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Educational achievements of student support recipients

New Zealand Government

Learners in tertiary education

This report forms part of a series called *Learners in tertiary education*.
Other topics covered by the series are access, pathways, support, participation, retention and qualification completions.

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The Student Loan Scheme Borrowers dataset combines information from the Ministry of Social Development, Inland Revenue and the Ministry of Education. The dataset has been approved by Statistics New Zealand as a data integration project. Only approved researchers who have signed Statistics New Zealand's declaration of secrecy can access the integrated data in the Data Laboratory. For information concerning confidentiality matters relating to this study, please contact Statistics New Zealand.

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1 Summary

Key findings:

- Student support is designed to remove financial barriers to tertiary education. The results of this study seem to suggest that student support system helps people succeed in study and so helps provide equity to some extent.

- Full-time students who either receive student allowances or use the student loan scheme are likely to benefit from the support system – they achieve better in tertiary education, controlling for all other factors.

- Those who qualify for student allowances tend to do better in their tertiary study, especially among those who studied at bachelors level and those who were non-employed or household person before starting their tertiary studies.

- While receiving allowances is associated with a greater probability of successful completion, changes to the student support system since the period analysed mean that caution is needed in drawing policy conclusions from this study. In addition, the explanatory power of the model used in this analysis implies that other factors not captured in the model – such as family background for instance – are also important factors in success in tertiary education.

- The effect of student support on completion was more pronounced for Māori – Māori who receive allowances or who borrow using the loan scheme are significantly more likely to succeed in their tertiary studies than those who do not receive student support.

- A literature review on this topic indicated that socio-economic factors have a strong influence on the probability of successful completion of qualification. Adding factors such as individual background characteristics and parental education to the model to control for the effect of socio-economic status may throw more light on the effect of support system on educational outcomes.

This report presents the results of a study on the effects of different types of financial aid, provided through the student support system, on educational outcomes of students participating in tertiary study. The types of student support looked at included the student allowances and student loan schemes. This support is provided to improve access to tertiary education and reduce the social disparity arising out of education benefits.

The study used the integrated dataset on Student Loans Scheme borrowers and student allowances recipients. This dataset includes details of more than 346,000 individuals enrolled in tertiary education and engaged in full-time study during the years 1999 to 2001. The study disaggregated student support into four categories - ‘loans only’, ‘allowances only’, ‘loans and allowances’ and ‘no loans and no allowances’. The last category was treated as a reference category for comparison purposes. The data were analysed using multivariate logistic regression and a bagging technique, to study the relationship between student support types and the probability of successful completion of a qualification over five years. Two models — a main effects model and an interaction effects model – were used to examine the effect of support types on the completion status.

In addition to student support types, there are potential effect modifiers that influence the probability of successful completion of a qualification. The potential effect modifiers are - age, ethnic group, gender, qualification level, field of study, prior activity, provider type, study load and nature of attendance. The intrinsic relationship between the support types and the nature of attendance indicator (full-time or part-

time study), distorts the causal effect of the primary variable on the outcome. As a consequence of this, data covering only those individuals who were engaged in full-time study was used.

The study found that there was a substantial positive effect on educational achievements for students receiving support, compared with students who received no support. The results indicated that different forms of student support have different effects on the outcomes.

For example, in the main effects model, the odds of successful completion were nearly two times higher for students who received allowances only, than for students who received no financial support. Further, the odds were 1.4 and 1.3 times higher for students who were recipients of both loans and allowances, or of loans only, than for students who received no financial support.

Among the main effects of study variables, the study load was most significant, followed by education provider, prior activity, field of study and qualification levels. A ten percent increase in study load increased the odds of success by 1.07 times. The Māori and Pasifika sub-groups showed a significantly lower likelihood of successful completion, compared with other ethnic groups in the main effects model.

Examining the interaction effects of demographic and study variables with support types showed the modifying impact of these variables on the qualification completion rate. In the presence of interaction effects, students who received an allowance only were two times more likely to complete a qualification, compared with students who received no financial support. By contrast, the likelihood of successful completion of a qualification for students who received both loans and allowances, or loans only, was on par with students who received no financial support. The likelihood of successful completion for the Māori students receiving ‘allowances only’, ‘loans and allowances’ or loans only’ was 3, 1.6 and 1.6 times higher than for students who received no support. The probability of successful completion for females was a marginal 5 percentage points higher than for males.

The literature states that socio-economic factors, such as individual background characteristics and parental education, have a strong influence on the probability of successful completion of qualification. As this analysis didn’t measure socio-economic status, it is suggested that an assessment of socio-economic status, along with longer-term outcomes, including participation and achievements in tertiary education be a focus for future study.

2 Introduction

Overview

The student support system, of which two major components are the student loans scheme and the student allowances scheme, aims to help people reach their potential by studying for qualifications that are relevant and of high quality. These qualifications contribute to improve people's employment opportunities, income prospects and consequently their quality of life. This, in turn, contributes to national development goals. The New Zealand government has been providing student allowances to individuals since 1989 and student loans since 1992. A policy objective of the student allowances is to reduce financial barriers to tertiary education for students from low and middle socio-economic groups. This report is part of the process of monitoring and reviewing the student support system to ensure that it continues to improve access to tertiary education and to reduce the potential for social disparity to arise out of education.

The extension in 2005 of the Student Loan Scheme Borrowers integrated dataset to include student allowances data enables a more complete analysis of the educational and employment outcomes for students who participate in tertiary study. The analysis can take into account the full level of government financial support received, that is, both student loans and student allowances. The extended dataset allows evaluation of how the student loans and allowances schemes meet the objectives of government and, thus, help to develop policy in a wider context. The findings from analysis of the dataset will provide guidance in improving student support systems, assistance in identifying good and weak practices and will also highlight the key factors for successful management of different support systems.

Although there has been an apparent increase in participation levels in the tertiary sector in recent years, there is no definite information about the educational achievements of student support recipients. The primary objective of this study centred on answering two policy questions:

- How do the various achievement and participation measures for student support recipients compare with other groups?
- Does financial support tend to reduce disparities in tertiary education?

This report focuses on the analysis of the effects of different types of student support on the completion of a qualification. The study sample consisted of starting cohorts covering more than 346,000 individuals of 15 years and older who entered tertiary study and engaged in full time study in the years 1999-2001 and looking at their completion status five years later. The approach used was to analyse the probability of educational outcomes of the students who received 'no loans and no allowances', compared with the outcomes of students in the three other groups — student loan borrowers only, both borrow student loans and receive student allowances, and student allowances only.

Literature review

Literature on the impact of the student support system on educational participation and achievement provides inconsistent and sometimes opposing conclusions. For example, there are two theories associated with the educational achievements of individuals from poorer family backgrounds. First, as advocated by researchers such as Becker and Tomes (1986), poorer families are financially constrained, which prevents them from investing in the human capital of their children. As the effect of family income on an individual's attainment is direct, policies of financial support could be efficient at reducing the differences between children from different backgrounds. Second, and by contrast, some writers argue that poorer parents may be endowed with characteristics that make them less successful in the labour market and worse at parenting (Mayer, 1997). Also, the family background characteristics might affect the motivation, access to career information or the discount rate of the individual (Card, 1999).

Achievement and participation in tertiary education is influenced by student support, as well as by family income and some unobservable family characteristics. Direct support to the individual, in the form of extra educational attention for example, could be more efficient than financial support at reducing inequality in schooling achievements. For example, using a longitudinal data set from New Zealand (Christchurch

Health and Development Surveys, CHDS), Maani (2006) found that the probability of attending university increases significantly with parental income, keeping other factors constant. On the contrary, the probability of attending polytechnic decreases significantly as income increases. An implication of Maani's study is that academic performance is expected to partly reflect the long-term effects of family background and their higher educational choices.

Herrnstein and Murray (1994), authors of the controversial book 'Bell Curve', claimed that cognitive ability mainly determines success in education. They argued that the observed effect of income reflects the correlation between ability and family wealth. As long-term improvement of cognitive ability is costly and 'of limited scope', the authors conclude that public interventions using financial incentives to reduce educational inequalities are bound to fail. The arguments by these authors were criticised by Heckman (1995), Golderberg and Manski (1995) and others who claimed that the conclusions drawn by Herrnstein and Murray were primarily attributable to the methods used. Cameron and Heckman (1998, 1999) also support the idea that educational decisions do not stem from short-term financial constraints but have their origins in the long-term effects of family characteristics on ability, motivation and other unobserved characteristics. Hence, the efficiency of income support policies in helping individuals from less favourable backgrounds to invest in their education is questionable (Cameron and Taber, 2000; Shea, 2000). Harmon and Walker (2000) relied on schooling contingent income to identify income effect, but found no significant effect on the probability of staying-on.

More recently Acemoglu and Pischke (2000) and Dynarski (1999, 2000), provide evidence that financial support can be efficient and cost effective. For example, Dynarsky (1999) uses a natural experiment, the suppression of the Social Security Student Benefit Program, to estimate that $1000 aid increases the probability of attending college by 4 percent for 'poor' students. Acemoglu and Pischke (2000) use changes in the income distribution over time and across states to identify the effect of family income on college enrolment and estimate an elasticity of 0.14.

In a report on the evaluation of the British education maintenance allowance, Middleton et al (2005) suggest that there may be a small educational maintenance allowance (EMA) effect for Year 11 low and moderate achievers. However, the impact was more substantial in terms of participation and retention in post-16 education. The muted outcomes may indicate that young people who were encouraged to remain in full-time education by the availability of EMA differ substantively from those who traditionally take this route, perhaps in terms of ambition, aptitude or temperament.

All the literature reviewed was based on either a sample survey or other small administrative data. Many of these data were lacking relevant covariate information to provide a robust estimate of the causal relationship. Fortunately, the integrated dataset used in this study is a rich source of information on the covariates of interest that was previously unavailable for analysis. Given this, the results emanating from this study provide an opportunity to verify theories on the educational outcomes of student support recipients in the New Zealand context.

Report structure

This report has six parts. The following part gives description of methods and data. The third part provides details and interpretation of the analytical outputs form different models. Discussion of the results interpretation and their context are explained in the fourth part. The remaining two sections deal with the conclusions and future plan of action. The report finishes with references and appendices.

3 Methods and Data

3.1 The model

The approach of the model is to distinguish between the direct and indirect effects of student support system on academic achievement. It is assumed that the student support system is focused on reducing the differences between individuals from different backgrounds.

The student support system has two main components, the student loan scheme and the student allowances scheme. The student loan scheme is accessible to all New Zealanders who are enrolled in approved qualifications. New Zealanders studying towards recognised tertiary qualifications may apply for student allowances, subject to certain eligibility criteria. The student loans scheme offers protection to lower income earners since the repayments are based on the individual's income. The aim of the allowances scheme is to ensure that the need to meet day-to-day living expenses does not act as a barrier to full-time education for students from low and middle socio-economic groups. There is a range of different allowance types available depending on individual circumstances, which mainly depends upon the parental, family or personal income. Individuals in the two categories 'allowances only' and 'loans and allowances' are merged together, and redistributed them into six allowance type categories. These student allowance types are:

- single students aged between 16 and 24 years old, subject to a personal income test and to a test of their parents' incomes
- single students aged above 25 years old, subject to a personal income test to determine their entitlement
- students with dependents, subject to personal income test
- independent circumstances, including those who are not living with their parents, may qualify for an accommodation benefit, subject to a personal income test
- others, including all other types of eligible individuals.

Individuals who are in the student support system scheme can be broadly grouped into three categories:

- in the loans scheme but not receiving allowances ('loans only')
- in the allowances scheme but not borrowing ('allowances only')
- in the loans scheme and receive student allowances ('loans and allowances').

For comparison purposes, a group of individuals who are not in any student support scheme has been included as a fourth category[1] and is referred to as the reference group. In effect, the student loan allowances dataset has been grouped into four major student support type categories.

Individuals aged under 25 years, who are in the student allowances scheme, provide information that can be viewed as a proxy to family background, since the eligibility to get a student allowance is determined mostly by individual's family and personal income. Such information is absent for those who do not receive allowances. In the absence of relevant factors to measure the socio-economic status of individuals in each of these categories, no attempt has been made to link the educational outcome and socio-economic status.

Because of the categorical nature of the dependent variable, a multivariate logistic regression analysis has been used, with a bootstrapping and aggregating technique to model the relationships between educational achievement and allowance types after controlling for other independent variables. The relationship between the educational achievement and different student support systems can be expressed with the following interactions effects model equation:

$$\mathbf{C_i=\alpha + \beta*Atype_i + \theta* X_i+Atype_i*X_i,}$$

1 The Student Loan Scheme Borrower's dataset includes educational information for individuals who are not covered under any scheme, but does not contain, their income related information.

Here, Ci is a measure of an individual's educational outcome, such as completion of a qualification, which takes the binary value 0 (not successfully completing a qualification) and 1 (successfully completing a qualification). $Atype_i$ is the type of student support accessed by the individual, and X_i is a vector of individual covariates namely, gender, age, ethnicity, provider, qualification level, field of study, prior activity, nature of study. The coefficients α, β,θ are estimated through the model. In order to obtain an unbiased estimate of the causal effect of allowance type on the educational outcome, it is prudent to include all of the causative factors influencing the student support eligibility in the model.

While establishing relationships in the model, the decision to add a control variable was based, not on its statistical significance alone, but on whether the presence of that variable in the model significantly changed the relationship between educational outcome and student support types. Variables that modify the relationship between the outcome and the covariates of interest can have a direct or indirect effect. The direct effects are called main effects and the indirect effects are called interaction effects. The interaction model measures the indirect effects, whereas the main effects model measures the direct effects and therefore the component $Atype_i*X_i$ is not included.

The test of whether a parameter is different from zero is based on two statistics that are generated in SAS: the likelihood ratio test (-2LL) and the Wald statistic. The likelihood ratio test is used to determine if a parameter is related to the probability of completing a qualification, and the Wald statistic is used to determine if a parameter is related to particular type of completion. Several indicators are used to evaluate the model. While not completely comparable to the R^2 in ordinary least-squares regression, the Cox and Snell pseudo-R^2 used here shows the strength of the relationship between the outcome variable and the independent variables. The ratio of scaled deviance (G^2) to its degrees of freedom, and the model chi-square provide three additional indicators of model fit. The model chi-square tests the difference in the '-2 log likelihood' between the final model and a model that includes the intercept only. The change in scaled deviance provides an indication of the improvement in fit that is associated with the inclusion of additional predictors. The effect of the primary variable on the response variable is measured and interpreted using odds ratio, predicted probability and delta-p statistics.[2]

Testing the possibility of interactions between predictors is an essential step in model building strategies. Because the theoretical framework and prior research suggests that the process of completing a qualification is different for those engaged in full-time and part-time studies, interaction terms between the 'nature of attendance' and primary variable support types was entered into the multinomial logit analyses. Interestingly, the interaction between these two variables has affected the results due to the presence of a multi-colinearity effect. To facilitate the interpretation of the interaction, separate multinomial logit analyses were conducted with and without the 'nature of attendance' variable (which is the indicator for full-time or part-time study). The results presented here are from the models for full-time study with and without interaction effects. To avoid the substantial reduction in sample size that would result from list wise deletion of missing data and to account for the tendency to be missing or undefined, a new category is defined under every variable that has missing data (Fitzgerald and Knuiman, 1998).

3.2 Data

The inclusion of student allowances data in the Student Loan Scheme Borrowers dataset allows analysis of the educational and employment outcomes for students participating in tertiary study by taking into account both of the principal means of government financial support namely, student loans and student allowances. The data consists of student loan borrower and student allowance recipient's demographic and educational characteristics covering cohort years 1999 to 2005. The education outcome of interest is the successful completion of qualification. The analysis was carried out using individuals from three starting cohorts (1999, 2000 and 2001) and looked at their completion status five years later. The definition of the starting cohort is given below.

2 The Delta-p statistics identify the relationship between a unit change in a predictor and the estimated percentage change in the outcome variable (Peterson, 1985; Cabrera, 1994). For example, Delta-p statistics of .05 indicate that a unit change in the predictor indicates a 5% increase in the probability of successful completion. See Appendix 1 for more details.

3.3 Starting cohort with five year completion

The starting cohort dataset covered first-year, first-time students who enrolled in 1999, 2000 and 2001 in a tertiary level programme. The outcome groups were individuals who completed a tertiary qualification by 2005 and those who did not. Individuals pursuing more than one qualification (multiple responses) under different providers were included. This means that the completion status of each qualification level is considered in the cohort. Allowances data is available only for those studying in 1999 and later. The requirement to track student performance over their first five years in study and the fact that the dataset used included no data for years after 2005, mean that we could not consider people who entered after 2001. Therefore, only three starting cohorts between — those between 1999 and 2001 could be used in this study.

The downside of this definition is that it may bias against the bachelors and postgraduate qualifications and especially so for those with doctorates who may require more than this time for completing their qualification (Scott and Smart, 2005). The number of cohorts available for analysis also gets considerably reduced under this definition. All of the results presented in this report are based on the starting cohort approach.

3.4 Dependent variable

The educational outcome variable of interest is a binary variable that takes on the values: 1 (one) completion of a qualification; and 0 (zero) non-completion of a qualification. The person who has not completed a qualification will be considered as the reference group for comparison.

3.5 Primary variable of interest — student support types

The objective of this study is to evaluate the educational achievement measures among different student support types that consisted of: those who receive student allowances only; those who borrow student loans only; people who both borrow and receive student allowances; and people with no student loan and no student allowance.

3.6 Demographic and study factors

To estimate the degree of association between allowance types and educational achievement, the frequency of support type was observed in different completion groups. However, support types often differ in factors that affect educational outcome, such as qualification level, tertiary education provider, prior activity before studies, and nature of attendance. If these factors are ignored, the comparison of different allowance types is 'confounded' (or entangled) because the difference in completion status among ethnic groups, gender, groups with different study characteristics etc may influence the overall effects. Hence, external factors that were responsible for the difference in educational outcomes among different student support types were adjusted in the analysis. Variables that modify the relationship between the educational outcome and the primary factor of interest can be called as either confounders or effect modifiers[3].

For example, suppose that a simple model was fitted with completion status as the binary outcome variable and student type as the only covariate. The initial results showed that the odds of the 'loans and allowances' category were three times greater than the odds of 'no loans and no allowance' category. However, upon further examination it was discovered that the 'no loans and no allowances' group mostly consisted part time students, while the 'loans and allowances' group or 'allowances only' groups consisted full-time students. Since 'nature of attendance' is related to the allowance type as well as to educational outcome, the perceived difference in completion status between different allowance groups may have actually been caused by the differences in the nature of studies. After adjusting for 'nature of attendance' by adding it to the model, the difference in completion between these groups was found to be not

3 Effect modifiers are variables that have a significant interaction with the risk factor (example ethnicity), manifested by the odds-ratios for the risk factor being different for different levels of the effect modifier (Centre for Biostatistics, Ohio State University).

significant. However, the interaction effect of allowance type by nature of attendance was found to be statistically significant. The effect of the nature of attendance was found to be masking the role of allowance type due to the multi-collinearity effect.

In other words, confounders are extraneous risk factors responsible for the difference in outcomes among different allowance type groups. Confounding is the confusion or mixing of extraneous factors with the effect under study (Rothman and Greenland, 1998). If the confounder is not adjusted for in the analysis, the confounding can lead to overestimation or underestimation of an effect, depending on the direction of the association that the confounding factor has with support type and completion status. Confounding can even change the apparent direction of an effect (Rothman and Greenland, 1998).

The demographic and study variables included in this analysis are shown in Table 2.1. A continuous variable, the 'equivalent full time studies usage' (efts usage) is entered into the model as one of the covariates.

Table 3.1: Variables that are included in the multivariate logistic model

Variables	Category levels	Reference category
Age	1=15-20, 2=21-25, 3=26-30, 4=31-35, 5=36-40,6=41-45, 7=46-50, 8=51-55, 9=56-60 and 10=> 60	Age 15-20
Gender	Male = 1; Female = 2;	Male
Ethnic group	1=NZ European/European/Pakeha, 2=New Zealand Maori, 3=Pacifica, 4=Asian (Chinese and Indians), 5=Others, 6=Unknown	NZ European/European/Pakeha
Qualification level	01=Certificate L1-3; 02= Certificate L4; 03= Certificate L5-6; 04=Bachelors degree; 05=PG Diploma; Masters and Doctorate	Bachelors degree
Allowance types	Loan and Allowances=11; Loan and No Allowance=10; No Loan but Allowance=01;No Loan and No Allowances=00;	No Loan and No Allowances=00;
Allowance type1	Single students between 16-24 years old=1; Single student over 25 years old=2; Dependents=3; Independent circumstances=4; Loan and No Allowance=5; No Loan and No Allowances=6;	No Loan and No Allowances=6;
Nature of attendance	Full-time = 1; Part-time = 2; X = 3;	Part-time
Completion indicator	Completed=1; Incomplete=0;	Incomplete
Field of study	01=Natural and Physical Sciences; 02=Information Technology; 03=Engineering and related technologies; 04=Architecture; 05=Agriculture and Environmental Studies; 06=Health; 07=Education; 08=Management and Commerce; 09=Society and Culture; 10=Creative Arts; 11=Food, Hospitality and personal services; 12=Mixed Field Programmes	Agriculture and Environmental Studies
Prior activity type	01=Secondary School student; 02=; 03=Wage or Salary worker and Self employed; 04=tertiary student; 05=House person or retired, Non-employed/Beneficiary; 06=Overseas	Secondary School student
Providers	Polytechnics; College of Education; Universities; Wananga; Others TEP	Universities
Equivalent full time study	Continuous variable	

3.7 Scope and Limitations of the data

The extended dataset contains matched records for the years 1999 to 2005. The integrated dataset includes all students who were enrolled in provider-based tertiary education in New Zealand between 1999 and 2001. Individuals were grouped into four categories based on the nature of student support type as explained earlier in this section. Financial support in the form of scholarships is not included in this study. Individuals who have declared their residence as overseas following study are excluded. A small number of records that did not match the information from various data providers were excluded. Preliminary analysis showed that the variable 'nature of attendance' correlated strongly with allowance types and, therefore, this is treated as redundant and excluded from the model.

The findings of this study should not be over generalised, given the small sample of 'allowances only' category. Additionally, the data utilised in this study limited the number of variables available for analysis.

3.8 Underlying assumptions

- The logit scale is the best possible scale for analysis even though it is approximately linear in the middle range and logarithmic at extreme value. Use of the scale is supported by the example of course completion rate and qualification level (Scott, 2006).
- The student support scheme gives every tertiary student a 200-week entitlement to student allowances, provided they are full-time students enrolled in an approved course of study of at least 12 weeks' duration and they meet the targeting criteria. There are instances where individuals switch from one allowance type to another due to changing circumstances.
- All individuals who received student allowances are treated as full-time students, although they may have switched from full-time to part-time in some point of time during study period.
- All individuals who borrowed a student loan are treated as loan borrowers, irrespective of the length of borrowing period.

4 Results

3.9 Descriptive statistics

Approximately 60 percent of the individuals engaged in full-time study used the student support system. As shown in Table 3.1, 28 percent of the tertiary education seekers were both student loan borrowers and student allowance recipients, 27 percent were student loan borrowers, 6 percent received student allowances only and the rest (40 percent) were neither borrowing nor receiving allowances. Individuals who receive student allowances appear in two groups – 'loans and allowances' and 'allowances only'.

There are more women participating in tertiary education. As a consequence, women outnumber men among those accessing the student support system. There were more women than men within the 'loans only' and 'allowances only' types. Approximately 59 percent of those who borrowed student loans only were women, compared with 53 percent in the 'allowances only' group. About half of those who received both loans and allowances were women. About 53% of those who neither borrowed nor received allowances were also women.

Table 4.1: Distribution of individuals in different support types by qualification level and gender

Gender	Qualification	Loans and allowances	Loans only	Allowances only	No loans and no allowances	Total
Female	Level 1-3 Certificates	16,336	22,291	2,772	38,891	80,290
	Level 4 Certificates	3,079	3,047	390	1,744	8,260
	Level 5-7 Diplomas	8,545	8,883	1,528	7,856	26,812
	Level 7 Bachelors	16,997	18,001	4,851	20,197	60,046
	Level 8-10 Postgraduates	4,390	3,673	766	4,688	13,517
Female total		49,347	55,895	10,307	73,376	188,925
Male	Level 1-3 Certificates	18,783	15,297	2,791	38,887	75,758
	Level 4 Certificates	3,002	1,802	384	1,927	7,115
	Level 5-7 Diplomas	9,761	5,894	1,600	5,918	23,173
	Level 7 Bachelors	14,217	12,253	3,749	15,571	45,790
	Level 8-10 Postgraduates	4,304	2,899	668	4,080	11,951
Male total		50,067	38,145	9,192	66,383	163,787
Percentage Female		50%	59%	53%	53%	54%

Source: Statistics New Zealand, Integrated dataset on student loan Scheme borrowers and student allowance recipients;
Data include individuals engaged in both full-time and part-time study.

Table 3.2 contains an analysis of the rate of successful completion of qualifications by student support type. The results indicate that women more often completed a qualification successfully than men, at all qualification levels and within all support types. Individuals engaged in full-time study more often successfully completed a qualification than those engaged in part-time study. The completion rate was the same for both men and women who received 'allowances only' and studied level 8-10. Successful completion of a qualification was least among the 'no loans no allowances' group, especially in the lower qualification levels.

Table 4.2: Five year completion rates (%) by support types, qualification level and gender

Allowance types	Qualification levels	Full-time		Part-time	
		Female	Male	Female	Male
Loans and allowances	Level 1-3 Certificates	47	41		
	Level 4 Certificates	43	38		
	Level 5-7 Diplomas	41	35		
	Level 7 Bachelors	53	44		
	Level 8-10 Postgraduates	65	59		
Total		46			
Loans only	Level 1-3 Certificates	46	37	26	31
	Level 4 Certificates	43	32	37	28
	Level 5-7 Diplomas	40	33	23	21
	Level 7 Bachelors	56	47	24	18
	Level 8-10 Postgraduates	62	58	44	45
Total		46		27	
Allowances only	Level 1-3 Certificates	53	44		
	Level 4 Certificates	51	39		
	Level 5-7 Diplomas	46	40		
	Level 7 Bachelors	67	60		
	Level 8-10 Postgraduates	67	67		
Total		57			
No loans and no Allowances	Level 1-3 Certificates	20	16	20	15
	Level 4 Certificates	41	28	33	12
	Level 5-7 Diplomas	37	32	15	9
	Level 7 Bachelors	54	48	21	15
	Level 8-10 Postgraduates	66	63	45	43
Total		32		19	
Overall		41		21	

Note: Aggregate of three starting cohort years 1999-2001.

4.2 Identification of the effect modifiers

The purpose of identifying effect modifiers was to understand and describe the relationship between allowance and loan type and educational outcome. Therefore, in building the model, the decision to add a variable was based not only on its statistical significance, but also on whether the presence of that variable in the model significantly changed the relationship between allowance type and educational outcome. The change in scaled deviance provided an indication of the improvement in fit that is associated with the inclusion of additional predictors. The magnitude of scaled deviance computed for each of the predictors showed the importance of the interaction effects of predictors used in the model. EFTS usage, provider types, prior activity, qualification level, field, ethnicity and age were potential effect modifiers as indicated by their magnitude of scaled deviance. Gender, though significant, was a weak modifier. All these predictors and their interaction with support types were included in the model.

4.3 Effect of student support types on tertiary qualification completion

A preliminary analysis to establish the relationship between the completion of a qualification and support types showed that data covering full-time study needed to be used, as two of the support categories did not have individuals engaged in part-time study. The confounding effect of 'nature of attendance' (the indicator for part-time and full-time study) on the support type also indicated the need for using full-time study data.[4]

4 This confounding effect arises due to a strong correlation between two variables entering the model that may result in a multi-colinearity effect, in which one variable become redundant since both variables represent the same effect.

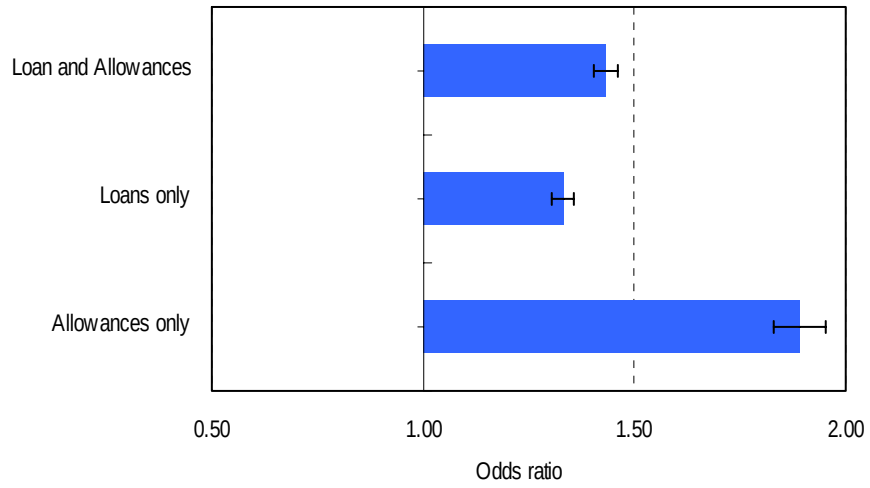
Tables A1.1 and A1.2 (Appendix 1) show the parameter estimates for each predictor variable, and the corresponding odds ratio and its confidence interval along with delta-p statistics[5] for main effects and interaction effects models respectively. Both the models tested are statistically significant as indicated by the model chi-square tests. The parameter estimates shown in the table A1.1 and A1.2 are aggregated over 100 replicates. The assessment of statistical significance of estimates is also made by how many times each estimate became statistically significant out of 100 samples. Each parameter estimate shown in Figures 3.1a and 3.1b tells the change in the log-odds of completing a qualification (i.e. the logit of the probability of completion) for each support type category, compared with the reference category ('no loans and no allowances').

The results of the logistic regression are interpreted in terms of odds ratios, as these are more intuitive than using log-odds. The odds ratio represents the change in the odds of completing a qualification successfully relative to the odds of not completing that is associated with a 1-unit change in a particular independent variable, while holding constant all other variables. An odds ratio greater than one represents an increase in the likelihood of completing a qualification relative to not completing, whereas an odds ratio less than 1 represents a decrease in the likelihood of completing a qualification. The results on the direct and indirect effect of each predictor on the odds of successful completion are given below. Delta-p statistics are used to confirm the results shown by the odds ratio.

4.4 Effect of student support types in the main effects model

The estimated effect of each predictor on the log-odds of successful completion of a tertiary qualification, controlling for all other predictors in the main effects model showed that the Cox-Snell pseudo R^2 value of 0.20 implying that the model predicts successful completion of a qualification moderately well and was a reasonably good fit. Each of the parameter estimates was significant at $p < 0.01$, which meant that the log-odds of successful completion of a qualification was significantly higher for individuals in each of the support type categories, than for individuals who received 'no loans and no allowances' (Figure 4.1a). The results indicated that the individuals receiving 'allowances only' were 1.8 more likely to complete a qualification compared to those who received 'no loans and no allowances'. Similarly, those who were in the 'loans and allowances' category were 1.4 times and those who were in 'loans only' category were 1.3 times more likely to complete a qualification in relation to the reference category. The 95% confidence intervals for the odds ratio do not include 1, which is another indication that they are all significant.

Figure 4.1a: Odds ratios of completion for student support types – main effects model



Note: The line bar denotes the 95% confidence interval for the odds ratio. If the line bar crosses 1, this indicates that the category is not significantly different from the reference category 'no loans and no allowances'.

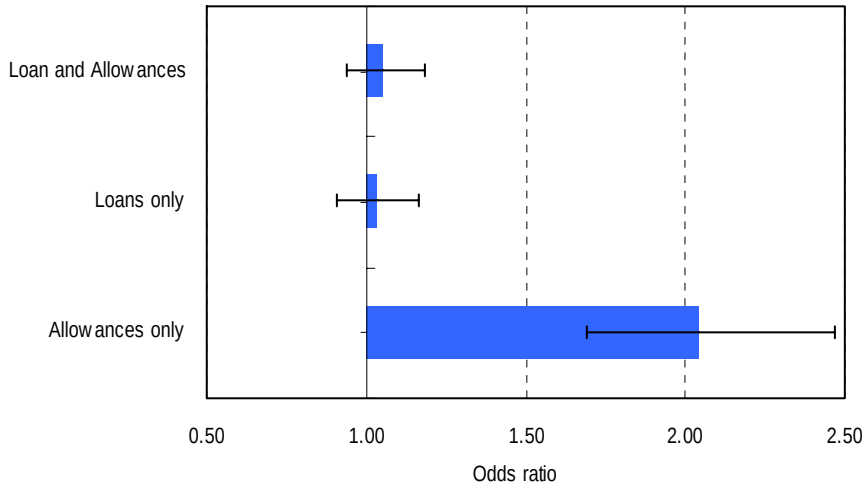
5 The delta-p statistics - See Appendix 1 for more details

The delta-p statistics indicated that the probability of successful completion by a student who receives 'allowances only', increases by 16 percentage point from the estimated baseline probability of 41 percent. This compares with a respective 9 and 7 percentage point increase in successful completion for the 'loans and allowances' and 'loans only' categories from the estimated baseline probability.[6]

4.3 Effect of student support types in the interaction effects model

Examining the possibility of interaction between predictors is an essential step in model-building strategies. Interpreting the effects of support type and other control variables is trickier, because of the presence of interactions. The effects of support types on the successful completion of tertiary qualification, in the presence of interaction effects are given in the appendix (Table A1.2). The presence of interaction effects modified the impact of support types differently for individual categories within each predictor variable (Table A1.2, Appendix 1).

Figure 4.1b: Odds ratios of completion - interaction effects model



Note: The line bar denotes the 95% confidence interval for the odds ratio. If the line bar crosses 1, this indicates that this category is not significantly different from the reference category 'no loans and no allowances'.

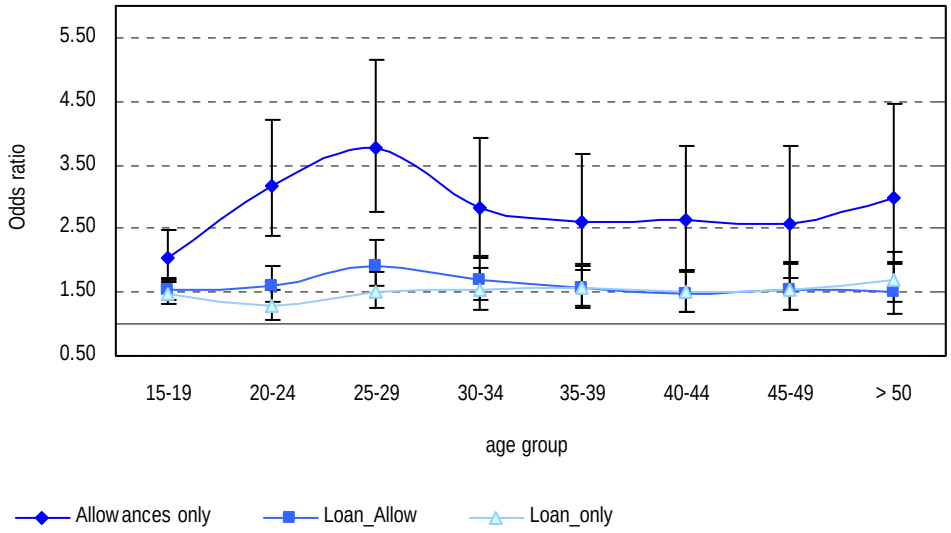
For comparison, the odds ratio of completing a qualification for each different support type is are shown in Figure 4.1b which is constant across reference categories of all the predictors. The results indicated that the odds of completion for the 'allowances only' group was two times higher than for the 'no loans and no allowances' group, whereas the other two types did not vary significantly from the reference group. The results showed that the presence of the interaction effect modified the impact of support types significantly. The effect of support types on the completion of qualification with interaction effects for each predictor is shown in the following sections.

4.4 Support type and age group

Age is a significant but negative effect modifier that is closely related to the support type. The age effect is confounded by the support type because most of those who receive student allowances are grouped into two age-based classes — single students under 25 and single students aged 25 years and over. The majority of the individuals who are allowance recipients fall into one of these groups, which leads to the multi-colinearity effect resulting in biased estimate of the age effect on the support type. Hence, caution needs to be exercised in interpreting the age effect on the support types.

6 Baseline probability is the probability of completion of a qualification observed in the entire dataset.

Figure 4.2: Odds ratio of completion by support types and age



Note: The line bar denotes the 95% confidence interval for the odds ratio. If the line bar crosses 1, this indicates that this category is not significantly different from the reference category 'no loans and no allowances'.

Figure 4.2 depicts the odds ratio of qualification completion, as affected by the interaction effect of support type with age. The 'allowances only' category showed a significantly higher likelihood of completion compared with the reference category, of 'no loan and no allowances', within each age group. In particular, the likelihood of completion was three times higher in the 20-24, 25-29 and > 50 year age groups, than the reference category. The 'loans and allowances' and 'loans only' categories also showed higher likelihoods of completion but at lower levels than the 'allowances only' category.

4.5 Support type and gender

Gender was found to be significant effect modifier, but its impact was weak as indicated by small Wald chi-square statistic. Considering the direct effect of gender on successful completion, when adjusted for other factors, gender significantly ($p < 0.01$) influenced the outcome. In terms of delta-p statistics, the change in probability of successful completion by females compared to male increased by only 5 percentage points in relation to baseline probability.

Figure 4.3: Odds ratio of completion by support types and gender

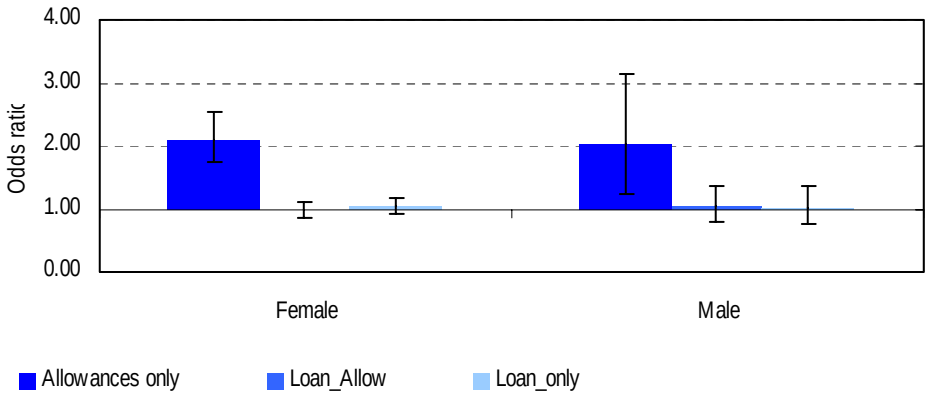
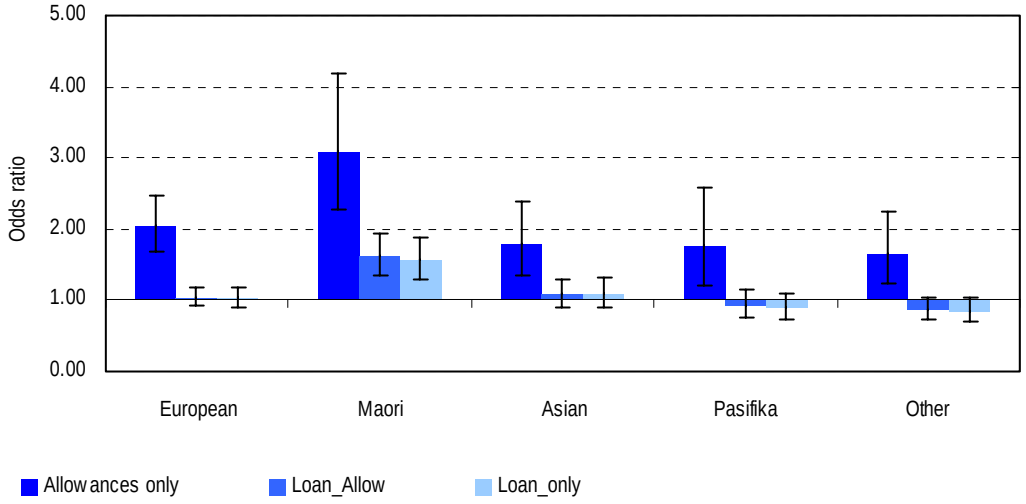


Figure 4.3 shows the interaction effect of gender on support types. 'Allowances only' recipients in both males and females showed two times higher likelihood of completing their qualification compared with the 'no loans and no allowances' category. In other words, no interaction effect was observed between support types and gender. The likelihood of completion in the remaining two categories did not differ significantly ($p < 0.05$) from the reference category.

4.6 Support type and ethnic group

Ethnic group is a strong effect modifier of support types. The effect of ethnicity in the presence of interaction with support type significantly affected the likelihood of qualification completion ($p < 0.01$). The main effects model showed a significantly lower likelihood of completion among the Māori and Pasifika peoples than the reference group (Table A2.2, Appendix 2. However, the effect of support type gets modified in the interaction effects model (Table A2.3 Appendix 2).

Figure 4.4: Odds ratio of completion by support types and ethnic group

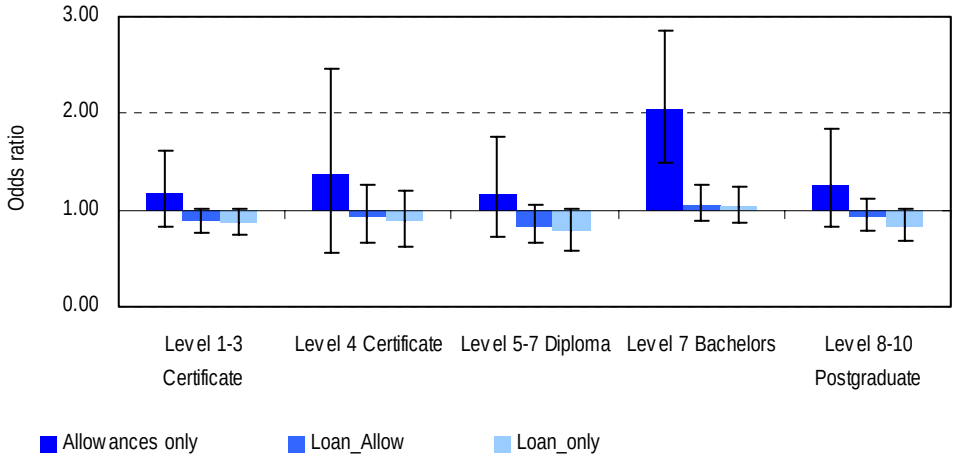


The effect of support types on different ethnic groups is shown in Figure 4.4. Individuals receiving 'allowances only' showed a higher likelihood of completion compared with the 'no loans and no allowances' category, irrespective of their ethnic affiliation. However, the magnitude of effect varied with different ethnic groups. The 'allowances only' recipients in the Māori group were three times more likely to complete qualification compared with the reference category. The other two support types also showed a significant effect on completion in the Māori group, while they were not significant in other ethnic groups. These results indicate that student support has had a positive influence on the academic outcomes for Māori compared with other ethnic groups. The predicted probability (Table A2.3, Appendix 2) indicates that although successful completion was lower in the 'no loans no allowances' category, the completion rate for Māori was substantially higher in the 'allowances only' category.

4.7 Support type and qualification level

Qualification level is a strong modifier of the effect of support types. The main effects model showed that the impact of qualification level on the likelihood of completion was highly significant ($p < 0.01$). The interaction effects model showed that those who receive 'allowances only' were more likely to complete their qualification in all qualification levels, compared with the reference category, except level 1-3 certificates. The likelihood of completion was two times higher in bachelors level than the reference category (Figure 4.5). The other two support types did not differ significantly from the reference category in any qualification levels. The predicted probability of completion was higher in bachelors or higher qualification levels (Table A2.2, Appendix 2).

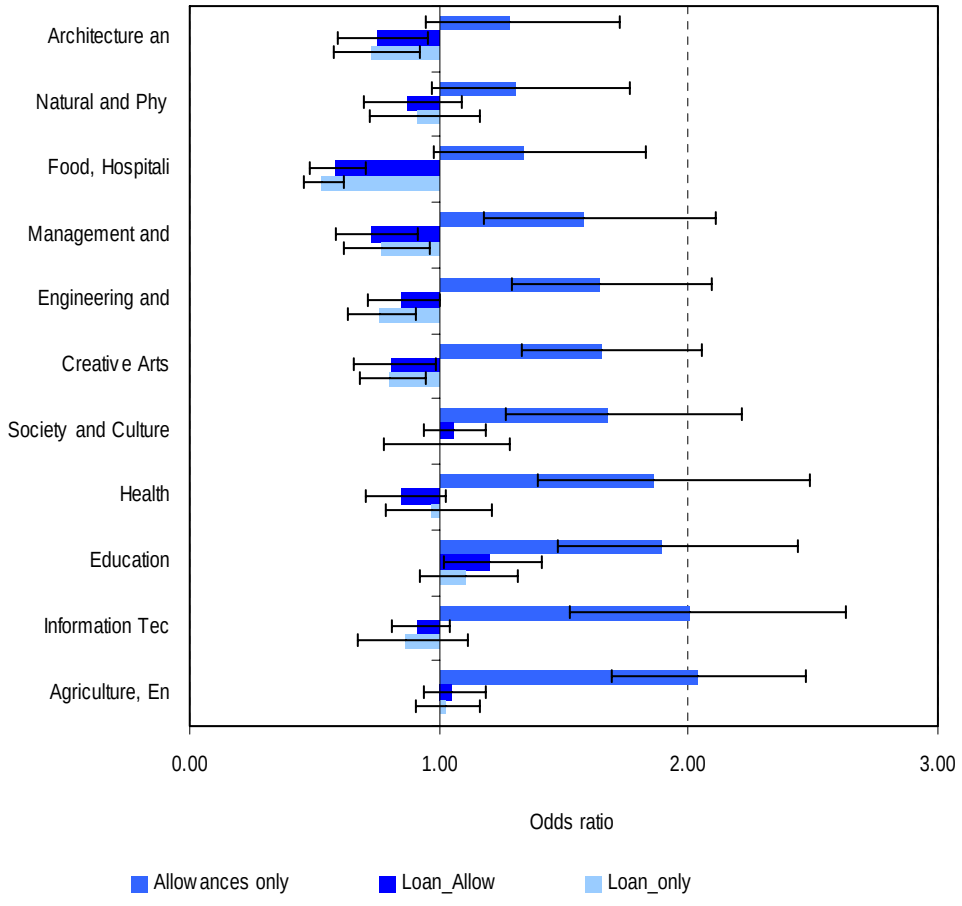
Figure 4.5: Odds ratio of completion by support types and qualification level



4.8 Support type and field of study

Field of study is an important effect modifier that influenced the effect of support type on completion. The effect of field of study on successful completion is significant except for the fields of 'management and commerce' and 'architecture and design'. A significantly higher likelihood of completion was seen for those students studying 'health, 'creative arts', education' and 'food and hospitality'. The delta-p statistics for these fields of study indicated that the probability of successfully completing a tertiary qualification 12, 8, 5 and 3 percentage points for the health, food and hospitality, education or creative arts fields respectively (Table A1.2, Appendix 1).

Figure 4.6: Odds ratio of completion by support types and fields of study

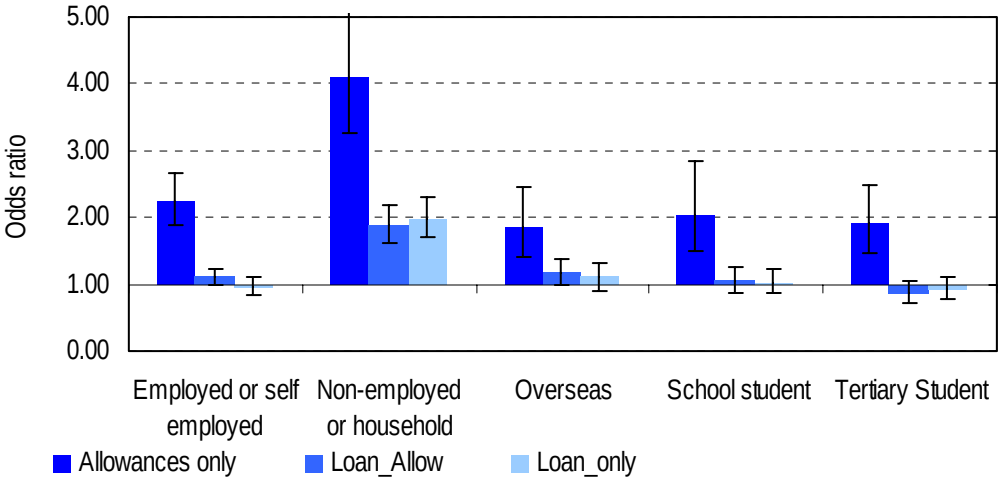


The interaction effects model showed that those who receive 'allowances only' were more likely to complete a qualification than those who did not receive support in all study fields. Individuals receiving 'allowances only' and studying in the fields of agriculture, information technology, education and health had a higher likelihood of completion relative to the 'no loans and no allowances' category. The two support categories of 'loans and allowances' and 'loans only' had a significantly lower likelihood of completion if study fields were food and hospitality, management and commerce, architecture and design, when compared with the reference category. In the remaining fields of study, these two support types did not differ significantly from the reference category.

4.9 Support type and prior activity

Prior activity is a potential and significant effect modifier. The results indicated that individuals, who were tertiary students or secondary school students, had an increased probability of completing a tertiary qualification. The likelihood of completion was significantly lower for those who were in either the non-employed or household person.

Figure 4.7: Odds ratio of completion by support types and prior activity

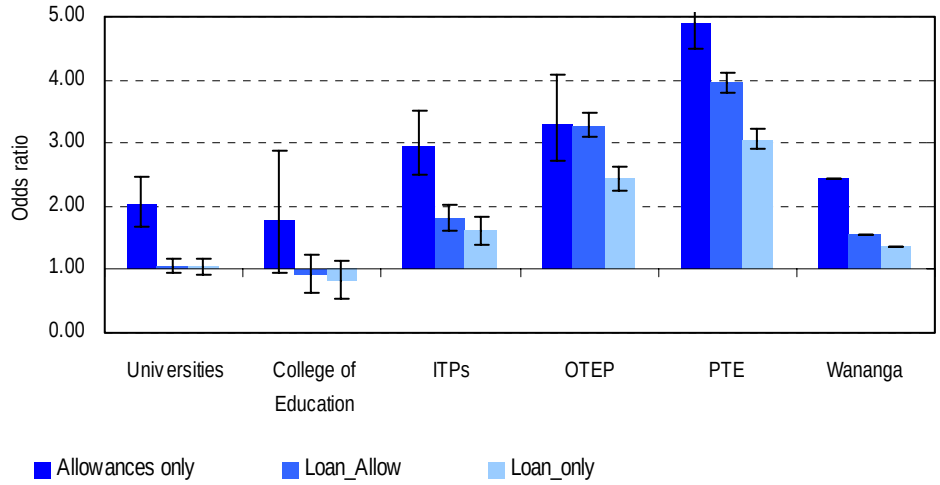


The interaction effects model showed a different picture (Figure 4.7). Those who received allowances only were more likely to complete their qualification compared with the 'no loans and no allowances' category within the prior activity variable. However, those whose prior activity was 'not employed/household person' and who were in 'allowances only' category were four times more likely to complete a qualification than those in the 'no loans and no allowances' category, with the same prior activity field. The 'loans only' and 'loans and allowances' categories with the prior activity of 'not employed/household person' also showed a higher likelihood of completion, compared with the reference category.

4.10 Support type and provider

Provider of tertiary qualification is a significant effect modifier. Considering its main effect on successful completion, the likelihood of completion is significant ($p < 0.01$) but differing in direction.

Figure 4.8: Odds ratio of completion by support types and providers

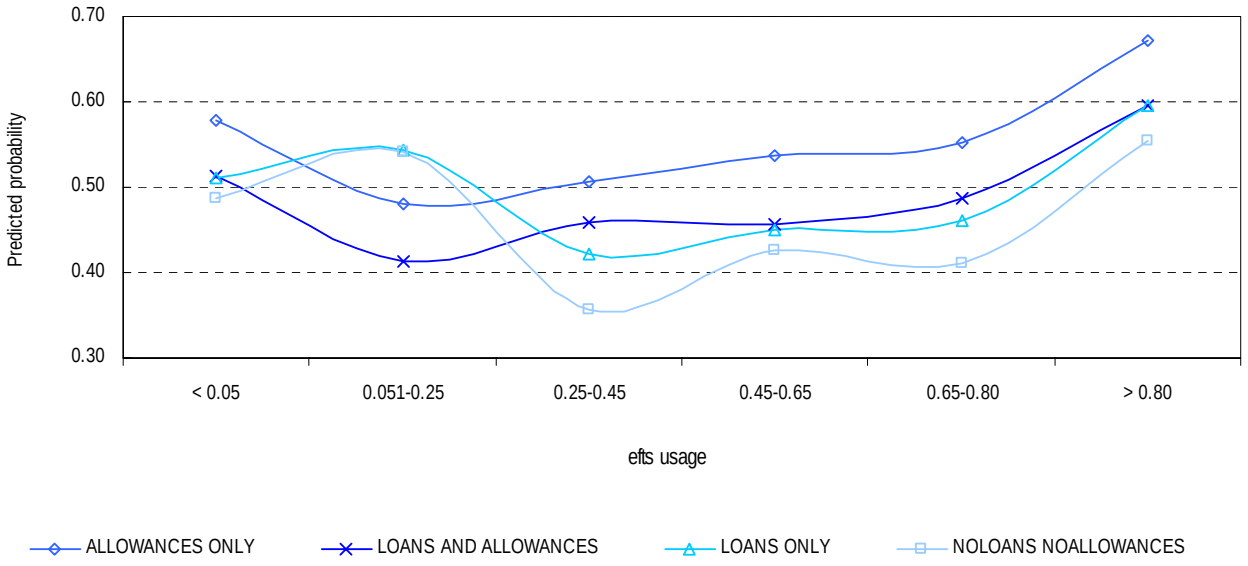


Except for the Institutes of Technology and Polytechnics (ITPs), all providers showed significantly lower completion rates in relation to universities (Table A1.2, Appendix 1). The interaction effects model revealed that those receiving 'allowances only' were more likely to complete a qualification in all types of provider. The 'loans and allowances' and 'loans only' categories showed (Figure 4.8) a significantly higher likelihood of completion in ITPs, Other Tertiary Education Provider (OTEPs) and Private Training Establishments (PTEs).

4.11 Support type and efts usage

Equivalent full time study represents the study load of an individual for one year. This variable is the foremost effect modifier which positively influenced the effect of support type on the completion status. The delta-p statistics showed that this variable has increased the probability of successful completion of tertiary qualification by 33 percent from the estimated 41 percent baseline probability. The main effects model also indicated that efts usage had a significant influence on the completion outcome (Table 1.1). The probability of completion with different levels of efts usage in different support types is shown in Figure 4.9. This indicates that those who study full time over a full year basis are more likely to complete than those who are engaged in part year but full time basis.

Figure 4.9: Predicted probability of completion by support types and efts-usage



The ‘allowances only’ category showed a higher probability of completion at higher efts usage levels, compared with other support types.

4.12 Effect of extended allowance types on academic achievements

The impact of six different types of allowances on the successful completion of a qualification was attempted and the results are shown in Table A3.1 (Appendix 3). In addition to the six student allowance types, the ‘loans only’ and ‘no loans and no allowances’ categories were included in the model for comparison. The estimated effect of the six categories of allowance types on the log-odds of successful completion of a qualification, controlling for all other predictors in the model is shown. The undefined cases were grouped under the ‘unknown’ class and treated as a reference category.

The overall effect of allowance type on the odds of successful completion is significant ($p < 0.01$). However, at the individual category level, the effect was not statistically significant ($p > 0.05$). Other important control variables significantly influencing the outcome were efts usage, ethnic group, gender and age group. Interestingly, the interaction effect of the qualification level and field of study with allowance types showed statistical significance but not their main effect. Several of the interaction effects between support type and predictor variables in the model were statistically significant. For example, field of study and allowance types, and provider and allowance types, were two important combinations showing a significant interaction effect.

The analytical results using the extended allowance types were not appealing on several counts, compared with the four support categories used in the earlier analysis. The main problem was that of dissimilar sample sizes, coupled with colinearity effects, influencing the results at individual level, as evidenced by the higher standard errors associated with each variable. The analysis was also unable to delineate the differences in the academic outcome among different allowances type as a function of socio economic status. This may be due to the weak role of allowances types used as a proxy to parental income in explaining the socio-economic status.

5 Discussion

The main aim of the student allowance and loan schemes is to enhance access to tertiary education by reducing barriers to participation. However, individuals availing themselves of the student support system do not necessarily attain a tertiary qualification. From the perspective of economic efficiency, successful completion of a qualification is more important at the individual and public level. It is also important from the perspectives of both economic benefit and education equity. Some students do not necessarily aim to complete a qualification, preferring instead of increasing their skills by passing a few courses. However, given that part-time students are excluded from the model and also given the fact that most full time students aim to achieve completion of a qualification successfully, completion of a qualification is an appropriate outcome for the purpose of this study. As the amount of research on the impact of student support system on successful completion of a qualification is very limited, this study advances the current understanding by examining the impact of the support system, including the specific type of student support received.

The overall result of this study is that the student support system has a positive association with the completion of a tertiary qualification. This study considers the context of student and educational characteristics and their interaction effects and shows how the effects of student support types are modified in the presence of these factors. The 'allowances only' group is associated with a higher proportion of completions[7]. The successful completion of qualifications among the 'loans and allowances' and 'loans only' categories was similar to those who did not receive any loans and allowances, keeping all other factors constant. Motivation and commitment are two important factors for achieving success in an individual's academic pursuit. The levels of these factors vary among individuals – for reasons other than the types of student support.

It needs also to be noted that the number of people in the 'allowances only' category is relatively small and has reduced further since the period analysed in this study. This analysis doesn't capture the changes to the criteria for eligibility for allowances that occurred in 2005. The introduction of interest free loans has changed the nature of this group again and has reduced its size further. Therefore, it is not appropriate to draw policy conclusions about the relative value of loans and allowances from this study.

A literature survey on the impact of the student support system on the educational achievements and outcomes showed that the conclusions are inconsistent. A study by Dowd and Coury (2006) reported that student loans were observed to have a negative effect on persistence and no effect on qualification attainment. The authors supported the theoretical proposition that student loan borrowers do not perform better than those who do not borrow. Empirical results in the context of a student loan programme (SOFES) implemented at private universities in Mexico suggested that SOFES recipients show better academic performance than students without a credit from SOFES (Canton and Blom, 2004). However, the authors concluded that this result cannot be interpreted purely as a causal impact of the student loan programme, since the impact could also reflect the selection process of students for loans.

Some authors argue that student support systems are growing culture globally and represent an inevitable part of education policy. Loans are a feasible way to pay for higher education and this culture results in the positive association between student support and degree attainment (Choy, 1998; Eyermann, 1999). Singell (2002) reported that the effect of student aid should be evaluated in the context of student background, including income or other personal characteristics such as socio-economic status (SES), ethnicity and their interaction effects. In particular, several reports concluded that institutional characteristics have a strong influence on the magnitude of student support and qualification completion (Kim, 2007; Astin and Oseguera, 2002; Thomas, 2000 etc.). However, little research has focussed on how the effects of interaction between student support types and educational and personal characteristics influence the academic outcome. This study advances earlier work by looking at the impact of student

7 It is important to note that the analytical power of the model is not strong enough (pseudo $R^2 = 0.23$) to arrive at a definite conclusion as the bias from omitted variables on the causal effect of support type on the successful completion could alter the results.

support types on the academic outcome using educational and personal characteristics and interaction effects, using a real-life dataset.

5.1 Profiles of student support recipients

Seventeen percent of the study population formed the 'loans and allowances' category. This category depended on the student support system for living costs and tuition fees. Thirty percent of the 'loans and allowances' category comprised of Māori and Pasifika peoples. More than 58 percent in this category were enrolled in undergraduate level qualifications.

New Zealanders enrolled in Tertiary Education Commission approved qualifications are eligible for student loans. The 'loans only' category comprises 22 percent of the total study population. The majority of individuals in this group borrow student loans for tuition fees, though some borrow for living costs also. Māori and Pasifika peoples constituted 32 percent of this category. Sixty-four percent of individuals in the 'loans only' category were enrolled in undergraduate level qualifications.

The 'allowances only' category was the smallest group, with a share of 3 percent of the total. Māori and Pasifika peoples constituted 12 percent of this category. About 50 percent of individuals were enrolled in undergraduate level qualifications. It may be of interest to see that the proportion of 'allowances only' type is dwindling over time. Of the total student support recipients, the proportion of students receiving 'allowances only' decreased from 12 percent in 2000 to 6 percent in 2006 (Ministry of Education, 2008). More and more students are inclined to borrow student loan along with student allowances as they are unable to cope with the financial constraints.

The remaining 58 percent of students were in the 'no loans and no allowances' category. This category had the highest undergraduate level enrolment (71 percent) and the proportion of Māori and Pasifika peoples was close to 20 percent.

It is interesting to note that the observed proportion of Māori and Pasifika peoples was 30, 32 and 12 percent for 'loans and allowances', 'loans only' and 'allowances only' respectively. The observed proportions of successful completion in the raw data for all students in each of these support categories was 46, 46 and 57 percent respectively, compared with 32 percent for the 'no loans and no allowances' group (Table 3.2). The proportion of successful completions was very similar for the 'loans and allowances' and 'loans only' categories compared with the students who received no support. This brings out the fact that the 'loans and allowances' and 'loans only' categories were closer in terms of educational outcome, than the 'allowances only' and 'no loans and no allowances' groups. Given the higher completion rate (57 percent) for the 'allowances only' group, the results tend to indicate that this group has different characteristics, while the other three groups have similar outcome.

One key message that comes out of this study is that student support system appears to be a motivating factor for academic achievements. This analysis implies that this may be especially so, when the support has fewer conditions imposed. This result confirms a similar study by Corder et al., (2004). Student loans with or without allowances, do not appear to exert the same kind of effect as that of student allowances only.

5.2 Are loans and allowances promoting equity?

The above characterisation of student support categories brings out the fact that the ethnic characteristics have a strong influence on the successful completion of a qualification. Statistical significance of the logistic regression estimates for ethnic groups confirmed this and Table A1.1 (Appendix 1) indicates that ethnic group is a potential effect modifier. The overall effect of ethnic group on completion in the main effects model showed that the likelihood of qualification completion for Māori and Pasifika peoples was significant and negative compared with a significant and positive effect for all other ethnic groups (Figure A2.2, Appendix 2). Scott and Smart (2005) reported similar findings where Māori and Pasifika students had lower completions rates, even after other factors have been adjusted for.

This suggests that the probability of qualification completion was different for individuals from different ethnic groups. However, in the interaction effects model, this configuration has changed, indicating that support types did influence the successful completion of qualifications for the Māori group, while for Pasifika people, the likelihood of completion was higher for those receiving 'allowances only'. An aim of the student support system is to provide equal education opportunity, by reducing barriers to education and to some extent the student support system has achieved this objective. There is a need to look further into the factors that are responsible for the lower probability of completion among Pasifika people in the 'loans and allowances' and the 'loans only' categories. The outcome from this study is that the student support system can be seen explicitly as a strong motivator of academic achievement among under represented ethnic group than other groups.

Equity of achievement is not a gender issue, as indicated by the odds ratio and delta-p statistics — that the probability of successful completion increased only by 5 percentage points for females compared to males, keeping other factors constant. Gender was also found to be a weak effect modifier.

Kim (2007) reported that students' increased reliance on support system may widen the ethnic gap in degree completion, despite the fact that a primary goal of the support system is to narrow this gap. Eyermann (1999) argues that equity cannot be realised until one examines the final outcomes, and said that equity can only be achieved when students who have similar ability and motivation attain comparable outcomes, regardless of their financial situations. Therefore, assessing equity demands an assessment of longer-term outcomes, including participation and achievement in tertiary education.

5.3 Why does the 'no loans and no allowances' category perform poorly?

The characteristics of the 'no loans and no allowances' group indicated that the proportion of undergraduate level enrolments in this category is high (71 percent). The proportion of Māori and Pasifika peoples in this category was close to 20 percent, which is slightly higher than the 'allowances only' category. The unadjusted successful completion rates for the 'no loans and no allowances' category were the lowest, irrespective of their nature of attendance. One reason behind their lower probability of completion could be that many individuals were engaged in part-time study, but even after the model was fitted using full-time study, the 'no loans and no allowances' category showed low completion rates. Low completion rates may be attributable to the high proportion of enrolments in undergraduate levels, as the analysis showed that the probability of successful completion was lower in these levels. Another probable reason may be that students from this group are more likely to engage in part-time job for an extra income. A negative effect of students engaged in part-time job is the time use trade-off between work and study. Students engaged in work are likely to use less time for studies and consequently affecting their academic performance. This may also lead to longer time to complete a qualification compared to those who do not work. It is therefore necessary to explore the impact of part-time jobs on the academic performance among tertiary students. In addition, it is possible that those whose tertiary goal is not a qualification may be disproportionately high in this group.

Several forces are acting in different directions on the system of successful completion and hence it is a complex system. The impact of student support types on successful completions is not independent of other influences, keeping aside the individual's innate ability. Family income and other, often associated characteristics, such as parents' education and aspirations for their children and single parenthood have an impact very early, even before children enter school, because they affect readiness to learn and the child's aspirations and performance. Although it is not enough to focus only on financial support for students attending tertiary education, it is recognised that student support may help some students to overcome disadvantages that prevent them from achieving goals for participation and achievement.

5.4 Role of potential effect modifiers

The control variables that have strongly modified the effect of student support type on successful completion, besides ethnicity and gender, are study load (efts usage), field of study, level of qualification, prior activity and providers. However, their effect was stronger in the presence of interaction effects. Previous research on the impact of study variables on the completion of degrees (Scott and Smart, 2005) reported that field of study, study-load, qualification levels and providers are all important predictors of successful completion of qualification. The nature of attendance was another strong effect modifier, but inclusion of this variable confounded the effect of support types due to multi-colinearity effect. Hence the nature of attendance variable was excluded from the final model. The results, however, unequivocally indicated that those who were engaged in full time studies had a higher likelihood of completion than those engaged in part-time study. Scott and Smart (2005) reported that the more full-time a student was, the higher their likelihood was of completing a degree. A study by Kim (2007) stated that if an individual is engaged in full-time study, there is a higher likelihood of degree completion than those who are engaged in part-time study ($p < 0.001$).

The provider sub-sector variable controls for the effect of the institution, which includes institutional size, institutional control, academic and social climates of the institutions. This factor had a significant ($p < 0.01$) effect on successful qualification completion. Kim (2007) showed that institutional variables, which covered tuition, selectivity and institutional control, were significantly related to degree attainment rates. In this study, the provider type had a significant effect on the successful completion, but in different directions. The 'allowances only' group showed a higher likelihood of completion in every provider type.

Activity prior to attending tertiary education has a significant impact on academic achievement and the results from this study emphasise this fact. Individuals who were not employed/household person and who were receiving any form of support types had a higher likelihood of completion relative to the 'no loans and no allowances' category.

Lower qualification levels had a significantly lower probability of completion for all student support categories. This finding supports the result that study load strongly influences the rate of completion. This is because the study load increases with the rise in qualification level. This also supports the argument that those who study full time over a full year basis are more likely to complete than those who are engaged in part year but full time basis. Field of study also influenced the rate of successful completion significantly.

A similar study by Kim (2007) showed that among individual background characteristics, parental education and income play a significant role in degree attainment. The study by Kim emphasises the importance of including more personal background characteristics to arrive at a reasonable conclusion on the impact of support types on the qualification completion. Hence, there is a need to add more measures of cultural and social capital[8] to reflect an individual's preferences and tastes for tertiary education, the system of values and beliefs in which an individual is living, as well as parental education. This will result in a more definite result on the impact of student support types on the successful completion.

5.5 Limitations of this study

One limitation of the current study was that the available information did not permit measurement of the socio-economic status (SES) of students and hence, could not link educational achievements to SES. SES is usually regarded as a composite of parents' education, occupation and income, although some measures of SES include only two of these three dimensions (Mayer, 2002). While some student allowances recipients qualify for allowances on the basis of their parents' income, parental income alone cannot be used as a proxy to measure SES.[9] In addition, the explanatory power of the model used in this

8 Cultural capital refers to the system of factors that is derived from one's parents that defines an individual's class status (Bourdieu and Passeron 1977). Social capital refers to social networks and the ways in which social networks and connections are sustained (Morrow 1999).

9 Socio-economic status is measured by the Highest International Socio-economic Index of Occupational Status (HISEI), which corresponds to the highest occupational index score of the student's father or mother (Ganzeboom et al. (1992, 1996)).

analysis implies that other factors not captured in the model – such as family background for instance – are also important factors in success in tertiary education.

Another limitation of this study was that that the dataset used students in the 1999-2001 starting cohorts who completed their qualification in the subsequent five years after enrolment. Hence, the study does not reflect changes in the support schemes since 2001 and their possible impact on academic achievements. Several policy changes that have been introduced since 2001, such as interest-free student loans, that may have a strong impact on student take-up of support and on academic outcomes. Hence there is a need for a follow-up study that takes account of these changes on the student allowances and student loans schemes.

The 'Allowances only' type is a relatively a small group of students and their numbers have been dwindling since 2002. The no-interest while studying policy introduced in 2000, and interest-free student loans implemented in 2006 may be exacerbating this change. Hence, it would not be wise to draw policy conclusions about the 'Allowances only' type despite the interesting results shown in the present study as we fear that this group may become less relevant in the years to come.

While receiving allowances is associated with a greater probability of successful completion, changes to the student support system since the period analysed mean that caution is needed in drawing policy conclusions from this study.

6 Recommended future work programme

This report showed that the analytical power of the model and the goodness of fit is moderately strong (pseudo R^2 = 0.20) to arrive at a definite conclusion as the omitted variable bias on the causal effect of support type on the successful completion could alter the results. So, it is worthwhile attempting analysis with additional factors representing more robust socio-economic characteristics.

Despite these limitations, the findings of this study suggest that more work is needed to identify the strengths and weaknesses of support types.

The ultimate goal of the work is to provide an evidence-based means of identifying the impact of student financial aid that has influenced the successful outcomes after controlling for other demographic and study related factors. As more data are added to the integrated student loan dataset, the impact study can be further extended to examine the impact of policy changes in the support types and its rolling effect on the academic achievements.

Feasible areas of work that can throw more light on the issues encountered in this report include:

- identifying factors responsible for lower completion rates among under-represented groups
- assessing the impact of part-time employment on academic achievements
- using the value of loans or allowances as proxy measures to capture student motivation and commitments
- studying the effects of recent policy changes to the student support system, especially the introduction of interest-free student loans, on academic achievement
- identifying factors influencing lower academic achievement in sub-degree levels
- classifying allowance types and studying the impact of each on the academic outcomes.

Another report, complementary to the current study, will use the same dataset to explore the longer term outcomes (and especially, the labour market outcomes) for student support recipients.

7 Conclusions

This study analyses Integrated Dataset on Student Loan Scheme borrowers and student allowances recipients to study the effect of the student support system on the success in the tertiary education. The study found that the student support system has a positive association with completion of a qualification, keeping all other control variables constant. A higher proportion of completions were associated with the 'allowances only' category. It is possible that higher levels of motivation and commitment or financial stability over the period of study may be among the factors responsible for higher achievement.

This study produced three important findings. First, individuals who were receiving 'allowances only' showed a higher probability of successful qualification completion, compared with their 'no loans and no allowances' counterparts, keeping other factors constant. Second, individuals who were in the 'loans and allowances' and 'loans only' categories showed a likelihood of successful completion on par with the 'no loans and no allowances' category. Finally, the results of this study showed that Māori and Pasifika peoples receiving 'allowances only' had significantly higher academic achievements, compared with their peers in the 'no loans and no allowances' category. In conclusion, this study supports the view that student support system can be considered as an effective support, especially for the under-represented groups.

The effect of support types on the successful completion of qualification in the presence of different control variables modified the impact of support types. Study load is one of the strongest factors influencing the rate of successful completion. The main effects model indicated that Māori and Pasifika peoples had a significantly lower probability of completion compared with Asians, Others and Europeans. However, the interaction effects model modified the effect of support type showing that Māori receiving any type of student support had a significantly higher likelihood of completion. Although Pasifika peoples receiving 'allowances only' showed a higher likelihood of completion, their performance in the other two support categories was on par with the reference category of 'no loans and allowances'. Individuals studying for a bachelors or higher level qualification had a higher probability of completion than those engaged in undergraduate level qualifications.

This result suggests that additional factors, such as individual background characteristics and parental education, should be included in future modelling to control for the effect of socio-economic status. A literature review on this topic indicated that socio-economic factors have a strong influence on the probability of successful completion of qualification.

8 References

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Appendix 1

Delta-p statistic

Delta-p statistics is a commonly used measure in logistic regression analysis to estimate the change in probability as a result of a unit change in an independent predictor, while holding constant all other predictors (Paterson, 1985). In notations, the delta-p (Δp) is defined as:

$\Delta p = P(Y=1|\ L_1) - P(Y=1|\ L_0) = P(Y=1|\ L_0+\beta j) - P(Y=1|\ L_0)$,

Where, $P(Y=1|\ L_1)$ is the probability of Y =1 (outcome of interest) given L1,
L1 represents the logit after a unit change in Xj, and
L0 represents the logit before the unit change in Xj,.

Generally, the logit L0 is derived from the baseline probability of response in the data and converting it as logit. The magnitude of Δp is not constant but changes as a function of both β and L0. If Xj is categorical, the magnitude of Δp depends on βj and the reference category. If Xj is continuous, the magnitude of Δp changes as a function of both βj and X_j changes.

Predicted probabilities

Odds ratios are calculated where a variable is not involved with an interaction. Where odds ratios are not available, predicted probabilities are provided. The predicted probability is calculated by substituting reference values of the variables into the logistic regression equations. Then the actual value of the independent variable of interest is substituted into the regression equation. By doing so, the impact of the selected variable on the predicted probability can be calculated for this reference value set.
It is important to note that predicted probabilities are for the selected reference value set only. If a different reference value set is chosen, then the values of the predicted probabilities would change. However, the nature of the relationship between the variable and the probability of the outcome would not change if a different reference value set was selected.

Table A1.1: Parameter estimates of support types– main effects model

Variable	estimates	Std Err	Wald chisq	OR	LLOR	ULOR	Delta-p
Intercept	-0.89	0.03	949.21**	0.41	0.39	0.44	-0.19
Allowance type							
Loan and Allowance	0.36	0.01	1338.77**	1.43	1.40	1.46	0.09
Loans only	0.29	0.01	843.88**	1.33	1.31	1.36	0.07
Allowances only	0.64	0.02	1500.24**	1.89	1.83	1.95	0.16
No Loan and No Allowance (Ref)							
Qualification level							
Level 1-3 Certificate	0.26	0.01	458.93**	1.30	1.27	1.33	0.06
Level 4 Certificate	-0.08	0.02	16.40*	0.92	0.89	0.96	-0.02
Level 5-7 Diploma	-0.31	0.01	539.48**	0.74	0.72	0.76	-0.07
Level 7 Bachelor (Ref)							
Level 8-10 Postgraduates	0.56	0.02	1320.82**	1.75	1.70	1.03	0.14
Gender							
Female	0.28	0.01	1366.21**	1.33	1.31	1.35	0.07
Male (Ref)							
Age group							
15-19(Ref)							
20-24	-0.36	0.01	1133.76**	0.70	0.68	0.71	-0.08
25-29	-0.20	0.01	207.94**	0.82	0.80	0.84	-0.05
30-34	-0.04	0.02	7.01*	0.96	0.93	0.99	-0.01
35-39	-0.03	0.02	3.10	0.97	0.94	1.00	
40-44	0.00	0.02	0.00**	1.00	0.96	1.04	
45-49	-0.03	0.02	1.82	0.97	0.93	1.01	
> 50	0.03	0.02	1.63	1.03	0.98	1.07	
Ethnic group							
Asian	0.10	0.01	60.45**	1.11	1.08	1.13	0.02
European (Ref)				1.00	1.00	1.02	
Maori	-0.41	0.01	1438.63**	0.67	0.65	0.68	-0.09
Other	-0.05	0.01	12.08**	0.95	0.93	0.98	-0.01
Pasifika	-0.52	0.02	1060.09**	0.60	0.58	0.62	-0.12
Unknown	-0.14	0.02	38.18**	0.87	0.83	0.87	-0.03
Field of Study							
Agriculture, En (Ref)							
Architecture an	-0.10	0.03	9.19*	0.91	0.85	0.97	-0.02
Creative Arts	0.33	0.03	161.46**	1.40	1.33	1.47	0.08
Education	0.21	0.03	57.50**	1.24	1.17	1.30	0.05
Engineering and	-0.20	0.03	60.38**	0.82	0.78	0.86	-0.05
Food, Hospitali	0.13	0.03	20.52**	1.14	1.07	1.20	0.03
Health	0.47	0.03	258.70**	1.59	1.51	1.69	0.12
Information Tec	0.02	0.03	0.45	1.02	0.97	1.07	
Management and	-0.13	0.02	29.28**	0.88	0.84	0.92	-0.03
Mixed Field Pro	-1.10	0.03	1797.49**	0.33	0.32	0.35	-0.22
Natural and Physical Science	-0.20	0.03	54.79**	0.82	0.78	0.86	-0.05
Society and Culture	-0.06	0.02	6.65*	0.94	0.90	0.99	-0.01
Efts usage (Continuous variable)	1.38	0.04	1274.4**	3.7	3.7	4.31	0.33
Prior Activity							

Table A1.1 continued…….

Employed or self	-0.01	0.01	0.87	0.99	0.96	1.05	
Non-employed or household person	-0.34	0.01	618.80**	0.71	0.70	0.73	-0.08
Overseas	0.18	0.02	129.18**	1.20	1.16	1.28	0.04
School (Ref)				1.00	1.00	1.08	0.00
Tertiary	0.05	0.01	12.81**	1.05	1.02	1.15	0.01
Other	0.10	0.02	22.34**	1.10	1.06	1.01	0.02
Provider							
Universities (Ref)							
Institutes of Technology and Polytechnics	0.44	0.03	191.61**	1.55	1.45	1.59	0.11
Colleges of Education	-0.34	0.01	869.05**	0.71	0.70	0.74	-0.08
Wananga	-0.15	0.03	21.44**	0.86	0.81	0.92	-0.04
OTEP	-0.49	0.01	1288.31**	0.61	0.60	0.63	-0.11
PTE	-0.06	0.02	6.99**	0.94	0.90	0.98	-0.02
Year							
1999 (Ref)							
2000	0.34	0.01	1336.05**	1.41	1.38	1.43	0.08
2001	0.42	0.01	1974.45**	1.52	1.49	1.54	0.10

*** Significant at 1 percent level; ** Significant at 5 percent level; Estimates are aggregate of 100 bootstrap samples.

Table A1.2: Parameter estimates of support types– interaction effects model

Variable	estimate	stdest	Wald chi-square	ProbChisq	Odds Ratio
Intercept	-0.80	0.05	300.67**	0.00	0.45
Allowance type					
Allowances only	0.71	0.10	54.44**	0.00	2.04
Loans and allowances	0.05	0.06	0.73	0.39	1.05
Loans only	0.03	0.06	0.22	0.64	1.03
No Loan and No Allowance (Ref)					
Qualification level					
Level 1-3 Certificate	0.40	0.02	364.79**	0.00	1.50
Level 4 Certificate	-0.02	0.04	0.35	0.56	0.98
Level 5-7 Diploma	-0.12	0.03	12.88**	0.00	0.88
Level 7 Bachelor (Ref)					
Level 8-10 Postgraduate	0.71	0.04	382.12**	0.00	2.04
Gender					
Male (Ref)					
Female	0.29	0.01	451.10**	0.00	1.34
Age group					
15-19(Ref)					
20-24	-0.37	0.01	1196.65**	0.00	0.69
25-29	-0.24	0.01	314.93**	0.00	0.78
30-34	-0.09	0.02	30.66**	0.00	0.91
35-39	-0.08	0.02	22.10**	0.00	0.92
40-44	-0.03	0.02	2.30	0.13	0.97
45-49	-0.04	0.02	3.70*	0.05	0.96
> 50	-0.01	0.02	0.31	0.58	0.99
Ethnic group					
Asian	0.02	0.02	1.12	0.29	1.02
European (Ref)					
Maori	-0.76	0.03	843.22**	0.00	0.47
Other	0.04	0.02	3.01	0.08	1.04
Pasifika	-0.43	0.03	155.67**	0.00	0.65

Table A1.2 continued…….

Unknown	-0.30	0.03	118.87**	0.00	0.74
Field of Study					
Agriculture, Environment (Ref)					
Architecture and building	0.15	0.06	6.78**	0.01	1.17
Creative Arts	0.50	0.05	97.92**	0.00	1.65
Education	0.23	0.05	18.42**	0.00	1.25
Engineering and allied technology	-0.02	0.05	0.11	0.74	0.98
Food, Hospitality	0.55	0.06	89.04**	0.00	1.74
Health	0.57	0.05	109.29**	0.00	1.77
Information Technology	0.07	0.05	2.15	0.14	1.08
Management and commerce	0.08	0.04	3.11	0.08	1.08
Mixed Field Programme	-1.07	0.05	564.88**	0.00	0.34
Natural and Physical Science	0.00	0.05	0.00	1.00	1.00
Society and Culture	-0.01	0.04	0.02	0.87	0.99
Provider					
Universities (Ref)					
Colleges of Education	0.61	0.06	92.70**	0.00	1.85
Institutes of Technology and Polytechnics	-0.61	0.02	917.79**	0.00	0.55
OTEP	-0.56	0.05	140.81**	0.00	0.57
PTE	-1.15	0.02	2442.15**	0.00	0.32
Wananga	-0.30	0.06	23.31**	0.00	0.74
Prior Activity					
Employed or self	-0.01	0.02	0.14	0.71	0.99
Non-employed or household person	-0.72	0.02	857.04**	0.00	0.49
Overseas	0.14	0.02	39.29**	0.00	1.16
School (Ref)					
Tertiary	0.15	0.02	44.97**	0.00	1.17
Other	0.21	0.03	46.91**	0.00	1.24
Efts usage (Continuous variable)	0.66	0.01	2528.11**	0.00	1.94
Year					
1999 (Ref)					
2000	0.37	0.01	1521.83**	0.00	1.44
2001	0.43	0.01	2088.97**	0.00	1.54

Because of space limitations interaction effects are not presented here but are available from the author upon request
** Significant at 1 percent level; * Significant at 5 percent level; Estimates are aggregate of 100 bootstrap samples

Appendix 2

Table A2.1: Predicted probability of completion by support types and qualification levels

Qualification level	Loan and allowances	Loan only	Allowances Only	No loans no Allowances
Level 1-3 Certificates	0.39	0.40	0.48	0.24
Level 4 Certificates	0.37	0.37	0.47	0.29
Level 5-7 Diplomas	0.33	0.33	0.42	0.22
Level 7 Bachelors	0.46	0.43	0.61	0.35
Level 8-10 Postgraduate	0.59	0.53	0.63	0.52

Table A2.3: Predicted probability of successful completion for support types and ethnic groups

Ethnic group	Qualification level	Loan and allowances	Loans only	Allowances only	No loans no allowances
European	Level 1-3 Certificates	0.45	0.44	0.53	0.23
	Level 4 Certificates	0.43	0.43	0.51	0.27
	Level 5-7 Diplomas	0.39	0.38	0.46	0.20
	Level 7 Bachelors	0.53	0.46	0.66	0.35
	Level 8-10 Postgraduate	0.60	0.60	0.69	0.51
European Average		0.48	0.46	0.56	0.31
Maori	Level 1-3 Certificates	0.36	0.36	0.43	0.16
	Level 4 Certificates	0.33	0.35	0.44	0.28
	Level 5-7 Diplomas	0.34	0.29	0.39	0.21
	Level 7 Bachelors	0.46	0.44	0.58	0.27
	Level 8-10 Postgraduate	0.58	0.50	0.62	0.44
Maori Average		0.40	0.38	0.50	0.26
Asian	Level 1-3 Certificates	0.44	0.49	0.52	0.36
	Level 4 Certificates	0.42	0.46	0.47	0.34
	Level 5-7 Diplomas	0.35	0.40	0.46	0.25
	Level 7 Bachelors	0.47	0.49	0.65	0.43
	Level 8-10 Postgraduate	0.58	0.55	0.66	0.61
Asian Average		0.46	0.48	0.55	0.39
Pasifika	Level 1-3 Certificates	0.32	0.33	0.40	0.21
	Level 4 Certificates	0.26	0.29	0.40	0.29
	Level 5-7 Diplomas	0.26	0.26	0.35	0.19
	Level 7 Bachelors	0.40	0.31	0.52	0.32
	Level 8-10 Postgraduate	0.56	0.51	0.56	0.50
Pasifika Average		0.34	0.33	0.45	0.30
Other	Level 1-3 Certificates	0.36	0.42	0.51	0.27
	Level 4 Certificates	0.38	0.36	0.51	0.33
	Level 5-7 Diplomas	0.30	0.38	0.43	0.27
	Level 7 Bachelors	0.40	0.46	0.63	0.42
	Level 8-10 Postgraduate	0.61	0.52	0.64	0.59
Other Average		0.40	0.42	0.55	0.37
Unknown	Level 1-3 Certificates	0.43	0.34	0.44	0.25
	Level 4 Certificates	0.47	0.35	0.44	0.27
	Level 5-7 Diplomas	0.32	0.26	0.38	0.19
	Level 7 Bachelors	0.45	0.35	0.60	0.34
	Level 8-10 Postgraduate	0.59	0.46	0.57	0.50
Unknown Average		0.44	0.35	0.50	0.31

Appendix 3

Table A3.1: Parameter estimates of support types with different allowance types

Variable	Estimate	Std Err	Odd Ratio	95% CI for Odds Ratio	
				Lower	Upper
Intercept	-5.74	6.09	0.00	0.00	4.93E+02
16-24 single	1.13	6.12	3.10	0.00	5.03E+05
> 25 single	5.69	8.14	295.74	0.00	2.50E+09
Dependants	3.77	10.92	43.21	0.00	8.47E+10
Independent Circumstances	4.57	8.27	96.31	0.00	1.05E+09
Loans only	4.81	6.12	122.78	0.00	1.98E+07
No Loans and no allowances	4.35	6.07	77.56	0.00	1.13E+07
Others	5.80	9.91	329.77	0.00	9.03E+10
Level 1-3 Certificate (Ref)					
Level 4 Certificate	-4.56	7.94	0.01	0.00	5.97E+04
Level 5-7 Diploma	-3.77	6.57	0.02	0.00	9.10E+03
Level 7 Bachelor	-1.44	2.76	0.24	0.00	5.27E+01
Level 8-10 Postgraduate	1.87	5.17	6.51	0.00	1.64E+05
Male (Ref)					
Female	-0.48	1.00	0.62	0.09	4.37E+00
1999	-0.25	0.01	0.78**	0.76	8.00E-01
2000	0.10	0.01	1.11**	1.08	1.14E+00
2001 (Ref)					
15-19	0.22	0.02	1.25**	1.19	1.31E+00
20-24	-0.16	0.02	0.85**	0.82	8.90E-01
25-29	-0.07	0.02	0.94**	0.90	9.80E-01
30-34	0.00	0.02	1.00	0.96	1.05E+00
35-39	0.02	0.02	1.02	0.97	1.07E+00
40-44	0.03	0.03	1.03	0.97	1.09E+00
45-49	0.01	0.03	1.01	0.96	1.06E+00
> 50 (Ref)					
Asian	0.41	3.65	1.51**	0.00	1.92E+03
European	0.59	3.20	1.81**	0.00	9.52E+02
Maori	-0.90	3.63	0.41**	0.00	5.04E+02
Other (Ref)					
Pasifika	-2.00	3.89	0.13**	0.00	2.73E+02
Agriculture, Environment and forestry	0.36	12.74	1.43	0.00	9.92E+10
Architecture and building	0.14	8.40	1.16	0.00	1.64E+07
Creative Arts	2.04	6.39	7.72	0.00	2.12E+06
Education	5.45	5.39	233.68	0.01	9.06E+06
Engineering and allied technology	-1.51	4.03	0.22	0.00	6.00E+02
Food, Hospitality	0.71	3.52	2.04	0.00	2.01E+03
Health	5.92	11.60	374.25	0.00	2.81E+12
Information Technology	-0.51	3.99	0.60	0.00	1.50E+03
Management and	-0.36	2.71	0.70	0.00	1.43E+02

Table A3.1 continued…….

Mixed Field Programme	-8.61	4.60	0.00	0.00	1.52E+00
Natural and Physical sciences	-3.66	6.46	0.03	0.00	8.13E+03
Other (Ref)					
Efts usage	2.42	3.46	11.27**	0.01	9.92E+03
Prior Activity					
College of Education	-5.62	17.53	0.00	0.00	3.04E+12
House person or retired	-2.94	13.58	0.05	0.00	1.93E+10
Non-employed or beneficiary	0.12	1.99	1.13*	0.02	5.65E+01
Overseas	1.49	13.65	4.42	0.00	1.83E+12
Polytechnic student	-2.10	6.92	0.12	0.00	9.48E+04
Private Training	-2.30	5.55	0.10	0.00	5.33E+03
Secondary school	1.14	2.20	3.13	0.04	2.33E+02
Self-employed	-6.71	12.16	0.00	0.00	2.76E+07
University student	2.05	5.00	7.80	0.00	1.41E+05
Unknown	0.69	5.33	1.99	0.00	6.78E+04
Wage or salary worker	0.03	1.17	1.03**	0.10	1.01E+01
Other (Ref)					
Provider					
Universities (Ref)					
Colleges of Education	1.19	5.05	3.29	0.00	6.49E+04
Institutes of Technology and Polytechnics	3.29	5.70	26.96	0.00	1.90E+06
OTEP	1.45	8.80	4.27	0.00	1.32E+08
PTE	-3.00	17.74	0.05*	0.00	6.28E+13
Wananga	-1.75	10.28	0.17	0.00	9.81E+07

*** Significant at 1 percent level; ** Significant at 5 percent level; Estimates are aggregate of 100 bootstrap samples

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