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Do Struggling Students Benefit From Continued Student Loan Access? Evidence From University and Beyond

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Do Academically Struggling Students Benefit From Continued Student Loan Access? Evidence From University and Beyond

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We estimate the effects of access to student loans on university students' educational attainment and labor market returns in New Zealand. We exploit the introduction of a policy mandating a minimum pass rate of 50% for student loan renewals using a fuzzy regression discontinuity design and linked administrative records. For students around the threshold, retaining access to student loans increases their likelihood of re-enrollment and bachelor's degree completion rate. The effects are observed primarily among female students due to a substantial gender difference in compliance with the pass rate criterion. We find that retaining student loan access leads to large labor market returns for struggling female students. The additional student loan debt from further borrowing declines quickly due to faster repayment.

Keywords: student loan; income-contingent loan; regression discontinuity
JEL Codes: I22, I23, I26, J24

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Disclaimer: These results are not official statistics. They have been created for research purposes from the Integrated Data Infrastructure (IDI) which is carefully managed by Stats NZ. For more information about the IDI, please visit https://www.stats.govt.nz/integrated-data/. The results are based in part on tax data supplied by Inland Revenue to Stats NZ under the Tax Administration Act 1994 for statistical purposes. Any discussion of data limitations or weaknesses is in the context of using the IDI for statistical purposes, and is not related to the data's ability to support Inland Revenue's core operational requirements.

I'm drowning in debt for a piece of paper I never received. Nobody should be in this position.

– Ashley, 27, University dropout[1]

1. Introduction

Student loans can remove financial barriers faced by credit-constrained young adults and reduce education gaps between rich and poor. Compared to other forms of student aid, student loans can incentivize greater study effort among students as well as competition across education institutions and thus increase operational efficiency. However, "crisis" is a term increasingly used to describe the current level of student loan debt (Chiwaya 2019; Friedman 2019b; Griffin 2018; Hoffower and Akhtar 2019; Mitchell 2019; Travers 2019). In the U.S., total student loan debt reached nearly $1.5 trillion in 2018 – an amount equivalent to roughly $30,000 per borrower and 7% of the gross domestic product (GDP) (Federal Reserve Bank of New York 2019). In the U.K., total student loan debt was £121 billion in 2018, or £32,000 per borrower and 6% of GDP (Bolton 2019). Due to the rising cost of education, the British government estimates that current undergraduates will accumulate more than £40,000 of student loan debt, and only 30% of them will be able to repay the debt in full (Bolton 2019). In New Zealand, total student loan debt as a proportion of GDP is also 6% and on a par with the U.K. and the U.S.[2] Concerns about borrowers' collective ability to find adequate work to service the growing debt has generated urgent calls for public intervention. For example, in the U.S., some proposals suggest restricting student loan access through loan underwriting, while others recommend tying repayment to earnings, allowing student loan debt to be discharged in bankruptcy or even outright debt forgiveness (Brooks and Levitin 2020; Draeger and Desjean 2019; Friedman 2019a; Goldrick-Rab and McCluskey 2016; Mitchell and Jamerson 2021; Nova 2019).

Recent research demonstrates the breadth of ways that student debt can affect students' life trajectories, such as through university major and career choice, home ownership, the likelihood of marriage and childbirth, entrepreneurship, and mental health (Gicheva 2016; Houle and Berger 2015; Krishnan and Wang 2019; Mezza et al. 2020; Min and Taylor 2018; Rothstein and Rouse 2011; Schmeiser, Stoddard, and Urban 2016; Sieg and Wang 2018; Walsemann, Gee, and Gentile

[1] Source: Nadworny and Lombardo (2019).

[2] Total student loan debt in New Zealand was NZ$16 billion in 2018, and the average debt per borrower was NZ$21,000 (Ministry of Education 2018a).

2015). A high level of average debt does not imply that the average borrower is struggling to repay her loans, however. Student loan defaults disproportionately concentrate among groups of borrowers for whom the returns to student loans are least certain, especially students who fail to graduate.[3] These students may accumulate little human capital while amassing insurmountable student loan debts. If academically struggling students are overwhelmingly "lost causes" who will not graduate, then providing them with prolonged access to credit may inflict long-term economic harm. Yet, there is little evidence on the extent to which continued access to student loans improves or harms education and labor market outcomes for academically struggling students, despite broad academic interest and substantial policy relevance (Avery and Turner 2012; Dynarski 2015; Dynarski and Scott-Clayton 2013).

In this paper, we estimate the causal effects of access to student loans on the education and near-term labor market outcomes of academically struggling university students by leveraging quasi-experimental variation in access to the New Zealand Student Loan Scheme. The Student Loan Scheme provides students enrolled in eligible courses with income-contingent loans – that is, loans with a repayment amount set at a fixed proportion of income. Beginning in 2011, a sudden policy change made sustained access to student loans contingent on sufficient academic performance. In particular, after completing two years' full-time study, all students now needed to pass at least 50% of their previously attempted coursework to receive further loans. Since the overall pass rate is very high, students with cumulative pass rates around 50% are in the bottom 10% of the university student distribution. We use a fuzzy regression discontinuity (RD) design and the variation in loan eligibility at the 50% threshold as an instrumental variable for subsequent borrowing. Together with the linked administrative records from the New Zealand Integrated Data Infrastructure (IDI), we follow students from the education sector into the labor market and investigate the effects of the policy change on both academic and employment outcomes.

Since the government asks students to determine their eligibility without requiring supporting documents, the performance assessment is only weakly binding. Interestingly, women appear to be more compliant with the self-assessment of the loan eligibility than men, and only women exhibit a strong borrowing discontinuity around the 50% pass rate threshold. Consequently,

[3] For example, in the U.S., Scott-Clayton (2018) finds that 18% of white college dropouts default on their student loans within 12-years compared with just 4% of white bachelor's degree graduates. In fact, half of outstanding U.S. student debt was used by borrowers to attend graduate schools for which the default rate is very low (Looney, Wessel, and Yilla 2020).

only women's outcomes exhibit large and statistically significant discontinuities around the 50% pass rate threshold. We find that female students just meeting the eligibility criteria are 16 percentage points more likely to receive a subsequent student loan compared to women just missing the criteria. As there are no private student loan providers, nor other source of public financial aid in New Zealand meant to cover the costs of tuition, the Student Loan Scheme is essentially the only financing instrument available to students. Similar to Stinebrickner and Stinebrickner (2008), we find that most students are credit constrained and not able to continue study without loan access. Female students just above the 50% threshold are 12 percentage points more likely to re-enroll in the following year compared to women just below the threshold, implying that three-quarters of students losing loan access will not re-enroll the following year.[4] More importantly, around the 50% loan eligibility threshold, we find that retaining access to loans increases the five-year degree completion rate by 57 percentage points, and seven-year completion rate by 64 percentage points. Thus, for struggling female students who retain access to loans, while they take roughly twice as long as is typical, the majority of them will eventually graduate. The dynamics of the degree attainment gap suggest that the positive effect of student loan access on graduation persists. The gap in graduation appears three years following the point where loan access becomes subject to adequate academic performance. The gap converges slightly over time but female students with continued loan access remain 53 percentage points more likely to graduate relative to students without loan access five years following the performance assessment.[5]

We perform several robustness checks to demonstrate that our estimates reflect the causal effects of variation in loan access generated by the policy. First, we perform the standard balance tests for cumulative pass rates and covariates. While student characteristics appear to be smoothly distributed around the threshold, there is a small excess probability of two percentage points at the 50% pass rate due to the discrete nature of number of courses passed. However, when we examine male students and earlier student cohorts before the policy change, we observe a similar excess probability around the 50% threshold but no discontinuity in their education outcomes. Next,

[4] The ratio of the discontinuity in re-enrollment over the discontinuity in loan receipt (0.12/0.16 = 0.75) does not represent the population average effect of loan access on re-enrollment because the willingness to re-enroll if credit is available is a necessary condition for receiving a loan. The population average effect includes many individuals for whom credit access has no effect on their future enrollment (e.g., dropouts). We thank an anonymous referee for this observation.

[5] Around the 50% threshold, while two thirds of students take exactly two years to accumulate enough credits to meet the performance assessment, the average student takes nearly two and half years. Therefore, a period of five years after the performance assessment, on average, is equivalent to seven and half years since a student's first enrollment.

because the policy change was announced in late 2010 and applied to coursework completed since 2009, it was partially retroactive and caught some students by surprise. For this subsample of students whose loan eligibility was assessed in the first year of the policy, strategic selection across the 50% threshold is less of a concern. We find similarly positive effects among these surprised students, and the graduation gap between students with and without continued loan access remains at 61 percentage points seven years following the performance assessment.

Since academically struggling students may acquire little human capital in university, degree attainment does not necessarily translate into substantial labor market gains. The benefits of having a bachelor's degree with poor grades might be outweighed by the opportunity costs of forgone work experience. Access to student loans could even harm struggling students' labor market prospects by channeling struggling students into careers in which they are ill-suited. To investigate early-career labor market returns to student loan access, we estimate the dynamic effects on average monthly earnings and earnings percentile in the years following the initial academic performance assessment. The evolution of labor market outcomes suggests a favorable trend for female students with sustained loan access. In the fifth year following the assessment, female students who retain access to student loans earn NZ$2,022 (NZ$1 ≈ US$0.7) more per month and rise by 41 percentile points in the earnings distribution of female earners in their cohort around age 25. The subsample of students caught by surprise by the policy change exhibit similar dynamics; female students who retain loan access earn about NZ$2,000 more per month and rise by roughly 35 percentile points in the earnings distribution five to seven years after the performance assessment. While these earnings estimates indicate large labor market returns of student loan access, the estimated standard errors are also relatively large and therefore the estimates are sometimes only marginally significant. The estimate magnitudes remain roughly the same when we condition on positive earnings, suggesting that the increases in earnings are not primarily driven by changes in labor force participation.

The dynamics of student loan debt also exhibits a favorable trend for struggling students, supporting the finding that most students who retain loan access eventually earn a qualification that brings substantial positive labor market returns. In the first two to three years after the performance assessment, female students who retain access to student loans accumulate significantly greater student loan debt — NZ$32,000 more — than students who lose access. However, consistent with our earnings estimates, the student loan balance goes down rapidly once

students fully enter the labor market. In the fifth year following the assessment, female students who retain access to student loans owe only NZ$24,000 more student loan debt than students who lose access. In the seventh year following the assessment, for the subsample of students assessed in 2010, female students who retain access to student loans owe only NZ$9,000 more student loan debt. Therefore, further student loan access does not appear to burden academically struggling students with inescapable debt.

Finding that most struggling students will graduate and prosper is important because within the current policy debate surrounding the student loan crisis, there is disagreement on policies to reduce the financial risk of large loans made to students with uncertain incomes. Some experts advocate restricting loan access through underwriting based on expected future earnings to reduce the risk of loans causing long-term economic hardship for borrowers (Brooks and Levitin 2020; Draeger and Desjean 2019; Goldrick-Rab and McCluskey 2016). At the same time, others argue that reform should instead lower the downside risk to students when borrowing for study, rather than restrict loan access. In particular, scholars and policy makers advocate expanding the existing income-based repayment program in the U.S. towards a universal income-contingent loan system to prevent loan repayment overburdening borrowers (Barr et al. 2019; Britton, van der Erve, and Higgins 2019; Mitchell and Jamerson 2021).[6] Even though loan underwriting can possibly generate a pool of borrowers with higher repayment rates, our findings suggest a sizeable opportunity cost to tightening lending criteria. Our finding of positive education and labor market effects from credit access should reduce the general concern that easy loan access attracts too many low-performing students into higher education. As Looney and Yannelis (2019) point out, the preponderance of student loan defaults come from borrowers enrolled in for-profit education providers. Regulating low-quality education providers and their access to student loan dollars may be more effective than limiting individuals' loan access.

Our paper builds on several literatures in economics. First, the broad literature on student financial grant aid generally finds that aid increases student enrollment, but the effects on

[6] An income-contingent student loan was first established in Australia in 1989 and then in New Zealand in 1992. Similar income-contingent loan systems that provide universal coverage for higher education students have now spread to three other countries: Hungary, the Netherlands and the U.K. Six other countries (Ethiopia, Japan, South Korea, Namibia, Thailand and the U.S.) have student loan programs with non-universal coverage that have some design characteristics similar to an income-contingent loan system. See Chapman and Doan (2019) for the introduction to a special issue at Economics of Education Review on designing income-contingent loan systems in several countries.

educational outcomes beyond initial enrollment are mixed.[7] Given the prevalence of loan-financed education, the number of studies investigating the effects of student loans is remarkably small compared to other forms of financial aid. Most student loan studies in the U.S. focus on community colleges and generally find positive effects on education performance (Barr, Bird, and Castleman 2019; Dunlop 2013; Marx and Turner 2019; Wiederspan 2016). For university students, Black et al. (2020) find that access to higher federal student loan limits increases bachelor's degree completion rates for students in Texas. However, Denning and Jones (2019) do not find a similar effect for students in Utah. Studies from Chile find that access to a guaranteed loan program prompts marginal students to enroll in universities instead of vocational schools, which creates a mismatch problem and lowers these students' likelihood of graduation (Aguirre 2019; Bucarey, Contreras, and Muñoz 2020; Montoya, Noton, and Solis 2018; Solis 2017). In contrast to Chile, our positive findings on student loan access are in line with the U.S. evidence where institution quality matters more for student outcomes than match quality (Goodman, Hurwitz, and Smith 2016). Indeed, the homogeneous tertiary sector in New Zealand that consists of high-quality education providers may be an important contextualizing factor to our positive findings.

Our paper contributes to the growing literature investigating the labor market returns to student aid programs using recently available administrative datasets. Research finds large labor market returns to several grant aid programs in the U.S. (Bettinger et al. 2019; Denning, Marx, and Turner 2019; Scott-Clayton and Zafar 2019). Gervais and Ziebarth (2019) and Black et al. (2020) also find large positive effects of U.S. federal student loan borrowing on students' near-term labor market earnings. Consistent with this literature, our findings suggest that positive educational outcomes facilitated by financial aid programs lead to substantial labor market returns. Nevertheless, as indicated by the limited educational gains, the access to a state guaranteed loan in Chile seems to foster little labor market returns early in one's career (Bucarey, Contreras, and Muñoz 2020; Montoya, Noton, and Solis 2018).

Lastly, our paper is related to the recent literature on the returns to higher education using a regression discontinuity design (Hoekstra 2009; Kirkeboen, Leuven, and Mogstad 2016; Ost, Pan, and Webber 2016; Zimmerman 2014). Although our earnings estimates are large, the estimated magnitudes of returns to a bachelor's degree in our paper are very close to the estimates

[7] For the broad literature on student financial aid, see detailed literature reviews from Deming and Dynarski (2009), Dynarski and Scott-Clayton (2013), and Page and Scott-Clayton (2016).

in the U.S. literature (Bettinger et al. 2019; Black et al. 2020; Denning, Marx, and Turner 2019; Ost, Pan, and Webber 2016; Scott-Clayton and Zafar 2019; Zimmerman 2014).

The paper proceeds as follows: Sections 2 and 3 describe the New Zealand Student Loan Scheme and the IDI data. Section 4.1 introduces the RD design and the estimation strategy, and Section 4.2 validates the approach. Section 5.1 presents the findings on the education outcomes, Section 5.2 presents the findings on labor market outcomes, and Section 5.3 considers loan repayment dynamics. In Section 6, we use our estimates to calculate the rate of return to student loans. Section 7 concludes.

2. New Zealand Student Loan Scheme

Before 1989, tertiary education in New Zealand was virtually free, with a tertiary grants scheme supporting students' living costs. In 1989, a major education reform introduced tuition fees, and the Student Loan Scheme was subsequently created in 1992 to issue student loans and student allowances (Crawford 2016).[8] There are no other major financial aid programs nor commercial student loan providers in New Zealand.[9] Today, the Student Loan Scheme accounts for nearly half of government expenditure on tertiary education (the other half is direct funding to education providers based on student enrollment).[10]

All New Zealand citizens and permanent residents under age 55 can access the Student Loan Scheme. Each student loan contract is issued for up to one year. (More than 90% of student loan contracts have an end date in December.) Students need to re-apply every year (and pay an establishment fee of NZ$60), typically before mid-December, ten weeks before the start of the next academic year.[11] Domestic students can borrow three components through the Student Loan Scheme: course fees (up to actual tuition fees, directly paid to education providers), course-related costs (up to NZ$1,000 per year), and living costs (up to NZ$163 per week in 2010, rising to NZ$240 in 2020). The tuition fee is regulated by the government and increases annually by around

[8] The education reform was part of the New Zealand Experiment in the 1980s and 1990s in which both Labour and National governments adopted radical policies of deregulation and privatization.

[9] There is only a small number of scholarships available, and most of them specifically target Māori and Pacific students. See https://www.education.govt.nz/further-education/information-for-students/scholarships.

[10] For example, in 2010, the Student Loan Scheme provided NZ$570 million for student allowances and NZ$1,525 million for student loans, while government funding (including both tuition subsidies and research funding) to education providers was NZ$2,364 million (Baxter 2012)..

[11] The academic year in New Zealand roughly runs from March to November. Very few students study in summer (December to February), which requires additional approval from the Student Loan Scheme.

2%. The tuition fee for one-year of bachelor's study was typically around NZ$5,000–7,000 in 2010 (NZ$6,000–8,000 in 2020). In 2010, the median amounts borrowed from the Student Loan Scheme were NZ$5,084 for course fees, NZ$3,851 for living cost, and NZ$1,000 for course-related cost (Ministry of Education 2011). The Student Loan Scheme also provides full-time students with a student allowance that is income-tested and does not need to be repaid. Importantly, the student allowance provides the same amount as the maximum living cost students could borrow and replaces the living cost they can borrow dollar-for-dollar.[12] (Approximately half of full-time borrowers receive some student allowance.) From 2001, all full-time students were made exempt from interest while studying, and from 2006, all borrowers residing in New Zealand have been exempted from interest after graduation. The loan repayment rate is 10% (12% since 2013) of income above the repayment threshold of NZ$19,084 (which gradually increased to NZ$20,020 in 2020) and is deducted along with income tax by the Inland Revenue.[13] People can discharge their student loans in bankruptcy but otherwise the debt cannot be written off.

From 1992 through the 2010 academic year, the rules regarding access to both allowances and loans changed very little. In 2010, the government introduced new rules restricting student loan eligibility for failing students, and these rules have since remained substantively unchanged.[14] Beginning with the 2011 academic year, in order to maintain loan eligibility, students must pass at least 50% of their credits taken over the past five years, after about two years of full-time study. The government measures credits in terms of *equivalent full-time student*, or EFTS, where 1 EFTS equals the workload of one year of full-time study. The minimum annual course load to be considered full-time is 0.8 EFTS, and consequently, the performance criterion was set to apply after a student studies at least 1.6 EFTS. The 1.6 EFTS may be accumulated over a longer period of part-time study. Practically, this means that when students re-apply for student loans before their third year of tertiary study, they may lose access to their only source of student finance if they demonstrate insufficient progress. Students can regain the access if they wait for five years, or they can increase their cumulative pass rate to at least 50% by passing more courses using their own

[12] For example, in 2010, single students living away from home received at most NZ$163 per week after tax. So, if a student receives NZ$63 from the student allowance, he can only borrow up to NZ$100 in living costs.

[13] The repayment threshold is calculated based on weekly income since 2013. There is no bunching around the repayment threshold likely because the threshold is lower than the full-time earnings from minimum wage. Britton and Gruber (2019) also find no bunching around the repayment threshold in the U.K.

[14] See Ministry of Education (2018b) for a summary of changes to student loans and allowances since 1992 (1989 for student allowance). First-year course fees were eliminated in 2018 for new entrant students but students continue to borrow living and course-related costs from the Student Loan Scheme.

money. The new policy was partially retroactive, with all courses taken after 2008 factored into the loan eligibility calculation. The calculation includes all courses that are eligible to be funded with a student loan irrespective of whether students paid for the course out-of-pocket.

Interestingly, the administering agency (StudyLink) asks students to determine whether they meet the performance requirement by themselves without requiring supporting documents. In fact, nowhere in the loan application process are students required to explicitly confirm that they conform to the performance assessment. The government also imposes no penalty, and the student only needs to return the overpaid amount even if a loan recipient's eligibility is later determined to be incorrect. The government does audit some loan applications, but the procedure used to select applications for scrutiny is not known. According to the Ministry of Social Development (through an Official Information Act request made by the authors), roughly 10% of loan applications are denied annually, but only 0.3% are denied because of failure to pass the performance criterion.[15] Still, the introduction of the performance assessment substantially reduced low-performing students' further loan access even though it has not always been strictly enforced. The performance criterion appears to be perceived as a credible threat to low performing students' continued loan access, though the resulting reduction in borrowing largely comes from students' voluntary compliance. Consequently, in the next section, we show that there is indeed a meaningful discontinuity around the 50% threshold.

One important feature of the policy change is that it does not affect student allowance eligibility. The performance requirement for maintaining the student allowance has remained constant since the establishment of the allowance. In order to maintain an allowance, in each year, students must pass more than half of the minimum full-time course load. As the minimum full-time load is 0.8 EFTS, students must pass 0.4 EFTS every year, regardless of the actual EFTS attempted. Students are not required to provide supporting documents for maintaining the student allowance either. However, the government appears to enforce the performance assessment for

[15] The government has likely improved enforcement over time. The rejection rate has substantially increased from 0.3% in 2011 to 1% in 2019. In 2011, out of 269,870 loan applications (158,790 females and 111,080 males) only 773 loan applications (376 females and 397 males) were denied because of failure of passing requirement. In 2019, out of 197,886 loan application (123,676 females and 74,149 males), 1,983 loan applications (1,189 females and 794 males) were denied because of failing the passing requirement. The above denied applications already exclude legitimate exemptions. There were 1,151 legitimate exemptions in 2011 (675 females and 476 males) and 1,607 legitimate exemptions in 2019 (1,006 females and 601 males). Students may ask for some courses to be exempted from the performance assessment based on special circumstances such as illness, natural disaster, or a major change in the direction of study.

student allowance more aggressively than for student loan, as the rejection rates due to failing the performance requirement are around 4–5%.[16] While some students that are denied a loan due to failing the pass rate performance requirement could still receive a student allowance, few do because they must study full-time and pay the tuition fees themselves.[17]

Before we turn to describing our data, we briefly summarize the tertiary education sector in New Zealand. Tertiary education participation is high. Half of the population aged 18–19 and one third of the population aged 20–24 study in the tertiary education sector. Roughly 60% of the tertiary students are females. Māori and Pasifika (descendants of the indigenous people of New Zealand and the Pacific region) have the highest tertiary participation rates, but their participation rates are lower than Europeans and Asians at the bachelor's level. Nearly 80% of tertiary students enroll in the eight public universities and 16 public polytechnics. About half of tertiary students enroll at the bachelor's degree and higher. Entry into university is not competitive, and students most commonly go to the university that is close to home. In New Zealand, there is a low entry barrier for bachelor's study both academically and financially.

3. Data and Sample

3.1. Integrated Data Infrastructure

Data for this study are accessed through the IDI maintained by Statistics New Zealand. The IDI houses nationally comprehensive data on all individuals from linked government administrative records. We use datasets on education, student aid and income from three sources found in the IDI. All data we use are available from 2001 to 2017.

We use tertiary education data from the Ministry of Education found in the Course Enrolment and Qualification Completions datasets. Together these provide detailed student records on each course enrollment and degree completion. The course enrollment data provide information on the nature of a course (e.g., subject, fee), and whether the student passed, failed, or withdrew (exact grades are unavailable). As it pertains to loan eligibility, after the full-refund deadline, withdrawal is effectively the same as failure because a withdrawn course still counts

[16] The rejection rates for student allowance due to failing the performance requirement increased from 3.5% in 2011 (5,518 out of 157,591 allowance applications) to 4.9% in 2019 (4,910 out of 101,886 allowance applications).
[17] Only 2% of students without a student loan have a student allowance in our sample.

towards the total EFTS credit accumulation and pass-rate calculation.[18] From this data, we calculate the accumulated pass rate, re-enrollment decisions and degree attainment outcomes for each student in each year. This data also includes demographic information such as sex, age, race and ethnicity, citizenship, disability status and high school information.

We draw student loan and allowance data from information provided by the Ministry of Social Development. This database records annual information on each student's loan and any allowance that a student receives through the administering agency (StudyLink). The IDI does not contain information directly from student loan applications such as whether an application was submitted but denied. Therefore, an individual observed in the data without a student loan either did not apply for one or had an application rejected.

Finally, we draw information on labor market outcomes from data provided by the tax authority, Inland Revenue. This includes monthly data on income broken down by income source (including public assistance) and individuals' student loan balances. (The data dictionaries for each dataset are available from the IDI website.)

3.2. Sample Creation

We impose certain restrictions during the creation of our sample. To create a relatively homogeneous sample of young university students who are eligible to participate in the Student Loan Scheme, we limit the sample to tertiary students who are New Zealand citizens and who attended a domestic high school. We exclude non-citizen permanent residents because the 2010 policy change that introduced the performance assessment also required them to wait for two years to become eligible to borrow (extended to three years in 2013). Since the performance assessment applies to courses taken in 2009 and after, sample members must accumulate at least 1.6 EFTS from 2009, onwards. We require that sample members accumulate 1.6 EFTS before 2013 so that we observe at least five years of observations after the initial performance assessment. To observe their 7-year degree attainment rates, sample members must first begin tertiary study before 2012.

[18] Course withdrawals are recorded only for courses dropped after the full-refund deadline (the first two weeks in each trimester). Withdrawal dates are not regularly reported in the data; 40% of the reported withdrawn courses have a withdrawal date, and the majority of them are reported by only two education institutions. As suggested in the Single Data Return manual provided by the Ministry of Education, we exclude any courses indicating a withdrawal date within 30 days of the course start date from the EFTS calculations. (The Single Data Return is the system for tertiary providers to submit education information to the Ministry of Education and the source of IDI education data.)

One practical concern is that some students who started many years before the policy change may have acquired a significant number of passed credits before 2009, and consequently, need few credits to graduate once the policy takes effect in 2011. In this case, some students will fail 50% of 1.6 EFTS taken from 2009, onwards, and yet not be significantly constrained by the policy change because they need so few credits to graduate. Including these transitional individuals in the sample would understate the treatment effect, relative to students facing the full force of the constraint. Therefore, we keep students who pass at most 1 EFTS in the period before failed credits count against eligibility (i.e., before 2009) and who began their studies no earlier than 2008. Moreover, this restriction adds further credence to the monotonicity assumption of our research design, as we explain below (see Footnote 24). For similar reasons, we drop a small number of students who appear to earn a bachelor's degree (or have passed 3 or more EFTS) in the year in which they accumulate at least 1.6 EFTS.

Finally, to be included in the sample, in the year they accumulate at least 1.6 EFTS, students must be enrolled in a three- or four-year bachelor's degree program,[19] have received a student loan, and be younger than 24 years old (the year they are treated as financially independent from their guardians). The resulting sample size is 49,389 students. Note that all reported sample sizes in this paper are randomly rounded to base three as required by Statistics New Zealand. Our analytic sample covers nearly three quarter of domestic students who start their bachelor study in 2008–2011 and ultimately complete 1.6 EFTS or more.

3.3. Sample Characteristics

Individual characteristics for the sample are reported in Table 1. For variables that could vary over time, they are measured in the year before performance assessment, that is, the year students complete more than 1.6 EFTS. (The average cumulative EFTS completed in the year before performance assessment is 2.0.) Column (1) shows the means and standard deviations for the whole analysis sample. 58% of the students in the sample are women, and the average age is 20 years old. According to the 2013 Census, Māori or Pasifika students account for more than a quarter of the country's college-age population, but they are underrepresented and only account

[19] In New Zealand, an honours degree is sometimes viewed as a one-year postgraduate degree after a three-year bachelor's degree. However, some fields such as law and engineering offer a "four-year bachelor's degree" with the honours degree bundled in. The data do not distinguish the two types of honours degree programs.

for 8% of the students in our sample. In contrast, New Zealanders of European descent are overrepresented in the sample. 3% of students have a documented disability, 86% are studying in one of the eight major universities, and 95% are studying full-time and full-year; 19% of the students are majoring in business-related subjects, and 23% of the students are majoring in science-related subjects.[20] The average amount borrowed is nearly NZ$10,000. In New Zealand, for funding purposes, the government assigns a decile number to each high school based on the proportion of the school's students from low socioeconomic households. The average student comes from a decile 7 high school which is roughly a high school in the top 30% of the distribution in terms of affluence.[21] The average high school performance percentile based on the National Certificate of Educational Achievement (NCEA) level three (final year) tests is 0.49.[22] On average, in the year following the performance assessment, 91% of the students receive a student loan, and 93% of the students re-enroll in bachelor study.[23] 71% obtain a bachelor's degree within five years of first enrolling at a tertiary institution, and 83% graduate within seven years.

Since the main pass-rate bandwidth we use for the RD design is 0.15, column (2) shows the descriptive statistics for students with pass rates of 35%–65%. Compared to the full analysis sample in column (1), these low performing students are more likely to be male, Māori or Pasifika, from lower decile schools, and with a lower NCEA percentile. Relative to the average student,

[20] We use the broad fields of study defined by the New Zealand Standard Classification of Education. Business-related majors are those in "Management and Commerce" (field code = 8), and science-related majors are those in "Natural and Physical Sciences," "Information Technology," and "Engineering and Related Technologies" (field codes 1–3).

[21] Decile 1 schools are the 10% of schools with the highest proportion of students from low socio-economic communities. Decile 10 schools are the 10% of schools with the lowest proportion of students from these communities. Please see the webpage for detail: https://parents.education.govt.nz/primary-school/schooling-in-nz/ministry-funding-deciles/.

[22] The NCEA is the main national qualification for secondary school students in New Zealand. The NCEA has three levels, and each level is generally studied in each of the three final years of high school, with NCEA level one in Year 11, NCEA level two in Year 12, and NCEA level three in Year 13. Students need to complete a series of standards (including both internally and externally assessed examinations) from a variety of subjects to accumulate credits for each NCEA level, and university entrance requires achieving NCEA level three. The NCEA website provides more details: https://www.nzqa.govt.nz/ncea/understanding-ncea/how-ncea-works. In our sample, the information on the NCEA expected percentile is only available for 44,757 students as not all high school students seeking a bachelor's degree complete the NCEA level three. For example, some students may take the International Baccalaureate as an alternative. The expected percentile is calculated based on the cumulative percentage of students in each of the four possible results for each subject: excellence, merit, achieved and not achieved, and then average across subjects to get the percentile for each student. The measure is often referred to as students' high school "achievement score" or "ability score" in government reports. Readers are referred to Scott (2008) and Ussher (2008) for a more detailed description of this variable.

[23] We define enrollment as enrolling in any tertiary courses with at least 0.1 EFTS in the year following the performance assessment.

students passing about half of their courses are truly struggling – a student with a 50% pass rate is in the 7th percentile of university performance. While the re-enrollment rate remains high at 78%, the five-year and seven-year graduate rates are much lower than the full sample at only 26% and 44%, respectively. Columns (3) and (4) show the descriptive statistics separately for students above and below the 50% pass rate threshold. As already mentioned, the 50% pass rate performance requirement is not strictly binding. 79% of the students above the performance threshold receive a student loan the year after they accumulate 1.6 EFTS, and 57% of the students below the threshold also obtain a student loan. Before the introduction of the performance assessment, about 71% of students below the 50% threshold would retain student loan access. (See Figure 2.) Therefore, 57% does represent a substantial drop in loan access. The difference in loan receipt across the threshold is mirrored by differences in education outcomes. 83% of the students above the threshold re-enroll in the year after the performance assessment, 32% of them complete a bachelor's degree in five years, and 50% of them complete a bachelor's degree in seven years. In contrast, only 68% of students below the threshold continue studying, and their five-year and seven-year completion rates are only 13% and 30%, respectively. Of course, these differences may simply reflect the effects of factors related to pass rates other than loan access such as academic ability. To determine whether access to a student loan causally affects these outcomes, we next discuss our fuzzy RD design based on the 50% threshold.

4. Research Design and Methodology

4.1. Estimation Strategy

We use a fuzzy RD to estimate the causal effects of student loan access on students' educational and near-term labor market outcomes. We construct our running variable based upon the cumulative percentage of all credits passed up to (and inclusive of) the year in which a student accumulates sufficient credits for the eligibility criteria to apply:

$$z_i^t = pass_i^t - 0.5.$$

For a student whose academic performance through year t (the year in which she accumulates at least 1.6 EFTS, termed the *year before performance assessment*) jeopardizes future access to loans, z_i^t will be negative, and we expect that the student will be less likely to borrow in year $t + 1$.

However, surpassing the pass rate threshold does not guarantee future loan receipt because some students will voluntarily not re-enroll (i.e., subsequent loan "never takers"). Similarly, students falling below the threshold may still receive loans due to imperfect enforcement. Although the lending authority possesses complete administrative records for all students, eligibility is self-assessed on loan applications without providing any supportive documents. Students who would obtain loans, irrespective of which side of the eligibility threshold they appear, constitute a group of loan "always takers". Our data have the actual pass rates but do not indicate which students misreported their eligibility, which students applied for waivers, and which students were denied loans. Therefore, our estimates reflect a "fuzzy" relationship between actual pass rates and loan receipt.

We investigate the effects of student loans on the decision to continue further study, graduation, and early-career labor market outcomes. Collectively, we study these outcomes with RD regressions of the following specification:

$$Y_i = \alpha^Y + \beta^Y \cdot loan_i^{t+1} + f(z_i^t) + X_i \Upsilon^Y + \epsilon_i, \quad (1)$$

where $loan_i^{t+1}$ equals one when student *i* receives a loan in year *t* + 1 and zero otherwise; $f(z_i^t)$ is a smooth function that accounts for the influence of pass rates on the outcome variables on either side of the 50% threshold; X_i is a vector of student characteristics (measured in year *t*) including age, gender, being Māori or Pasifika, disability status, studying full-time full-year, high school deciles, business major, science major, and indicators for student cohort, year of assessment, and each university. We do not control for high school testing performance in order to maintain a larger sample size.

We treat loan receipt as endogenous, and employ two-stage least squares, using the indicator for a 50%-or-greater pass rate as an excluded instrument. Thus, we measure the effects of loans on various longer-term outcomes for a pool of low academic ability students whose decision to borrow is swayed by which side of the eligibility threshold they fall on (i.e., "compliers"). In this group of policy-compliant students, all would take a loan if eligible, but

because of marginally poorer performance, many fail to access loans.[24] The underlying "first stage" regression model is given by the following equation:

$$loan_i^{t+1} = \alpha + \beta^{loan} \cdot 1[z_i^t \geq 0] + f(z_i^t) + X_i\Upsilon + u_i, \quad (2)$$

where $1[z_i^t \geq 0]$ is an indicator function for whether student i passes at least 50% of her EFTS accumulated through year t.

Several econometric modelling decisions must be made before estimating the above equations. We follow Gelman and Imbens (2019) who advocate for local linear regressions with a triangular kernel and appropriate bandwidths. (In a local linear regression, $f(z_i^t) = \delta_0 z_i^t + \delta_1 z_i^t \cdot 1[z_i^t \geq 0]$.) To select the bandwidths, we use both ad hoc fixed bandwidths and optimal bandwidth selection procedures developed by Calonico, Cattaneo, and Titiunik (2014a; 2019; 2015).[25] Our preferred bandwidth is 0.15, and the optimal bandwidths are usually between 0.10–0.20. The standard errors are robust to heteroskedasticity.[26] Our empirical results are robust to these various modeling choices.

4.2. Validity of RD

As discussed in Lindo, Sanders, and Oreopoulos (2010) and Ost, Pan, and Webber (2018), selection across the eligibility threshold for policies involving school grades represents one possible threat. Relatively persistent students could more aggressively advocate for positive grade changes if their pass rates fall below 50%. If this generates a discontinuity in the potential outcomes at the threshold, then we cannot interpret our RD estimates as causal. In New Zealand,

[24] A requirement is that falling below the threshold does not make some individuals *more* likely to seek a loan, and falling above the threshold does not make some individuals *less* likely to seek a loan (monotonicity). This might occur if, for example, falling above the threshold meant a student would graduate, and not need further loans. Given our sample restrictions, however, it is unlikely that a student failing nearly 50% of the coursework would be able to graduate in the following year. Therefore, we do not believe that losing future loan eligibility would increase the odds a student seeks a loan.

[25] These procedures are implemented in the Stata commands *rdrobust* and *rdbwselect* (Calonico et al. 2017; Calonico, Cattaneo, and Titiunik 2014a; Calonico, Cattaneo, and Titiunik 2014b). See table notes for more details.

[26] The standard errors are calculated by *rdrobust* and from a heteroskedasticity-robust nearest neighbor variance estimator in which the minimum number of neighbors to be used is three. We do not cluster standard errors by the running variable because Kolesár and Rothe (2018) show that confidence intervals constructed from heteroskedasticity-robust standard errors tend to perform better than those constructed from clustered standard errors when the bandwidths are small to medium. In the current context, the clustered standard errors are generally smaller than those reported in the paper.

however, this is less likely a concern as universities explicitly prohibit communication between students and instructors until after grades are finalized, and students are only allowed to know their course grades or view their exam scripts after the grades are officially entered into the system.[27] After grade entry, changes to the grades are largely out of the instructor's control. Indeed, anecdotally, grade bartering behavior is very uncommon among New Zealand students, especially in comparison to experiences of teaching at U.S. institutions.

To further investigate the validity of our RD design, albeit indirectly, we look for potential evidence of a discontinuity in the distribution of the running variable and values of the pre-determined characteristics occurring at the 50% threshold, which would be an indication that strategic forward-looking students select just above the threshold. Alternatively, if the distribution of the running variable and the average values of observable student characteristics appear smooth through the threshold, this suggests that unobserved characteristics are probably smooth as well, and sorting just above the threshold is less likely to be an issue.

The upper panel of Figure 1 plots the distribution of the running variable, cumulative pass rates, in the year before the performance assessment for the analysis sample. The pass rate is extremely skewed with nearly half of the students in our sample passing all of their courses. Therefore, we exclude students with a 100% pass rate in Figure 1 to increase the visibility around the 50% threshold. Notice that because the numbers of courses enrolled and passed are discrete variables, the pass rate is not strictly a continuous variable. Since typical students enroll in 16 courses over the span of two years (eight courses a year), there are spikes at pass rates that are multiples of 6.25% (1/16) including the threshold of 50% (8/16). To further verify that there is no systematic manipulation of the running variable, the lower panel of Figure 1 plots the distribution of pass rates among students who have completed at least 1.6 EFTS in 2002–2006 and started their tertiary study in 2001–2005. These 2001–2005 student cohorts were not subjected to the performance assessment but exhibits a similar pattern of discreteness. (The spikes all along the distribution are smaller for 2001–2005 student cohorts because the EFTS for each course were less

[27] For example, from the Victoria University of Wellington's Assessment Handbook, Section 7.5.b: "Schools should not communicate results to students prior to official course grades being entered." From the University of Otago's Examination and Assessment Regulations, Section 4.3: "No candidate shall communicate with an examiner in regard to an examination either in the examination script or otherwise before the official release of confirmed final results, except through the Head, Student Experience." And from Section 12.2: "…following the official release of confirmed final results a student may, after completing an application form available from the University Information Centre, collect the original of that student's script from the Department concerned."

standardized and more dispersed.[28]) Appendix Figure A1 plots the distribution of pass rates by gender. Since later we will show that only female students exhibit a discontinuity in loan access, the spike at the 50% threshold should be observed only among female students if manipulation is the reason. However, both genders' pass rates exhibit the same discrete pattern in Figure A1.

Because our running variable is not smoothly continuous and somewhat discrete, instead of conducting a density test, we estimate excess probability to better quantify the spikes at the 50% threshold. [Appendix Figure A2 plots densities of pass rates along with density test statistics (Cattaneo, Jansson, and Ma 2018; McCrary 2008).[29]] We create the cumulative distribution function (CDF) of the pass rates for each of the fixed bandwidths of 0.20, 0.15, and 0.10 and estimate the discontinuity of the CDF at the 50% threshold using Equation (1) without control variables. We report these results for both the analysis sample and female students in Table 2. In columns (1) to (3), the estimated excess probabilities of the spike at the 50% threshold are only around 1–3 percentage points. In columns (4) – (6), the estimated excess probabilities for female students are also around 1–3 percentage points. Since the CDF is defined within a bandwidth, the excess probability is largest when the bandwidth is smallest. However, even in the 0.10 bandwidth, the excess probability is only 3 percentage points, and it is only 2 percentage points in our preferred bandwidth of 0.15. More importantly, the estimated excess probabilities are nearly identical in both the analysis sample and the sample of 2001–2005 student cohorts, suggesting that the small spike at the 50% threshold is a result of the discreteness of the running variable rather than manipulation of pass rates. (Later, we use the excess probability to adopt a bounding strategy as a robustness check.)

We next conduct a series of balance tests to see whether pre-determined student characteristics (measured in year *t*) are distributed smoothly throughout the 50% threshold. Table 3 reports the RD estimates for pre-determined student characteristics from Equation (1) without control variables. Nearly all of the RD estimates in Table 3 are small and not statistically significant. One exception is the estimate for the NCEA level three percentile in column 2. This

[28] Two thirds of courses are exactly 0.125 EFTS (eight courses per year) in the analysis sample. However, only one third of courses are exactly 0.125 EFTS in the sample of 2001–2005 student cohorts. Notice that Figure 1 is somewhat misleading due to plotting distribution in discrete cells. In fact, the spike at exactly 50% is slightly larger among 2001–2005 student cohorts than in the analysis sample (as the estimates in Table 2 suggest).

[29] In the upper two panels of Appendix Figure A2, for the analysis sample, density tests do not reject the null hypothesis that the pass rates are smooth around the 50% threshold. However, these test statistics are suggestive at best due to the discreteness of the running variable.

estimate is statistically significant at the 5% level but small and likely a result of natural randomness of the data. Nevertheless, since the estimates are *negative* and suggest that students above the 50% threshold had performed *worse* in high school, any potential bias shall work against finding positive effects of loan access on education and labor market outcomes. Appendix Figures A3 and A4 plot these pre-determined student characteristics against pass rates. These figures show little to no discontinuity at the 50% threshold in these student characteristics; even the discontinuity in NCEA percentile appears to be negligible. Appendix Figures A3 and A4 also show that students in our sample are very homogeneous and exhibit rather similar observable characteristics regardless of their pass rates.

5. Empirical Results

5.1. Education Outcomes

To visualize the efficacy of the performance assessment, Figure 2 plots the "first stage" [Equation (2)] relationship between cumulative pass rate ($pass_i^t$) and student loan receipt ($loan_i^{t+1}$) by gender, along with local linear regression fits using a bandwidth of 0.15.[30] The top two panels are from the analysis sample and highlight that the performance assessment is not strictly binding. For example, about half of the students who have passed 40% of their EFTS still obtain a student loan in the following year. Importantly, pass rates do create a discontinuity in student loan access for women. In the top left panel, the proportion of female students having a student loan drops significantly across the 50% threshold. In the top right panel, however, there is no discontinuity in student loan access for men. Notice that the proportion of students with a loan above the threshold are similar for men and women. Therefore, the effect is indeed driven by women who are just below the threshold failing to obtain loans. Although the performance assessment is not strictly enforced, the introduction of performance assessment does reduce loan access. In the bottom two panels, the 2001–2005 student cohorts with less than 50% pass rates are much more likely to receive student loans than similar students in the top two panels. Moreover, there is no gender difference in student loan access for the 2001–2005 student cohorts prior to the introduction of the

[30] All of the RD figures in the paper are created by *rdplot* Stata command written by Calonico et al. (2017). Because the sample size above the threshold is roughly twice as large as the sample size below the threshold, when we plot by gender, we use a bin size of 0.025 for pass rates below the threshold and a bin size of 0.020 for pass rates above the threshold. For results restricted to students assessed in 2010, because of a still smaller sample size, we use a bin size of 0.025 for pass rates both above and below the threshold.

performance assessment. Therefore, women's continued student loan access is not more responsive to pass rates than men's in the absence of performance assessment.

Since the actual loan rejection rates are very low and without gender difference (see Footnote 15), the gender difference in loan receipt around the threshold shown in Figure 2 appears primarily driven by gender differences in application behaviors. Several reasons could underlie the gender difference in loan receipt around the threshold. First, research shows that women are more risk averse than men which could lead to differences in the propensity to intentionally ignore the pass-rate requirement. (See a review by Croson and Gneezy (2009).) Second, existing studies document that women are more voluntarily compliant, on average, with rules than men in various contexts such as compliance with tax obligations, anti-jaywalking measures and public health orders, and women assign higher subjective probabilities and expect more severe consequences to being caught cheating (Chung and Trivedi 2003; D'Attoma, Volintiru, and Steinmo 2017; Galasso et al. 2020; Granié 2007; Hasseldine and Hite 2003; Kastlunger et al. 2010; Tom and Granié 2011; Torgler and Valev 2006; Torgler and Valev 2010). Third, women may more likely be discouraged by academic sanctions than men and drop out of university (Dong 2019).[31] Accordingly, more women than men who fall below the performance threshold may interpret their loan ineligibility as a signal of poor fit with university and drop out.

Table 4 presents the RD estimates of causal effects of access to the Student Loan Scheme on education outcomes using Equation (1) with a bandwidth of 0.15. Columns (1) and (3) show the reduced form estimates by gender, and columns (2) and (4) show the 2SLS estimates by gender. In column (1), as seen in the top left panel of Figure 2, the reduced form estimate for female students shows a large discontinuity of 16 percentage points in the likelihood of receiving a student loan in the year following the performance assessment across the 50% threshold. The reduced form estimate also indicates a discontinuity of 12 percentage points in the likelihood of re-enrollment in the year following the performance assessment. Note that a positive effect on re-enrollment that is smaller than the effect on loan receipt implies that some students in the compliant sub-population self-fund further study (approximately one-in-five students below the threshold), and the remainder drop out after losing loan access (this is given by the 2SLS estimate in column (2)).

[31] Dong (2019) uses data from a large public university in Texas and finds that women are more likely to drop out than men when placed on academic probation. However, this gender difference could be context specific as Lindo, Sanders, and Oreopoulos (2010) find opposite results using data from a Canadian university.

Since the Student Loan Scheme is the only source of student finance to cover the costs of tuition in New Zealand, unsurprisingly, there is a strong effect of student loan access on continued enrollment for female students.

Turning to graduation outcomes, for female students, the reduced form estimates suggest a discontinuity of 9 percentage points in the five-year degree completion rate and a discontinuity of 10 percentage points in the seven-year degree completion rate across the 50% threshold. Column (2) gives the 2SLS estimates of the causal effects of student loans for females. Female students in the compliant sub-population with continued access to student loans are 57 percentage points more likely to graduate in five years than those who lost access, and 64 percentage points more likely to graduate in seven years. All of the estimates are statistically significant at the 5% level.

In contrast to females, in column (3), the reduced form estimate for male students shows no discontinuity in the probability of student loan receipt across the 50% threshold (consistent with the top right panel of Figure 2). Consequently, the reduced form estimates for re-enrollment and degree completion are close to zero and not statistically significant. In column (4), the 2SLS estimates for re-enrollment and graduation have very large standard errors and are not statistically significant. In Appendix Table A1, we drop a small interval on either side of the 50% threshold and construct a "donut" RD for female students. The donut RD estimates are nosier but remain quantitatively similar to those reported in Table 4. In Appendix Table A2, we check the robustness of the results using the fixed bandwidths of 0.20 and 0.10. All of the estimates are robust to the choice of bandwidths.

Figure 3 plots the corresponding relationships between cumulative pass rate and re-enrollment rate, five-year graduation rate, and seven-year graduation rate by gender. In the rest of the paper, for all of the figures on education and labor market outcomes, we focus on cumulative pass rates between 30% to 70% to increase visibility, along with local linear regression fits with a bandwidth of 0.15. In the top left panel, mirroring the jump in loan receipt around the 50% threshold in Figure 2, there exists an obvious discontinuity in re-enrollment rates for female students. In the middle and bottom left panels, female students just above the threshold are more likely to complete a bachelor's degree than those just below the 50% threshold. However, for male students' education outcomes in the right panels, there are no apparent discontinuities. The gender differences support the findings from Table 4 that student loan access plays a causal role in determining education outcomes.

Other policies that operate around the 50% threshold could coincide with the loan eligibility criterion and affect a failing student's decision to continue with higher education. First, universities can restrict enrollment for unsatisfactory academic progress. As universities use a 50% pass rate as the criterion for satisfactory academic progress, this may result in students around the loan-eligibility threshold taking fewer credits and, if poor performance persists, suspension from university.[32] Second, 30–40% of the students in our sample receive some student allowance. Although the threshold for maintaining a student allowance is 0.4 passed EFTS, per year, and there is no discontinuity in student allowance at the 50% pass rate threshold for student loan, 80% of the students who fail to pass the loan threshold also fail to pass the allowance threshold and therefore could lose both the loan and allowance components from the Students Loan Scheme.[33] (See also Footnote 17.) To provide further evidence that the discontinuity in education outcomes is indeed caused by differential access to student loans, we look for discontinuities in outcomes at the 50% pass rate threshold for students who started their bachelor's degrees in 2001–2005 and completed at least 1.6 EFTS in 2002–2006. For these earlier student cohorts, university progression and receipt of a student allowance were subject to sufficient academic performance, but continued loan access was not.[34] In Figure 4, we do not see discontinuities in re-enrollment and graduation at the 50% threshold among female or male students from these 2001–2005 student cohorts, and there is no meaningful gender difference in these education outcomes. Appendix Table A3 shows the reduced form point estimates for these earlier cohorts. All are small and insignificant. Moreover, in Appendix Table A4, for female students in our analysis sample, we exclude those who have ever received any student allowance through the year of performance assessment. The estimates are very similar to those shown in Table 4, suggesting that student allowance is not driving the

[32] Suspension appears to be uncommon and only applies to non-engaged students with very poor performance. For example, at the institution where the authors work, university records indicate that only about 5% of students who do not have satisfactory progress are eventually suspended (after several semesters of continued poor performance).

[33] Since a typical student takes eight courses per year, and each course is worth 0.125 EFTS, to fail more than half of one's courses implies a student only passes three course worth 0.375 EFTS. For students with allowance, there is no visible discontinuity in the likelihood of receiving student allowance in the following year at the 50% threshold but a distinct discontinuity of roughly 20 percentage point at the 0.4 EFTS threshold. Moreover, both men and women exhibit a similar discontinuity in the likelihood of receiving allowance at the 0.4 EFTS threshold. However, there is no discontinuity in the education outcomes at the 0.4 EFTS threshold. These results are available upon request.

[34] For 2005 student cohort, their seven-year graduation rate was measure in 2011 after the introduction of performance assessment. For students who accumulate 1.6 EFTS in 2006, their earnings and graduation rate in year $t + 5$ were also measured in 2011. The results remain virtually unchanged if we exclude these more recent student cohorts.

results. Together, these findings support our conclusion that the discontinuities in re-enrollment and graduation indeed result from the loan eligibility criteria change.

In Table 5, we investigate the dynamic effects of losing access to student loans on graduation one to five years after the initial performance assessment (years $t + 1$ to $t + 5$). In column (1), the reduced form estimates indicate no discontinuity in females' bachelor's degree graduation rate in the first two years. A large discontinuity of 12 percentage points emerges in the third year and narrows slightly to 8 percentage points in the fifth year. In column (2), for academically marginal female students around the 50% threshold, continued access to student loans in year $t + 1$ increases the likelihood of graduation with a bachelor's degree by about 70 percentage points three to four years following the performance assessment. The effect of a student loan on graduation declines somewhat to 53 percentage points in the fifth year. Figure 5 plots bachelor's degree attainment rates one to five years after one's initial performance assessment against cumulative pass rates in the year that a student first accumulates more than 1.6 EFTS. (Appendix Figure A5 shows the dynamics for male students.) Consistent with Table 5, most students who only pass around half of their EFTS have not graduated with a bachelor's degree within two years after the performance assessment, and there is little discontinuity in graduation rate at the 50% threshold. Starting from the third year after initial assessment, female students just above the threshold are significantly more likely to graduate than those just below the threshold. While some students below the threshold eventually graduate, the magnitude of the discontinuity largely persists through the fifth year.[35]

Before we turn to labor market outcomes, we perform one last robustness check to address the possibility that selection across the threshold generates the effects we attribute to student loans. The introduction of performance requirement was officially announced in May 2010. However, the exact rules and the inclusion of performance in courses already taken in 2009–2010 were announced during the second academic semester in 2010. The retroactive nature of the pass rate calculation and the abrupt policy rollout gave students already in universities reduced capacity to quickly improve their pass rates. In particular, as loan applications are required before the start of the next academic year, at most only one semester of coursework could potentially be manipulated

[35] In our sample, 80% of the students who are below the threshold and do not receive a loan in year $t + 1$ do not receive any student loans in later years. Only 20% of students losing loan access are observed taking a student loan in later years, and one third of these borrowers eventually earn a bachelor's degree.

by the first cohort of students to be subject to the new loan eligibility criteria. In Appendix Figure A6, we plot the number of courses passed by semester in 2010 and show that female students assessed in 2010 do not try to manipulate the threshold by bumping up their pass rate in the last semester before the performance assessment.[36] Therefore, we restrict our sample to students who accumulated more than 1.6 EFTS in 2010.

For this early cohort, we can examine outcomes up to seven years after the performance assessment without censoring observations. In Table 6, in column (1), we observe a large effect on subsequent loan taking: falling below the 50% pass rate threshold reduces the probability of receiving a loan by 25 percentage points. Beginning three years after the performance assessment, we observe a persistent 12–18 percentage point gap in degree attainment at the 50% pass rate threshold. In column (2), we report that receiving a student loan increases the likelihood of graduation with a bachelor's degree by 46–72 percentage points up to seven years after the performance assessment. These estimates are comparable to those from the main sample. Consistent with Table 6, Figure 6 shows a large persistent gap in graduation rates from the third year through the seventh year following the performance assessment for female students assessed in 2010. Overall, the dynamic results in Table 5 and 6 suggest that the effects of student loan access on bachelor's degree completion rates can be largely permanent, and selection across the threshold is unlikely the cause of the discontinuities in outcomes.

5.2. Labor Market Outcomes

We next investigate whether the positive effects of continued loan access on educational attainment translate into higher labor market returns. We focus on female students and study the effects of continued loan access on labor earnings and labor supply.[37] As the students' average age is 20 years old in the year before performance assessment, and we observe each students' labor

[36] We also find similar results for the entire sample that female students do not try to bump up their pass rate in the last semester before the performance assessment. Courses in the summer semester that finish before the end of the calendar year are included in the second semester. The figures are nearly identical when summer courses are excluded.
[37] We also look at the number of months receiving welfare benefits which is a proxy for unemployment, as this is the main type of public assistance for young adults in our sample while they seek work. While female students above the threshold exhibit less unemployment, the results are imprecise since few students receive welfare benefits. Additionally, we investigate the effects of student loan access on job characteristics based on detailed occupation codes. However, we do not find any meaningful difference in the likelihood of having a high-accident-risk job or the likelihood of working in the retail or hospitality industry (a proxy for student-type jobs). These results are available upon request.

market outcomes five to seven years following the performance assessment, our results capture the effects of student loan access on labor market outcomes at the early career stage.

In Table 7, we estimate the dynamics of the effects of student loan access on average monthly earnings [columns (1) and (2)] and earnings percentile ranked across all New Zealand earners from the same gender and birth cohort [columns (3) and (4)].[38] First, the estimates in the year before the performance assessment (Year *t*) are close to zero and statistically insignificant. This provides additional support for the comparability of people just above and below the threshold. Second, the estimates are negative in the first two years following the performance assessment, suggesting that female students who lose their student loans earn nearly NZ$800 more per month and rise by 19–27 percentile points in the earnings distribution. It is noteworthy that earnings by those just below the threshold do not increase more, given the large drop in the re-enrollment observed earlier and greater flexibility to engage in full-time work. This suggests that remuneration for the work available to the recent dropouts is largely commensurate with student work. In fact, the negative estimates are statistically significant at the 10% level only in the first year after the assessment and when earnings are measured relative to students' birth-cohort-gender peers. Third, consistent with the findings in Table 5 that female students with continued loan access complete their bachelor's study three years after the initial assessment, the estimates in the fourth and fifth years become large and imply a growing favorable trend in earnings among female students just above the 50% threshold. While the standard errors grow larger, the estimates in the fifth year are statistically significant at the 5% or 10% level. In columns (1) and (3), the reduced form estimates indicate a discontinuity in monthly earnings of NZ$321 and a discontinuity in the earnings percentile of 6.5 percentile points in the fifth year. In columns (2) and (4), five years after the performance assessment, the 2SLS estimate suggests that female students who receive a student loan in the year after the initial eligibility assessment earn NZ$2,022 per month more and rise by 41 percentile points in the earnings distribution of all female earners in their cohort around age 25. While not reported in the paper, the earnings estimates are somewhat larger for students who have never received any student allowance. This is consistent with Appendix Table A4 that suggests it

[38] We define average monthly earnings as annual earnings divided by the number of months with positive earnings and then calculate earnings percentile based on average monthly earnings. People without any positive earnings are assigned average monthly earnings of zero. Earnings includes only wages and salary as almost no people are self-employed in our sample, and the tax records on self-employed earnings are often reported with substantial measurement error. The results remain substantively unchanged if we include self-employment earnings or use income from all sources instead of only employment earnings.

is indeed the student loan, not student allowance, driving the results. In Appendix Table A5, we estimate the effects of student loan access separately for students majoring in science-related subjects and students majoring in business-related subjects. While the estimates become somewhat noisy because of diminished sample sizes, the point estimates are similar across field of study (especially the reduced form estimates). The positive effects of student loan access on earnings do not appear to be limited to only majors associated with the highest market returns. Therefore, our findings suggest providing student loan access to low-performing students, even in majors associated with low market returns.

These earnings estimates survive a number of robustness checks. First, in columns (1) and (2) of Appendix Table A6, we follow Ost, Pan, and Webber (2018) and Scott-Clayton and Zafar (2019) and adopt a bounding strategy developed by Gerard, Rokkanen, and Rothe (2020). We exclude 57 top earners above the 50% threshold based on the estimated excess probability at the threshold from Table 2 (0.021 × 2,697). These bounded estimates remain quantitatively similar to those in Table 7. Columns (3) – (6) of Appendix Table A6 show the donut RD estimates. These estimates are somewhat larger than the results reported in Table 7. Second, Appendix Table A7 shows that the effects for monthly earnings and earnings percentile remain quantitatively similar under the fixed bandwidths of 0.20 and 0.10. Third, in Appendix Table A8, we report the reduced from estimates for average monthly earnings and its percentile from year t though year $t + 5$ for male students of the analysis sample as well as for 2001–2005 student cohorts by gender. All of the estimates are very small and indicate no discontinuity in monthly earnings and earnings percentile across the 50% threshold.

Figures 7 and 8 plot pass rates against average monthly earnings and earnings percentile. In Figure 7, as expected, there is no discontinuity in monthly earnings in the year before the performance assessment. The earnings are virtually the same across pass rates. Note that for students receiving a student allowance, the allowance is reduced one-for-one for every dollar earned above NZ$200 per week. This may partly explain the flat earnings at about NZ$800 per month across pass-rates. In the first three years after the initial performance assessment, possibly because some students who lose student loans drop out and begin working more hours, female students below the threshold earn more than those above the threshold. However, the average earnings of students above the threshold rise at a faster rate, and the earnings gap is decreasing over time. In the fourth year, the average earnings of students above the threshold start to surpass

the earnings of students below the threshold. A discontinuity in monthly earnings around the 50% threshold is evident in the fifth year.[39] Figure 8 closely mirrors the pattern seen in to Figure 7, and there is a clear discontinuity in earnings percentile around the 50% threshold in the fifth year. Also note that the discontinuity in the first year after the performance assessment is more visible in Figure 8 than in Figure 7. Even though absolute earnings difference is not very big, students who lose student loans and drop out do meaningfully shift within the earnings distribution. Interestingly, while female students around the 50% threshold are at the bottom 10 percentile of university academic performance, they do not perform too poorly in the labor market compared to their peers since their earnings still rank around the 40–45 percentiles of all female earners of the same age.[40] In the Appendix, Figure A7 plots average monthly earnings and earnings percentile in the fifth year after initial assessment for male students in the analysis sample and for male and female students in 2001–2005 student cohorts. We see no discontinuity in any of the panels in Appendix Figure A7.

In Table 8, we repeat the above analysis using only the first cohort of female students subject to the performance assessment in 2010. For this group, we can observe their labor market outcomes seven years after the performance assessment. Although some estimates become statistically insignificant in Table 8 due to a smaller sample size, the quantitative magnitudes align with the effects we estimate for the main sample in Table 7. Continued access to loans appears to depress labor market outcomes one to three years after the initial performance assessment while borrowers remain in school. Then, beginning in year four, there appears a reversal in fortunes, with loans positively affecting average monthly earnings. From year five to year seven, for female students first assessed in 2010, loan receipt increases average monthly earnings and earnings percentile by NZ$1,851–$2,152 and 32–40 percentile points, respectively. Figure 9 plots the average monthly earnings and earnings percentile from the fifth year to the seventh year for female students assessed in 2010, and they are consistent with the estimates in Table 8. Appendix Table A9 shows the estimates for years five to seven using fixed bandwidths of 0.20 and 0.10, and they remain quantitatively similar to those reported in Table 8.

[39] The earnings appear to be slightly downward sloping below the 50% because some students who fail 50% but receive a student loan still enroll in university. Our DD estimates are identified from compliers and therefore not driven by those always takers.

[40] Interestingly, students' earnings percentile is similar to their percentile of high school academic performance. In Appendix Figures A3 and A4, students with pass rates around 50% are at the 40th percentile of their NCEA test.

In Tables 9 and 10, we investigate whether the positive labor market returns accrue through greater labor supply or higher wage rates. (Appendix Figures A8–A10 provide visualization for estimates reported in Tables 9 and 10.) For female students in the analysis sample, we focus on effects in the fifth year after performance assessment; for female students assessed in 2010, we look at effects from year five to year seven. In Table 9, we condition on female students with positive earnings and re-estimate the effects of continued student loan access on earnings percentile and average monthly earnings in logarithm. In columns (1) and (2), the estimates indicate an increase in average monthly earnings of more than 90%. (The unconditional estimates for average monthly earnings in Tables 7 and 8 are equivalent to increases of 80–90%.) In columns (3) and (4), the estimates show an increase of roughly 30–40 percentile points in the earnings distribution. The conditional estimates in Table 9 are very similar to the unconditional estimates in Tables 7 and 8, suggesting that the labor market returns are not driven by increases in labor force participation.

In Table 10, we utilize the available monthly earnings information to proxy for the extensive and intensive margins and estimate the effects of student loan access on labor supply. [41] We use the number of months with positive earnings as a proxy measure for labor force participation. Since we do not have information on wage rates and hours of work, we use as a proxy measure for working full-time the number of months that earnings meet or exceed the amount received when working full-time (40 hours × 4 weeks) at the minimum wage. In columns (1) and (2), the estimates for monthly labor force participation are positive but with large standard errors and not statistically significant at the conventional levels. We draw from this that the positive effects on earnings do not operate primarily on the extensive margin. In columns (3) and (4), the estimates for working full-time are often statistically significant, and the estimate magnitudes are somewhat larger than those for labor force participation. Female students who receive a student loan work about 6 additional months with earnings above the full-time minimum wage salary. Overall, the estimates in Tables 9 and 10 suggest that the positive effects of continued loan access on earnings are large and likely accrue through higher wage rates. We do not find strong evidence

[41] One reason people exhibit no earnings could be migration away from New Zealand. However, we estimate the RD model where the outcome variable is whether or not a person is a tax resident (being in New Zealand for at least six months) and find no discontinuity around the 50% threshold. Therefore, we treat annual months of positive earnings as a proxy measure for labor force participation.

that the effects are driven by labor force participation on the extensive margin but some evidence on more hours worked on the intensive margin.

5.3 Student Loan Debt

To further evaluate the returns to student loan access, we investigate how much student loan debt academically struggling students accumulate and whether or not they are able to repay these debts. Table 11 presents the reduced form and 2SLS estimates for the dynamics of student loan debt for female students. In column (1), as expected, there is no apparent discontinuity in the year before the performance assessment. After the performance assessment, however, there exists a discontinuity in outstanding loan balance of NZ$2,900 in the first year and a discontinuity of around NZ$5,000 in the second and third years. The discontinuity decreases to NZ$4,200 in the fourth year and then to NZ$3,700 in the fifth year following the performance assessment. In column (2), the 2SLS estimates indicate that compared to students who became ineligible for a student loan, loan recipients owe NZ$18,000 more student loan debt in the first year, about NZ$32,000 more debt in the second and third years after the performance assessment. These estimates are statistically significant at the 1% level and in line with the cost for three more years of university study. Notably, the difference in student loan balance between students with and without a student loans decreases rapidly in the fourth and fifth years following the performance assessment and becomes statistically insignificant. Five years after the performance assessment, students who maintained access to student loans owe only NZ$24,000 more than students who lost loan access.

In columns (3) and (4), we again focus on female students who were initially assessed in 2010. For these people, student loan debt can be observed for seven years. Most of the reduced form estimates in column (3) are quantitatively similar to those in column (1).[42] In column (4), the 2SLS estimates suggest that students retaining loan access owe about NZ$24,000 more debt than students losing loan access in the second and third years after the performance assessment. The gap in student loan debt starts to decline four years after the performance assessment; seven years

[42] Student loan balance information is from the Inland Revenue data, but the data quality was poor before 2012, and the information was often lagged significantly. Since 2012, the information on a student loan borrower was digitalized and can be transferred from StudyLink to the Inland Revenue on a near real-time basis when a borrower applies for a loan. In columns (3) and (4), the estimates for Year t and Year $t + 1$ are based on data from 2010 and 2011 and therefore are not as reliable as estimates for later years.

after the performance assessment, students who received a student loan owe only NZ$9,000 more student loan debt than students who lost access to loans. Table 11 indicates that for many academically struggling students, the extra student loan debts incurred from further study are not insurmountable, as continued access to student loans facilitates a transition into jobs that allow for expedient repayment of student loan debt. Recall that students retaining loan access earn NZ$2,022 more per month in the fifth year (column (2) of Table 7). With the required repayment rate of 12% of earnings, a back-of-the-envelope calculation suggests that the difference in student loan debt in column (2) of Table 11 will disappear in eight years [$23,612 ÷ ($2,022 × 12 × 0.12)]. For female students assessed in 2010, the estimates of the seventh year in column (2) of Table 8 and in column (4) of Table 11 suggest that the difference in student loan debt will only take another three years [$9,171 ÷ ($2,113 × 12 × 0.12)] to converge.

Figure 10 shows the evolution of the outstanding student loan debt among female students. In the year before the performance assessment, after accumulating approximately 2 EFTS, students amass nearly NZ$20,000 student loan debt, with no discontinuity at the 50% threshold. After the performance assessment, an obvious discontinuity across the 50% threshold appears and grows from the first year to the third year. The student loan balance among students just above the threshold is nearly NZ$35,000 in the third year after assessment. Consistent with Table 11, the discontinuity in outstanding student loan debt narrows in the fourth and fifth years as students just above the threshold begin to pay back their student loan debt. Figure 11 shows similar dynamics in student loan debt for female students assessed in 2010. For students above the threshold, their student loan debt continues to decrease from the fourth year to the seventh year, and the discontinuity disappears seven years after the assessment.

6. The Rate of Return to Student Loans

Our results show higher earnings and quick repayment for the student loan debt used to finance further study. On average, struggling students with continued loan access accumulate NZ$24,000–32,000 more student loan debt and earn NZ$24,000 more, annually, five to seven years after performance assessment. Thus, a NZ$1,000 increase in student loan borrowing leads to a subsequent annual earnings increase of about NZ$750–1,000, on average. The magnitude of this annual return for a student loan (ignoring repayment) is close to the returns from some financial aid programs reported in the U.S. literature. Black et al. (2020) report an annual return of

US$750 in earnings for an increase of US$1,000 in student loan borrowing. Denning, Marx, and Turner (2019), and Scott-Clayton and Zafar (2019) also report a roughly dollar-to-dollar association between grant aid and students' annual earnings. If we make a somewhat conservative assumption that these low-performing female students work thirty years, and the increases in earnings stay at the same level, with a 5% discount rate, our earnings estimate indicate a net present value of nearly NZ$300,000 after factoring repayment of the loan.[43]

Given the relatively large standard errors in the earnings estimates, we cannot rule out that the true labor market returns to student loan access could be more modest than the point estimates imply for struggling students. Another way to evaluate the student loan debt is to calculate the lower bounds for the returns on student loan debt to be positive. Consider an individual assuming NZ$32,000 more in debt and foregone savings of NZ$30,264 over three years [monthly earnings of NZ$800 under a 5% interest rate: $\sum_{i=0}^{2}(\$800 \times 12)1.05^{i}$]. To yield a net present value higher than $62,264, factoring in 12% repayment, monthly earnings need to rise by only approximately NZ$385 over thirty years under a 5% discount rate. Even in a scenario in which a person leaves the labor force after only working five years after university, her monthly earnings need to rise by just NZ$1,365 for the net present value to exceed $62,264.[44]

While a full cost-benefit analysis is beyond the scope of this paper, we can also calculate the lower bounds for the public investment in struggling students to have positive returns. One notable feature in New Zealand is that the funding to universities directly depends on EFTS and so the public cost per student can be easily estimated. The direct subsidy to universities is roughly NZ$8,000 per EFTS, and the indirect cost to the government of providing student loans is estimated to be 45 cents per dollar (Baxter 2012; Ministry of Education 2018a). Therefore, as these academically struggling students borrow NZ$32,000 and study three more years, the cost to the government is roughly NZ$38,400 (NZ$32,000 × 0.45 + NZ$8000 × 3 EFTS). Assuming a 5% discount rate over thirty years and a 20% income tax rate, the annual income tax collected needs to rise by NZ$2,498 and thus the average annual earnings need to increase by NZD$12,490 for the

[43] We assume that students spend three more years in university with forgone earnings of $800 per month and then take eight years to pay off the additional student loan debt with a 12% repayment rate: $\sum_{i=1}^{3} -\$800 \times 12/1.05^{i} + \sum_{i=4}^{33} \$2{,}000 \times 12/1.05^{i} - \sum_{i=4}^{11} 0.12 \times \$2{,}000 \times 12/1.05^{i} = \$276{,}481.$

[44] $\sum_{i=1}^{30} \$385 \times 12 \times (1-0.12)/1.05^{i} = \$62{,}498$; $\sum_{i=1}^{5} \$1365 \times 12 \times (1-0.12)/1.05^{i} = \$62{,}407$

return to be positive for the government.[45] Therefore, on average, providing academically struggling students with loan access is likely a good investment to both the students and the government.

Using the ratio of the largest estimated cost of student loan debt to the lowest estimate for degree completion rates, we calculate the cost per additional bachelor's degree to be no more than NZ$60,000 (NZ$32,000 ÷ 0.531). Even though we focus on academically struggling students, the cost per additional bachelor's degree from the New Zealand Student Loan Scheme is comparable to the cost per degree of US$35,000 from the U.S. Federal Student Loan reported in Black et al. (2020). Our estimated cost per additional degree is much lower than the estimates from the U.S. grant programs, perhaps because grants do not need to be repaid, and student loans can incentivize greater study effort. For example, Bettinger et al. (2019) and Scott-Clayton and Zafar (2019) estimate the cost per additional bachelor's degree to be roughly US$100,000–120,000. Note that the above costs only account for payouts from financial aid programs but ignore government spending on universities. Deming and Walters (2017) estimate the cost per additional bachelor's degree to be around US$150,000 based on U.S. state funding. In contrast, our estimate indicates a much lower public cost per additional bachelor's degree of only NZ$72,000 (NZ$38,400 ÷ 0.531). The low public cost per additional degree produced in New Zealand is probably a result of its generally well-regulated, high-quality tertiary education sector. Overall, in New Zealand, to push a struggling student in the bottom tenth percentile to graduate with a bachelor's degree, the total social cost (private plus public costs) seems low at around NZ$105,000 [(NZ$32,000 + NZ$8000 × 3 EFTS) ÷ 0.531].

7. Discussion and Conclusion

In this paper, we examine the importance of student loan access for academically struggling students who have already accumulated approximately two years' worth of university credits. We consider a New Zealand policy which reduces access to further student loans for students who fail more than 50% of their prior coursework. First, we find the policy substantially reduces further loan receipt for low-performing students, but the 50% pass rate threshold is not strictly binding as the enforcement largely relies on students' self-compliance. Our second result is that the gap in

[45] $\sum_{i=1}^{30} \$12{,}490 \times 0.2 / 1.05^{i} = \$38{,}400$

subsequent borrowing is much greater for women than men in the year following the initial eligibility performance test. Thus, the performance testing provision of the policy appears to have a "gendered bite" at the threshold. We next show that for the policy compliant subpopulation, continued access to student loans significantly increases the probability of eventual bachelor's degree attainment by 60–70 percentage points. These effects are comparable to the average completion rate of bachelor's degrees in New Zealand, where the five-year and seven-year bachelor's graduation rates are 70% and 80% for female students younger than 25 years old (Ministry of Education 2020b; Scott 2009).

Exploring the labor market outcomes of these students over time, we find that five to seven years after loan access becomes conditional on performance, continued loan access greatly increases average monthly earnings by NZ$2,000 and earnings percentile by 30–40 percentile points. The implied university premium is close to the average return to a university degree in New Zealand. Using the ratio of the reduced form estimate for monthly earnings to the reduced form estimate for degree completion rates (columns (1) from Tables 5–6 and 7–8), five to seven years after the performance assessment, the earnings premium of a bachelor's degree is roughly NZ$3,000 per month or 120% for female students. According to the New Zealand Household Labour Force Survey, for women aged 25–34, the university premium is about 100%; the median weekly earnings are nearly NZ$1,000 for holders of bachelor's degree or higher and around NZ$400–NZ$500 for high school graduates or below (Ministry of Education 2020a). Estimates from several different financial aid programs also suggest similar university premiums in the U.S. of about 120% (around the magnitude of roughly USD$30,000 per year) (Bettinger et al. 2019; Black et al. 2020; Denning, Marx, and Turner 2019; Scott-Clayton and Zafar 2019). We note that our estimates for labor market outcomes are economically significant but less precise than our estimates for education outcomes. To what degree our estimates represent the signaling value of a tertiary degree versus the returns to greater human capital remains an open question.

Our findings provide useful policy implications for countries with generous access to student loans, including those with income-contingent loan schemes supported by government lending and without stringent underwriting. Such systems lower the expected costs of university attendance, *ceteris paribus*, and may attract low-performing students for whom the return on university enrollment is not obvious. Based upon the positive findings, our estimates support continued lending to at least some academically marginal students.

Our results represent the effects of credit access for a group of struggling students whose borrowing is swayed by which side of the pass-rate eligibility threshold they fall on. What can be said about this compliant subgroup? First, note that the "first-stage" estimates for student loan access represent the proportion of students who are compliers. Therefore, compliers account for roughly 15% of the sample. Second, while the compliers consist of a relatively small fraction of students, they generally have observable pre-determined characteristics like other students around the threshold. In Appendix Table A10, we use Abadie's (2003) kappa-weighting scheme to estimate the sample characteristics of the compliant populations.[46] In terms of these characteristics, compliers are not very different from the average student in the analysis sample. The similarity between compliers' and the average student's pre-determined characteristics suggests that their potential outcomes may not be too different either, and therefore our findings probably could apply to the broader population of struggling students. In addition, we estimate the derivatives of our RD effects following Dong and Lewbel (2015). The derivative estimates are noisy but always positive, and suggest the effects of student loan access to be increasing with pass rates.[47]

A final observation is that the performance assessment is effective in altering the behavior of some individuals even with its current imperfect level of enforcement. A cost-benefit analysis weighing the administrative costs of greater enforcement with the benefits of less wasteful lending might indeed support the status quo of weak enforcement. At the same time, it may be troubling for reasons of equity that this policy disproportionately binds for women. Our findings suggest that how strictly a policy provision is enforced could be a factor which holds sway over the gender equity of the policy, and the two issues should be jointly considered when crafting policy. As a result, when economically sensible, strict enforcement of rules may make sense for achieving greater gender equity.

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[46] In Appendix Table A10, we report the summary statistics for all students with pass rates of 0.35–0.65 (same as column (2) of Table 1) and the estimated sample means for compliers (also conditional on pass rates of 0.35–0.65). We present these summary statistics for both sexes and for females alone.

[47] If the eligibility threshold increases from 50% to 60%, our derivative estimates suggest that the effects of student loan access on monthly earnings and earnings percentile five years after performance assessment will further increase by NZ$1654 and 28 percentile points, respectively. However, these derivative estimates are very noisy and not statistically significant at conventional levels probably because our running variable, pass rate, is not sufficiently smooth to precisely identify the derivatives.

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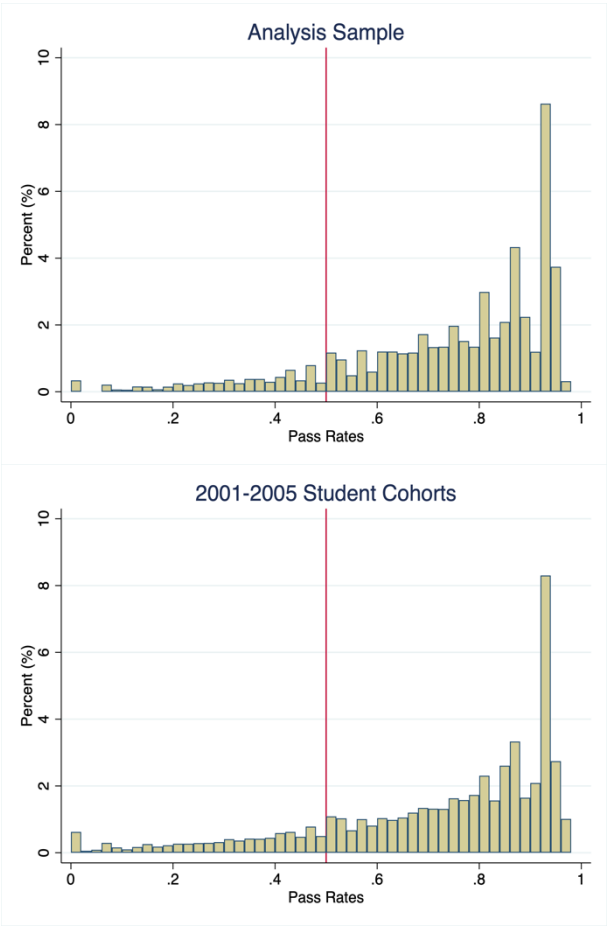
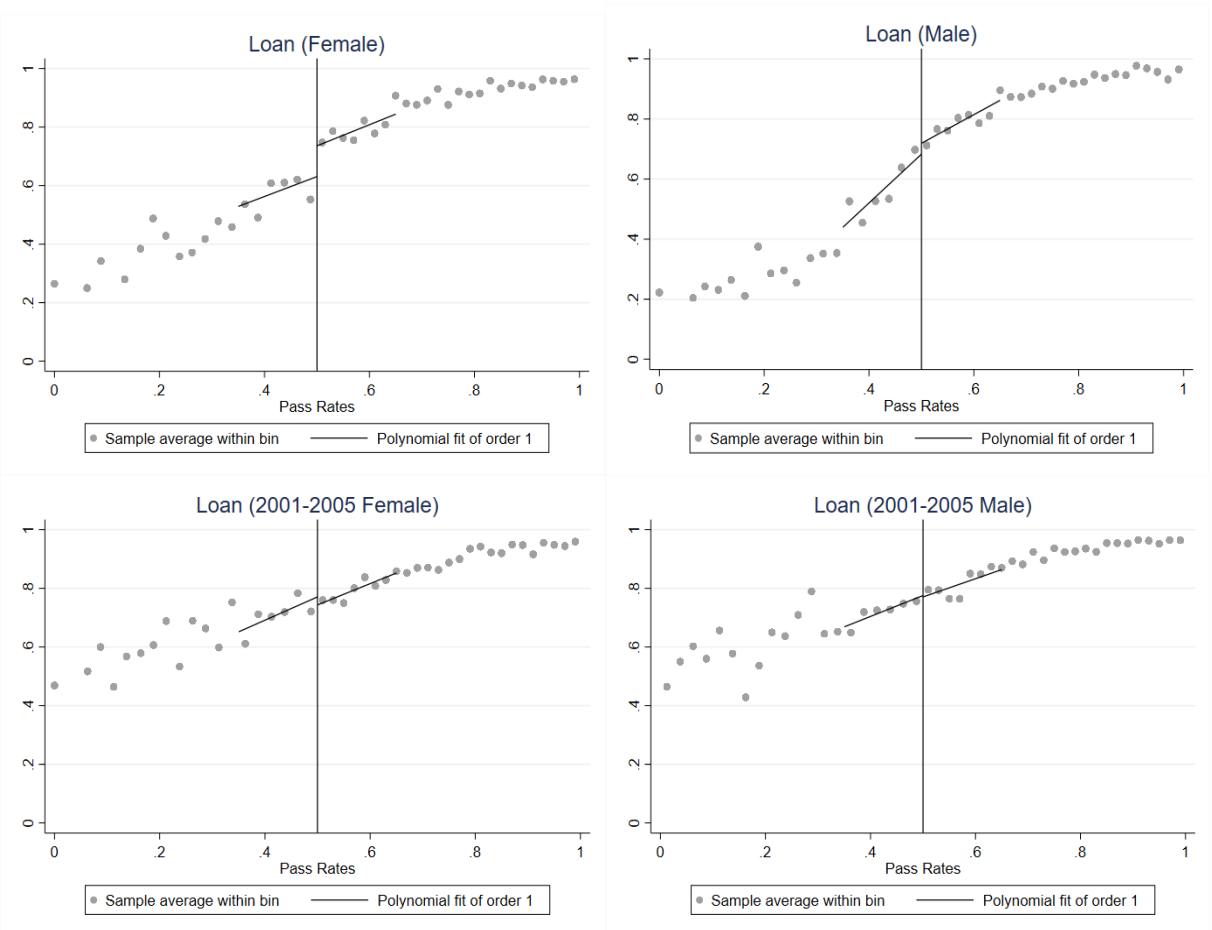
Figure 1: Distribution of Pass Rates for the Analysis Sample (upper) and for 2001-2005 Student Cohorts (lower)



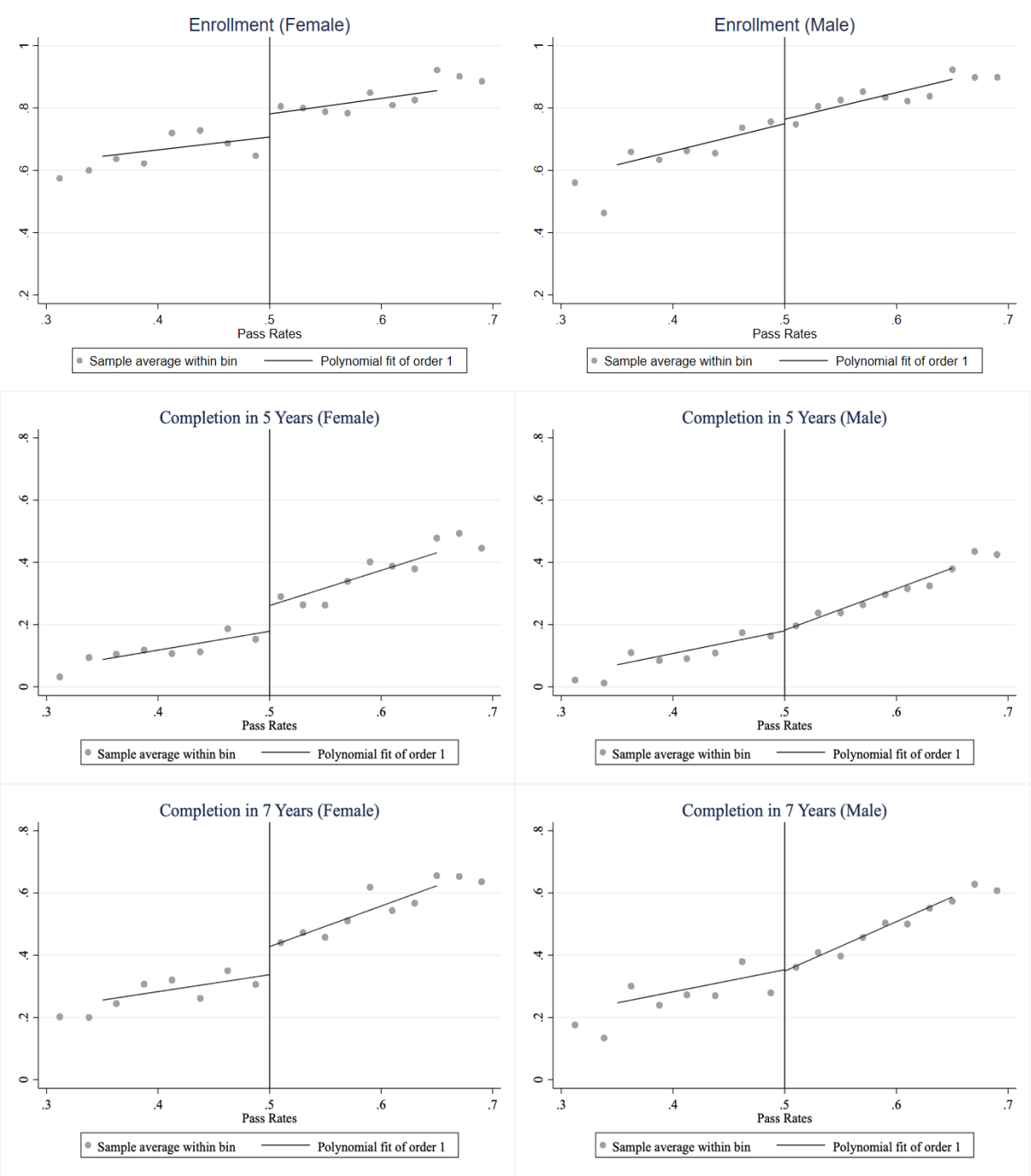
Note: Each bar represents a 0.020 bin. To keep cell sizes above twenty, the bins [0.020, 0.040) and [0.040, 0.060) are grouped with the bin [0, 0.020) in the upper panel. The rightmost bins are excluded as the pass rate of 1 accounts for 48% of the observations in both panels. 2001–2005 student cohorts were not subjected to performance assessment. These students started their bachelor's degrees in 2001–2005 and have completed at least 1.6 EFTS in 2002–2006.

Figure 2: Student Loan Access by Pass Rate for the Analysis Sample (upper) and for 2001-2005 Student Cohorts (lower)



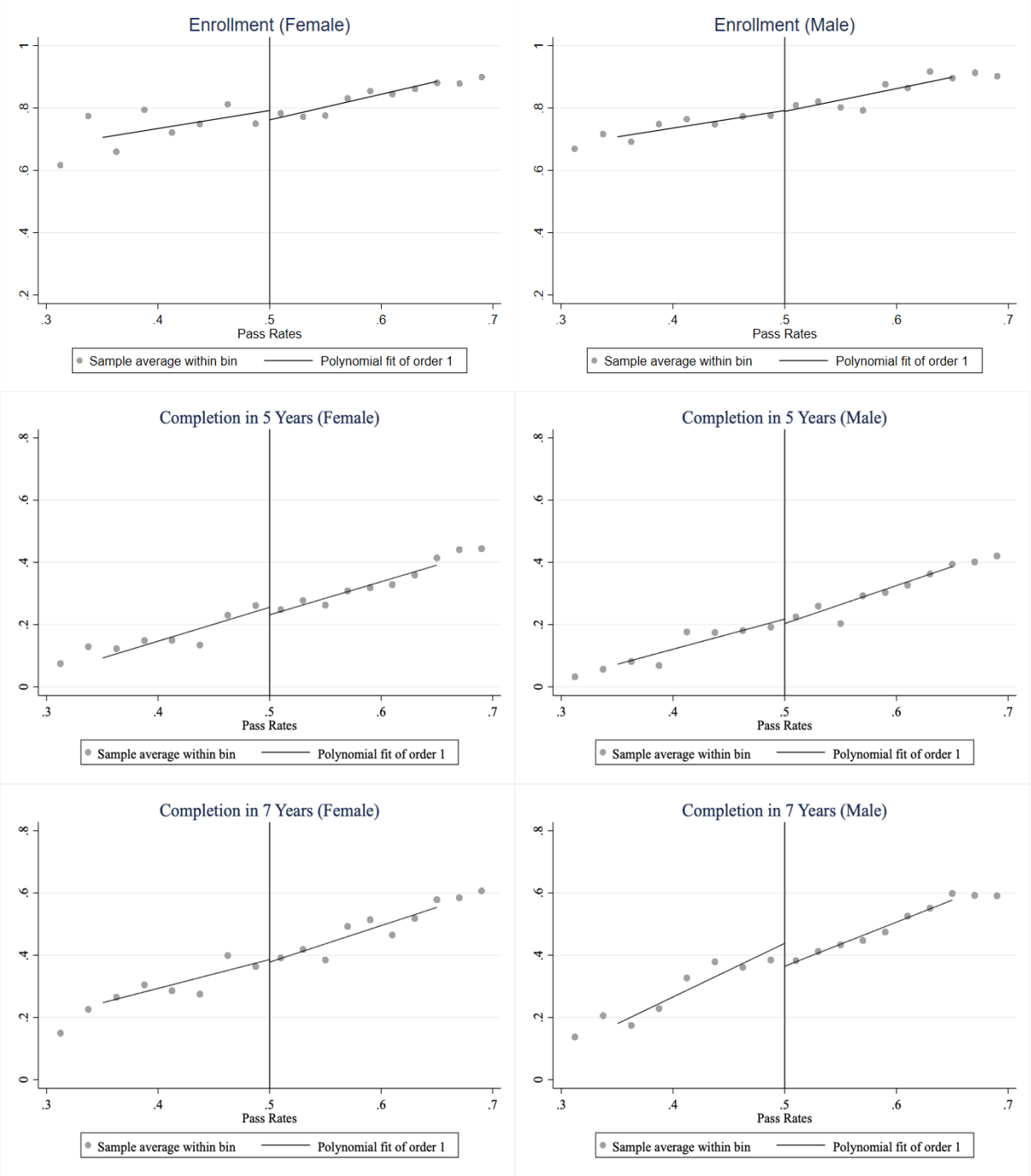
Note: This figure gives the female and male proportion of students receiving a student loan in the year after performance assessment by pass rate. Each dot represents a sample average within a 0.025 bin for pass rates below 0.5 and a sample average within a 0.020 bin for pass rates above 0.5. The fit comes from a local linear regression with a bandwidth of 0.15. To keep cell sizes above twenty, the bin [0.025, 0.050) is grouped with the previous bin in the top two panels and bottom left panel, and the bin [0.100, 0.125) is grouped with the previous bin in the top left panel.

Figure 3: Students' Education Outcomes by Pass Rate



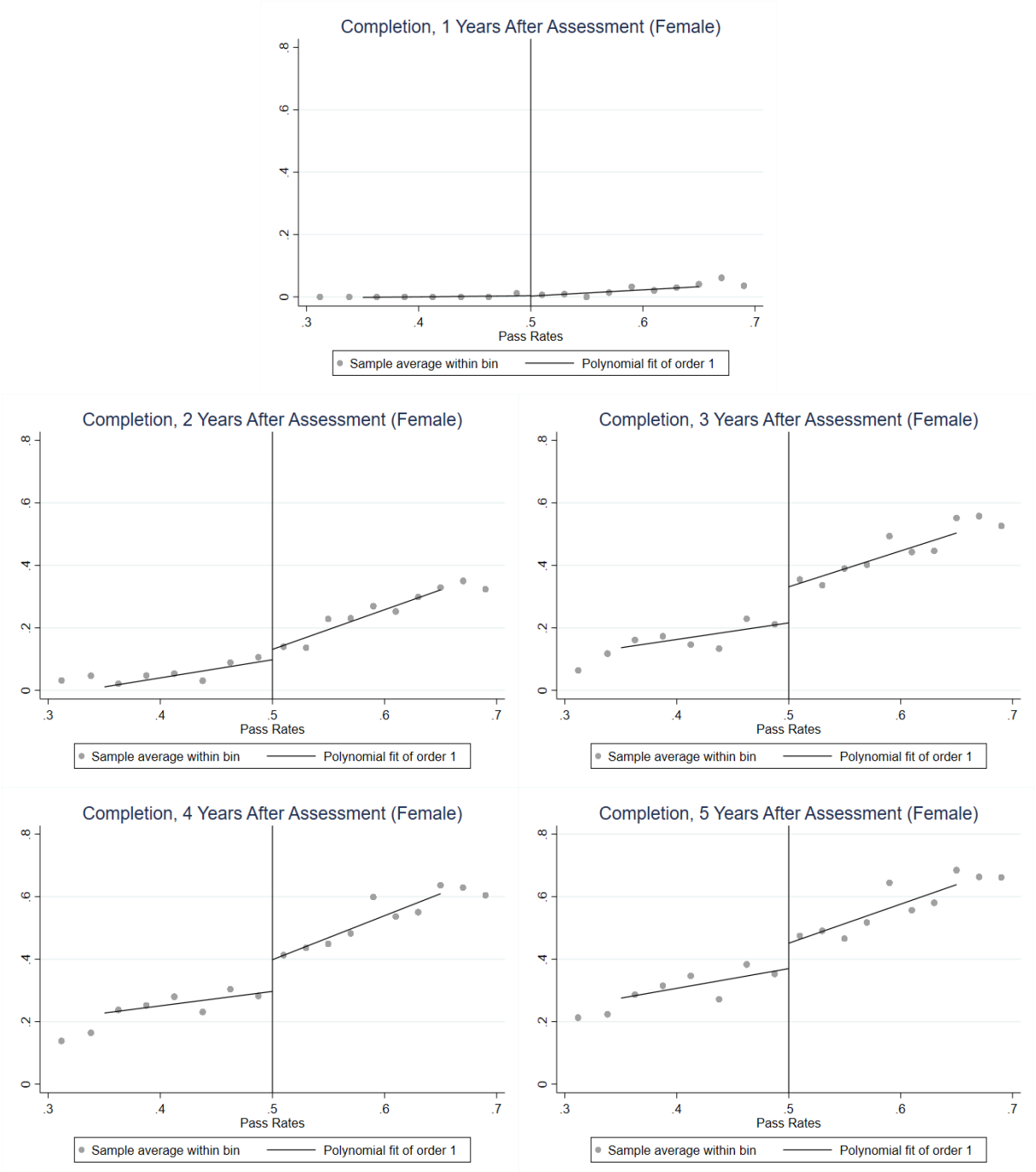
Note: This figure gives male and female average education outcomes. Outcomes include re-enrollment in the year following performance assessment, and degree completion within five and seven years from first enrollment. See the Note in Figure 2 for further details.

Figure 4: 2001–2005 Student Cohorts' Education Outcomes by Pass Rate



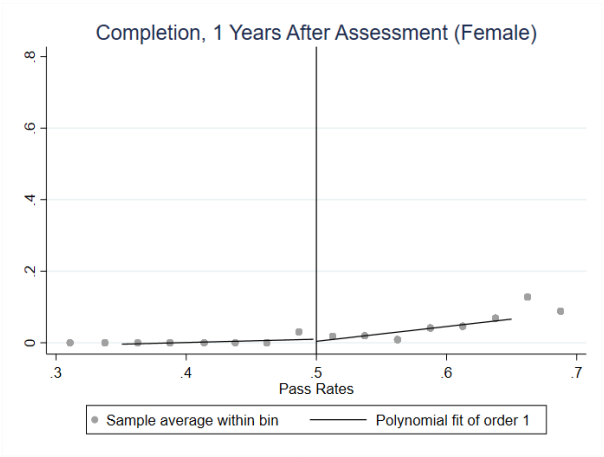
Note: This figure gives female and male average education outcomes for earlier cohorts unaffected by the policy change. See the Note in Figure 2 for further details.

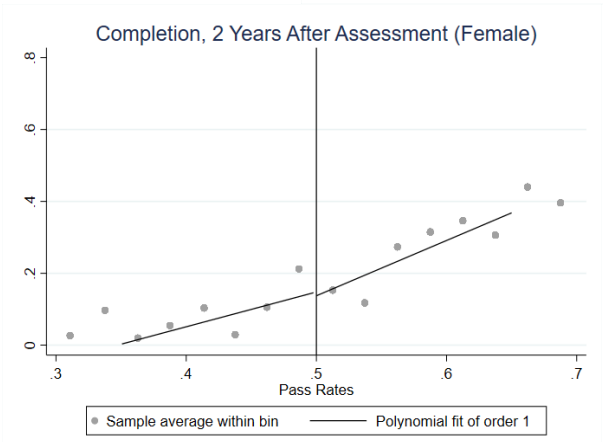
Figure 5: Bachelor's Degree Completion Rates by Year and Pass Rate (Female Students)

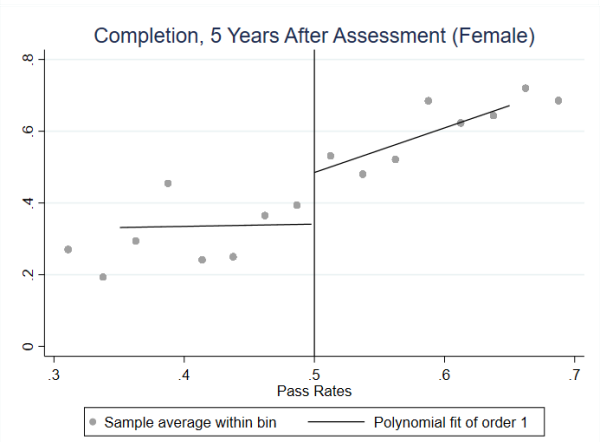


Note: This figure gives female average degree completion rates up to five years post assessment. See the Note in Figure 2 for further details.

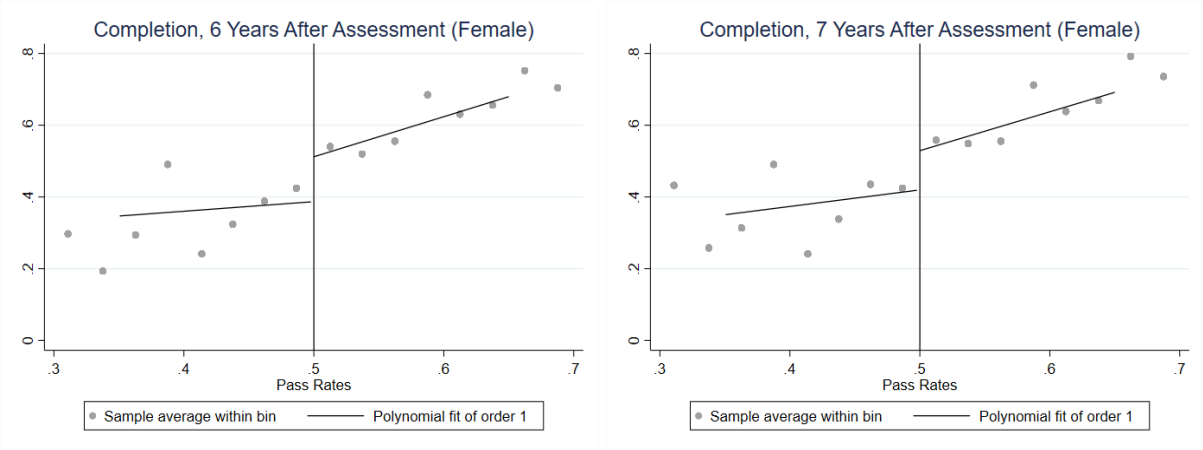
Figure 6: Bachelor's Degree Completion Rates by Year and Pass Rate (Female Students Assessed in 2010)





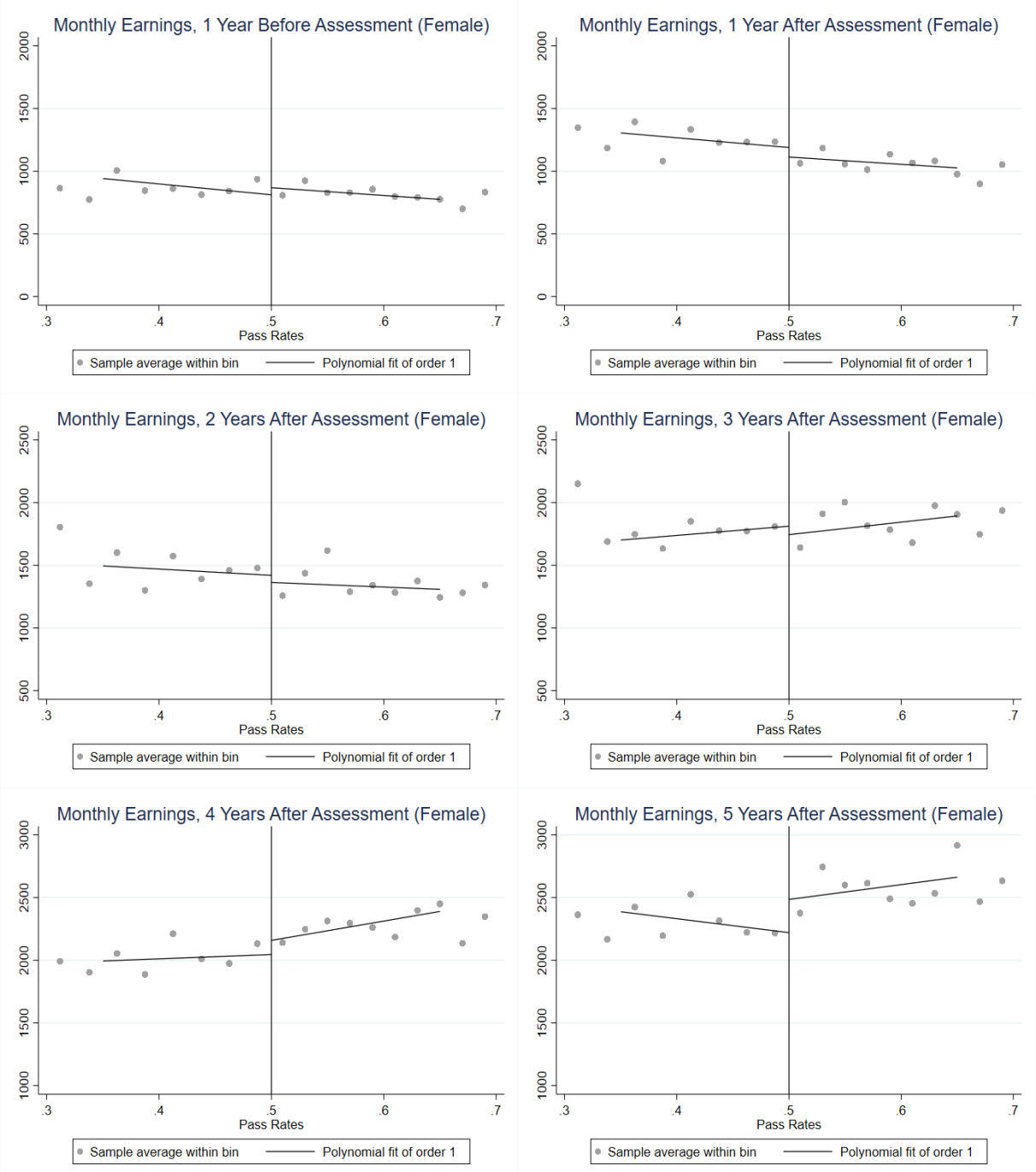


(continued) Figure 6: Bachelor's Degree Completion Rates by Year and Pass Rate (Female Students Assessed in 2010)



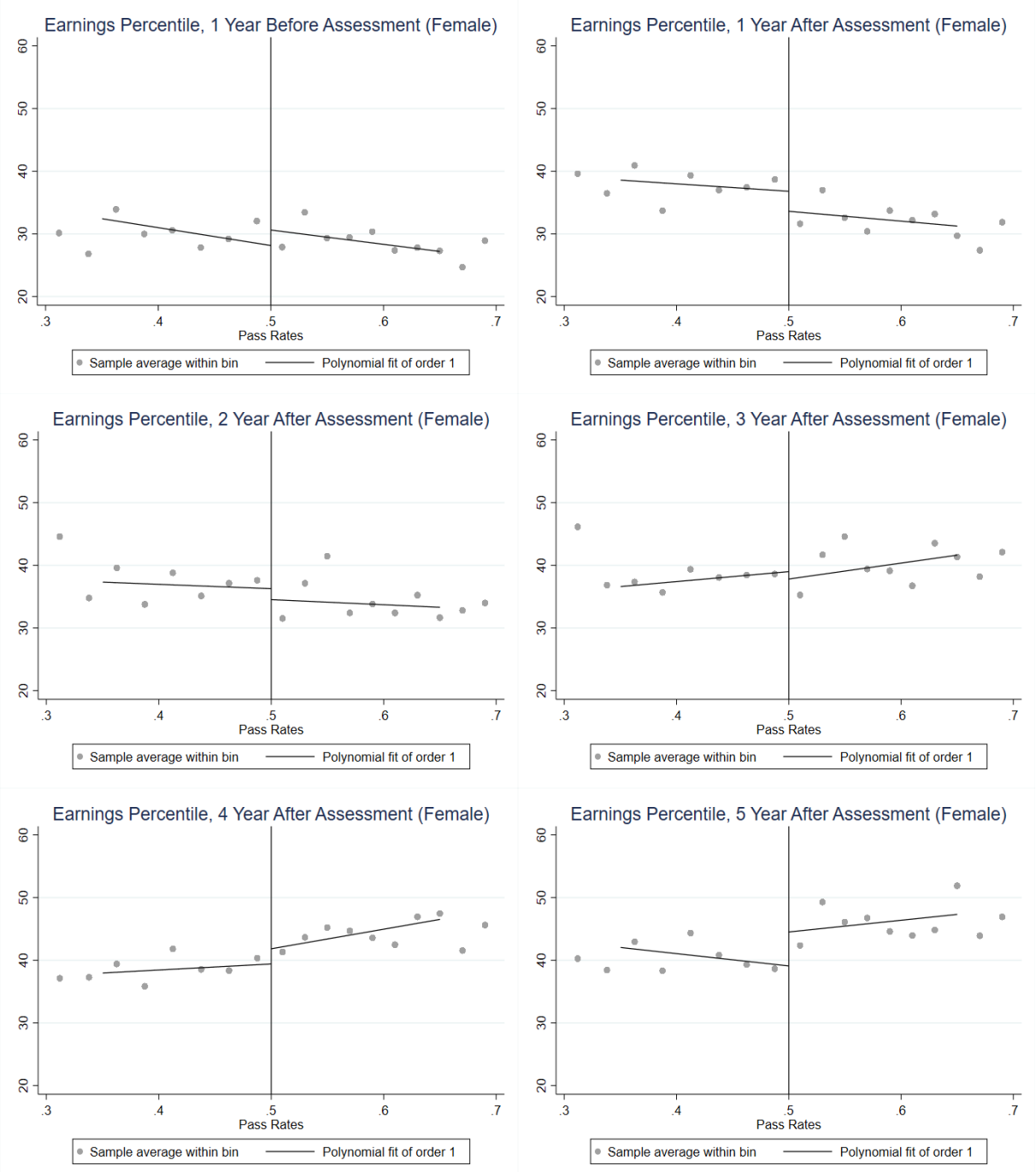
Note: This figure gives average degree completion rates up to seven years post assessment for female students assessed in 2010. Each dot represents a sample average within a 0.025 bin. The fit comes from a local linear regression with a bandwidth of 0.15.

Figure 7: Average Monthly Earnings by Year and Pass Rate (Female Students)



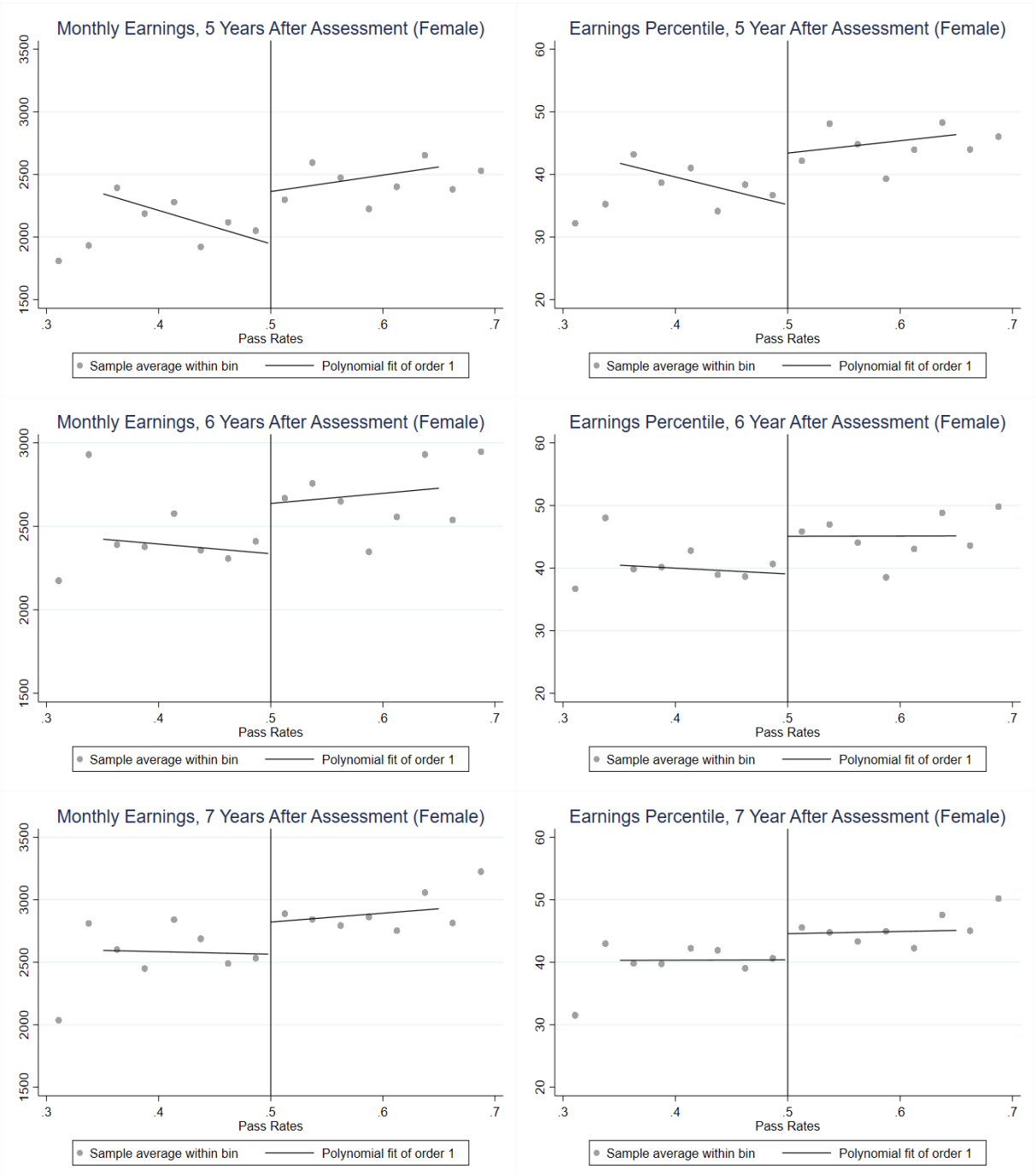
Note: This figure gives female average monthly earnings up to five years post assessment. See the Note in Figure 2 for further details.

Figure 8: Earnings Percentile by Year and Pass Rate (Female Students)



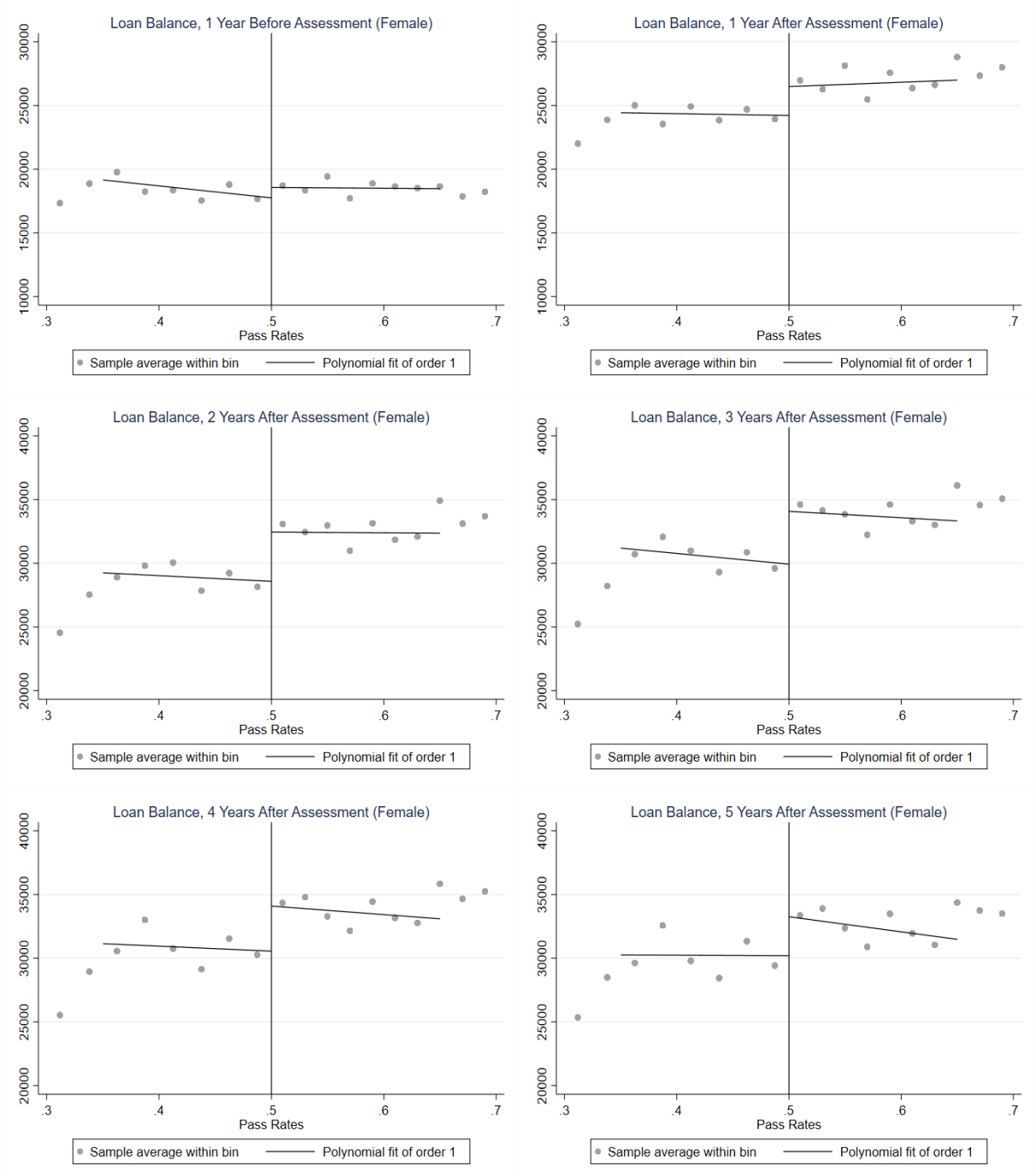
Note: This figure gives female average earnings percentile among same birth-cohort-gender peers up to five years post assessment. See the Note in Figure 2 for further details.

Figure 9: Average Monthly Earnings and Earnings Percentile by Year and Pass Rate (Female Students Assessed in 2010)



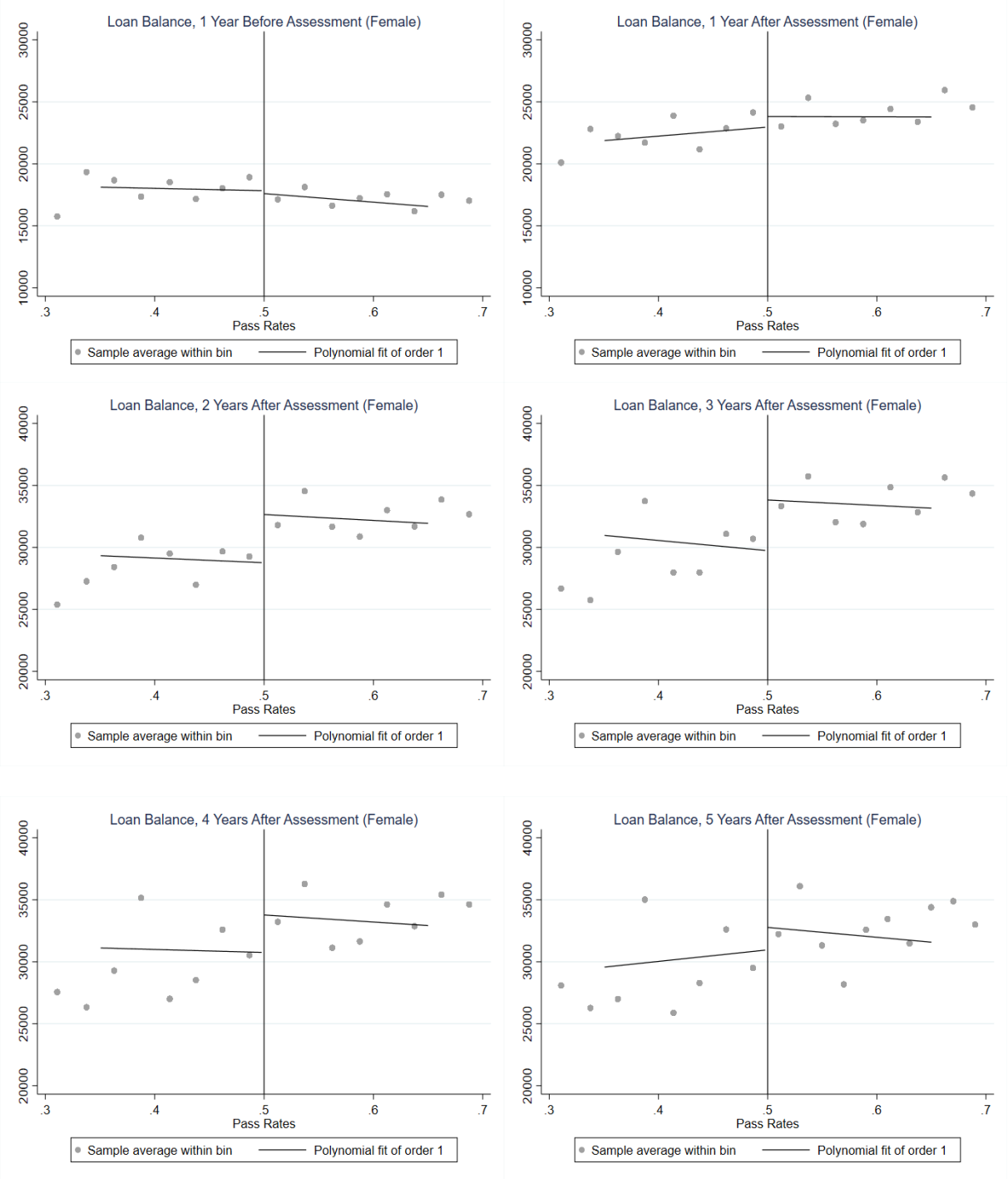
Note: This figure gives average earnings and earnings percentile among same birth-cohort-gender peers five to seven years post assessment for female students assessed in 2010. See the Note in Figure 6 for further details.

Figure 10: Outstanding Student Loan Balance by Year and Pass Rate (Female Students)

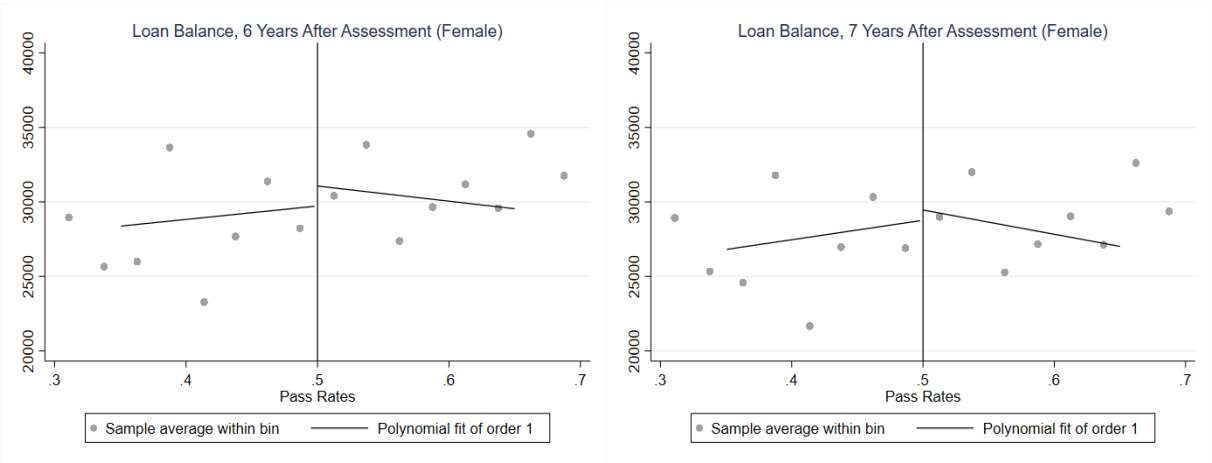


Note: This figure gives female average loan balance up to five years post assessment. See the Note in Figure 2 for further details.

Figure 11: Outstanding Student Loan Balance by Year and Pass Rate (Female Students Assessed in 2010)



(continued) Figure 11: Outstanding Student Loan Balance by Year and Pass Rate (Female Students Assessed in 2010)



Note: This figure gives average loan balance up to seven years post assessment for female students assessed in 2010. See the Note in Figure 6 for further details.

Table 1: Summary Statistics

	(1) Analysis Sample	(2) Pass Rates 0.35-0.65	(3) Pass Rates [0.50-0.65)	(4) Pass Rates [0.35-0.50)
Female	0.58	0.49	0.48	0.49
	(0.49)	(0.50)	(0.50)	(0.50)
Age	20.02	20.20	20.19	20.22
	(0.89)	(0.98)	(0.98)	(0.98)
Māori or Pasifika	0.08	0.16	0.15	0.19
	(0.27)	(0.37)	(0.36)	(0.39)
European	0.77	0.67	0.68	0.65
	(0.42)	(0.47)	(0.47)	(0.48)
Disability	0.03	0.04	0.04	0.04
	(0.16)	(0.20)	(0.20)	(0.19)
University Student	0.86	0.85	0.84	0.87
	(0.34)	(0.36)	(0.36)	(0.34)
Studying Full-time and Full Year	0.95	0.87	0.89	0.85
	(0.77)	(0.33)	(0.32)	(0.36)
Business Major	0.19	0.23	0.24	0.23
	(0.39)	(0.42)	(0.43)	(0.42)
Science Major	0.23	0.26	0.27	0.25
	(0.42)	(0.44)	(0.44)	(0.44)
Borrowed Loan Amount	9,576.85	9,650.00	9,597.37	9,767.67
	(3,894.51)	(3,756.98)	(3,776.29)	(3,711.85)
High School Deciles	6.94	6.50	6.52	6.43
	(2.44)	(2.66)	(2.66)	(2.66)
NCEA Level 3 Percentile	0.49	0.39	0.40	0.38
	(0.17)	(0.14)	(0.14)	(0.14)
Pass Rates	0.86	0.53	0.58	0.43
	(0.20)	(0.08)	(0.05)	(0.04)
Loan	0.91	0.72	0.79	0.57
	(0.29)	(0.45)	(0.40)	(0.50)
Re-enrollment	0.93	0.78	0.83	0.68
	(0.25)	(0.41)	(0.38)	(0.47)
5-year Completion	0.71	0.26	0.32	0.13
	(0.46)	(0.44)	(0.47)	(0.34)
7-year Completion	0.83	0.44	0.50	0.30
	(0.38)	(0.50)	(0.50)	(0.46)
Observations	49,389	5,550	3,834	1,716

Note: Standard deviations are reported in parentheses. Age, disability status, university student status (i.e. non-polytechnic status), full-time status, majors, borrowed loan amount, and pass rates are measured in the year students complete 1.6 EFTS; loan status and enrollment status are measured in the year following the performance assessment. The information on the National Certificate of Educational Achievement (NCEA) level 3 percentiles is only available for 44,757 students as not all students take the NCEA. All numbers of observations are randomly rounded to base 3.

Table 2: Excess Probability at the Threshold

	(1)	(2)	(3)	(4)	(5)	(6)
	Analysis Sample					
	Both Sexes			Female		
Cumulative Distribution Function	0.011*** (0.000)	0.020*** (0.001)	0.030*** (0.001)	0.012*** (0.001)	0.021*** (0.001)	0.029*** (0.002)
Observations	7,461	5,550	3,444	3,657	2,697	1,689
Bandwidths	0.20	0.15	0.10	0.20	0.15	0.10
	2001–2005 Student Cohorts					
	Both Sexes			Female		
Cumulative Distribution Function	0.016*** (0.0002)	0.022*** (0.0003)	0.032*** (0.0007)	0.017*** (0.000)	0.024*** (0.001)	0.034*** (0.001)
Observations	7,770	5,820	3,861	3,753	2,811	1,854
Bandwidths	0.20	0.15	0.10	0.20	0.15	0.10

Note: The estimates are from local linear regressions using the triangular kernel and fixed bandwidths of 0.20, 0.15, and 0.10. Heteroskedasticity standard errors are in parentheses. All numbers of observations are randomly rounded to base 3. *** p<0.01, ** p<0.05, * p<0.1.

Table 3: Discontinuities in Student Characteristics at the Threshold

	(1) Both Sexes	(2) Female
Female	-0.011 (0.032)	
Age	0.063 (0.061)	0.054 (0.085)
Māori or Pasifika	-0.008 (0.025)	0.024 (0.040)
European	-0.002 (0.030)	-0.039 (0.044)
Disability	0.011 (0.011)	0.019 (0.017)
University Student	-0.008 (0.024)	0.013 (0.037)
Studying Full-time and Full Year	-0.024 (0.020)	-0.028 (0.031)
Business Major	0.030 (0.027)	-0.001 (0.036)
Science Major	0.041 (0.027)	0.023 (0.033)
Borrowed Loan Amount	-373.1 (261.4)	269.5 (343.7)
High School Deciles	-0.127 (0.174)	-0.235 (0.272)
NCEA Level 3 Percentile	-0.011 (0.010)	-0.031** (0.015)
Observations	5,550	2,697
Bandwidths	0.15	0.15

Note: The estimates are from local linear regressions using the triangular kernel and fixed bandwidths of 0.15. Heteroskedasticity standard errors are in parentheses. All numbers of observations are randomly rounded to base 3. *** p<0.01, ** p<0.05, * p<0.1.

Table 4: Effects of Student Loan Access on Retention and Bachelor's Degree Completion Rates by Gender

	(1)	(2)	(3)	(4)
	Female		Male	
	RF	2SLS	RF	2SLS
Loan	0.159***		0.016	
	(0.045)		(0.041)	
Re-enrollment	0.119***	0.751***	-0.009	-0.566
	(0.042)	(0.143)	(0.038)	(3.601)
5-year Completion	0.091**	0.574**	-0.006	-0.358
	(0.036)	(0.228)	(0.031)	(2.317)
7-year Completion	0.102**	0.642**	-0.000	-0.011
	(0.044)	(0.267)	(0.040)	(2.441)
Observations	2,697		2,853	
Bandwidths	0.15		0.15	

Note: Columns 1and 3 give the reduced form effects of crossing the performance criteria threshold on subsequent loan taking, re-enrollment in the immediate year after initial eligibility assessment, and graduation within five and seven years of first enrolment. Columns 2 and 4 give the 2SLS effects of loan receipt on the same outcomes. The estimates are from local linear regressions using the triangular kernel and a fixed bandwidth of 0.15. All regressions control for age, gender, being Māori or Pasifika, disability status, studying full-time full-year, high school deciles, business major, science major, and indicators for student cohort, year of assessment, and each university. Heteroskedasticity standard errors are in parentheses. All numbers of observations are randomly rounded to base 3. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Table 5: Effects of Student Loan Access on Bachelor's Degree Completion Rates by Year (Female Students)

	(1)	(2)
	RF	2SLS
Year $t + 1$	0.001	0.008
	(0.006)	(0.041)
Year $t + 2$	0.037	0.235
	(0.028)	(0.174)
Year $t + 3$	0.117***	0.739***
	(0.040)	(0.261)
Year $t + 4$	0.108**	0.683**
	(0.044)	(0.266)
Year $t + 5$	0.084*	0.531**
	(0.045)	(0.260)
Observations	2,697	
Bandwidths	0.15	

Note: Column 1 gives the reduced form effects of crossing the performance criteria threshold on degree completion one to five years after initial loan eligibility assessment. Column 2 gives the 2SLS effects of student loan receipt in the year after initial loan eligibility assessment ($t + 1$) on degree completion. See Note in Table 4 for further estimation details. *** p<0.01, ** p<0.05, * p<0.1.

Table 6: Effects of Student Loan Access on Bachelor's Degree Completion Rates by Year (Female Students Assessed in 2010)

	(1)	(2)
	RF	2SLS
Loan	0.250***	
	(0.067)	
Year $t + 1$	0.008	0.033
	(0.017)	(0.068)
Year $t + 2$	0.009	0.037
	(0.054)	(0.213)
Year $t + 3$	0.115*	0.459*
	(0.067)	(0.240)
Year $t + 4$	0.163**	0.651***
	(0.069)	(0.241)
Year $t + 5$	0.179**	0.716***
	(0.071)	(0.276)
Year $t + 6$	0.170**	0.681**
	(0.070)	(0.280)
Year $t + 7$	0.151**	0.606**
	(0.070)	(0.280)
Observations	1,014	
Bandwidths	0.15	

Note: Column 1 gives the reduced form effects of crossing the performance criteria threshold on subsequent loan taking and degree completion one to seven years after initial loan eligibility assessment for female students whose initial eligibility test occurs in the year of the policy change (2010). Column 2 gives the 2SLS effects of student loan receipt in the year after initial loan eligibility assessment ($t + 1$) on degree completion. See Note in Table 4 for further estimation details. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Table 7: Effects of Student Loan Access on Average Monthly Earnings and Earnings Percentile by Year (Female Students)

	(1)	(2)	(3)	(4)
	Average Monthly Earnings		Earnings Percentile	
	RF	2SLS	RF	2SLS
Year *t*	-4	-25	0.70	4.40
	(60)	(376)	(2.17)	(13.8)
Year *t* + 1	-123	-773	-4.28*	-26.98*
	(83)	(507)	(2.57)	(15.82)
Year *t* + 2	-126	-794	-3.03	-19.08
	(102)	(635)	(2.64)	(16.48)
Year *t* + 3	-61	-386	-0.85	-5.35
	(125)	(790)	(2.81)	(17.64)
Year *t* + 4	141	885	3.02	19.03
	(142)	(896)	(2.88)	(18.22)
Year *t* + 5	321**	2,022*	6.52**	41.05**
	(156)	(1,081)	(2.93)	(20.67)
Observations		2,697		
Bandwidths		0.15		

Note: Columns 1 and 3 give the reduced form effects of crossing the performance criteria threshold on average monthly earnings and birth-cohort-gender earnings percentile from the year before loan access is jeopardized by poor academic performance (*t*) and up to five years after for female students. Columns 2 and 4 give the 2SLS effects of student loan receipt (in the year after initial loan eligibility assessment (*t* + 1)) on these earnings measures. See Note in Table 4 for further estimation details. *** p<0.01, ** p<0.05, * p<0.1.

Table 8: Effects of Student Loan Access on Average Monthly Earnings and Earnings Percentile by Year (Female Students Assessed in 2010)

	(1)	(2)	(3)	(4)
	Average Monthly Earnings		Earnings Percentile	
	RF	2SLS	RF	2SLS
Year *t*	94 (93)	376 (396)	3.66 (3.50)	14.64 (14.99)
Year *t* + 1	-99 (130)	-396 (481)	-4.26 (4.21)	-17.06 (15.28)
Year *t* + 2	-29 (170)	-114 (673)	-0.63 (4.56)	-2.53 (18.05)
Year *t* + 3	-38 (219)	-150 (871)	-0.33 (4.97)	-1.33 (19.83)
Year *t* + 4	295 (243)	1,183 (1,030)	6.20 (4.95)	24.84 (21.07)
Year *t* + 5	462* (265)	1,851 (1,179)	9.07* (4.97)	36.31 (22.35)
Year *t* + 6	537* (288)	2,152* (1,298)	9.99** (5.03)	39.99* (22.83)
Year *t* + 7	527* (318)	2,113 (1,400)	8.02 (5.12)	32.12 (22.38)
Observations	1,014			
Bandwidths	0.15			

Note: Columns 1 and 3 give the reduced form effects of crossing the performance criteria threshold on average monthly earnings and birth-cohort-gender earnings percentile from the year before loan access is jeopardized by poor academic performance (*t*) and up to seven years after for female students whose initial eligibility test occurs in the year of the policy change (2010). Columns 2 and 4 give the 2SLS effects of student loan receipt (in the year after initial loan eligibility assessment (*t* + 1)) on these earnings measures. See Note in Table 4 for further estimation details. *** p<0.01, ** p<0.05, * p<0.1.

Table 9: Effects of Student Loan Access on Log Monthly Earnings and Non-zero Earnings Percentile (Female Students)

	(1)	(2)	(3)	(4)
	Log Monthly Earnings		Non-zero Earnings Percentile	
			Full Sample	
	RF	2SLS	RF	2SLS
Year $t + 5$	0.151**	0.982*	6.23**	40.49*
	(0.074)	(0.562)	(2.64)	(21.15)
Observations		2,121		
			Assessed in 2010	
	RF	2SLS	RF	2SLS
Year $t + 5$	0.208	1.076	7.97*	41.25
	(0.133)	(0.808)	(4.67)	(29.38)
Observations		768		
Year $t + 6$	0.234**	0.951*	7.85	31.85
	(0.115)	(0.537)	(5.01)	(21.53)
Observations		735		
Year $t + 7$	0.191	0.698	5.59	20.41
	(0.135)	(0.536)	(4.94)	(18.73)
Observations		735		
Bandwidths		0.15		

Note: Columns 1 and 3 give the reduced form effects of crossing the performance criteria threshold on birth-cohort-gender earnings percentile (conditioned on positive earnings) and log monthly earnings (conditioned on positive earnings) between five and seven years after the initial performance assessment. The top panel gives estimate for all female students in the sample and the bottom panel gives the estimates for female students whose initial eligibility test occurs in the year of the policy change (2010). Columns 2 and 4 give the 2SLS effects of student loan receipt (in the year after initial loan eligibility assessment ($t + 1$)) on these earnings measures. See Note in Table 4 for further estimation details. *** p<0.01, ** p<0.05, * p<0.1.

Table 10: Effects of Student Loan Access on Annual Months with Positive Earnings and Annual Months with Earnings Above full-time Minimum Wage (Female Students)

	(1)	(2)	(3)	(4)
	Months with Positive Earnings		Months with Earnings Above Full-time Minimum Wage	
			Full Sample	
	RF	2SLS	RF	2SLS
Year $t + 5$	0.66	4.14	0.88*	5.54*
	(0.46)	(3.04)	(0.47)	(3.23)
Observations		2,697		
			Assessed in 2010	
	RF	2SLS	RF	2SLS
Year $t + 5$	1.62**	6.49*	1.46*	5.83
	(0.75)	(3.61)	(0.77)	(3.58)
Year $t + 6$	1.22	4.87	1.81**	7.23**
	(0.75)	(3.38)	(0.78)	(3.68)
Year $t + 7$	1.27	5.08	1.51	6.03*
	(0.75)	(3.52)	(0.76)	(3.26)
Observations		1,014		
Bandwidths		0.15		

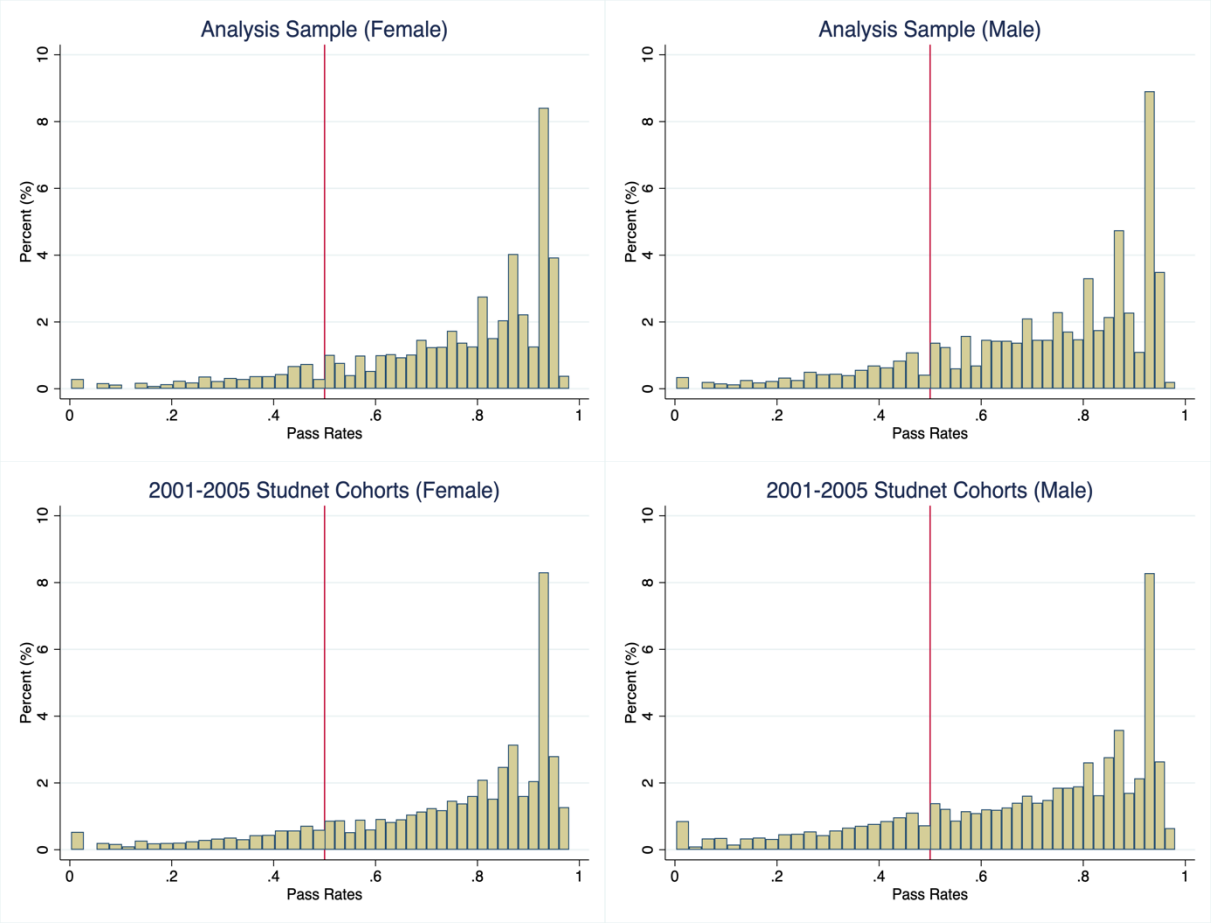
Note: Columns 1 and 3 give the reduced form effects of crossing the performance criteria threshold on average months with positive earnings and months with earnings above the full-time minimum wage income rate between five and seven years after the initial performance assessment for female students. The top panel gives estimate for all female students in the sample and the bottom panel gives the estimates for female students whose initial eligibility test occurs in the year of the policy change (2010). Columns 2 and 4 give the 2SLS effects of student loan receipt (in the year after initial loan eligibility assessment ($t + 1$)) on these earnings measures. See Note in Table 4 for further estimation details. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Table 11: Effects of Student Loan Access on Outstanding Student Loan Balance by Year (Female Students)

	(1)	(2)	(3)	(4)
	Full Sample		Assessed in 2010	
	RF	2SLS	RF	2SLS
Year *t*	898 (720)	5,657 (4,639)	639 (1,034)	2,558 (4,182)
Year *t* + 1	2,865*** (1,042)	18,045*** (6,146)	2,190 (1,530)	8,771 (5,731)
Year *t* + 2	4,997*** (1,380)	31,479*** (8,442)	5,988*** (2,105)	23,983*** (7,213)
Year *t* + 3	5,065*** (1,561)	31,907*** (9,455)	5,791** (2,414)	23,193*** (8,570)
Year *t* + 4	4,210** (1,696)	26,516*** (9,904)	4,737* (2,658)	18,970** (9,642)
Year *t* + 5	3,748** (1,769)	23,612** (10,559)	3,974 (2,813)	15,915 (10,458)
Year *t* + 6			3,028 (2,977)	12,127 (11,255)
Year *t* + 7			2,290 (3,055)	9,171 (11,723)
Bandwidths	0.15		0.15	
Observations	2,697		1,014	

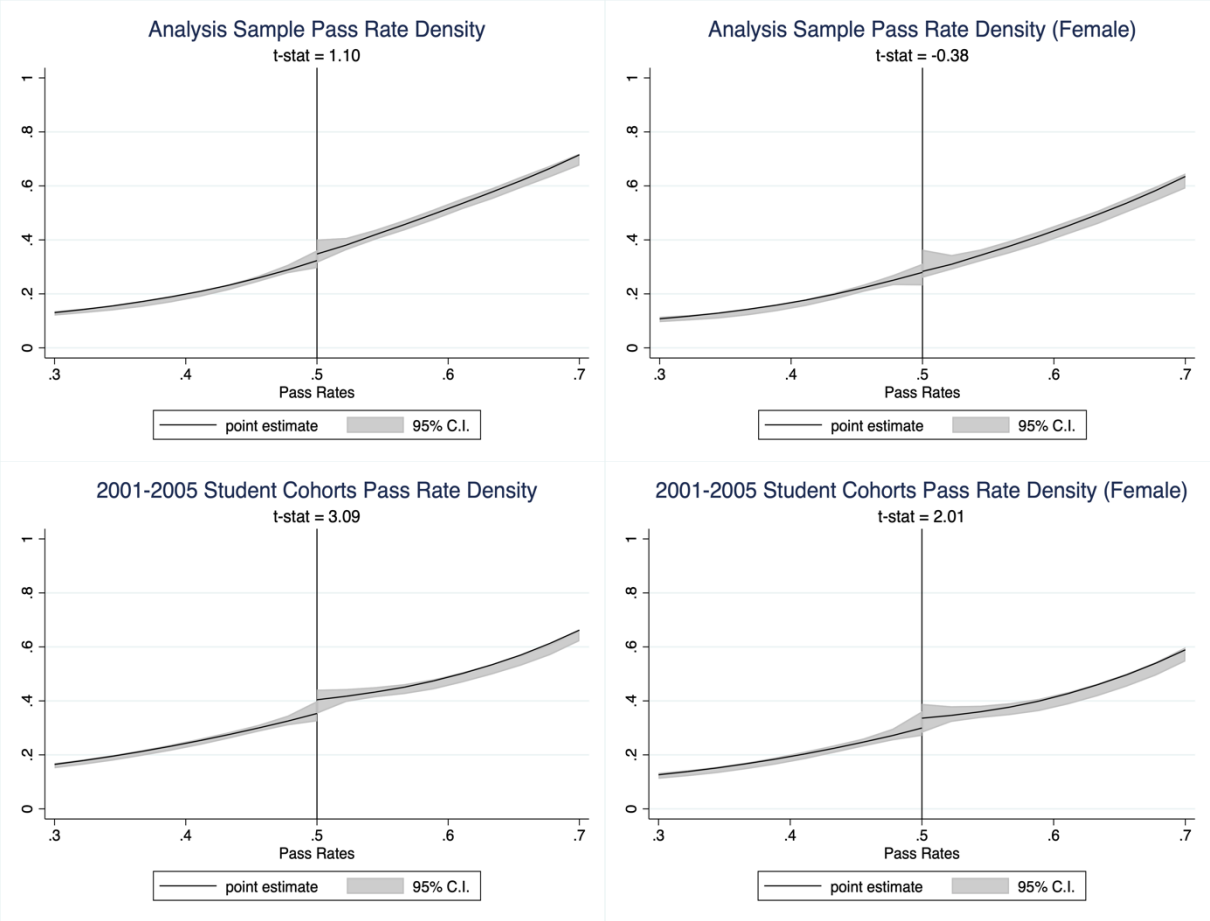
Note: Columns 1 and 3 give the reduced form effects of crossing the performance criteria threshold on total outstanding loan balance in the year before loan access is jeopardized by poor academic performance (*t*) and up seven years later for female students. Columns 2 and 4 give the 2SLS effects of student loan receipt (in the year after initial loan eligibility assessment (*t* + 1)) on loan balances. Columns 1 and 2 give estimates for all female students in the sample, and columns 3 and 4 give estimates for female students whose initial eligibility test occurs in the year of the policy change (2010). See Note in Table 4 for further estimation details. *** p<0.01, ** p<0.05, * p<0.1.

Appendix Figure A1: Distribution of Pass Rates by gender for the Analysis Sample (upper) and for 2001-2005 Student Cohorts (lower)



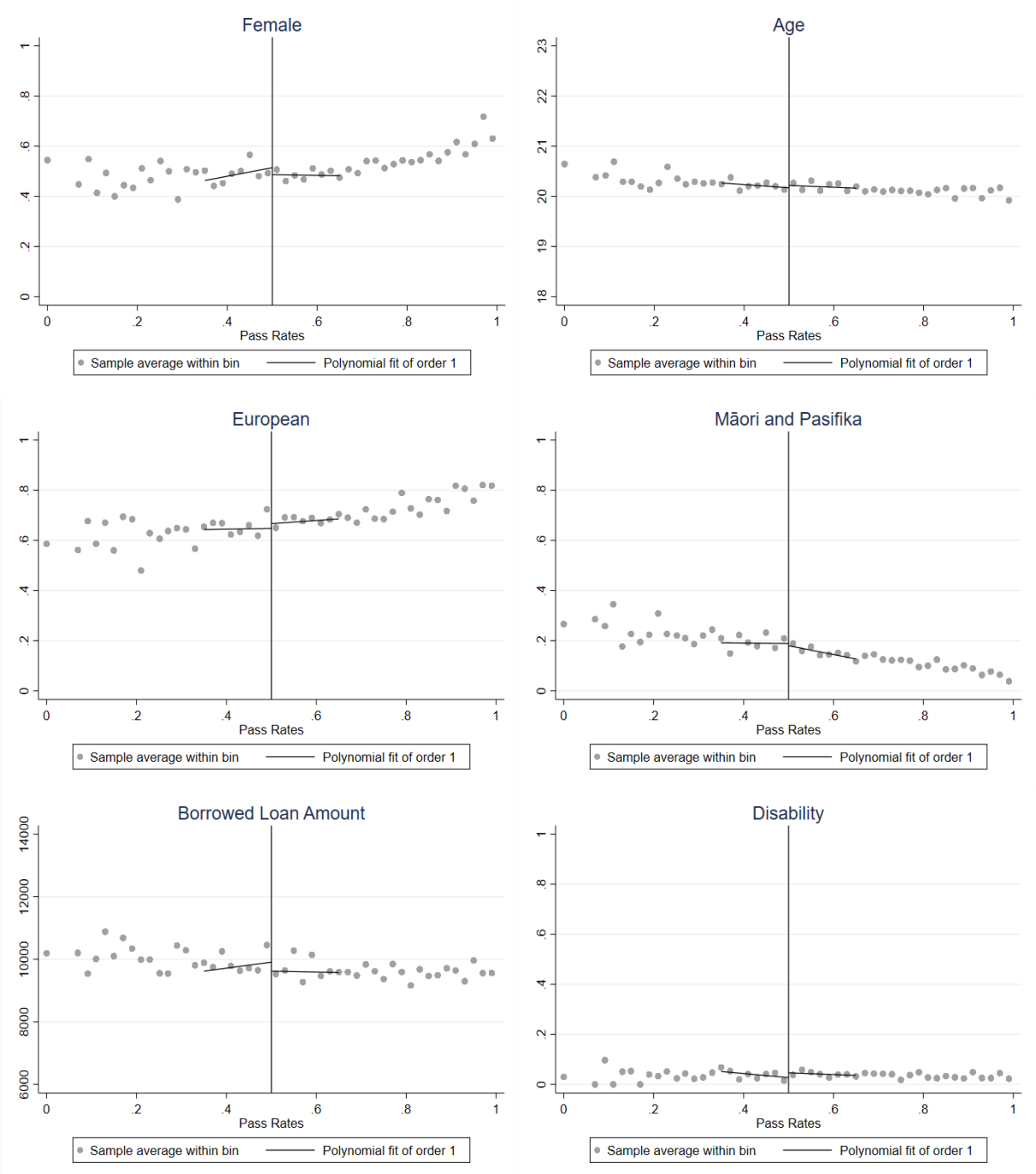
Note: Each bar represents a 0.025 bin for pass rates below 0.5 and a 0.020 bin for pass rates above 0.5. To keep cell sizes above twenty, the bin [0.025, 0.050) is grouped with the previous bin in the top two panels and bottom left panel, and the bin [0.100, 0.125) is grouped with the previous bin in the top left panel. The last bins are excluded as the pass rate of 1 accounts for 52% (female) and 42% (male) of the observations. 2001–2005 student cohorts were not subject to performance assessment. These students started their bachelor's degrees in 2001–2005 and have completed at least 1.6 EFTS in 2002–2006.

Appendix Figure A2: Density of Pass Rates for the Analysis Sample (upper) and for 2001-2005 Student Cohorts (lower)

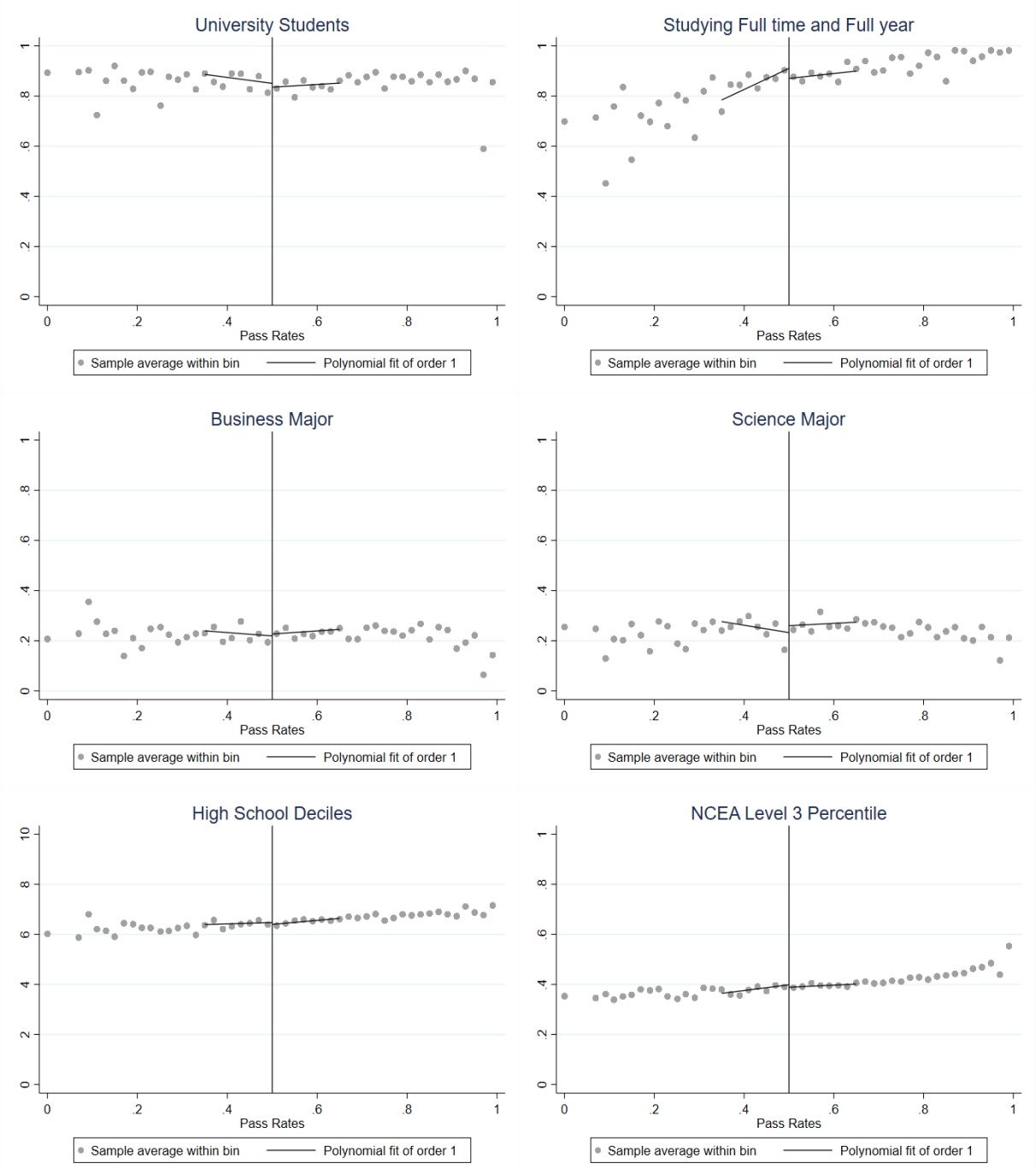


Note: The density point estimates are based on a local quadratic density point estimator and a bandwidth of 0.15 (Cattaneo, Jansson, and Ma 2018; McCrary 2008).

Appendix Figure A3: Balance of Student Characteristics

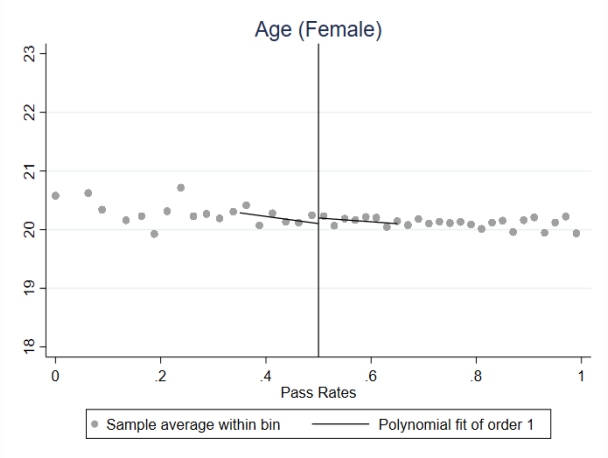


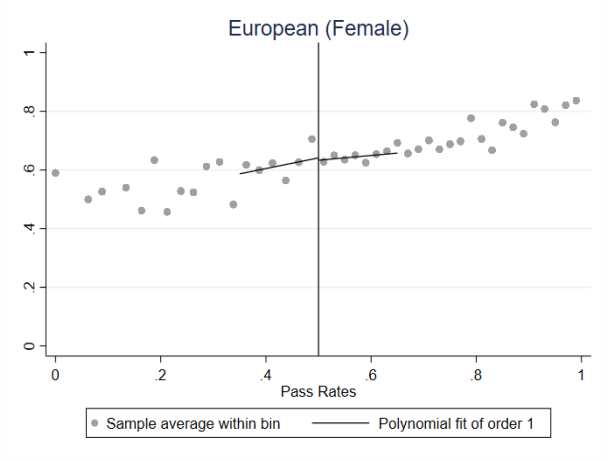
(continued) Appendix Figure A3: Balance of Student Characteristics

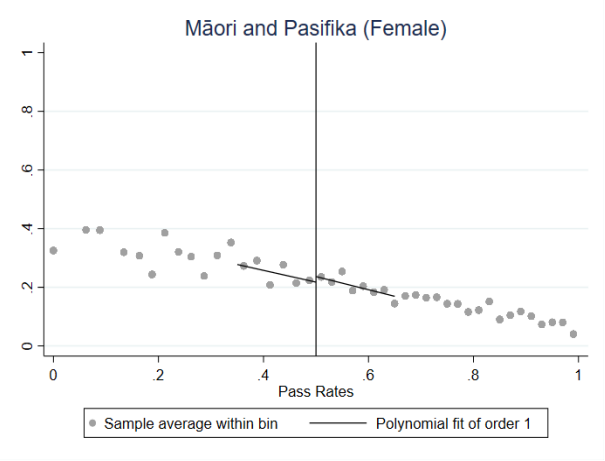


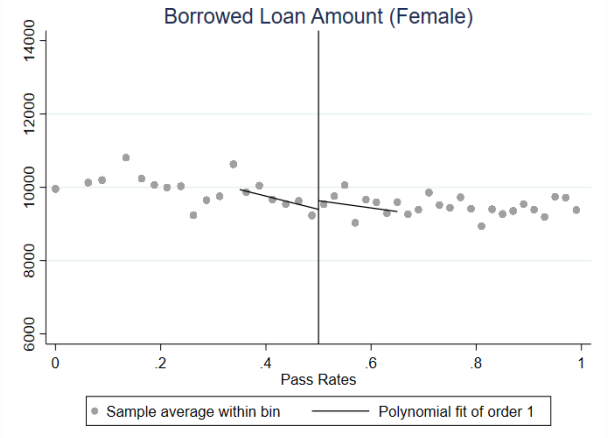
Note: Each dot represents a sample average within a 0.020 bin, and the fit comes from a local linear regression with a bandwidth of 0.15. To keep cell sizes above twenty, the bins [0.020, 0.040) and [0.040, 0.060) are grouped with the bin [0, 0.020).

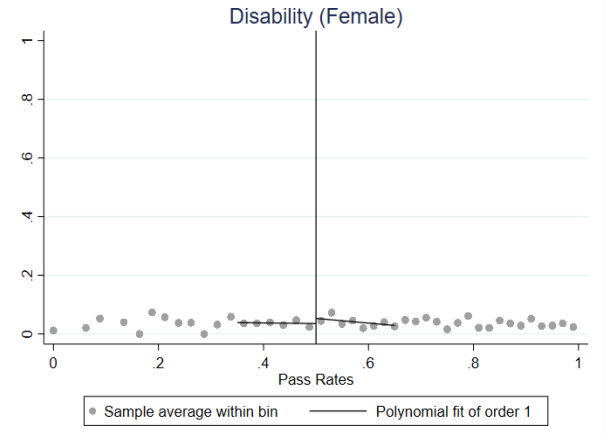
Appendix Figure A4: Balance of Student Characteristics (Female Students)



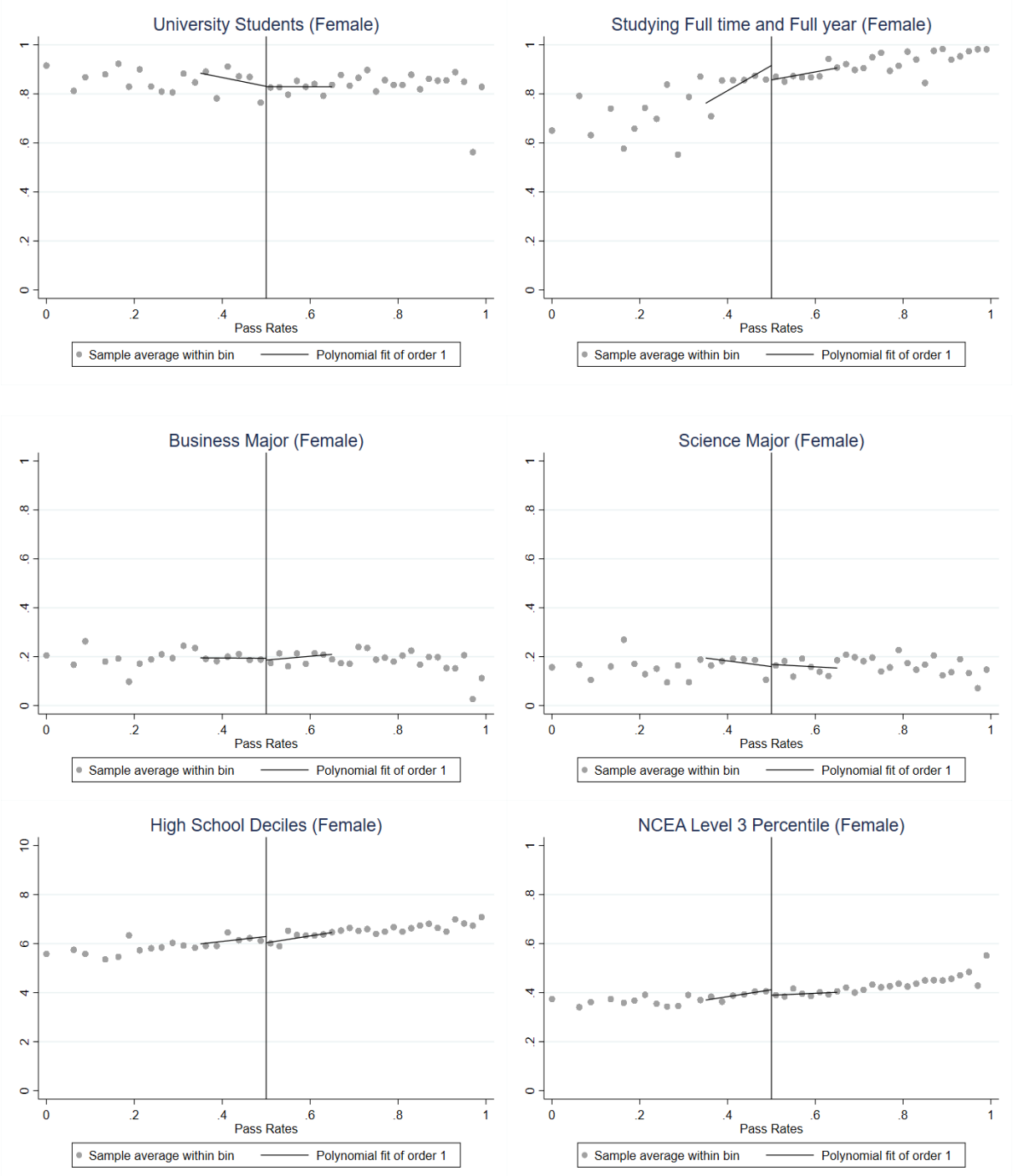






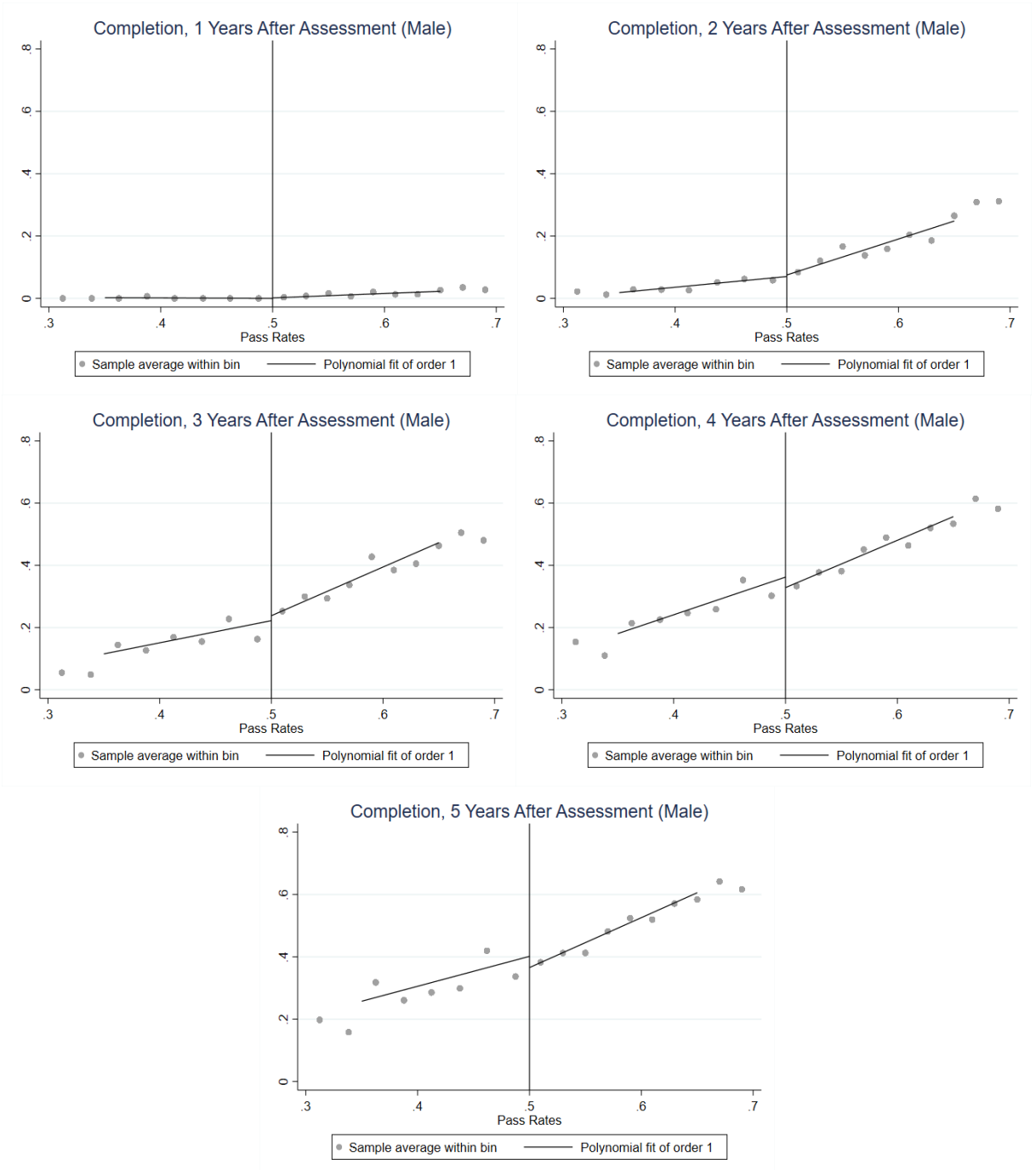


(continued) Appendix Figure A4: Balance of Student Characteristics (Female Students)



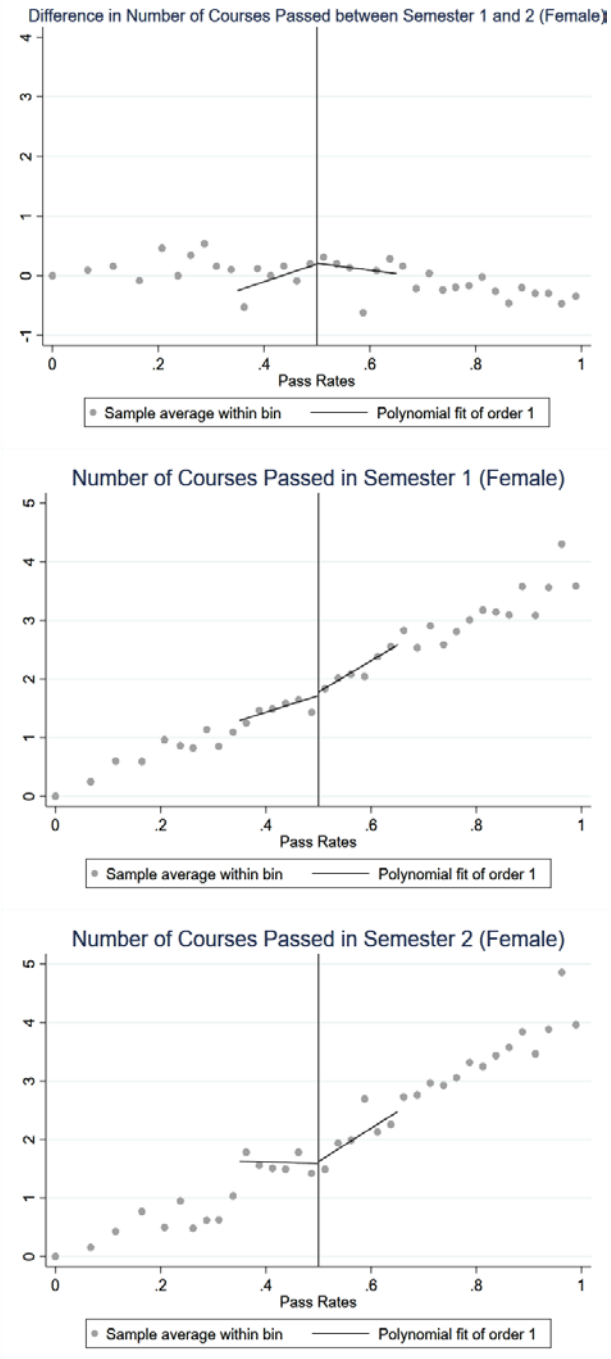
Note: Each dot represents a sample average within a 0.025 bin for pass rates below 0.5 and a sample average within a 0.020 bin for pass rates above 0.5. The fit comes from a local linear regression with a bandwidth of 0.15. To keep cell sizes above twenty, the bins [0.025, 0.050) and [0.100, 0.125) are grouped with the previous bins.

Appendix Figure A5: Bachelor's Degree Completion Rates by Year and Pass Rate (Male Students)



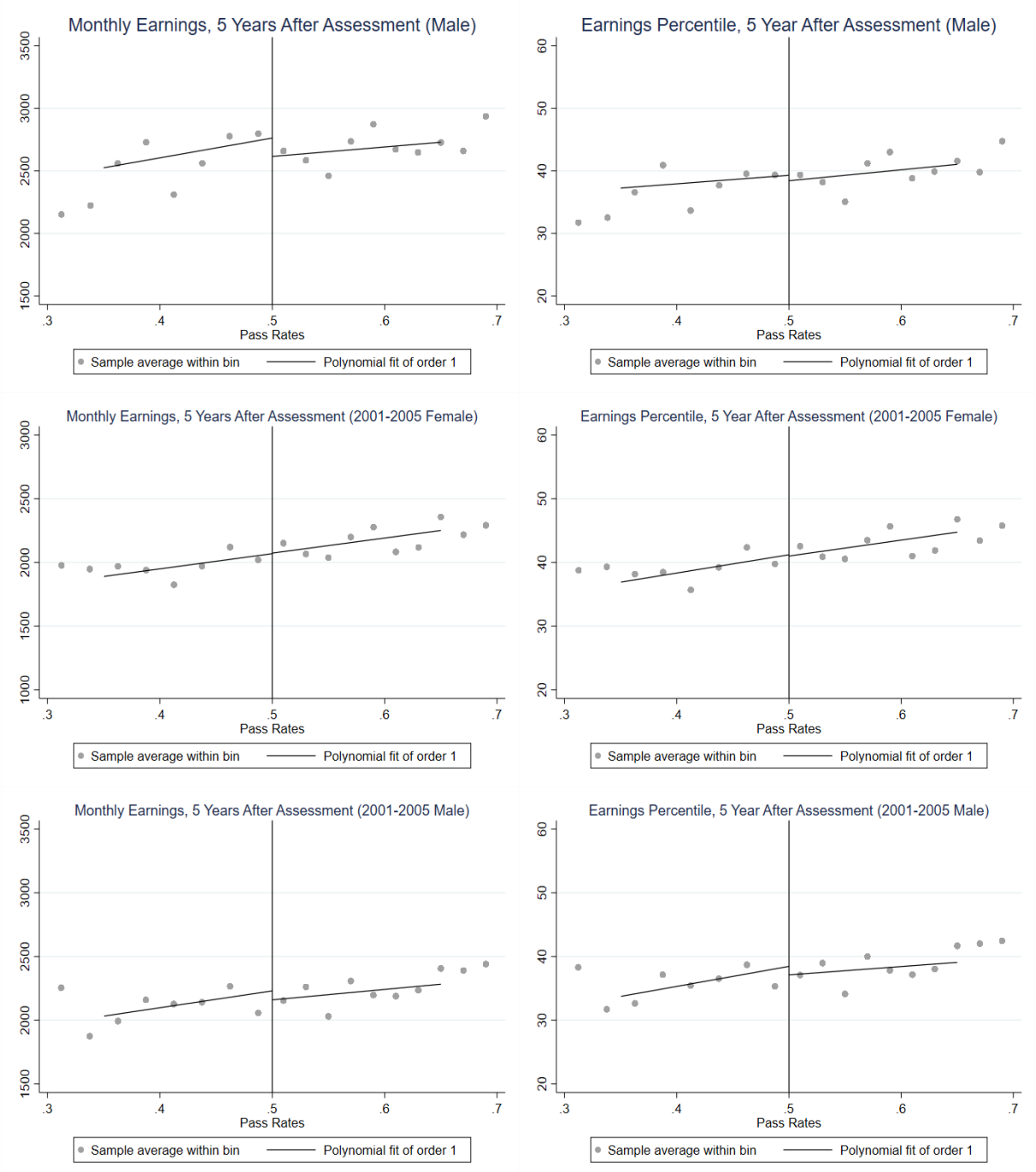
Note: This figure gives male average degree completion rates up to five years post assessment. Each dot represents a sample average within a 0.025 bin for pass rates below 0.5 and a sample average within a 0.020 bin for pass rates above 0.5. The fit comes from a local linear regression with a bandwidth of 0.15.

Appendix Figure A6: Number of Courses Passed by Semester in the Year Before Performance Assessment (Female Students Assessed in 2010)



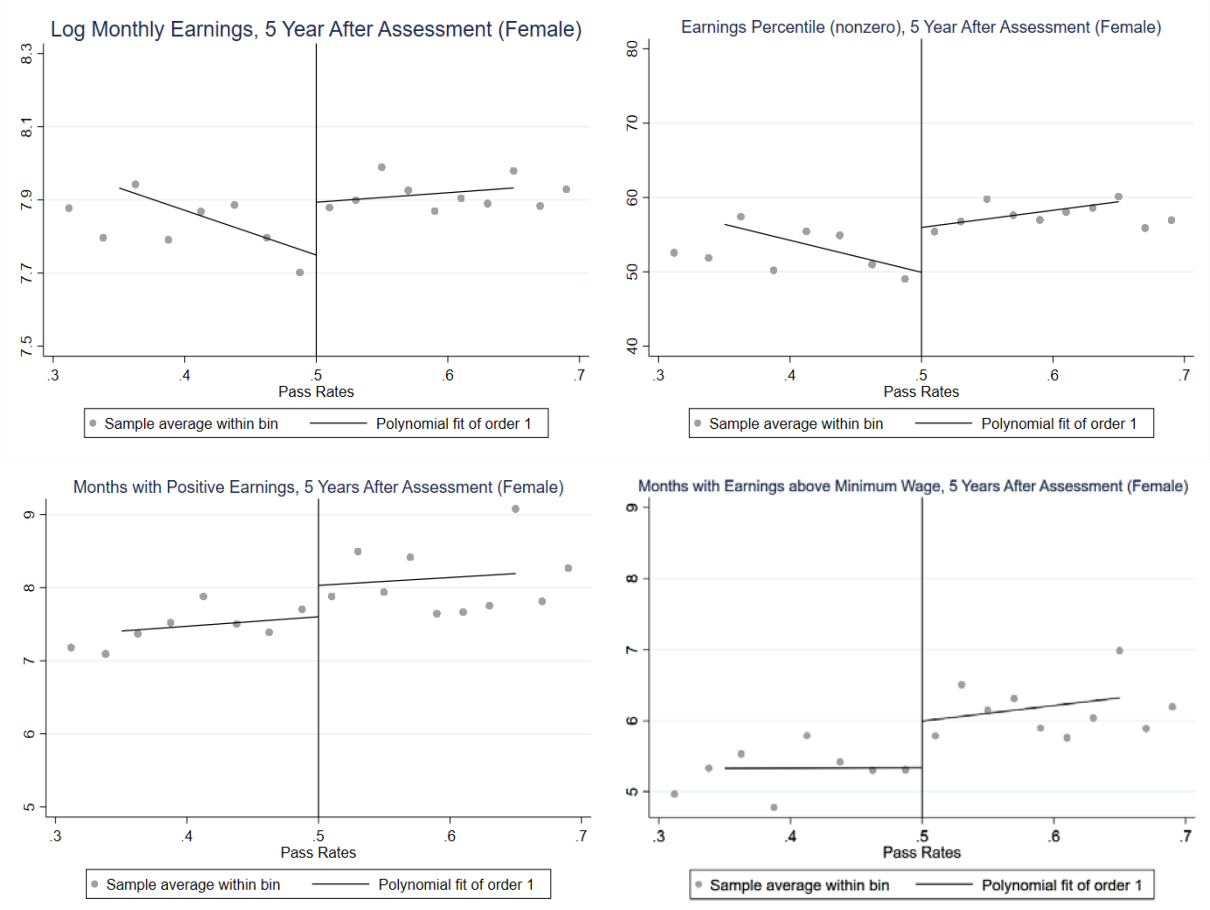
Note: This figure gives information on the average number of courses passed by semester for female sample assessed in 2010. Each dot represents a sample average within a 0.025 bin. The fit comes from a local linear regression with a bandwidth of 0.15. To keep cell sizes above twenty, the bins [0.025, 0.050), [0.075, 0.100), [0.125, 0.150), and [0.175, 0200) are grouped with the previous bin.

Appendix Figure A7: Average Monthly Earnings and Earnings Percentile Five Years After Performance Assessment by Gender and Pass Rate (Male Students, 2001–2005 Male Students, and 2001–2005 Female Students)



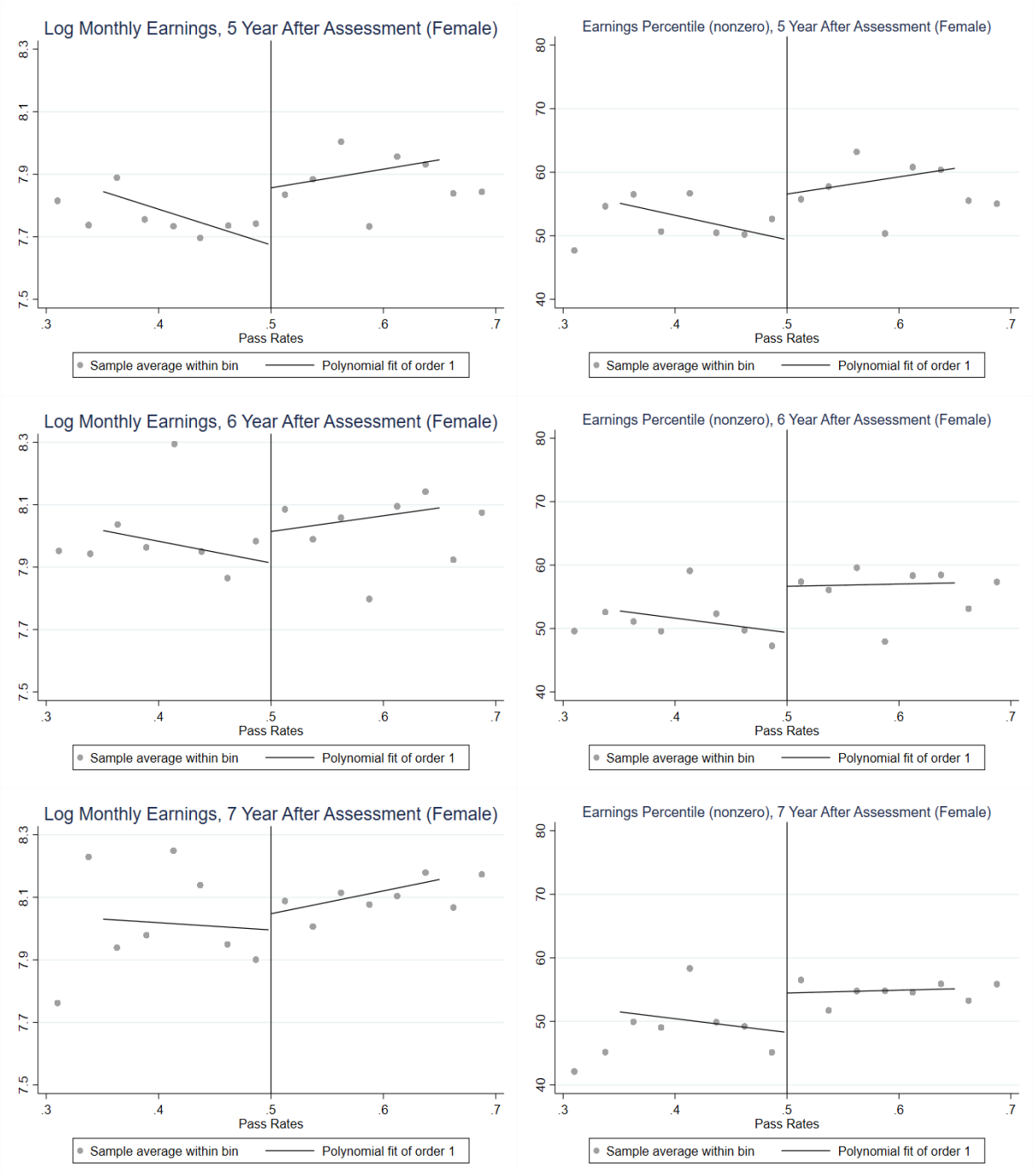
Note: This figure gives average monthly earnings (left column) and birth-cohort-gender earnings percentile (right column) for males in the analysis sample (row 1), females in the pre-policy change cohorts (row 2) and males in the pre-policy change cohorts (row 3). See Note in Figure A6 for further estimation details.

Appendix Figure A8: Average Monthly Earnings in logarithm, Non-zero Earnings Percentile, Annual Months with Positive Earnings and Annual Months with Earnings Above Full-time Minimum Wage by Pass Rate (Female Students)



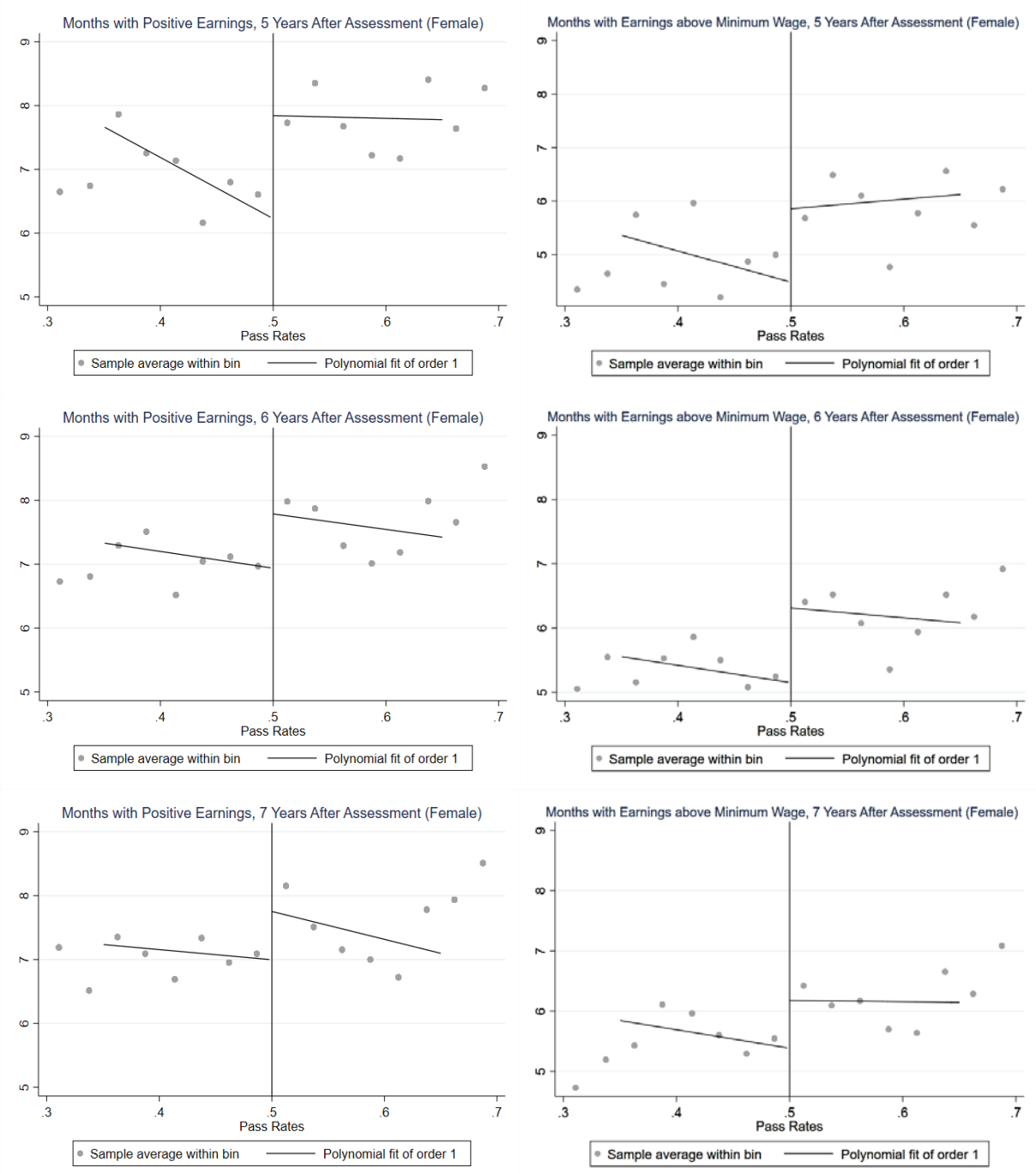
Note: This figure gives female average log monthly earnings (conditioned on positive earnings), birth-cohort-gender earnings percentile (conditioned on positive earnings), annual months with positive earnings, and annual months with earnings above the full-time minimum wage rate five years post assessment. See Note in Figure A6 for further estimation details.

Appendix Figure A9: Average Monthly Earnings in logarithm and Non-zero Earnings Percentile by Year and Pass Rate (Female Students Assessed in 2010)



Note: This figure gives average same-cohort-gender earnings percentile (conditioned on positive earnings) and log monthly earnings (conditioned on positive earnings) five to seven years post assessment for female students assessed in 2010. See Note in Figure A6 for further estimation details.

Appendix Figure A10: Annual Months with Positive Earnings and Annual Months with Earnings Above Full-time Minimum Wage by Year and Pass Rate (Female Students Assessed in 2010)



Note: This figure gives annual months with positive earnings and annual months with earnings above the full-time minimum wage rate five to seven years post assessment for female students assessed in 2010. See Note in Figure A6 for further estimation details.

Appendix Table A1: Donut RD Reduced Form Estimates for Discontinuity in Bachelor's Degree Retention and Completion Rates (Female Students)

	(1)	(2)	(3)	(4)
	(0.485, 0.515) Donut		(0.470, 0.530) Donut	
	RF	2SLS	RF	2SLS
Loan	0.150***		0.107*	
	(0.051)		(0.062)	
Enrollment	0.111**	0.739***	0.055	0.518
	(0.049)	(0.154)	(0.060)	(0.328)
5-year Completion	0.059	0.396	0.051	0.474
	(0.045)	(0.291)	(0.053)	(0.494)
7-year Completion	0.127***	0.848**	0.092	0.861
	(0.054)	(0.361)	(0.063)	(0.608)
Bandwidths	0.15		0.15	
Observations	2,385		2,196	

Note: This table gives the donut RD reduced form effects of crossing the performance criteria threshold (columns 1–2) and 2SLS effects of loan receipt (columns 3–4) on \ subsequent loan taking, re-enrollment in the year after initial eligibility assessment, and graduation within five and seven years of first enrolment for female students.. See Note in Table 4 for further estimation details. *** p<0.01, ** p<0.05, * p<0.1.

Appendix Table A2: Effects of Student Loan Access on Bachelor's Degree Retention and Completion Rates (Female Students), Bandwidths of 0.20 and 0.10

	(1)	(2)	(3)	(4)
	RF		2SLS	
Loan	0.127***	0.216***		
	(0.038)	(0.061)		
Enrollment	0.095***	0.172***	0.718***	0.796***
	(0.035)	(0.056)	(0.151)	(0.146)
5-year Completion	0.091***	0.092*	0.715***	0.424**
	(0.031)	(0.048)	(0.265)	(0.203)
7-year Completion	0.098***	0.097*	0.769***	0.449*
	(0.038)	(0.058)	(0.298)	(0.249)
Bandwidths	0.20	0.10	0.20	0.10
Observations	3,657	1,686	3,657	1,686

Note: This table uses bandwidths of 0.10 and 0.20 and gives the reduced form effects of crossing the performance criteria threshold (columns 1–2) and 2SLS effects of loan receipt (columns 3–4) on subsequent loan taking, re-enrollment in the year after initial eligibility assessment, and graduation within five and seven years of first enrolment for female students. See Note in Table 4 for further estimation details. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Appendix Table A3: Discontinuities in Bachelor's Degree Retention and Completion Rates by Gender (2001–2005 Student Cohorts)

	(1)	(2)
	Female	Male
	RF	RF
Loan	-0.019 (0.035)	0.017 (0.033)
Enrollment	-0.027 (0.034)	0.019 (0.032)
5-year Completion	-0.044 (0.034)	0.007 (0.030)
7-year Completion	-0.029 (0.039)	-0.041 (0.037)
Bandwidths	0.15	0.15
Observations	2,811	3,009

Note: This table gives the reduced form effects of crossing the performance criteria threshold on subsequent loan taking, re-enrollment in the year after initial eligibility assessment, and graduation within five and seven years of first enrolment for students in cohorts prior to implementation of the performance criteria policy. See Table 4 Note for further estimation details. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Appendix Table A4: Effects of Student Loan Access on Retention and Bachelor's Degree Completion Rates (Female Students without Student Allowance)

	(1) RF	(2) 2SLS
Loan	0.189***	
	(0.066)	
Re-enrollment	0.113*	0.598***
	(0.067)	(0.227)
5-year Completion	0.147***	0.777**
	(0.052)	(0.311)
7-year Completion	0.120*	0.634**
	(0.066)	(0.318)
Observations	1,200	
Bandwidths	0.15	

Note: This table uses only female students who have not received any student allowance through the year of performance assessment and gives the reduced form effects of crossing the performance criteria threshold (columns 1–2) and 2SLS effects of loan receipt (columns 3–4) on subsequent loan taking, re-enrollment in the year after initial eligibility assessment, and graduation within five and seven years of first enrolment. See Note in Table 4 for further estimation details. *** p<0.01, ** p<0.05, * p<0.1.

Appendix Table A5: Estimates for the Effects of Student Loan Access on Average Monthly Earnings and Earnings Percentile by Field of Study (Female Students)

	(1)	(2)	(3)	(4)	(5)	(6)
	Science Majors		Business Majors		Other Majors	
	RF	2SLS	RF	2SLS	RF	2SLS
Monthly Earnings $t + 5$	293	1,531	287	1,426	296	2,364
	(331)	(1,791)	(386)	(1,912)	(191)	(1,814)
Earnings Percentile $t + 5$	7.07	36.93	5.72	28.42	5.94*	47.35
	(6.20)	(34.33)	(7.07)	(34.99)	(3.61)	(35.07)
Bandwidths	0.15		0.15		0.15	
Observations	450		521		1,716	

Note: This table gives RD estimates of the reduced form effects of crossing the performance criteria threshold (columns 1, 3, and 5) and 2SLS effects of loan receipt (columns 2, 4, and 6) on earnings outcomes five years after initial performance assessment for female students by field of study. See Table 4 Note for further estimation details. *** p<0.01, ** p<0.05, * p<0.1.

Appendix Table A6: Bounded and Donut Estimates for the Effects of Student Loan Access on Average Monthly Earnings and Earnings Percentile (Female Students)

	(1)	(2)	(3)	(4)	(5)	(6)
	Bounded Estimates		(0.485, 0.515) Donut		(0.470, 0.530) Donut	
	RF	2SLS	RF	2SLS	RF	2SLS
Monthly Earnings $t + 5$	285*	1,822*	590***	3930**	611**	5727
	(155)	(1,028)	(199)	(1786)	(239)	(3932)
Earnings Percentile $t + 5$	6.03**	38.53*	9.22***	61.42**	9.13**	85.54
	(2.92)	(20.64)	(3.07)	(27.86)	(3.71)	(59.36)
Bandwidths	0.15		0.15		0.15	
Observations	2,640		2,385		2,196	

Note: This table gives bounded estimates and donut RD estimates of the reduced form effects of crossing the performance criteria threshold (columns 1, 3, and 5) and 2SLS effects of loan receipt (columns 2, 4, and 6) on earnings outcomes five years after initial performance assessment for female students. See Table 4 Note for further estimation details. *** p<0.01, ** p<0.05, * p<0.1.

Appendix Table A7: Effects of Student Loan Access on Average Monthly Earnings and Earnings Percentile (Female Students), Bandwidths of 0.20 and 0.10

	(1)	(2)	(3)	(4)
	RF		2SLS	
Monthly Earnings $t + 5$	284**	301	2,234*	1,394
	(136)	(197)	(1,200)	(935)
Earnings Percentile $t + 5$	5.88**	6.23*	46.18**	29.15
	(2.54)	(3.70)	(23.05)	(17.91)
Bandwidths	0.20	0.10	0.20	0.10
Observations	3,657	1,686	3,657	1,686

Note: This table uses bandwidths of 0.10 and 0.20 and gives the reduced form effects of crossing the performance criteria threshold (columns 1–2) and 2SLS effects of loan receipt (columns 3–4) on earnings outcomes five years after initial performance assessment for female students. See Table 4 Note for further estimation details. *** p<0.01, ** p<0.05, * p<0.1.

Appendix Table A8: Reduced Form Estimates for Discontinuity in Labor Market Outcomes by Year (Male Students and 2001–2005 Student Cohorts)

	(1)	(2)	(3)	(4)	(5)	(6)
	Average Monthly Earnings			Earnings Percentile		
	Male	2001–2005 Male	2001–2005 Female	Male	2001–2005 Male	2001–2005 Female
	RF	RF	RF	RF	RF	RF
Year *t*	111	-29	42	2.76	-0.94	1.68
	(68)	(50)	(47)	(1.73)	(1.55)	(1.95)
Year *t* + 1	53	25	41	0.68	0.56	0.88
	(89)	(63)	(69)	(2.11)	(1.75)	(2.28)
Year *t* + 2	-22	5	1	-1.23	-0.01	-0.35
	(113)	(85)	(81)	(2.25)	(2.06)	(2.31)
Year *t* + 3	-48	39	-1	-0.90	0.92	1.40
	(144)	(104)	(131.056)	(2.64)	(2.18)	(2.42)
Year *t* + 4	-37	58	-6	1.48	1.76	-0.55
	(171)	(116)	(117)	(2.74)	(2.37)	(2.57)
Year *t* + 5	-192	36	-43	-0.71	0.76	-1.35
	(213)	(137)	(133)	(2.84)	(2.54)	(2.67)
Bandwidths	0.15	0.15	0.15	0.15	0.15	0.15
Observations	2,853	3,009	2,811	2,853	3,009	2,811

Note: This table gives the reduced form effects of crossing the performance criteria threshold on earnings outcomes for male students in the analysis sample (columns 1 and 4), and male and female students in cohorts prior to the implementation of the performance criteria. See Table 4 Note for further estimation details. *** p<0.01, ** p<0.05, * p<0.1.

Appendix Table A9: Effects of Student Loan Access on Average Monthly Earnings and Earnings Percentile (Female Students Assessed in 2010), Bandwidths of 0.20 and 0.10

	(1)	(2)	(3)	(4)
	RF		2SLS	
Monthly Earnings $t + 5$	424*	382	2,018*	1,316
	(228)	(345)	(1,218)	(1,256)
Monthly Earnings $t + 6$	459*	670*	2,187	2,310
	(253)	(361)	(1,339)	(1,446)
Monthly Earnings $t + 7$	396	759**	1,885	2,619*
	(278)	(403)	(1,413)	(1,649)
Earnings Percentile $t + 5$	8.33*	7.74	39.68	26.70
	(4.27)	(6.48)	(23.07)	(23.85)
Earnings Percentile $t + 6$	8.36	12.53*	39.82*	43.21*
	(4.38)	(6.31)	(23.33)	(25.64)
Earnings Percentile $t + 7$	5.86	11.13*	27.92	38.37
	(4.45)	(6.48)	(22.45)	(26.01)
Bandwidths	0.20	0.10	0.20	0.10
Observations	1,368	636	1,368	636

Note: This table uses bandwidths of 0.10 and 0.20 and gives the reduced form effects of crossing the performance criteria threshold (columns 1–2) and 2SLS effects of loan receipt (columns 3–4) on earnings outcomes for female students assessed in 2010. See Tables 4 Notes for further estimation details. *** p<0.01, ** p<0.05, * p<0.1.

Appendix Table A10: Complier Sample Means

	(1)	(2)	(3)	(4)
	Analysis Sample		Female	
	Pass Rates 0.35-0.65	Compliers	Pass Rates 0.35-0.65	Compliers
Female	0.49 (0.50)	0.46		
Age	20.20 (0.98)	20.17	20.19 (0.98)	20.14
Māori or Pasifika	0.16 (0.37)	0.16	0.21 (0.41)	0.20
European	0.67 (0.47)	0.68	0.64 (0.48)	0.67
Disability	0.04 (0.20)	0.05	0.04 (0.19)	0.05
University Student	0.85 (0.36)	0.93	0.84 (0.37)	0.88
Studying Full-time and Full Year	0.87 (0.33)	0.92	0.86 (0.34)	0.91
Business Major	0.23 (0.42)	0.24	0.20 (0.40)	0.19
Science Major	0.26 (0.44)	0.35	0.16 (0.37)	0.27
Borrowed Loan Amount	9,650.00 (3,756.98)	9,439	9,491 (3,582)	9,433
High School Deciles	6.50 (2.66)	6.59	6.21 (2.76)	6.22
NCEA Level 3 Percentile	0.39 (0.14)	0.39	0.40 (0.15)	0.37

Note: Columns (1) and (3) report sample means and standard deviations (in the parentheses) for students with pass rates between 0.35 to 0.65. Columns (2) and (4) report sample means for compliers using Abadie's (2003) kappa-weighting scheme: $E[X_i|\ loan_{i1}^{t+1} > loan_{i0}^{t+1}] = \frac{E[K_i\, X_i]}{E[K_i]}$ where $K_i = 1 - \frac{loan_i^{t+1}(1 - 1[z_i^t \geq 0])}{1 - P(1[z_i^t \geq 0]|X_i)} - \frac{(1 - loan_i^{t+1})1[z_i^t \geq 0]}{P(1[z_i^t \geq 0]|X_i)}$

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