high school result and the need to collect further information on programs that have not already been considered and evaluated in detail as part of the first stage of the application process. Changes might be more likely in cases where $a_i < \hat{a}_i$ as such surprises are more likely to rule out some

programs listed in the first stage application. Any reassessment, and consequent changes, will also depend on the student's post-school network. As students have completed school by the third stage, the available post-school network may exclude teachers and student advisors, with students relying more on other sources such as parents, peers and other family members for information. Heterogeneity in these networks, and their ability to provide information pertinent to university applications, will play a role in our empirical modelling below.

We define three broad possible strategies that students can take at the third and final stage of the application process:

- (i) Students may leave their applications unchanged. This is most likely to occur when a student's final achievement is in line with expectations.
- (ii) Students may change applications based on information they have already collected about programs they may be interested in. This is essentially changing the ordering of the $|K_i|$ programs they have applied for and is most likely to occur when deviations between a_i and \hat{a}_i are small.
- (iii) Students may add new programs to their application, removing those they believe are less attractive given their new achievement information; recall the limit on applications $|K_i| \leq k$. These are the most extreme changes and are expected with larger deviations between a_i and \hat{a}_i . Adding new programs requires more effort in the collection of information and advice in order to evaluate the potential benefits and chances of successful application.

Given these possible changes in student application portfolios, we devise ways to gauge the information content of students discovering actual high school achievement. We focus on various aspects of changes in application portfolios between the first and third stages. First we consider the number of changes between these two portfolios. This ranges from swapping the order of some programs to replacing all programs in the application portfolio with new ones. We interpret a larger number of changes as indicating more new information is conveyed by the result, requiring more changes and adjustment by students.

Using information on the program offered to students we are able to compare the rank of the program in the application portfolio submitted at first and third stage. We use both a cardinal

measure of this improvement and a discrete indicator of improvement. This provides us with some sense of how students use the new information embodied in a_i to revise their portfolios. For example, if the rank is higher in the third stage, it would suggest that students use the information to refine applications and rule out unrealistic applications.

This type of evaluation is only possible if the program offered is included in both application portfolios. However, the fact that the program offered is or is not in the first stage application portfolio conveys useful information so we also model an indicator of whether the program offered is newly included in the third stage. This reflects the importance of both the new information and the opportunity to modify the application portfolio at the third stage.

Given the student's achievement, a_i , and our knowledge of acceptance thresholds, h_j , we compare the offer that would have been made if the first stage portfolio was left unchanged with the offer that was made based on the third stage application portfolio. This provides another measure of how the information contained in student achievement is used by students to either eliminate low probability programs from their application portfolio or to add less likely (*stretch*) programs ahead of more certain (*safety*) programs.

Optimal portfolios

This portfolio choice problem is similar to that studied in Chade and Smith (2006) where students simultaneously submit applications to multiple institutions. In the first stage, the admission probabilities may be correlated due to the uncertainty around final high school achievement. This implies the results of Chade and Smith (2006) may not apply to the first stage.¹⁰ However, we focus on how students respond to the information contained in their high school achievement results. Questions include whether the application portfolio submitted at stage one is optimal at stage three, given the student's actual high school achievement, and how students respond to the information conveyed in their high school achievement when determining the optimal final portfolio. These questions relate to decisions at stage three, after students become "fully aware of their calibre" as described by Chade and Smith (2006). Given the resolution of uncertainty surrounding high school achievement, the Chade and Smith (2006) results do apply to student optimisation at stage three and can be used to motivate analysis of changes made to application lists at that stage.

¹⁰ Refer to Chade and Smith (2006, p. 1296), where it is assumed that students are fully aware of their true calibre.

Chade and Smith (2006) show in Theorem 1 that the optimal application portfolio for this problem is constructed by following their Marginal Improvement Algorithm (MIA). Some key features of the algorithm are that students add programs that provide the greatest marginal benefit to the objective function in equation (0) as long as the marginal benefit of inclusion exceeds any additional costs. We have assumed a fixed cost for submitting a portfolio of up to k programs with zero marginal costs for each additional program included in the portfolio. Another important point is that students list programs in order of expected benefit, U_{ij} .

One of the key insights from this work is that students do not simply list the $|K_i|$ highest expected utility, $U_{ij}P_{ij}$, programs. Instead they take into account the interaction between including additional programs and the effects on the probability weighted utility derived from lower ranked programs already in the portfolio. For example, consider adding program U_{i1} to a portfolio which already has U_{i2} and U_{i3} included. Assume $U_{i1} > U_{i2} > U_{i3}$ and U_{i1} has an admission probability P_{i1} . Including this new program will increase the objective by $U_{i1}P_{i1}$ but will lead to the rest of the objective function being scaled down by a factor of $(1 - P_{i1})$; see equation (0). The net benefit is compared against all other possible inclusions and U_{i1} is only added to the portfolio if it provides the greatest net benefit.

The level of student risk taking, or portfolio aggressiveness, is considered in Chade and Smith (2006) by comparing optimal portfolios with other application strategies such as sequential applications and applying for the highest expected utility programs. Portfolio aggressiveness is reflected in programs with lower probability and higher expected benefit being included in the portfolio. They show that in the optimal portfolio students are willing to include low probability high payoff *stretch* programs rather than focus only on high probability low payoff *safety* programs. We use information on actual high school achievement, a_i , and the admissions achievement thresholds, h_j , for the top programs in the student's portfolio to gauge portfolio aggressiveness. We also gauge portfolio aggressiveness by considering the number of programs students have included where high school achievement falls below historical admissions attainment thresholds, $h_j > a_i$. Our contribution to the question of portfolio aggressiveness exploits the distribution of student types by SES to investigate how portfolio risk taking varies across student types.

The concept of upward diversity of application portfolios also emerges in Chade and Smith (2006). The idea behind upward diversity is that portfolio applications induce students to diversify their applications by applying for more selective institutions or more selective programs rather than building a portfolio of applications to a set of very similar programs. We investigate portfolio diversity by using the difference between admissions achievement thresholds, h_j , for the top and bottom programs in the student's portfolio. We use this measure to again investigate how diversity varies by a number of individual characteristics.

Theorem 4 of Chade and Smith (2006) provides, in part (a), comparative statics on portfolio aggressiveness and how it varies with admission probabilities, while part (b) provides results on how the size of an application portfolio varies with admissions probabilities. The market for admission is primarily based on high school achievement, a_i , so the probability of admission to all programs rises as a_i rises. We are thus able to test these claims by considering how a_i affects portfolio aggressiveness, anticipating by part (a) of the Theorem that a_i will positively affect portfolio aggressiveness. We also model portfolio size and the result in part (b) of the Theorem implies a negative relationship between a_i and portfolio size.

Chapter 8: Empirical Method and Results

In this chapter, we develop and estimate empirical models in order to identify how different groups of students operate within the higher education application process. Two broad approaches arise from the stylised model of student choice developed in the previous chapter. The first approach and set of empirical results examine how new information arriving as part of the student's ATAR, and any subsequent re-evaluations, impact on the student's application portfolio. The second approach builds on the theoretical work of Chade and Smith (2006), investigating the levels of student application portfolio aggressiveness, diversity and portfolio size. Our focus in this empirical analysis is how application behaviour varies across students by SES and whether low SES students experience any disadvantage in the application process.

Determinants of changes in programs and orderings

As discussed in previous chapters, students have the opportunity to change their application portfolio after they receive their final high school results (ATAR). These changes range from simply reordering choices within the portfolio through to adding new programs to the portfolio. We argue that there are two key factors that drive changes in student application portfolios at this time. The first is the surprise in actual high school achievement or ATAR. The second is the accumulation of additional information after discovering the actual ATAR. Using OLS, we estimate a model of the number of changes made by student i , denoted Δ_i , given by:

$$\begin{aligned} \Delta_i = & \alpha_0 + \alpha_1 \cdot (\hat{a}_i - a_i) + \alpha_2 \cdot \text{Income}_i + \alpha_3 \cdot \text{Parent_Education}_i \\ & + \alpha_4 \cdot \text{Parent_Education}_i \times (\hat{a}_i - a_i) \\ & + \alpha_5 \cdot \text{ATAR}_i + \alpha_6 \cdot \text{ATAR}_i^2 + \alpha_7 \cdot \text{ATAR}_i^3 + \alpha_8 \cdot Z_i, \end{aligned} \quad (0)$$

where $(\hat{a}_i - a_i)$ is the level of surprise in the student ATAR. Household SES is reflected in both parental income and education, and Z_i is a vector of demographic variables, some of which reflect aspects of the student's network from which they can draw information in the reassessment of their application portfolio. The full list of variables can be found in Table 6 which provides the results of our estimation of the model in equation (0).

Table 6: Total number of changes made between November and December snapshots.

	Optimistic		Pessimistic	
	Coef.	P>t	Coef.	P>t
Key Independent Variables				
$(\hat{a}_i - a_i)$	0.103	0.000	0.064	0.000
Log income	0.788	0.000	0.018	0.935
Parent education	0.259	0.007	0.262	0.024
Parent education missing ^a	0.408	0.000	0.427	0.025
Parent education * $(\hat{a}_i - a_i)$	0.008	0.114	0.025	0.024
ATAR	0.218	0.000	-0.041	0.848
ATAR ²	-0.002	0.001	0.002	0.531
ATAR ³	3.64E-06	0.216	-1.13E-05	0.366
Student Variables				
Male	-0.653	0.000	-0.580	0.000
Primary language not English	1.401	0.000	1.082	0.000
Student accepted part-time offer ^b	0.157	0.405	-0.096	0.841
Student accepted deferred offer ^b	-1.220	0.000	-0.209	0.042
Student rejected offer ^b	-1.924	0.000	-0.655	0.000
No offer made ^b	-4.366	0.000	-2.644	0.237
Student SEIFA (ABS)	-0.001	0.114	0.001	0.341
Proportion of 15 to 64-year old in suburb	1.00E-05	0.000	9.83E-06	0.001
School Variables				
Attended catholic school ^c	0.080	0.275	-0.138	0.125
Attended independent school ^c	0.274	0.005	-0.109	0.318
Attended adult school ^c	-0.610	0.014	0.114	0.859
School SEIFA (ABS)	0.001	0.069	0.001	0.006
Proportion of 15 to 64-year old in suburb	-2.14E-06	0.353	-2.48E-06	0.405
Ave ATAR of the school	0.018	0.000	0.003	0.739
Standard deviation of ATAR of the school	0.072	0.000	0.050	0.009
Number of students in sample for the school	0.001	0.009	0.001	0.428
Constant	-11.183	0.000	-1.737	0.747
Number of observations	23138		12373	
Adjusted R²	0.155		0.043	

Notes:

^a. If a student left a specific field blank (did not answer that question) then we recorded this using a dummy variable and the variable is called missing.

^b. Reference is student accepted a full time offer.

^c. Reference is student attended a public (or state funded) school.

We distinguish between optimistic and pessimistic students by defining optimistic (pessimistic) students as those who have $(\hat{a}_i - a_i) > 0 (< 0)$, estimating the model for each

group separately. Student expectations of final high school results, \hat{a}_i , are calculated as the mean clearly in ATAR threshold of the top four choices for student i . While students can submit up to 12 programs, the top four programs were considered a strong reflection of student expectations as 85% of students were offered a program from their top four choices. Including more than the top four choices in calculating \hat{a}_i is therefore likely to bias down the student's ATAR estimate.

As conjectured, students respond asymmetrically to the new information contained in their ATAR. We find a wide range of variables are statistically significant in the analysis of optimistic students ($R^2 = 0.155$), with fewer variables significant for pessimistic students ($R^2 = 0.043$). We consider first the key independent variables, then student variables and finally school variables.

We note that optimistic students have a positive value for $(\hat{a}_i - a_i)$; recall that for optimistic students the mean is 15.74 and standard deviation is 12.66. The coefficient of 0.103, significant at the 1% level, implies that all else being constant, a 10 unit increase in this variable leads to one more change in the student portfolio. This is an intuitively appealing result, telling us that the larger a student's error in their expectations, the more they do to correct for it. For pessimistic students the coefficient is 0.064, significant at 1%. Recalling that the pessimistic student mean is -7.47, with a standard deviation of 6.26, the result implies that the larger the error for pessimistic students, the fewer changes they make. Pessimistic students receive a positive surprise, with their actual ATAR exceeding their expectations, and as a consequence, they are likely to be admitted to their most preferred programs. These results are also intuitively appealing in that we expect fewer changes to be made by students in this position.

Students from higher income backgrounds make more changes but only among optimistic students who have overestimated their ATAR. Parental education enters the model linearly and is interacted with the over/underestimation of ATAR, $(\hat{a}_i - a_i)$. We find strong positive effects of parental education implying that the children of more educated parents make more changes to their application portfolio; the coefficient is around 0.26 for both optimistic and pessimistic groups, significant at 1% and 2.4% respectively. The interaction term *Parent education* * $(\hat{a}_i - a_i)$ is significant only for the pessimistic group, implying a stronger response to positive ATAR surprises among children of more educated parents. The result

implies that while higher parental education leads to more changes, the greater the positive surprise, the smaller the effect of parental education. The interaction term implies a 10 unit surprise in $(\hat{a}_i - a_i)$ for a pessimistic student which would balance the effect of parental education. A student's actual level of achievement, ATAR, is included through a third order polynomial and has no significant relationship with the number of changes among pessimistic students but is significant for optimistic students. The overall effect is 5 to 7 more changes, with the maximum at an ATAR of about 65 and the minimum at the extreme ATAR values of 30 and 99. The implication is that students with average ATARs of 65 make on average 2 more changes than students with extreme ATARs.

Turning to student specific variables we find that females, students that do not speak English as their primary language at home and students who live in a suburb with a higher proportion of the population in the 15 to 64-year old age bracket make more changes to their portfolio. These relationships hold for all students but are greater for optimistic students.

We also included the type of offer accepted by the student; specifically, part-time, deferred, rejected and no offer are included as dummy variables which are then compared to the reference category of a full-time place. These variables are determined after students finalise their application portfolio. However, we include them as a proxy for the student's intention, interpreting them as a measure of how committed students are to immediate post-secondary study. We found that students who rejected or deferred an offer made fewer changes, with larger effects among optimistic students. Optimistic students who did not receive an offer made 4.366 fewer changes on average while no relationship was identified among pessimistic students. We speculate that this finding might provide evidence of disengagement where students are not adjusting their application portfolio and as a consequence are not receiving an offer. Finally, the occupational status of the parent, as measured by the SEIFA occupational index of the student's suburb of residence, has no relationship with the number of changes made by the student.

Of the school sector variables, only independent school attendance is found to have a positive impact, 0.274 significant at 1%, on the number of changes among optimistic students. Adult schools cater for mature age students who might have specific plans and may be more committed than the average school leaver so it is not surprising that adult school graduates make 0.610 fewer changes than public school students on average. The average school ATAR is found to be positively related to the number of changes among optimistic students, though the effect is small. The number of students in the sample from a

student's school also has a positive and significant effect on the number of changes among optimistic students, though it is also a small effect with school size ranging between 1 and 381 (the number of students at the school that apply through VTAC in 2011). Finally, the variance of the school's ATAR was positively related to the number of changes for both optimistic and pessimistic students; however, the size of the effect is again small.

The benefits of making changes to application portfolios

As already discussed, changes made to application portfolios by students should, according to revealed preference theory, result in some increase in utility for that student. We examine the possible gains for students from changing application portfolios by developing proxies of possible benefits and estimating the marginal impact of the number of changes along with a set of individual and school control variables. The estimated equation is

$$\begin{aligned}
 Benefit_i = f(\alpha_0 + \alpha_1 \cdot \Delta_i + \alpha_2 \cdot (\hat{a}_i - a_i) + \alpha_3 \cdot Income_i + \alpha_4 \cdot Parent_Education_i \\
 + \alpha_5 \cdot Parent_Education_i \times (\hat{a}_i - a_i) + \alpha_6 \cdot ATAR_i + \alpha_7 \cdot ATAR_i^2 \\
 + \alpha_8 \cdot ATAR_i^3 + \alpha_9 \cdot Z_i) \quad (0)
 \end{aligned}$$

where all explanatory variables are as defined above and $Benefit_i$ is one of four variables constructed to measure any improvements in the student's application portfolio after the student's actual high school achievement (ATAR) is confirmed. The first measure is an indicator of whether the program offered to the student was in the final portfolio but not in the November, pre-ATAR portfolio; this is modelled using a probit specification. The second measure focuses on the program ultimately offered to the student, comparing the rank of this program in the final portfolio submitted with the rank of this same program in the pre-ATAR portfolio and modelling the difference in the rank. The third measure is similar to the second and is an indicator of whether this rank improved between November and January; this too is modelled using a probit specification. The fourth measure uses the student's realised ATAR to calculate the rank of the program they would have been offered had they retained their pre-ATAR application portfolio after discovering their ATAR. We then calculate the improvement in rank between what was actually offered compared to the rank that would have been offered based on the pre-ATAR portfolio.

The results of estimating equation (4) are presented in Table 7 for optimistic students and in Table 8 for pessimistic students. Our benefit measures are positively related to the number of portfolio changes made by optimistic students, with the exception of the fourth measure. This suggests that a student receives a lower ranked offer compared to what would have

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received based on the original application portfolio (though this effect is small and significant only at the 5% level). Similar positive relationships are found for pessimistic students, including measure 4.

The ATAR surprise ($\hat{a}_i - a_i$) has a positive and significant relationship with all measures for optimistic students, indicating the benefit of being able to change the application portfolio is greater for students who overestimate their ATAR in the first place. We find mixed results for pessimistic students, with negative effects of surprises on measures 1 and 2, a positive relationship for 4, and no relationship with measure 3. These negative coefficients imply benefits to these students as ($\hat{a}_i - a_i$) is negative for pessimistic students.

There are no statistical differences in benefits from portfolio changes between students with different levels of parental education or income, the exception being benefit measure 4 where higher parental education has a positive effect among pessimistic students.

Table 7: Benefits from changing portfolio – optimistic students.

	Measure			
	1 (Probit)	2 (OLS)	3 (Probit)	4 (OProbit)
Key Independent Variables				
Δ	0.140***	0.515***	0.241***	-0.003**
$(\hat{a}_i - a_i)$	0.021***	0.068***	0.020***	0.039***
Log income	0.037	0.177	0.100	0.009
Parent education	0.008	-0.052	-0.024	-0.004
Parent education missing	0.054	0.103	-0.012	-0.007
Parent education * $(\hat{a}_i - a_i)$	-0.0008	0.002	0.001	0.003**
ATAR	0.052***	0.140***	0.049***	0.136***
ATAR ²	-0.0006***	-0.002***	-0.001***	-0.002****
ATAR ³	1.16E-06	4.45E-06	3.21E-06	1.22E-05***
Student Variables				
Male	0.077***	0.239***	0.079***	0.075***
Primary language not English	0.077***	0.185**	0.022	0.200***
Student accepted part-time offer	0.321***	0.798***	0.185**	0.113**
Student accepted deferred offer	0.165***	0.261***	-0.002	0.080***
Student rejected offer	0.123***	-0.007	-0.093***	0.363***
No offer made	-1.515***	Omitted	Omitted	2.526***
Student SEIFA (ABS)	-0.0002	-0.0003	-8.2E-05	0.0001
% of 15 to 64-year old in suburb	-9.92E-07	-3.37E-06	-5.32E-07	1.95E-06***
School Variables				
Attended catholic school	-0.068**	-0.076	-0.028	-0.008
Attended independent school	-0.055	0.011	0.036	-0.004
Attended adult school	0.147	-0.125	-0.082	0.261***
School SEIFA (ABS)	0.0004***	0.0006*	0.0003**	0.0002**
% of 15 to 64-year old in suburb	2.33E-06***	4.74E-06**	7.35E-07	-1.22E-06**
Ave ATAR of the school	0.013***	0.026***	0.005**	0.005***
Std deviation of ATAR of school	0.013***	0.034***	0.001	-0.007**
Number of students in sample for school	-6.72E-05	-0.0001	6.04E-05	0.0003**
Constant	-4.709***	-7.567***	-4.004***	NA
Number of observations	23138	21384	21384	23138
Pseudo R²/Adj R²	0.2234	0.3134	0.397	0.1127

Note: *** 0.01; ** 0.05 *0.1

Table 8: Benefits from changing portfolio – pessimistic students.

	Measure of benefit			
	1 (Probit)	2 (OLS)	3 (Probit)	4 (OProbit)
Key Independent Variables				
Δ	0.148***	0.369***	0.222***	0.023***
$(\hat{a}_i - a_i)$	-0.016***	-0.026***	0.001	0.027***
Log income	-0.168	-0.130	-0.074	0.076
Parent education	0.087	0.119	0.034	0.072**
Parent education missing	0.121	0.361**	0.070	0.090*
Parent education * $(\hat{a}_i - a_i)$	0.003	0.006	0.005	0.007**
ATAR	-0.102	-0.061	0.042	-0.005
ATAR ²	0.002	0.001	-0.0003	-0.0004
ATAR ³	-9.15E-06	-7.38E-06	3.95E-07	3.56E-06
Student Variables				
Male	0.107***	0.137**	0.067**	0.060***
Primary language not English	0.090	0.136	0.013	0.102***
Student accepted part-time offer	0.372*	0.449	0.284	0.107
Student accepted deferred offer	0.212***	0.369***	0.109***	0.060**
Student rejected offer	0.133*	0.240**	0.057	0.297***
No offer made	omitted	omitted	omitted	2.506***
Student SEIFA (ABS)	0.001	0.0007	0.0003	6.26E-06
% of 15 to 64-year old in suburb	-4.14E-07	-6.10E-07	3.98E-07	7.21E-07
School Variables				
Attended catholic school	0.045	0.067	0.027	-0.068***
Attended independent school	-0.012	0.011	0.038	0.005
Attended adult school	-0.490	-0.878*	-0.313	0.440**
School SEIFA (ABS)	0.001**	0.0006	0.0004*	9.94E-05
% of 15 to 64-year old in suburb	3.04E-06*	4.8E-06**	1.64E-06	-1.87E-06**
Ave ATAR of the school	0.003	0.007	0.003	0.004**
Std deviation of ATAR of school	0.010	0.010	-0.008	0.004
Number of students in sample for school	-0.001**	-0.007*	-0.001**	0.0004**
Constant	-1.151	-0.220	-3.340	NA
Number of observations	12370	12370	12370	12373
Pseudo R²/Adj R²	0.181	0.194	0.306	0.023

Note: *** 0.01; ** 0.05 *0.1

For optimistic students the relationship between ATAR and benefit is statistically significant, while for pessimistic students the relationship is not statistically significant. For measure 1, ATAR has a positive linear effect on the benefit, implying the higher the ATAR among optimistic students, the more likely the final program offered to the student was not part of their pre-ATAR portfolio. ATAR has a quadratic relationship with measures 2 – 4, declining over the relevant ATAR range. For measures 2 and 3, the effect ranges from 2 to -6, while for measure 4 the effect ranges from 2 to -14. These results imply that students with higher ATARs are more optimistic with their portfolios in that they might retain more programs they might not qualify for in their portfolio, thereby seeing the rank of their final offer being lower – this is related to the theoretical work of Chade and Smith (2006) and we return to this when we empirically analyse optimal portfolios in the next section of this chapter.

Of the student variables, our measures all show, after conditioning on the number of changes, larger benefits for male students, both optimistic and pessimistic. We also find students whose primary language is not English benefit more than their English speaking counterparts though this relationship is mixed. Positive effects are found for pessimistic students on measure 4 and for optimistic students on measures 1 and 4 while the effect on measure 2 is significant at the 5% level. This suggests language issues might play an important part in the application process, with non-English speaking background (NESB) parents possibly unable to offer good information and support at early stages and NESB students making more changes after discovering their ATAR and adapting to their new circumstances. Students who are seeking part-time study, or to defer their studies, also appear to benefit more from changing compared to those students seeking to enrol full-time.

For the school variables, the type of school attended by the student does not appear to directly impact on the benefit of changes to the portfolio of programs. However, the average ATAR, and the size of the distribution of the ATAR, have an impact for optimistic students. The higher the average ATAR of the school, the more the student benefits, while the relationship between the size of the distribution and benefit is positive for measures 1 and 2.

Portfolio aggressiveness and socioeconomic status

In this section we build on the work of Chade and Smith (2006) by empirically investigating variability in optimal student application portfolios. Our focus is on student socioeconomic status and student high school achievement, complemented by a range of other demographic and school factors, similar to those above.

The general form for each of the tests is as follows:

$$\begin{aligned} measure_i = & \alpha_0 + \alpha_1 \cdot ATAR_i + \alpha_2 \cdot ATAR_i^2 + \alpha_3 \cdot ATAR_i^3 \\ & + \alpha_4 \cdot Income_i + \alpha_5 \cdot Parent_Education_i + \alpha_6 \cdot Z_i \end{aligned} \quad (0)$$

where all explanatory variables are as defined above and $measure_i$ is one of four variables constructed to measure either portfolio aggressiveness, portfolio diversity or portfolio size.

We present summary statistics of the four variables used as $measure_i$ in Table 9, with the results of estimating equation (0) using OLS presented in Table 10. We estimate the model in equation (0) using two measures of portfolio aggressiveness. In the first column we use the difference between the average clearly in attainment threshold of the top four programs listed in the portfolio and the actual achievement, while in the second column we use the number of programs in the portfolio with clearly in attainment thresholds above the student's actual achievement. In the third column we estimate the model using the difference between the clearly in attainment threshold of the highest and lowest ranked program in the student's portfolio as a measure of portfolio diversity. The number of programs included in the portfolio is used in the third column as a measure of portfolio size. The summary statistics in Table 9 aid in our interpretation of the results in Table 10.

Referring to Table 10, socioeconomic status measured by parental education is found to have a strong positive relationship with portfolio aggressiveness. The coefficients of 0.516 and 0.201 are significant at the 1% level and imply that students from a higher SES background construct more aggressive application portfolios in the sense that (i) the top four programs applied for have a higher average clearly in attainment threshold and (ii) their portfolios include more programs with past admissions thresholds above their own high school attainment.

Table 9: Summary statistics for measures of student application portfolio aggressiveness, portfolio diversity and size.

Parental Education	Portfolio aggressiveness (1)	Portfolio aggressiveness (2)	Portfolio diversity	Portfolio size
High SES	1.45 (12.06)	2.69 (2.57)	8.89 (15.44)	8.26 (3.10)
Low SES	6.46 (15.03)	3.08 (2.74)	6.73 (16.78)	8.01 (3.27)
Total	4.02 (13.89)	2.89 (2.67)	7.78 (16.18)	8.13 (3.19)

Notes: Portfolio aggressiveness (1) – measured by Expected ATAR - ATAR (based on January application portfolio).
 Portfolio aggressiveness (2) – measured by number of Programs applied for with clearly in ATAR above actual ATAR.
 Portfolio diversity – measured by the difference between the ATAR of the first and last program in portfolio.
 Portfolio size – measured by number of applications in portfolio.
 Standard Deviation in parentheses.

We find only weak evidence of differences in portfolio diversity based on SES, with a coefficient of 0.357 significant only at the 10% level. However, we find strong support for SES differences in portfolio size, with a coefficient of 0.191 significant at 1%, implying high SES students construct larger application portfolios. This latter result is consistent with the more aggressive portfolios in the first two columns requiring more back-up options, leading to larger portfolios.

Our second focus is on student high school achievement, ATAR. We find that ATAR has a negative overall relationship with the first measure of portfolio aggressiveness. The second measure of portfolio aggressiveness rises at lower ATAR levels and decreases for higher ATAR. The difference in sign on ATAR between portfolio aggressiveness measures (1) and (2) might be unexpected. However, when the overall marginal effect of ATAR is considered (i.e. the combined effect of $ATAR$, $ATAR^2$ and $ATAR^3$), we find for high levels of ATAR the overall relationship is negative for both measures of portfolio aggressiveness. The portfolio diversity measure rises with ATAR, with an overall effect ranging from -6 to 4 over the ATAR range. The coefficients in the fourth column of Table 10 show that although significant, portfolio size does not vary much with ATAR, with the number of programs applied for rising by 0.5 programs over the ATAR range.

Our analysis includes a range of individual student controls. Males in general submit a more aggressive or ambitions portfolio, with both a higher average clearly in attainment threshold (0.431) for the top four programs applied for and more (0.065) programs with past admissions thresholds above their own high school attainment. We also find that males

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submit portfolios with greater portfolio diversity, with a 1.365 greater ATAR point gap between top and bottom programs, and that their portfolios are smaller, with 0.256 fewer programs listed on average.

Coming from a NESB has a strong positive effect on all measures considered. The results suggest that NESB student portfolios are more ambitious or aggressive with higher average ATAR and more programs with clearly in ATARs above their own ATAR. These students' portfolios are more upwardly diverse and list a larger number of programs. While these findings to some degree suggest poorer information, such students seem to be fully exploiting the scope available in the portfolio in terms of size and portfolio diversity.

We include the type of offer accepted by the student – part-time, deferred, rejected and no offer made compared to the reference category of a full-time place taken up in order to proxy for the student's intention, interpreting these variables as a measure of how committed students are to immediate post-secondary study. We found students who accepted part-time offers had less aggressive portfolios and also submitted a portfolio with fewer applications. Students who deferred offers also submitted less aggressive and smaller application portfolios. Students who rejected their offer submitted more (less) aggressive portfolios on aggressiveness measure 1 (2), while they also submitted smaller portfolios. Students who did not receive an offer submitted more aggressive portfolios, suggesting they may have been over-ambitious. They also had a smaller portfolio and a smaller ATAR gap between the top and bottom programs, suggesting less portfolio diversity in their portfolio.

Table 10: Models of portfolio aggressiveness, portfolio diversity and portfolio size, with measures as defined in Table 9.

Key Independent Variables	Portfolio aggressiveness (1)	Portfolio aggressiveness (2)	Portfolio diversity	Portfolio Size
ATAR	-1.367***	0.085***	-0.416***	0.049***
ATAR ²	0.008***	0.0001	0.009***	-0.001**
ATAR ³	-1.7E-05***	-1E-05***	-3.9E-05** *	0.26E-05**
Log income	0.672**	0.124	1.557**	0.625***
Parent education	0.516***	0.201***	0.357*	0.191***
Parent education missing	-0.079	0.067	0.483	0.249***
Student Variables				
Male	0.431***	0.065***	1.365***	-0.256***
Primary language not English	1.875***	0.973***	2.128***	1.375***
Student accepted part-time offer	-0.501	-0.640***	0.257	-0.408***
Student deferred offer	-0.473***	-0.098**	-0.558*	-0.367***
Student rejected offer	1.606***	-0.346***	-0.415	-0.460***
No offer made	7.550***	1.231***	-1.533***	-1.832***
Student SEIFA (ABS)	0.004***	-0.0002	0.001	-0.002***
% of 15 to 64-year old in suburb	1.66E-05***	0.53E-05***	1.91E-05**	1.53E-05***
School Variables				
Attended Catholic school	-1.021***	6.55E-05	-0.098	0.232***
Attended independent school	-0.017	0.129***	0.755**	0.172***
Attended adult school	3.599***	1.187***	0.194	0.504***
School SEIFA (ABS)	0.004***	0.0003*	0.001	0.0001
% of 15 to 64-year old in suburb	-2.8E-05***	-0.41E-05***	-3.2E-05** *	-0.94E-05** *
Ave ATAR of the school	-0.025***	-0.007***	-0.057***	-0.019***
Standard deviation of ATAR of the school	-0.051**	-0.002	0.123**	0.014*
Number of students in sample for the school	0.005***	0.002***	0.004***	0.002***
Constant	52.899***	-0.480	-4.276	4.241***
Number of observations	35128	39244	27405	39244
Adj R²	0.611	0.173	0.042	0.064

Note: *** 0.01; ** 0.05 *0.1

Catholic and Independent school attendance has mixed effects. Relative to public schools, Catholic school students submit less aggressive portfolios, with lower average ATAR.

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Conversely, again relative to public schools, independent school students submit more aggressive portfolios by including more programs with clearly in ATARs above their own ATAR. Both Catholic and Independent school student portfolios on average include more programs, implying a stronger intention to continue studying beyond high school. Students attending adult schools submit more aggressive portfolios, both in terms of higher average ATAR and more programs with clearly in ATARs above their own ATAR, while their portfolios also include more programs on average.

Students from schools with higher average school ATARs are found to submit less aggressive portfolios that are less upwardly diverse and have smaller application portfolios. The size of the graduating (and applying) cohort has a positive effect on all these measures. Moving from the smallest (1 student) to the largest (381 students), applying class increases portfolio aggressiveness measure 2 by 0.76 increases the ATAR gap between the top and bottom programs by 1.50 ATAR points and increases portfolio size by 0.76 programs.

Chapter 9: Discussion and Conclusions

We have studied the university application portfolios of a state-wide cohort of graduating high school students in Victoria, Australia. Students apply through a centralised university admissions system, VTAC, and submit portfolios of up to 12 programs across different universities to be considered for. These applications were submitted before students discovered their ATAR. A month later students were able to change their application portfolio after they discovered their ATAR. This application process provides insights into the way students processed the information contained in their ATAR.

There is growing evidence that part of the SES gradient in university attendance is related to disadvantaged students struggling with the application process. Disadvantaged students either lack information about universities, programs, or both, as they typically have less informed networks to draw on; Avery and Kane (2004). Two important sources of information are family and friends and school counsellors. Evidence from both Australia and the US suggest that parents who have not undertaken a higher education qualification are limited in the amount of information and help they are able to provide to their children concerning the admissions process; Davies *et al.* (2014), Bryce and Anderson (2008), MacAllum *et al.* (2007), Bedson and Perkins (2006) and Ceja (2006). While family members are an important source of information for students in choosing university, they seem to have more and better information and advice to share if the family is high SES than when it is low SES. Counselling is considered more important for low SES, but less important for high SES students; Kerr *et al.* (2014), MacAllum *et al.* (2007) and Brennan and Marriott (1996). According to Krause *et al.* (2009, p. 25), “Extensive research in Australia and other western countries indicates that students from low SES backgrounds receive little and/or poor guidance, information and support regarding post-school education and training options from schools”.

Given the institutional setting under consideration, we developed a model based on economic theory that incorporated a range of the features highlighted in the literature around university application behaviour and the role of timing and information. Early application portfolios were based on ATAR expectations while the post-ATAR application portfolio had this achievement uncertainty resolved. The resulting ATAR surprise used in the study formed an important part of our modelling. The other key aspect of our modelling was the way students responded to this new information or surprise. Given the evidence in the literature, we incorporated demographic characteristics that emphasised SES.

These features of our theoretical model motivated our empirical analysis which focused on the role of ATAR surprise and SES. Our empirical approach comprised three broad components. We first considered the number of changes made by students to their application portfolios after they discovered their ATAR. We found the number of changes in the application portfolio increases with the ATAR surprise. Optimistic students, those who overestimated their ATAR, made more changes than those who underestimated their ATAR, i.e. pessimistic students. SES, measured by both parental income and education, was also found to play an important role in the development of university application portfolios. We found that students from high SES backgrounds made more changes than low SES students on average. Further, the interaction between parental education and ATAR surprise showed that higher SES students reacted to the ATAR surprise with more changes than their low SES counterparts. This is a surprising finding, as it was expected that high SES students would have their plans and aspirations worked out in advance and would not need to make changes. It seems instead that high SES students are able to exploit the information available to them after they discover their ATAR to better respond to the information contained in the ATAR. The key mechanisms seem to be that high SES students can draw on their more educated and informed family and peer networks to make decisions about higher education, whereas low SES students are more reliant on school support networks for information. This is consistent with Holcomb-McCoy (2010) who found the interaction between low SES parents and school councillors to be lower than expected, given that councillors are a critical resource for students whose parents did not attend university. As students discover their ATAR after school is completed, low SES students have greatly reduced access to an important support mechanism in their application process. This is consistent with the growing evidence that low SES students are disadvantaged in the application process because of a lack of knowledge about the process and higher education more broadly.

The second component of our empirical approach was to consider the benefits of the institutional arrangement that allows students to change their application portfolio after they discover their final high school achievement. This analysis focused on how the number of portfolio changes made by students was related to a number of potential benefit measures. We found that the number of changes was positively related to all four of our benefit measures. This suggests that being able to make changes to the application portfolio provides benefits to students, independent of whether they overestimate or underestimate their ATAR. Our interpretation of these findings is that they provide further empirical support

for a range of findings in the literature regarding the importance of information in the university application process.

The third component of our empirical work relates to the theoretical findings in Chade and Smith (2006) about optimal application portfolios. Our work investigates the aggressiveness, diversity and size of optimal student application portfolios. While their work was theoretical in nature and focused on the comparison of optimal application portfolios with various other choice or application mechanisms, our focus is on how the characteristics of optimal portfolios vary across the distribution of students, particularly student SES. We find that higher SES students submit more aggressive application portfolios in that they are trying to gain admission to more selective institutions, consistent with the work of Hoxby and Turner (2013a) and Smith *et al.* (2013). Weak evidence (10% level of significance) of more portfolio diversity among high SES students is found with these students applying for a widerer range of programs; possibly to ensure admission. We also find that high SES students submit larger portfolios, suggesting these students have thought about more possible alternatives and have more *safety* school options. Our finding that portfolio size increases with ATAR is the reverse of that anticipated based on Theorem 4 (b) of Chade and Smith (2006) in that higher ATAR implies higher admission probability and we would expect portfolio size to decrease with ATAR. We also find that portfolio diversity rises with ATAR, again suggesting that as student achievement and admission probability rises, students are creating a more diverse application portfolio. Our interpretation of this is that greater portfolio diversity here implies these students are more committed to university study. They are willing to apply for, and consider, study options where the clearly in ATAR threshold covers a wider range.

Overall the empirical findings suggest that high SES students seem to construct application portfolios that are more attentive to the application process and ultimate admission. These results highlight an important mechanism through which low SES students are hindered in their efforts to participate in university education in Australia, and to the extent that these patterns are observed beyond borders, internationally. High SES students respond to new information with more changes to their application portfolio and they benefit more from the opportunity to make changes to their application portfolios. Their final portfolios are more aggressive, more upwardly diverse and include more possibilities (larger portfolios). Particularly important is that these SES results are identified while holding the effect of ATAR constant so that they should not be attributed to the effects of high school achievement. Rather we view these findings as strong empirical evidence from a system wide analysis

that supports the range of findings in the literature pointing to the importance of information in the university application process. They particularly validate the idea that students from disadvantaged backgrounds are less engaged with the application process.

From a policy perspective, these findings suggest that stronger advice and support services targeted to disadvantaged students are required. There is emerging evidence in the US that providing students more information (for example through counselling) can benefit disadvantaged students applying to university. Avery and Levin (2010) found that students offered counselling were 7.9 percentage points more likely to enrol in the “most competitive” colleges. This large effect suggests that better information and guidance around the application process can have a significant impact on the university participation of low SES students. Borghans *et al.* (2013) found that counselling had a statistically significant impact on the quality of education choice, as measured by a decrease in the probability of students preferring a different field of education. The authors found that the effects were strongest for males and students whose parents had low levels of education. Cunha and Miller (2009) found that students who took part in a college information and awareness campaign increased college application rates by 4.1 to 6.5% and that the program was an effective way of increasing college application, acceptance and enrolment rates among lower SES students. Hoxby and Turner (2013b) found that providing high-achieving, low income students with interventions, including application guidance and an application fee waiver, increased application submission by 19% and students were 27% more likely to submit at least five applications. Low income students whose parents received tax preparation assistance and were also offered assistance in applying for student aid and calculating tuition costs, were found to be 8% more likely to complete a two-year college degree; Bettinger *et al.* (2012). Outside the US, Kerr *et al.* (2014) found that male students from low SES neighbourhoods in Finland benefited from information intervention. Oreopoulos and Dunn (2013) found that students from disadvantaged high schools in Toronto, Canada, had a greater likelihood of attending higher education after obtaining information on costs and benefits. Loyalka *et al.* (2013) found that providing advice on costs and financial aid to high school students in poor regions of northwest China positively affected the choice to attend college.

While in the context of VTAC in Victoria, Australia, a range of services might be in place, they might not be well understood and utilised by disadvantaged students. Key strategies would be to evaluate the range of communication and information strategies in place, establishing the types of students accessing services and how they are accessed. This would enable the

development of new strategies to target disadvantaged students with this information. While the inclination is to suggest more school-based outreach and university visits, i.e. formal interpersonal information in the language of Brennan (2001), the findings here suggest that the breakdown is in the window when students discover their ATAR. Disadvantaged students seem to be responding less well in this window to the new information contained in their ATAR. To maximise effectiveness, resources should be targeted not only to disadvantaged groups but also at the time that students receive their ATAR results, and of course before the final application deadline. One concern is that additional services and support might be taken up by high SES, given their better understanding of the application process, thereby crowding out less knowledgeable low SES students who need, and would benefit more, from the service. Therefore, any efforts at providing more information should be complemented with earlier information, to raise awareness among low SES students of additional support available at the critical final change window, after ATAR results are released. This type of integrated long-term strategy would start in the outreach, school visit stages, alerting students of the availability of targeted support. An important aspect of this strategy might be outreach follow-up in schools dominated by low SES students, providing the formal interpersonal information to address the shortfall in the family and friends-based informal interpersonal sources of information so readily available to high SES students.

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Appendix: University Admission Systems across Australia

In most states and territories university admission is based on the Australian Tertiary Admission Rank (ATAR). The ATAR is calculated by a state or territory Tertiary Admission Centre (TAC) based on a Year 12 Award program of study. The ATAR is used by tertiary institutions to compare the overall achievement of students who have completed different combinations of final year high school units. The ATAR is an overall ranking reflecting a student's comparative final year of high school achievement relative to that of other students completing high school in a given year. The ranking is between 0 and 99.95 in intervals of 0.05. For example, an ATAR of 90.00 puts a student in the top 10 per cent of their cohort. The ATAR is used in all states and territories except Queensland, which uses a similar ranking system of Overall Positions (OPs) and Field Positions (FPs).

The ATAR and the OP in Queensland is currently calculated in the following way:

- In New South Wales and the Australian Capital Territory the ATAR is calculated by the Universities Admissions Centre (UAC) using students' Higher School Certificate marks (HSC);
- In Victoria the ATAR is derived by the Victorian Tertiary Admissions Centre (VTAC) from students' Victorian Certificate of Education (VCE) subject scores;
- In South Australia, the South Australian Tertiary Admissions Centre (SATAC) calculates an ATAR from the South Australian Certificate of Education (SACE) and the Northern Territory Certificate of Education (NTCE);
- In Tasmania, the University of Tasmania calculates ATAR for that state from the Tasmanian Certificate of Education (TCE);
- In Western Australia the ATAR is calculated by the Tertiary Institutions Service Centre (TISC) from students' Tertiary Entrance Aggregate, TEA; and
- Queensland does not calculate an ATAR. Instead, the Queensland Tertiary Admissions Centre (QTAC) calculates students' Overall Position (OP) rank, based on student's secondary school Subject Achievement Indicators (SAIs), on a scale of one to twenty-five (with the twenty-fifth position the lowest).

The ATAR is constructed by scaling the scores of individual subjects to adjust for differences

in difficulty between subjects. There are a number of differences in the way the aggregates are determined in different states. For example, results in English are only included in the ATAR in South Australia, Western Australia and the Australian Capital Territory ACT only if it is one of the student's four highest scoring subjects (or best five in Tasmania). However, a score for English is compulsorily included in the ATAR in New South Wales and Victoria. In some states results from Year 11 can form part of the score, whereas in other states results are only based on Year 12 performance. Similarly different rules apply to students who repeat Year 12 or do an additional year of study. Table A1, adapted from McCurry (2013), sets out in detail the various procedures used by TACs across Australia in calculating the ATAR and OP.

Table A1: Details of procedures used by TACs across Australia to calculate ATAR and OP.

State	Procedures
ACT	<ul style="list-style-type: none"> • A course score is calculated for each student completing an approved course. The ACT Board of Senior Secondary Studies scales the course scores where between school differences are evident in the results. This ensures that all approved course scores can be meaningfully compared within and across schools. • Each student's Aggregate Score is the sum of the best three major scaled scores plus 0.6 of the next best scaled course score, whether a major or minor. • Aggregate Scores for all eligible students are ranked (highest to lowest). Ranks are converted to a cohort rank with a table supplied by the NSW Technical Committee on Scaling.
NSW	<ul style="list-style-type: none"> • The ATAR is based on the best 10 approved units, including 2 of English. Courses must include at least 3 courses of at least 2 units and also at least 4 subjects. • A scaling process modifies the mean, standard deviation and maximum mark in a course. The maximum mark in a course is related to the mean of the scaled marks in that course (to discourage students from taking easy courses in order to get high marks). • Each student's scaled HSC marks are added together to produce that student's aggregate score (interim calculation not reported). • All students' aggregate scores are placed in rank order. Individual student ranking expressed as position in the entire age cohort expressed as a percentile.
South Australia	<ul style="list-style-type: none"> • The ATAR is derived from the university aggregate. The university aggregate is calculated from scaled scores. The best scaled scores (on a scale of 20.00) from three 20 credit Tertiary Admission Subjects (TAS) plus the best outcome from the 'flexible option', which can be either the score of a fourth 20 credit TAS or Recognised Studies or any two of the following:

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	<ul style="list-style-type: none"> • half the score of a fourth 20 credit TAS or Recognised Studies; • the score of a 10 credit TAS or Recognised Studies; • the score of another 10 credit TAS or Recognised Studies. • To calculate the ATAR the scaled scores for the student's best three 20-credit subjects are added to the score for the 'flexible option'. This is the university aggregate score. A percentile distribution and corresponding percentile rank (0–100) is then calculated which represents the ATAR.
Tasmania	<ul style="list-style-type: none"> • A scaled score is then calculated for each subject result. The ATAR is calculated by adding the three best scaled subject scores from approved subjects satisfactorily completed in Year 12 (or a subsequent year), together with the next best two other subject scores taken from either the same year, or any other single year after Year 10. • The Tasmanian ATAR is determined from a ranking based on the tertiary entrance scores as a percentile ranking of students from the total age cohort.
Victoria	<ul style="list-style-type: none"> • Each student gets a Study Score on a scale 0–50 for each subject undertaken. This is a measure of performance relative to others who took the subject. • For each VCE subject, study scores are scaled according to the strength of the competition in that study. The strength of competition in a particular study is gauged by comparing students' performance in all their other VCE studies with their performance in the particular study. This scaled study score is the ATAR subject score. • Subject scores are aggregated to obtain the ATAR aggregate. A maximum of 6 results are used in the aggregate according to the following sequence: <ul style="list-style-type: none"> • best subject score for an English study • next best 3 ATAR subject scores (of an allowable combination) • 10% of any fifth and sixth ATAR subject score as/if available • Up to 3 scored VCE VET sequences may be included in the primary four; a fourth or fifth may count as an increment. VET sequences may count as the fifth and/or sixth increment by adding 10% of the average of the primary four. The increment for the sixth study may be for an approved university study as part of the VCE extension study program. • Students are assigned a percentile rank that (as far as possible) distributes the students evenly. This percentage rank is then converted to an ATAR.
Western Australia	<ul style="list-style-type: none"> • The Tertiary Entrance Aggregate (TEA) is calculated by adding a student's best four scaled scores plus 10% of that student's best Language Other Than English (LOTE) scaled score, based on the following rules: <ul style="list-style-type: none"> • The best four scaled scores may be accumulated scaled scores which contribute to the ATAR over five consecutive

	<p>years, with no subject or course counting more than once.</p> <ul style="list-style-type: none">• There are unacceptable course combinations whereby scores in both courses/subjects cannot both be used.• Marks are scaled to adjust for differences in difficulty between courses. The scaling procedure uses the averages in other courses, to adjust the average of the course/stage to create a 'scaled' score. The maximum TEA is 410. The TEA is used to derive the ATAR for university admission purposes.
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Source: Adapted from McCurry, D., Overview of Senior Assessment and Tertiary

The university application processes is similar across all states and territories. All states have a centralised application and admissions process with most undergraduate university applications being made through Tertiary Admissions Centres (TACs). Each TAC website provides a portal that students can log into during the application and admissions process, allowing them to submit their preferences, change their preferences if needed and receive tertiary offers from institutions. Critical VTAC dates for applications, changes of preferences and offers of places in Victoria are summarised in Table A2.

In each state, students submit 'course preferences' that is applications for a specific course and university. Submitting preferences allows students to apply for several courses at once, without having to submit separate applications to individual institutions. There is a limit on the number of preferences that can be submitted. In Queensland, students can submit six preferences, in NSW nine and in Victoria 12 preferences.

Once a student lodges an application, the details of the application and the ATAR are provided to all universities on the list of preferences. Universities inform the TAC if they are prepared to make an offer. The TAC then goes down the list of preferences in order and makes a formal offer to the student for the first course on the preference list for which a university has indicated that the student is eligible.

There are multiple offer rounds in each state for students who have submitted applications through a TAC. The main round is in January, however there are also early offer rounds starting in September and late offer rounds up until February and March in some states. Most students who are eligible will receive a tertiary offer during the first round.

Table A2: Critical dates for university applications through VTAC in 2014.

Critical Dates	Open	Close
Course applications (Timely Applications)	5 August (9am)	27 September (5pm)
Course applications (Late Applications)	27 September (7pm)	8 November (5pm)
Course applications (Very Late Applications)	8 November (7pm)	6 December (5pm)
Change of preference (Prior to results)	5 August (9am)	25 October (5pm)
VCE results and ATAR	16 December (7am)	17 December
Change of preference (Post results)	25 November (9am)	23 December (12noon)
Round 1 offers	17 January 2014 (2pm)	17 January 2014
Round 2 offers	6 February 2014 (2pm)	6 February 2014
Supplementary offers	February 2014	February 2014

Source: Adapted from VTAC, ABC of Applying - Getting it right 2014

If an offer has been received in one round, in subsequent offer rounds, students will be considered for course preferences higher than the offers they have already received. Students can accept an offer that is more favourable in a later round, even if they have already accepted an offer they receive in the first round. Students who do not receive an offer in the first round may receive one in a subsequent round. This is because additional course places can become available in later offer rounds where students who receive offers in the first round choose to defer or reject their place, or where universities reserve places in individual courses for subsequent rounds.

All states have a change of preference period which allows time for students to reassess their options and to make changes to their course preferences which would help them increase their chances of receiving an offer. This may involve changing some or all of the courses and universities listed; changing the order of preferences for any or all of the courses previously listed; or a combination of the two. Preferences can be changed as often as required up until the relevant closing dates. There are generally two change of preference periods. The first is prior to the ATAR becoming available and the second commences after the ATAR is provided to students. Queensland, however, seems to have one change of preference period in respect to the main offer round which ends approximately 3 weeks after results are known. For each state, the relevant process and the dates for university courses commencing in 2014 is set out in Table A3.

Table A3: Comparison of critical dates for applications and offers in Victoria, NSW, South Australia, Western Australia and Queensland.

	Victoria		NSW		SA		WA		Queensland	
	Open	Close	Open	Close	Open	Close	Open	Close	Open	Close
Course applications (Timely Applications)	5 Aug (9am)	27 Sept (5pm)	7 Aug (9am)	27 Sept (5pm)	5 Aug	27 Sept	12 Aug	27 Sept (11.00pm)	1 Aug	27 Sept
Course applications (Late and Very Late Applications)	27 Sept (7pm)	6 Dec (5pm)	28 Sept	29 Nov		2 Dec		29 Nov (11.00pm)		11 Dec
Change of preference (Prior to results)	5 Aug (9am)	25 October (5pm)	5 Aug (9am)	Different closing dates for different rounds until 3 Dec				29 Nov (11.00pm)		8 Jan 2014
Results and ATAR	16 Dec (7am)	17 Dec	19Dec	20 Dec	19 Dec		30 Dec		14 Dec	

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	Victoria		NSW		SA		WA		Queensland	
	Open	Close	Open	Close	Open	Close	Open	Close	Open	Close
Change of preference (Post results)		23 Dec (12noon)		Main offer round: 4 Jan 2014 Subsequent to main offer round there are additional offer rounds until July 2014. Each of these rounds has a different closing date for change of preferences		6 Jan 2014		3 Jan 2014 (11.00pm) (Change of preferences re-open after main round offers made and close 22 Jan)		8 Jan 2014 (for the main round offer period). Preferences can also be changed for round 2 and subsequent offer periods up until the date when offers are made in Feb and Mar.
Main round offers	17 Jan 2014 (2pm)		16 Jan 2014		16 Jan 2014	17 Jan 2014	17 Jan 2014		16 Jan 2014	23 Jan 2014
Round 2 and Supplementary offers	Feb 2014	Feb 2014		Additional offer rounds make offers until July 2014	29 Jan 2014	Feb 2014		4 Feb 2014	Feb 2014	Mar 2014