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WHO IS OFFERED A UNIVERSITY PLACE AND WHO REJECTS THEIR OFFER?

A 2014 Student Equity in Higher Education Research Grants Project

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Executive Summary

This report studies the university offers made to a population of students who apply for places through a centralised university admissions system operated by the Victorian Tertiary Admissions Centre (VTAC) in Victoria, Australia. Students submit an application portfolio of up to 12 programs they wish to be considered for. The project builds on the work of Cardak et al. (2015) who concentrate on university applications of students by focusing on who receives an offer and how students respond to offers, particularly whether they accept those offers. The focus of the current analysis is on differences between high and low socioeconomic status (SES) students.

Preliminary analysis finds SES based differences. Relative to high SES students, low SES students are twice as likely to receive no offer and 60% more likely to reject an offer they have received. We apply a number of empirical techniques, including non-parametric smoothing and probit analysis. These approaches allow us to condition for a range of factors that affect offer received and offer rejected. An important conclusion of our analysis is that differences in offer received and offer rejected outcomes vary across the distribution of students.

First, after controlling for a range of factors, we do not find SES differences in offer received or rejected outcomes. The implication is that SES operates through other mechanisms like ATAR (Cardak and Ryan, 2014) and how students negotiate the application process (Cardak et al., 2015).

We find that high school achievement, measured by ATAR, is an important determinant. Estimated average marginal effects indicate a one point increase in ATAR which raises the probability of receiving an offer by 0.33% and lowers the probability of rejecting an offer by 0.46%. However, focusing on students with ATARs of 40 and 50, we find marginal effects of a one point increase in ATAR as high as 1.33% and -1.31%. The implication is that the main effects of ATAR on the outcomes of interest are concentrated among low ATAR students who might be struggling to match aspirations and ambition with feasible programs. Here we find the marginal effect of one more change to the application portfolio is 0.22% on offer received and -0.48% on offer rejected. These results relate to the findings in Cardak et al. (2015) where we found low SES students benefited less from making changes in the

applications process. We include a number of optimal application portfolio measures and find that the more aggressive or ambitious a student application portfolio, the less likely they are to receive an offer and the less likely they are to reject an offer. For example, adding one more program with an ATAR admission threshold (clearly in ATAR) above the student's attained ATAR reduces the probability of receiving an offer, i.e. by 1.84%, and the probability of rejecting an offer, i.e. by 0.31%. For a 10 point increase in portfolio diversity, measured in ATAR points and defined in the report, the chances of receiving an offer increase by 0.40% and the chances of rejecting an offer fall by 0.5%. For portfolio size, measured in the total number of programs applied for, a one unit increase in portfolio size raises the probability of receiving an offer by 1.86% but is not a significant determinant of rejecting an offer.

The strongest policy implication of the findings is that the allocation of university places works well for students with high ATARs but students with lower ATARs, below 70, seem to struggle with the reality of their achievement and matching that achievement with feasible programs. This is highlighted by the fact that the failure to receive an offer and rejecting an offer are both higher among students not making many changes to their application portfolio after they discover their ATAR. This suggests, consistent with Cardak et al. (2015), that more careers counselling and advice for students with lower ATARs might be valuable in helping them modify their application portfolio in order to find university courses that match both their interests and their ATAR. This could involve more information on non-university study pathways and other alternative career paths.

1 Introduction

In this report we investigate offers of university places received and how students respond to the opportunity to study at university. The focus is on the socioeconomic status (SES) gradient in university participation identified in many studies across many countries; see for example Brennan and Osborne (2008), Cardak and Ryan (2014) and Cardak and Vecci (forthcoming) for Australian evidence. The empirical regularity in Australia is that more than 60% of high SES students attend university while less than 20% of low SES students attend university. Our purpose is to build on a previous report on student behaviour with respect to university applications in Cardak et al. (2015), by analysing how applications decisions map into offers and to investigate any empirical regularities in the rejection of offers. This is an important part of a wider and more complex problem of access to higher education. Our work seeks to understand the matches between student, programs of study and institutions and, importantly, to understand when the matches offered are viewed as unacceptable by students or alternatively when matches proposed by students are not met with an offer by institutions.

We take an empirical approach, based on Victorian Tertiary Admissions Centre (VTAC) data which includes all school leaving (Year 12) applicants for a university place in Victoria. The institutional setting is that students submit an application portfolio for up to 12 different university places (programs and institutions) before they complete their final exams and find out their final high school results. Students have an opportunity to change their application after high school exams are completed and results used for admissions purposes are finalised. Our focus is on two key outcomes: (i) whether a student receives an offer of a university place; and (ii) whether a student who has received an offer rejects that offer. We use a range of individual specific and school level data to investigate systematic differences in these outcomes. We measure SES using both the Australian Bureau of Statistics' Socio-Economic Indexes for Areas (SEIFA) and the level of parental education attainment. Our results show the key SES measure is the latter. Along with SES, we incorporate other variables such as high school achievement and measures of application strategies to understand the mechanisms through which SES affects university offers, rejections of those offers and ultimately attendance.

We find a range of important factors affecting whether a student receives an offer of a place and whether they reject that offer. While we observe differences by SES in the receipt and rejection of offers, these are concentrated among low ATAR students, where low SES students are less likely to receive an offer and more likely to reject offers received. One of the dominant factors in offer received and offer rejected is ATAR. We find a nonlinear relationship between these outcomes and ATAR, with a 10 point increase in ATAR raising the probability of receiving an offer by 3.3% and reducing the chances of rejecting an offer by 4.6%. These marginal effects are average effects and when we focus on students with ATARs of 40 and 50, the marginal effects are much higher with a 1 point increase in ATAR raising the chances of receiving (rejecting) an offer rising (falling) by 1.3%. Another important finding is that each additional change to the application portfolio has a 0.22% positive marginal effect on the probability of receiving an offer and a -0.48% marginal effect on the probability of rejecting an offer. The preferred models include a set of variables that are drawn from Cardak et al. (2015) and relate to optimal application portfolios. We find that the more aggressive or ambitious students are with their application portfolios, the less likely they are to receive an offer but the results on rejecting an offer are mixed, possibly due to the variability of the relationship over the range of portfolio aggressiveness. We find weak effects of portfolio diversity, as measured by the range of admissions thresholds of the programs applied for. However, the likelihood of receiving an offer increases with portfolio size, though there is no effect on probability of rejecting an offer. A key point of our analysis is that effects vary across the distribution of students quite widely. High ATAR students are likely to receive offers and to take them up, irrespective of their SES. Conversely, low ATAR students are much less likely to receive an offer and have a lower chance of taking that offer up; these effects are strongest for low SES students but similar patterns are observed for high SES students with low ATAR. The implication is that, consistent with Cardak et al. (2015), low achieving, low SES students who are less engaged with the university application process could benefit from more information and advice on how to prepare an application and what the possibilities might be in taking up a less preferred offer.

In the next section of the report we provide an explanation of the institutional setting around university applications and admission in Victoria, outline the details of the data used for the study and provide an explanation of the optimal portfolio variables we

construct and employ in this report. This is followed by a short section that explains our empirical approach to the data which includes conditional summary tables, non-parametric analysis and probit models of the outcomes of interest, offer received and offer rejected. The report then presents the analysis of these variables, systematically using the techniques outlined, and offering interpretations of the findings. We then present brief conclusions.

1.1 Existing literature and evidence

As noted, this is the second of two reports that seek to identify the challenges facing low SES students as they participate in the application process for higher education places in Victoria, Australia. The first report, Cardak et al. (2015), focused on the application process, including (i) the manner in which students construct a portfolio of programs that form their application for higher education courses; and (ii) how they change their application portfolio in response to receiving their Australian Tertiary Admission Rank (ATAR).[1] The key finding of the first report was that high SES students have a strong advantage in terms of their understanding of the application process. They make more changes to their application portfolios in the window between receiving their ATAR and finalising their portfolio, and those students that make more changes to their application portfolio reap larger benefits from the opportunity to revise their application portfolios. The positive relationship between high SES and the number of portfolio changes was found to be significant after controlling for a range of factors, including the level of surprise as measured by the difference between the student's expectation and their actual level of their ATAR.[2] In a second finding, high SES students construct more aggressive portfolios and construct larger application portfolios.

The Department of Education (DOE), formerly the Department of Education, Employment and Workplace Relations (DEEWR), has published data on offers of university places and the take-up of those offers since 2008. This aggregate level data is derived from data held by the various state Tertiary Admission Centres (TACs), and submitted to DEEWR. The data provides detailed information on higher education supply and demand. This data is complemented by a substantial amount of research offering an aggregate level "snapshot" of the number and characteristics of students being offered places in higher education. Our report builds on this existing work by investigating individual behaviour at the student level, in order to build our understanding of the trade-offs and important aspects of the decision to take up a university offer and attend university.

[1] The ATAR is based on final high school achievement and is the key means by which university places are allocated in Victoria.

[2] Students first construct their portfolio prior to receiving their ATAR, and it is based on their expectation of their ATAR. They then have an opportunity to revise this portfolio after receiving their ATAR.

In the publicly available DEEWR data, applicants are categorised by, among other things, their SES derived from their postcode using the Australian Bureau of Statistics (ABS) Socio-Economic Index for Areas (SEIFA). Low SES comprises the lowest quartile, medium SES the two middle quartiles and high SES the highest quartile. The most recent complete data available is for 2014 (Department of Education, 2014). It is presented in Table 1 and indicates that that as of May 2014, there were 275,410 applications made through TACs for places at higher education institutions. Relative to 2013, school leaver (Year 12) applications increased by 0.4%, while non-Year 12 applications decreased by 0.5%. In response to these applications, there were 227,394 offers made by institutions, representing an increase of 1.2% over 2013. Offers to Year 12 school leaver applicants increased by 1.7% while offers to non-Year 12 applicants increased by 0.4%.

The data in Table 1 also shows that applications for university places have been steadily increasing in all states except for Western Australia in most recent years. The decrease in applications in Western Australia is likely a result of a combination of both a change in school starting age in 2002 which reduced the size of the high school graduating cohort in 2014 and stronger labour market opportunities due to the mining boom in that state; see Jha (2015) for details of the change in school starting age in Western Australia. Since 2009, the number of applications to higher education institutions has increased by 10.3% nationally.

Table 1: Applications to higher education institutions by state and territory, 2009-2014

State	2009	2010	2011	2012	2013	2014	% Change
NSW/ACT	81,101	83,108	84,415	86,999	88,697	86,998	7.3%
Vic.	67,457	71,984	71,202	72,275	72,078	72,786	7.9%
Qld	50,055	57,205	55,852	56,512	56,233	54,787	9.5%
WA	18,650	20,834	20,532	19,304	18,941	18,073	-3.1%
SA/NT	23,279	24,235	24,766	26,425	27,065	29,633	27.3%
Tas.	9,201	9,630	10,443	11,652	12,383	13,133	42.7%
Australia	249,743	266,996	267,210	273,167	275,397	275,410	10.3%

Source: DOE, 2014

The national offer rate, which represents the number of offers as a percentage of highest preference applications, increased from 81.6% in 2013 to 82.6% in 2014. The offer rate provides an indication of the extent to which universities respond to student demand and the level of unmet demand for higher education (DOE, 2014).

The DOE data indicates that Regional Universities Network (RUN) universities were most likely to make an offer to students, with these universities having an offer rate of 107.4%, suggesting offers were made to students who did not apply to these institutions and did not qualify for offers elsewhere. These particular students are most likely to have low ATARs and may be more likely to reject offers, providing a potential explanation of the patterns observed in our student level data below. The Innovative Research Universities (IRU) had an offer rate of 85.1% and the Australian Technology Network (ATN) universities made offers to 76.2% of applicants. The Group of Eight (Go8) universities had the lowest offer rate at 70.1%. This provides some sense of the supply of places, the need and willingness of universities to offer places and their expectations of students accepting offers.

Prior research has shown that there is a substantial gap between aspiration for university and offers of places at higher education institutions and that this gap becomes wider as the level of student achievement decreases. Kirby (2000) notes that as academic achievement falls, both aspirations for university education and offers made by higher education institutions decrease. However, offers decrease substantially faster than aspirations. Using unpublished Victorian Tertiary Admissions Centre (VTAC) data, Kirby shows that the gap between university applications and offers widens as academic achievement decreases until at the lowest level of academic achievement, approximately 50% of students applied for university places but the offer rate for students in this range was approximately 12%. A similar conclusion was reached by Marks (2005) who found that the first-preference intentions of those who applied to enter university but did not receive an offer were often unrealistic with the cut-off entrance score for their first preference course being on average 20 points higher than their actual score. The market for undergraduate places in Victoria has evolved and expanded significantly since these studies and our analysis shows that even at low levels of academic achievement, opportunities exist for students who are flexible with what they wish to study.

The DOE data also provides an indication of the degree to which student aspirations are aligned with university offers. In 2014, 56% of students received an offer for their highest preference course. WA recorded the highest first preference offer rate of 67.7%, consistent with falling overall demand evident in Table 1, while Victoria had the lowest offer rate for first preferences with only 45.9% of applicants receiving an offer for their highest preference course. School leaving Year 12 applicants were less likely to receive an offer for their highest preference course compared to non-Year 12 applicants. Across Australia, 54.9% of Year 12 students received an offer for their highest preference compared to a first preference offer rate of 57.4% for non-Year 12 applicants. The DOE notes that these figures may reflect the fact that many school leaving students nominate an aspirational first preference, while non-Year 12 applicants are more likely to be mature students who have a stronger sense of what they wish to study and are more realistic in their preferences.

A number of researchers have observed that students from lower SES backgrounds are less likely to apply to university and are also less likely to receive an offer once they apply. Palmer, Bexley and James (2011), for example, conclude that in 2008-2009 the application rate for medium SES students, who represent the middle 50% of SES bands by postcode, were approximately equal to the representative population share at 48.7%. However, low SES applicants who represent the lowest 25% of SES bands were under-represented with an 18% application rate. High SES applicants, who make up the top 25% of SES bands, were over-represented relative to their population share with an application rate of 31.6%.

Gale and Parker (2013) find that even though offers to low SES students since 2009 have increased substantially, low SES students in 2012 were still less likely to receive an offer to attend university than middle and high SES students. The offer rate in 2012 for low SES students was 79.4%, while it was 81.4% for medium SES applicants and 83.6% for high SES students. Similar conclusions were reached by Newnham, Anderson and James (2012). Using Victorian data they find that the two lowest SES quartiles have offer rates much lower than the two highest SES quartiles and that both the share of applications by low SES students, which stood at 16.2% in 2011, and the share of offers at 14.8% in 2011, were substantially below the low SES population share of approximately 22% in Victoria.

The most recent DOE data supports these previous findings. Low SES students continue to be under-represented both in terms of applications to university and offers from higher education institutions. In 2014, 18.9% of all university applications across Australia were from low SES students, compared with 49.3% from medium SES applicants and 30.2% from high SES applicants. Given that the population share of low SES and high SES students is 25% for both, low SES students are under-represented and high SES students over-represented in the share of applications to attend university (DEEWR, 2014). We find similar patterns in our data and build on our previous analyses using non-parametric and multivariate estimation techniques that incorporate measures of application portfolio optimality developed in Cardak et al. (2015).

DOE data on offer rates by SES by state, presented in Table 2, show that low SES students are less likely to receive an offer compared with students from other SES backgrounds. The national offer rate for low SES applicants in 2014 was 80.8% compared with 82.5% for medium SES students and 84.4% for high SES students. In all states and territories except Queensland and Tasmania, offer rates for low SES students were lower than for other SES groups.

Table 2: Offer rates by SES by state, 2014

Region	Low SES	Medium SES	High SES	Total
NSW/ACT	82.1%	83.4%	86.3%	84.0%
Vic.	77.9%	82.5%	87.2%	83.3%
Qld	86.1%	86.0%	82.4%	84.9%
WA	79.9%	83.1%	86.8%	83.7%
SA/NT	71.8%	72.3%	72.4%	71.9%
Tas.	87.4%	83.6%	74.4%	81.6%
Australia	80.8%	82.5%	84.4%	82.6%

Source: DOE (2014)

Compared to research and data on student applications and university offers, relatively little research has been undertaken on the characteristics of students who reject university offers (Norton, 2013). The DOE data (DOE, 2014) indicates that low SES students who received an offer in 2014 were slightly less likely to accept their offer compared with other SES groups, with 70.4 % of low SES applicants accepting their

offer compared with 71% of medium SES applicants and 70.9% of high SES applicants.

One reason why students may reject offers is because of a perception that, as a result of their low ATAR they are being offered a low-level course. In fact, 40% of those applicants with an ATAR below 60 who receive an offer reject it (Norton, 2013). This is consistent with other research that indicates the rate at which students reject offers increases as ATAR scores decline (Kemp and Norton, 2014).

A further likely explanation of the reason that rejections increase as ATAR declines is that students with low ATARs generally receive offers for courses that do not interest them. Cameron, McClelland and Pope (1990) conducted a survey of Queensland students who rejected offers, and found the “not interested in the course” to be the second most important reason for offer rejection (with 12% of students rejecting offers for this reason). Other reasons for rejecting offers included receiving better offers from a source other than the Queensland Tertiary Admissions Centre (19.5% of students), financial circumstances (6.5% of students), family circumstances (5% of students) and the cost of study seemingly being too high (4.8% of students).

These findings on the relationship between low ATAR and offer rejection are consistent with other research which finds a strong positive link between high school achievement and university eligibility (as measured by the value of the ENTER score) and university participation (Cardak and Ryan, 2009; Cardak and Ryan, 2014). However, Cardak and Ryan (2014) also find a higher probability of university attendance among students likely to be credit constrained students relative to students who are unlikely to be credit constrained, with the difference more pronounced at ATARs of 70 or lower. This partly motivates our study to reconcile these findings with the data and studies outlined above, in particular focusing on individual factors that are correlated with student choices and behaviour. The aim is to provide possible explanations for different students not taking up offers and to build potential directions for policymakers and institutions who seek to improve the matches between disadvantaged students and the programs they study and the institutions they study at.

2 Institutional setting and data

In this chapter we describe the university application and admissions process in Victoria, including the process for qualifying for university admission through final examinations and submitting applications through a centralised admissions authority, the Victorian Tertiary Admissions Centre (VTAC). A full description of the institutional setting is provided in Cardak et al. (2015). In this chapter we reproduce the aspects of the institutional settings relevant to this study for completeness.

2.1 Institutions

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), consisting of at least five VCE subjects. 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.

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 3, Panel A. The academic school year corresponds to the calendar year, running from late January to late November. As the focus in this study is on offers, and acceptances of offers, we only briefly discuss the application and change of preferences details. Students can submit an application portfolio between August and December, with numerous deadlines where relevant application fees increase as the *first* application portfolio is submitted later in the application period; see Table 3 for more detail. Another key feature of the application process is that once the *first* application portfolio is submitted, students have numerous opportunities to change (i) the programs included in their application portfolio, and (ii) the order of those included programs. A key feature of the application process is that students have an opportunity to modify their application portfolios after they discover

their final high school achievement, the ATAR. This provides students the opportunity to process important new information on their academic ability and is exploited in the work of Cardak et al. (2015), where a more detailed discussion of the application process and portfolios is provided.

Table 3: 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: Open		No fee	1 August 2001
Close			28 October 2011[b]
Second change of preference period: Open		No fee	28 November 2011
Close			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.

Once applications are finalised, the details of each student's application and ATAR are provided to all universities listed on their application portfolio. 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 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 the “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.

2.2 Data

The data used in this study was also used in Cardak et al. (2015), another report supported by a grant from the NCSEHE. The research questions are related, and as a consequence, the approach to the data is similar. For completeness, we discuss details of the data and provide relevant summary statistics here. Interested readers can consult Cardak et al. (2015) for more details of the portfolio changes aspects of the data.

The data was obtained from VTAC by application and involves a confidentiality agreement.[3] 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 elements of the dataset for this study are final student application portfolios, offers made to students and how students responded to those offers. Each student’s application portfolio includes up to 12 degree programs applied for in order of preference. As outlined in our discussion of the institutional setting, students have

[3] 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.

several opportunities to modify their application portfolio. The number of changes made by students is an important measure of the sophistication of students in the application process and is used as an explanatory variable in the analysis below. The key variables we wish to explain are whether students receive an offer of a university place and whether they accept that offer and how these vary by SES.

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 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.[4]

The second measure of SES, as noted above, 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.[5] 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 commonly used in government reports and is an average measure of socioeconomic status based on neighbourhood (postcode)

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

[5] We do not have data on family structure so we cannot identify the impact on students from sole parent or other non-traditional households.

characteristics. On this basis, it is a more reliable indicator of SES; see Bowden and Doughney (2010), James (2002) and McMillan and Western (2000).

These offer received and offer rejected variables are summarised by SES in Table 4. High SES students are those where at least one parent has completed a bachelor's degree or higher. On all the measures presented, low SES students are at a disadvantage. Compared to high SES students, almost 21% more low SES students received offers outside their top four degree choices. Similarly, 62% more low SES students rejected offers and the proportion of low SES students receiving no offer is more than double that of high SES students. These findings motivate further analysis, particularly as Cardak and Ryan (2014) find a higher probability of low SES students attending university, particularly with ATAR below 70.

Table 4: Summary statistics for 2011 VTAC applications by SES

SES (parental education)	Average changes[1]	Average rank of offer[1]	Offer outside top 4[1]	Offer rejected	No offer received
Low SES	4.48	2.19	10.30%	14.55%	7.61%
High SES	4.75	2.11	8.50%	8.98%	3.00%
Overall	4.61	2.16	9.40%	11.86%	5.37%

Notes:

1. Small discrepancies between these figures and those in Table 5 arise because students that did not report the parents' level of education, or were not made an offer, have been excluded here.

Our analysis is undertaken with a range of academic, socioeconomic and demographic variables recorded for each individual student. Academic variables include student ATAR and VCE results for each subject (study scores) and type of school attended.[6] 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). 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.

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

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. We also create an indicator of whether a student's ATAR exceeds the average ATAR at their school, which is used to measure the effects of rank within the students' peer group and how students respond to offers and opportunities if they have performed poorly relative to their school cohort.

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.[7]

Variables and summary statistics are provided in Table 5, 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 1213. We find that 47.3% of students have at least one parent who has completed a bachelor's degree or higher, and therefore on our preferred measure of SES, just over half (52.7%) of students are considered to be low SES. Only a small fraction do not speak English at home (13%), less than half the sample are male (44.4%), while nearly half attended private schools (23.7% independent and 25.9% Catholic), with less than 1% attending adult schools and the remaining 49.4% attending public schools.

The next three 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 37.2% of all applicants change their top ranked program after

[7] 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.

they have received their ATAR. The average rank of the offer received is 2.18, with a standard deviation of 2.20, suggesting that students have a good sense of what programs are feasible though there is a lot of variability in this measure.

In Panel B of Table 5, we present a number of school level summary statistics. The average school SEFIA IEO is 1024. Average school ATAR is 68.58 and the average within school variance in the ATAR is 16.78, which is lower than the overall standard deviation of ATAR of 20.05, suggesting some school-based clustering of students with similar ATARs.

Table 5: 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	68.58	20.05
Student SES (SEIFA) ABS	1015	90
Student SES (at least one parent has a bachelor's degree) (n =36793)[2]	47.3%	
Primary language English	87%	
Male	44.4%	
Attended independent school	23.7%	
Attended Catholic school	25.9%	
Attended adult school	0.98%	
Average number of changes in application (November-December)	4.50	4.48
Proportion changing 1st preference (November-December)	37.2%	0.49
Average preference rank of course offered in January (n = 37280)[2]	2.18	2.20
Panel B: School Specific Variables		
School SES (SEIFA) (n = 39285)	1024	103
School average ATAR	68.58	10.79
Within school variance in ATAR (n = 39329)	16.78	2.81

Notes:
1. Unless otherwise noted, sample size used to calculate summary statistics is n = 39335.
2. The sample size is lower for students' SES by parents' level of education due to missing data and for average preference rank of course offered as it excludes students not made an offer.

2.3 Optimal portfolios

In Cardak et al. (2015), a theoretical model of student application behaviour is constructed that draws on the optimal application portfolios of Chade and Smith (2006) where students simultaneously submit applications to multiple institutions. Chade and Smith (2006) investigate the characteristics of optimal application portfolios relative to alternative application strategies such as sequential applications and applying for the highest expected utility programs. Along with their Marginal Improvement Algorithm (MIA), which outlines how to construct an optimal portfolio, they also focus on the level of student risk taking, or portfolio *aggressiveness*, the upward diversity of application portfolios and the size of student application portfolios. In Cardak et al. (2015), using VTAC data, an empirical approach is taken to measuring these concepts and investigating how these portfolio characteristics vary across the student population; for a more detailed discussion in the context of VTAC applications, see Cardak et al. (2015).

Given the differences across the student population, we include measures of portfolio *aggressiveness*, diversity and size in our analysis of the success of student applications in being offered a university place and whether students accept those offers. These measures are important as they reflect the level of sophistication among applicants. They tell us how well students understand the application process and whether they approach it in a strategic manner that ensures they are allocated a university place that suits them. We now turn to an explanation of the variables used.

Similar to our analysis in Cardak et al. (2015), we use two measures of portfolio aggressiveness. Our first measure is given by the difference between the average clearly in attainment threshold of the top four programs listed in the student's application portfolio and the actual ATAR. The second measure uses the number of programs in the portfolio with clearly in attainment thresholds above the student's actual ATAR. The difference between the clearly in attainment threshold of the highest and lowest ranked program in the student's portfolio is used 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. Summary statistics for these four measures are provided in Table 6.

Table 6: 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.

These measures all suggest that low SES students are at a disadvantage as their portfolios are on average less diverse and have fewer programs listed, suggesting they are not considering all possibilities when preparing an application portfolio. Conversely, the portfolios of low SES students are on average more aggressive, implying they are overly ambitious in their application strategies. This may be interpreted as reflecting a good understanding of the application process in that offers will be made to the highest ranked feasible program in the application portfolio and listing infeasible or unlikely programs does not hurt the student's chances of receiving an offer as long as a feasible program is listed as some point. We now turn to statistical testing for the effects of these, and the other variables discussed above, on our variables of interest, offer received and offer rejected.

3 Empirical methods

Our interest is in the factors that affect (i) the receipt of an offer of a university place (hereafter offer received), and (ii) whether a student rejects an offer of a university place (hereafter offer rejected). We undertake preliminary analysis by constructing a cross-tabulation of offer rejected and offer received by ATAR, SES and the number of portfolio changes made after receiving their ATAR. This simple analysis highlights some interesting aspects of the data and potential relationships. Based on these results we estimate a series of correlations using non-parametric methods. This allows us to illustrate how the relationships vary across the distribution of students. As will be shown, this is quite important given the nature of the market for university places as many students seem to find a good match to an institution and program. The non-parametric analysis focuses on offer rejected and offer received and how these outcomes vary with ATAR and the optimal portfolio measures of portfolio aggressiveness, diversity and size. Finally, we build on the above evidence with probit regression analysis to understand the impact of the three key variables while controlling for a range of individual and school associated variables.

3.1 Non-parametric analysis

The non-parametric analysis in this report is based on the lowess smoother command in STATA 13.[8] This estimation technique provides an estimate of the relationship between the dependent and explanatory variables at different points in the range of possible values of the explanatory variable. For example, in estimating the relationship between offer made and ATAR, we end up with the probability of an offer being made at different ATAR values. The estimate can be viewed as a probability as the outcome is dichotomous.

The lowess function estimates the relationship at a series of *m* locations or evaluation points equally-spaced across the range of the horizontal axis. It does this by performing a series of *m* weighted 'local' regression analyses using a subset of observations that fall closest to that evaluation point along the horizontal axis. The local regressions in this report employ a running line least squares. The observations

[8] Lowess is nonparametric fitting technique that does not require an a priori specification of the relationship between the dependent and independent variables.

included in each local regression are inversely weighted according to their distance from the evaluation point along the horizontal axis. The coefficients from each local regression are used to estimate a predicted or fitted value at that evaluation point. After all of the local regressions are completed, the *m* different ordered pairs consisting of the horizontal location of the m^{th} and the estimate fitted value, are plotted connected by line segments. See Jacoby (2000) for more information on the procedure.

3.2 Probit analysis

The above approaches provide limited or no conditioning on potentially important controls. We build on the above approaches by estimating a probit model of offer received and offer rejected, including student and school characteristics along with ATAR, SES and the number of changes made to the student's application portfolio as controls.

$$\begin{aligned} DependantVariable_i = f(&\alpha_0 + \alpha_1 \bullet Ln(income)_i + \alpha_2 \bullet Parent_Education_i \\ &+\alpha_3 \bullet ATAR_i + \alpha_4 \bullet ATAR_i^2 + \alpha_5 \bullet ATAR_i^3 + \alpha_6 \bullet \Delta_i + \alpha_7 \bullet Z_i) \end{aligned} \quad (0)$$

We estimate a second similar model where we include optimal portfolio variables, portfolio aggressiveness, diversity and size as additional controls to reflect student sophistication with respect to student applications.

$$\begin{aligned} DependantVariable_i = f(&\alpha_0 + \alpha_1 \bullet Ln(income)_i + \alpha_2 \bullet Parent_Education_i \\ &+\alpha_3 \bullet ATAR_i + \alpha_4 \bullet ATAR_i^2 + \alpha_5 \bullet ATAR_i^3 + \alpha_6 \bullet \Delta_i + \alpha_7 \bullet \chi_i + \alpha_8 \bullet Z_i) \end{aligned} \quad (0)$$

where $DependantVariable_i$ is either offer made or offer rejected, Δ_i is the number of changes made to the application portfolio after student i discovers their final high school results $(ATAR_i)$, χ_i is a vector consisting of the portfolio aggressiveness, diversity and application size variables and Z_i is a vector consisting of the student and school characteristics. The full list of variables can be found in Table 9 and Table 11, which provide the results of our estimation of the models in equations (0) and (0) for both dependent variables respectively. We report average marginal effects as they are more informative of actual effects, while we also provide marginal effects at a range of ATAR values because of the importance of ATAR in the allocation of university places.

4 Results and discussion

In this chapter we analyse offer and acceptance data in order to build a picture of the important factors determining which students receive and accept an offer of a university place. We present a range of conditional summary statistics in order to highlight key factors. These statistics are built upon using non-parametric estimates of a number of important correlations to illustrate how they vary across the distribution of students. This is followed with estimates of average marginal effects based on probit models of receiving and rejecting an offer. The range of approaches is important and highlights how the presented regression analysis can mask some important effects present only in subsections of the student distribution.

Table 7: "Offer made" by SES, ATAR and number of changes (each cell contains relevant proportion of population)

SES (parental education)	Four changes or fewer		More than four changes		
	No offer received	Offer received	No offer received	Offer received	Total
Low SES					
ATAR < 70	2.96%	13.86%	0.71%	14.33%	31.86%
ATAR >= 70	0.06%	10.35%	0.00%	10.45%	20.86%
High SES					
ATAR < 70	1.02%	6.04%	0.26%	8.87%	16.19%
ATAR >= 70	0.08%	15.18%	0.01%	15.82%	31.09%
Total	4.12%	45.43%	0.98%	49.47%	100%

We begin our analysis by examining relationship between offer received with SES, the number of changes made by the student to their portfolio and ATAR. The overall share of students falling into various categories is presented in Table 7 where it can be seen that, almost without fail, students with an ATAR greater than 70 receive an offer of a university place. This implies that in order to understand who does not receive an offer, we should focus on students with an ATAR less than 70. It can be seen that a greater share of students who make less than 4 changes to their application portfolio do not receive offers; 17.59% = 2.96/(2.96+13.86) for low SES, ATAR<70 and less than 4 changes, versus 4.7% for low SES, ATAR<70 and more than 4 changes. A similar

comparison for high SES students shows a 14.44% versus 2.85% failure to receive an offer. The null of equality of these proportions is tested and easily rejected at the 0.1% level. These results are consistent with the findings in Cardak et al. (2015) where the number of portfolio changes is a strong indicator of student awareness of the application process. Another important point illustrated in Table 7 is the external validity of the data. We observe a higher proportion of low SES students with a low ATAR (60%) relative to high SES students with a low ATAR (34%). This is consistent with the SES gradient in high school achievement highlighted by Cardak and Ryan (2009).

Table 8: "Offer rejected" by SES, ATAR and number of changes (each cell contains relevant proportion of population)

SES (parental education)	Four changes or fewer		More than four changes		
	Offer accepted	Offer rejected	Offer accepted	Offer rejected	Total
Low SES					
ATAR < 70	10.44%	4.17%	12.96%	2.14%	29.71%
ATAR >= 70	10.15%	0.76%	10.56%	0.45%	21.92%
High SES					
ATAR < 70	4.82%	1.54%	8.35%	0.99%	15.71%
ATAR >= 70	14.93%	1.07%	15.94%	0.73%	32.67%
Total	40.33%	7.54%	47.81%	4.31%	100%

The exercise is repeated for offer rejected in Table 8 with similar patterns observed. The rates of offer rejected are much higher among low ATAR students, for example 28.54% of low SES, ATAR<70 students with less than 4 portfolio changes reject offers compared with 6.97% of ATAR>70 students. A similar pattern is observed for high SES students and once again, tests of the null hypothesis of equality of the proportions of students rejecting offers between these different groups are easily rejected at the 0.1% level of significance. The levels and differences in offer rejected are smaller for students with more than 4 application portfolio changes, implying students making more changes are less likely to reject an offer. We interpret this as students making more changes having refined their expectations and application portfolio in line with

realised achievement as reflected by their ATAR. In absolute terms, the biggest incidence of students rejecting offers is among low SES, ATAR<70 students, providing immediate pointers as to where the policy issues might lie. These students may have high aspirations and with the relatively low ATAR realisation may be discouraged from their university study plans and therefore reject the offer made. Alternatively, these students may have felt pressure from their families, school or peers to apply for a university place even though they may not have wanted to study at university. We suspect this pattern is driven by a combination of these two effects and the data does not allow us to disentangle them. In Table 8, as in Table 7, we find higher proportions of low SES students with ATAR<70. This may provide some clue as to the motivating finding in Cardak and Ryan (2014) where the probability of university attendance is higher among students likely to be credit constrained relative to students who are unlikely to be credit constrained with ATAR<70. We speculate that the higher number of low SES students with ATAR<70 may be driving the surprising result. We investigate a number of these findings further below.

Non-parametric estimates of the relationship between offer received (rejected) and ATAR are presented in Figure 1 (Figure 2), with the dashed blue curve denoting the relevant outcome for low SES students and the solid red curve denoting the outcome for high SES students.

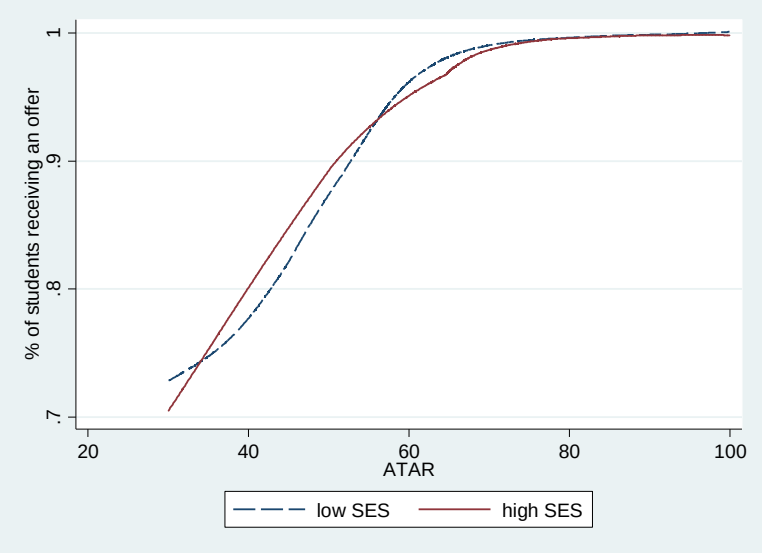

Figure 1: Offer received by level of ATAR for low and high SES students

Several important points can be inferred from Figure 1. First, as the curves are horizontal for high and low SES students with ATAR>70, the chances of receiving an offer are virtually unaffected by ATAR. This implies that these students are making plausible applications and as they are in demand by institutions, they apply, leading to high chances of an offer. Second, for high and low SES students with ATAR<70, we observe a strong and positive relationship between ATAR and the probability of receiving an offer, with chances of receiving an offer falling from 100% with an ATAR of 70 to around 75-80% with an ATAR of 40. This is a complex finding as it is related to both the supply of university places with ATAR admissions requirements below 70 as well as a demand from students for those places. Once again, our interpretation is that students with lower ATARs have high aspirations and are unwilling to compromise on these aspirations in their application portfolios, leading to lower probabilities of an offer being made, or these students may have felt pressure to apply for a university place without a genuine aspiration to attend. These interpretations are consistent with Table 7 where we show failure to receive an offer is much more common among those students who do not adapt to their ATAR circumstances and are potentially being more unrealistic about study possibilities. It is also interesting that the high and low SES curves separate for ATARs below 70. While the curves cross over, at the lowest ATARs, the low SES students are less likely to receive an offer, with the largest difference of five percentage points for low ATAR students. The finding suggests at the lowest ATARs, low SES students may be a bit more unrealistic than their high SES counterparts.

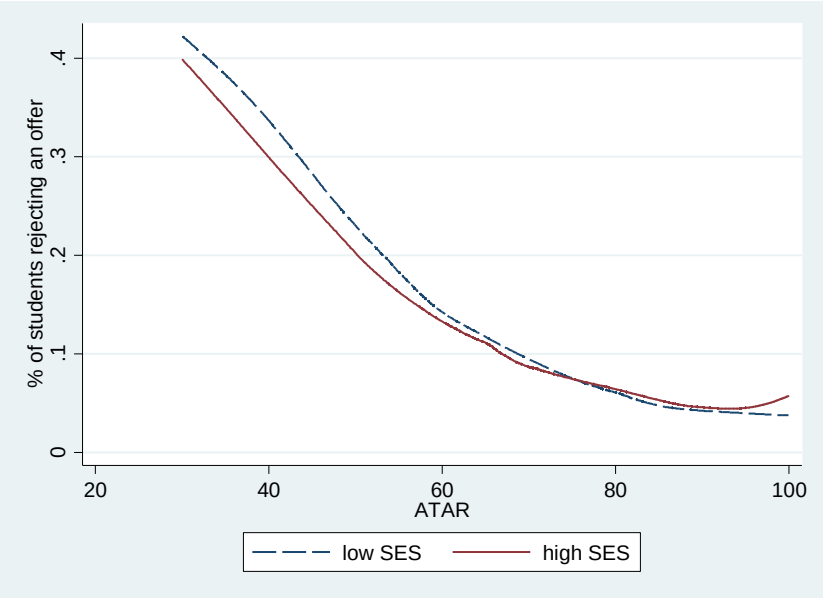

Figure 2: Offer rejected by level of ATAR for low and high SES students

The probability of rejecting an offer in Figure 2 also has a strong relationship with ATAR. This probability falls below 10% when ATAR rises above 70 and is relatively flat at these higher achievement levels. However, students reject 30-35% of offers with ATARs of 40 and 12-15% of offers with ATARs of 60. These results are also consistent with Table 8 and imply that low ATAR students who do manage to prepare an application portfolio that will lead to an offer of a university place may be dissatisfied with that offer or may not have wanted to study at university and will reject the offer. This relationship holds for both high and low SES; however, low SES students are more likely to reject an offer between the ATAR ranges of 30 to 60. At its largest, this gap is about 5%. Considering the impact of SES on both offer received and rejected, it can be seen that low SES students with ATARs in the 30-60 range are less likely to receive an offer and, if they do receive an offer, are more likely to reject that offer.

We apply similar non-parametric techniques to the optimal portfolio variables discussed above, presenting estimates of the probability of offer received by both portfolio aggressiveness measures, portfolio diversity and size in Figure 3. It can be seen that each of these variables has an important impact on whether an offer is received. Recalling that the first portfolio aggressiveness measure is the difference between the average clearly in attainment threshold of the top four programs listed in the student's application portfolio and the actual ATAR, we find that if this measure is

negative, students are certain of receiving an offer. This is because their achievement qualifies them for some of their top four programs. For positive values of this measure the student's expected ATAR (measured by the top four programs applied for) exceeds their actual ATAR, and the probability of an offer decreases. For very ambitious students (with a difference between expected and actual ATAR of 75) the probability of receiving an offer falls to 40%.

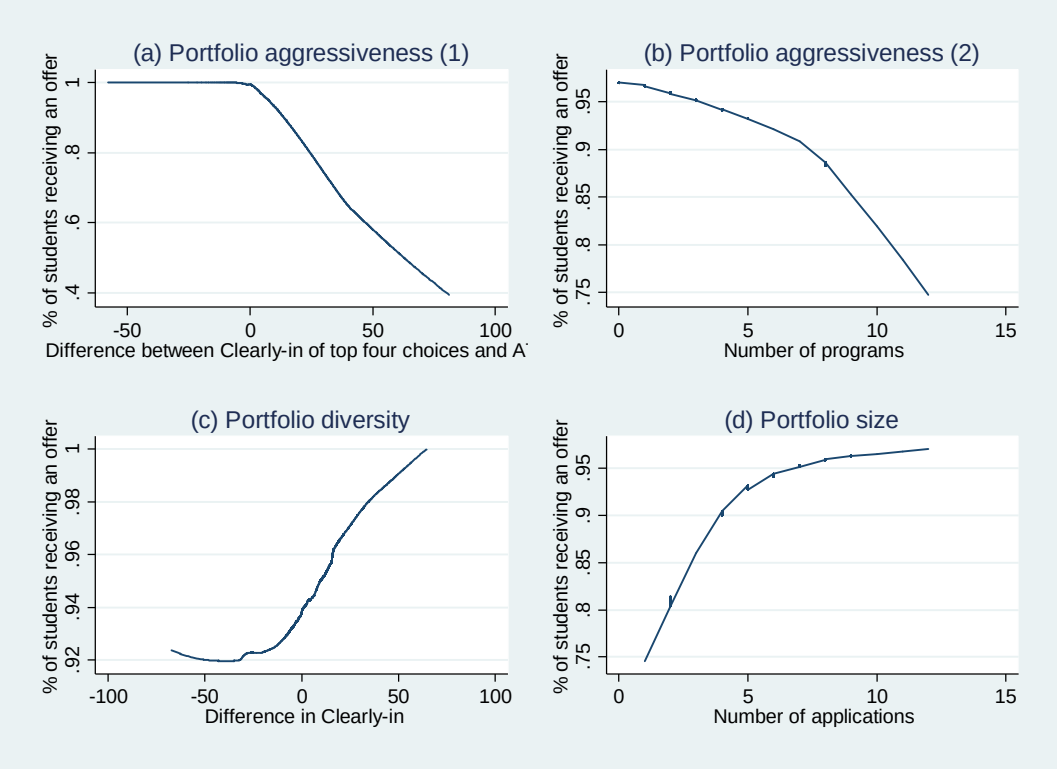

Figure 3: Offer made by portfolio aggressiveness, diversity and size

Notes:

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

In panel (b) of Figure 3, we find that as the number of programs with clearly in ATAR thresholds above the student's actual ATAR increases, the probability of receiving an offer decreases. However, the probability only falls to 75% compared to the low 40% probability of offer received for the first measure of aggressiveness. We suspect this indicates a number of students are using most, if not all, of the possible 12 programs

listed to apply for stretch programs, though many are still using lower preferences as safety applications.

A strong relationship is observed between portfolio diversity and chances of receiving an offer. However, the difference between low and high portfolio diversity is only 8% at the extreme. This implies the difference between the admission thresholds between the top and bottom listed programs is not as important for receipt of an offer as the various portfolio aggressiveness measures or the portfolio size, which we turn to next.

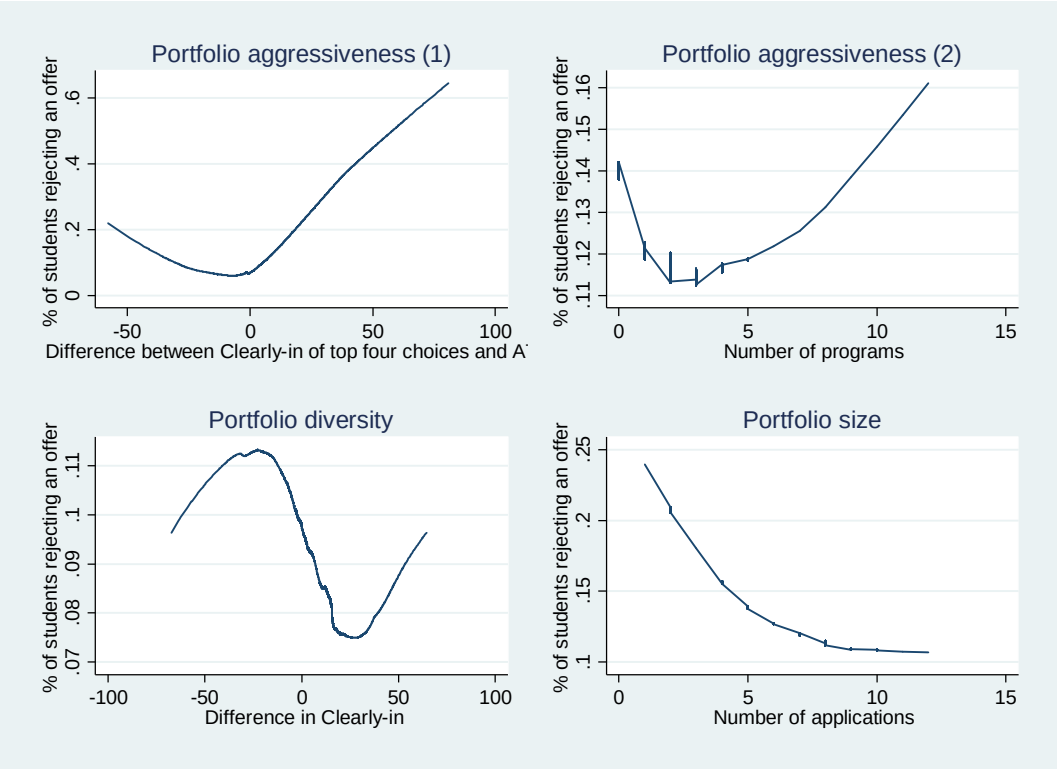

Figure 4: Offer rejected by portfolio aggressiveness, diversity and size

Notes:

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

As the number of programs included in the application portfolio increases, so too does the number of students receiving an offer. However, the relationship plateaus at the 5 programs level, with very little difference in probability of offer received for students with 5 to 12 programs listed in their application portfolio. This suggests that students with larger application portfolios are using the larger number of applications to build in some safety applications, ensuring they receive an offer of some sort

We estimate and present in Figure 4 the same relationships for the offer rejected variable, finding similar effects. First, students with more aggressive portfolios have a higher propensity to reject an offer. Portfolio diversity appears to have little to no systematic impact on the likelihood of rejecting an offer, with the probability of rejecting ranging between 7 and 11%. Finally, students with many programs included in their application portfolio are less likely to reject an offer. Again, recalling that applying for additional programs does not increase explicit application costs, this suggests that students with large portfolios are taking advantage of the low marginal cost associated with applying for stretch programs and then backing this up with safety programs. We believe that this idea is worthy of future investigation, requiring more detailed investigation of individual application portfolios and is reserved for future research.

Much of the preceding analysis does not condition on a full range of variables that are typically considered important for educational outcomes. In order to account for factors like gender, SES and school sector, among other things, we estimate a probit model with a full set of control variables. The results of the probit analysis are presented in Table 9 and Table 10 for the offer received outcome and in Table 11 and Table 12 for the offer rejected outcome. The estimates presented in these tables are marginal effects rather than parameter estimates.

Our preferred specification is model 2 which is presented in the second column of each table. This specification includes the optimal portfolio variables discussed above, all of which are highly statistically significant. We also note that we have modified portfolio aggressiveness measure 1 in order to avoid confounding the effect of ATAR. In the following econometric modelling, portfolio aggressiveness measure 1 is given by the average clearly in attainment threshold of the top four programs listed in the student's application portfolio without subtracting the student's actual ATAR.

In Table 9 we see that portfolio aggressiveness has a negative effect on offer received. An increase of 10 ATAR points of the average clearly in ATAR of the top four programs (portfolio aggressiveness measure 1) will reduce the probability of receiving an offer by 1.5%, while adding one more program with a clearly in ATAR above the student's own ATAR lowers the probability of receiving an offer by 1.8%. Recalling that portfolio diversity ranges between -60 and 60, a 10 point increase in portfolio diversity raises the chances of receiving an offer by 0.4%, while the average effect of increasing portfolio size by one application is 1.8%. These results are in line with intuition and are consistent with the non-parametric analysis undertaken above.

Table 9: Probit models of offer received

	Model 1		Model 2	
	dy/dx	P>z	dy/dx	P>z
Aggressiveness Variables				
Portfolio aggressiveness (1) [1]			-0.0015	0.000
Portfolio aggressiveness (2) [2]			-0.0184	0.000
Portfolio diversity[3]			0.0004	0.000
Portfolio Size[4]			0.0186	0.000
Student Variables				
Log income	0.0258	0.000	0.0065	0.299
Parent education (SES)	-0.0015	0.544	0.0031	0.192
Parent education missing[5]	0.0028	0.454	0.0045	0.222
ATAR[6]	0.0025	0.000	0.0033	0.000
Δ	0.0069	0.000	0.0022	0.000
ATAR above average of School	0.0136	0.002	0.0065	0.126
Male	0.0112	0.000	0.0074	0.000
Primary language not English	-0.0015	0.653	0.0049	0.126
Student SEIFA (ABS)	-5.2E-05	0.048	-1.5E-05	0.473
% of 15 to 64 year old in suburb	1.86E-07	0.021	3.47E-08	0.661
School Variables				
Attended catholic school[7]	0.0039	0.163	0.0030	0.266
Attended independent school[7]	0.0052	0.186	0.0012	0.756
Attended adult school[7]	-0.0371	0.000	-0.01334	0.025
School SEIFA (ABS)	2.09E-05	0.045	9.46E-06	0.344
% of 15 to 64 year old in suburb	-9.93E-08	0.234	-5.83E-08	0.482
Ave ATAR of the school	-0.0002	0.184	-0.0002	0.316
Std deviation of ATAR of school	0.0014	0.005	0.0009	0.063
Number of students in sample for school	2.67E-05	0.128	0.00002	0.222

Notes:

1. Portfolio aggressiveness (1) – measured by Expected ATAR - ATAR (based on January application portfolio).
2. Portfolio aggressiveness (2) – measured by number of Programs applied for with clearly in ATAR above actual ATAR.
3. Portfolio diversity – measured by the difference between the ATAR of the first and last program in portfolio.
4. Portfolio size – measured by number of applications in portfolio.
5. 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.
6. This is the average marginal effect of the 3rd degree polynomial for ATAR in equations (0) and (0).
7. Reference is student attended a public (or state funded) school.

Our estimates also include the number of portfolio changes with a marginal effect of 0.22% for each additional portfolio change (recall that the average number of changes is 4.5) while males are 0.74% more likely to receive an offer. This gender effect, while small (i.e. the marginal of being male is equivalent to a 1 point increase in ATAR), is a little surprising given that female university enrolments are typically higher than males. Given that 44% of the sample is male (Table 5), the result may reflect selection from the university study track before year 12 for many males. However, any academic ability differences visible to universities making offers are contained in ATAR, which has been controlled for. Another possible explanation is the gender bias in science, technology, engineering and maths (STEM) subjects which might form the basis of prerequisites for admission to some programs and drive the small positive effect on males.

We also include an indicator of whether a student's ATAR exceeds their school average ATAR as a measure of aspirations and relative position in their school cohort. This variable is positive and significant in model 1 with a 1.3% marginal effect of having an ATAR above school average but is significant only at the 12.6% level in model 2.

Table 10: Marginal effects of ATAR on offer received at different points of the ATAR distribution

	Model 1		**Model 2**	
ATAR	dy/dx	P>z	dy/dx	P>z
40	0.0082	0.000	0.0133	0.000
50	0.0073	0.000	0.0092	0.000
60	0.0038	0.000	0.0034	0.000
70	0.0013	0.000	0.0008	0.000
80	0.0003	0.000	0.0001	0.000
90	6.74E-05	0.000	-2.2E-05	0.561
95	1.05E-06	0.973	-0.00012	0.255

We calculate an overall average marginal effect of ATAR and find a 10 point increase in ATAR to raise offer received probability by 3.3%. However, as illustrated by the non-parametric estimates above, this relationship varies widely across the ATAR distribution, so we calculate marginal effects of ATAR at different points of the distribution and present them in Table 10 for offer received. For our preferred

specification, model 2, we see that at ATARs as low as 40 and 50, the marginal effect of a 1 point increase in ATAR is to raise offer received probability by up to 1.33%, which is nearly 4 times the marginal effect at the mean. This highlights that after conditioning on a full set of covariates, the effects of ATAR are extremely important in whether students receive an offer of a university place but the magnitude of that effect varies with the level of ATAR. In particular, for ATARs above 80, the marginal effect of ATAR on offer received is either very small, 0.01%, or statistically insignificant, for ATAR above 90.

Finally, we note that none of the school variables included play a role in predicting the probability of receiving an offer with the exception of attending an adult school (relative to attending a public school). These students are 1.3% less likely to receive an offer, significant at the 2.5% level. It is perhaps surprising that Catholic or independent school attendance do not have an effect on offer received but given the conditioning that has been undertaken, these school effects are likely to have been absorbed by ATAR.

We present similar analysis for offer rejected in Table 11 and Table 12. In Table 11 we see that portfolio aggressiveness has a mixed effect on offer received. An increase of 10 ATAR points of the average clearly in ATAR of the top four programs (portfolio aggressiveness measure 1) will increases the probability of rejecting an offer by 2.2%, while adding one more program with a clearly in ATAR above the student's own ATAR lowers the probability of rejecting an offer by 0.31%. These equivocal results are a little at odds with the non-parametric estimates in panels (a) and (b) of Figure 4 and may be a result of the averaging effects of the regression approach when the relationships seem non-linear. A 10 point increase in portfolio diversity also lowers the probability of rejecting an offer by 0.5%, which fits with expectations as greater diversity implies a wider range of clearly in ATARs across the application portfolio. This finding suggests more thought is being given to a fall back application in the portfolio, referred to as a safety school in Chade and Smith (2006), and possibly a greater commitment to university study. Portfolio size is not statistically significant.

Table 11: Probability of rejecting an offer after receiving it

	Model 1		Model 2	
	dy/dx	P>z	dy/dx	P>z
Aggressiveness Variables				
Portfolio aggressiveness (1) [1]			0.0022	0.000
Portfolio aggressiveness (2) [2]			-0.0031	0.001
Portfolio diversity[3]			-0.0005	0.000
Portfolio Size[4]			0.0009	0.198
Student Variables				
Log income	-0.0256	0.022	-0.0143	0.202
Parent education (SES)	-0.0021	0.569	0.0001	0.977
Parent education missing[5]	0.0043	0.505	-0.0002	0.973
ATAR	-0.0039	0.000	-0.0046	0.000
Δ	-0.0075	0.000	-0.0048	0.000
ATAR above average of School	-0.0027	0.648	0.0018	0.761
Male	-0.0111	0.001	-0.0055	0.108
Primary language not English	-0.0240	0.000	-0.0354	0.000
Student SEIFA (ABS)	8.87E-05	0.018	5.77E-05	0.108
% of 15 to 64 year old in suburb	-1.99E-07	0.120	-9.43E-08	0.488
School Variables				
Attended catholic school[6]	-0.0124	0.003	-0.0109	0.014
Attended independent school[6]	-0.0108	0.048	-0.0079	0.163
Attended adult school[6]	-0.0039	0.804	0.0024	0.882
School SEIFA (ABS)	-3.7E-05	0.048	-2.2E-05	0.277
% of 15 to 64 year old in suburb	2.59E-08	0.846	6.97E-08	0.622
Ave ATAR of the school	0.0005	0.119	0.0007	0.028
Std deviation of ATAR of school	-0.0018	0.016	-0.0012	0.134
Number of students in sample for school	-9.6E-05	0.001	-0.0001	0.000

Notes:

1. Portfolio aggressiveness (1) – measured by Expected ATAR - ATAR (based on January application portfolio).
2. Portfolio aggressiveness (2) – measured by number of Programs applied for with clearly in ATAR above actual ATAR.
3. Portfolio diversity – measured by the difference between the ATAR of the first and last program in portfolio.
4. Portfolio size – measured by number of applications in portfolio.
5. 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.
6. Reference is student attended a public (or state funded) school.
7. Standard Deviation in parentheses.

Estimates also include the number of portfolio changes with a marginal effect of -0.48% for each additional portfolio change (average change is 4.5), implying that more portfolio changes indicate a stronger engagement with the application process and commitment to study, reducing the chances of rejecting an offer of a place. Students whose primary language is not English are 3.54% less likely to reject an offer of a university place. This is consistent with previous studies where non-English speaking background immigrants exhibit a strong focus on education.

For the school variables we find that Catholic school graduates are 1.09% less likely than public school students to reject a university offer, though we have no strong intuition for this effect. The effect of school size is positive. Year 12 cohorts at any one school can be up to 381 students, so coming from a 100 student larger school cohort lowers the chances of rejecting an offer by 1%. We suspect this is a peer effect. Coming from a larger school means the student is on average more likely to know another student who has been offered a university place, leaving them more confident about accepting an offer.

Table 12: Marginal effect of ATAR on offer rejected at different points of the ATAR distribution

	Model 1		**Model 2**	
ATAR	**dy/dx**	**P>z**	**dy/dx**	**P>z**
40	-0.0092	0.000	-0.0131	0.000
50	-0.0087	0.000	-0.0123	0.000
60	-0.0066	0.000	-0.0090	0.000
70	-0.0040	0.000	-0.0054	0.000
80	-0.0020	0.000	-0.0027	0.000
90	-0.0006	0.001	-0.0011	0.000
95	5.45E-05	0.830	-0.0006	0.000

We again calculate an overall average marginal effect of ATAR and find a 10 point increase in ATAR lowers the offer rejected probability by 4.6%. We also calculate marginal effects of ATAR at different points of the distribution and present them in Table 12. For our preferred specification, model 2, we again see that at ATARs as low as 40 and 50, the marginal effect of a 1 point increase in ATAR is to lower offer rejected probability by up to 1.31%, close to 3 times the marginal effect at the mean.

As with offer received, this highlights the perils of focusing only on averages as indicated in regression analysis. Some deeper analysis, as in Figure 2 and Table 12, can uncover subsections of the population that are more adversely affected than the average effects emerging from regression analysis might indicate. In this case, the effects of ATAR on decisions are almost non-existent at high ATARs; but at low ATARs, students exhibit greater heterogeneity in their responses to university offers. This is certainly an area for further policy analysis; for example, seeking to understand the types of programs that are rejected. The broad category of institutions whose offers are rejected might generate a better understanding of student demand for programs and what is perceived to be an attractive program to potential candidates. Another interesting question is what students who reject a university offer do instead and whether these students are better off rejecting their offers. Our data does not allow us to examine this interesting longitudinal question and as a result, this is left for future research with improved data sources.

5 Conclusions

This report utilises offer and acceptance data for all school leaving (Year 12) applicants for a university place in Victoria to understand the characteristics of students who receive and accept/reject offers. We found that there are a number of key attributes of the student that help understand the probability of receiving and rejecting offers. First, we found a strong and non-linear relationship between the student's level of ATAR with both receiving and accepting an offer. For the offer data we found that at high levels of ATAR (> 70) there was no significant relationship between ATAR and the probability of receiving an offer as these students are universally offered a university place. This compares to students with lower ATARs where there was a strong and positive relationship between the two variables. A similar situation was found with the acceptance data with the probability of rejecting an offer negatively related to ATAR across all levels (with the possible exception of ATAR >95). However, this relationship was much stronger for ATAR of less than 70.

Second, the SES measure based on parental education suggests that low SES students are less likely to receive an offer, and further, when low SES students did receive an offer they were also more likely to reject it. However, this relationship was closely tied with the earlier result, with high ATAR, low SES students no different from their high SES, high ATAR counterparts. On the other hand we found that low SES students with ATARs of less than 70 were 5% less likely to receive an offer compared to high SES students with the same ATAR. There is a very similar story for those students rejecting offers with no significant difference between low and high SES where ATAR is high (>70), but low SES 5% more likely to reject an offer when their ATAR is less than 70. The relationship between ATAR, SES and the propensity to receive/reject an offer is also dependent on how many changes the student makes to their portfolio of programs. Students who make four or more changes are more likely to receive and less likely to reject an offer. As with SES, this relationship is dependent on ATAR and only significant for low ATAR students.

Put together, these results imply that low SES students with low ATAR are least likely to be receiving an optimal outcome from the application process. However, high SES students with low ATAR also appear to be realising sub-optimal outcomes. This result, however, needs to be considered within the broader context where low SES students

achieve, on average, lower ATAR scores than high SES students. In Cardak et al. (2015) it was found that low SES students are less likely to make changes to their portfolio of programs after receiving their ATAR. It would therefore appear that a multi-dimensional approach should be adopted to address the disadvantage faced by low SES students. The policy implications of this report include that low SES students with low ATAR require more information prior to the closing of the application process to both better understand what options are available to undertake further studies and to help them match these options with their aspirations, expectations and application portfolios submitted to VTAC.

One of the most significant limitations of this report is that we examined only those students that are applying for post-secondary studies through VTAC. It is possible that low SES students who are completing Year 12 may be contemplating further study but do not end up applying for university through VTAC, possibly for reasons of low self-efficacy or low aspirations. Low SES students may be opting out of a “university track” in Years 10 and 11 when they plan to take the requirements for the state certificate (VCE) and they may become ineligible for a place in higher education, even though they may have the ‘ability’ to obtain a place if circumstances were different; see Bowden and Doughney (2010, 2012) for a discussion of the role of aspirational differences.

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