Conflicting Incentives: Government Financial Aid, Vocational-to-University Track Change and Graduates' Wages in Chile

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Although literature on education economic returns is not uncommon, research focusing in vocational students is quite scarce. This paper addresses labor market outcomes of vocational high schools' students and their trajectories in the two possible paths in the Chilean higher education system: college education or vocational higher education. Using OLS regressions, we find that vocational high school education is associated with higher relative wages compared with students from regular or academic high schools. Moreover, when students follow tertiary education, higher relative wages are expected both for students from vocational and general high schools, specially for the latter. Using a regression discontinuity design (RDD) on two different discontinuity rules in the allocation of financial aid, we found that vocational high school students that continue in vocational higher education have neutral to positive wage impact of pursuing higher education. However, these students face a negative wage impact when they are induced to follow college higher education.

KEYWORDS

vocational education, regression discontinuity, college, university, educational track, governmental financial aid, labor market returns

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Incentivos contradictorios: Ayuda financiera, cambio de track educacional y salarios de los graduados de educación superior en Chile

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Aunque existe variada literatura sobre los beneficios económicos de la educación, es escasa la investigación enfocada en la formación técnico profesional o vocacional. Este artículo aborda los resultados en el mercado laboral de los estudiantes de educación secundaria vocacional y sus trayectorias en los dos posibles caminos del sistema de educación superior chileno: cambiarse a la educación universitaria o continuar en la educación superior técnico profesional. Por medio de regresiones lineales, encontramos que la educación secundaria técnico profesional se asocia a salarios iniciales relativamente más altos en comparación con los estudiantes secundarios del track académico o científico humanistas. En general, para todos quienes continúan en la educación superior se esperan salarios más altos, tanto técnico profesionales como científico humanistas. Usando regresiones discontinuas, con dos reglas de discontinuidad en la asignación de ayuda financiera, encontramos que los estudiantes de secundaria vocacional que continúan en la educación superior vocacional tienen un impacto salarial de neutral a positivo al seguir la educación superior. Sin embargo, estos estudiantes enfrentan un impacto salarial negativo cuando se les induce a cambiarse de track hacia la educación superior universitaria.

1 | INTRODUCTION

Wage gaps between different ethnic, gender or socioeconomic groups in the Americas have been widely recorded (Atal et al., 2009; Contreras and Gallegos, 2011).). However, most studies do not address how educational and occupational trajectories influence wage differentials or which factors could reduce gaps between high- and low-income groups. This paper follows a cohort of students in Chile for thirteen years, distinguishing them by high school educational type (vocational or academic) and income group (higher or lower). Using descriptive statistics and causal regression analysis, we measure the economic impact of institutional and educational factors that affect students' labor market outcomes by income groups and school type in Chile, deriving some policy implications. This paper starts by analyzing students from vocational high schools in Chile (Technical-Professional or TP as they are called in Chile) and compare their performance with students that attend academic track high schools (known in Chile as Scientific-Humanistic or SH). Vocational high schools graduate about 40% of students in Chile and are usually attended by lower income students (Farías and Sevilla, 2015). Traditionally, these TP high schools direct students towards the labor market, while academic SH high schools, mainly prepare students to attend colleges and universities. However, in 2019 over 75% of students that graduate from high schools attended higher education (SIES, 2015), and almost half of the students from vocational high schools enrolled in some tertiary level educational institution. Nevertheless, higher educational trajectories are not homogeneous. Students from TP high schools enroll at different rates, different times and mostly in vocational higher education, when compared with their counterparts in SH education (Farías and Sevilla, 2015; Rolando et al., 2012). Moreover, the dropout, stopout and timely graduation rates are associated with high school type, family income and academic credentials (Bordon et al., 2015; Calcagno et al., 2008; Goldrick-Rab, 2010; Melguizo et al., 2011; Stratton et al., 2008; Yorke and Longden, 2004). SH and TP students face different conditions for higher education enrollment, as governmental financial aid imposes different requirements for college or vocational higher education. While recent studies analyzed educational trajectories after high school, fewer research studies approach the impact of vocational higher education on labor market outcomes and the uneven results between students from vocational and academic high schools and from different income groups (Blanco et al., 2018; Larrañaga et al., 2014). Regarding the impact of education on wages, some studies looked at the effect of financial aid for college education on labor market outcomes in Chile (Bucarey et al., 2018), and the impact of financial aid on vocational higher education enrollment and graduation (Aguirre, 2019).

This study innovates by profiling students considering their high school type (vocational or SH) and their family socioeconomic characteristics. Using these categories and detailed information of high school and higher education specialization, we follow students for over a decade and analyze their educational and labor market trajectories. The analysis of these trajectories allows us to identify and measure the economic impact of the main barriers and bottlenecks that affect low income students from vocational high schools. The study shows that once students attend higher education, both types of students benefit from college and vocational higher education; however, students from SH high schools tend to have higher economic rewards from college education. Our research builds upon the previous work of several authors (Aguirre, 2019; Blanco and Meneses, 2013; Flores et al., 2020; Solis, 2017). To provide causal estimates, we take advantage of strict discontinuity rules for financial aid, which requires a minimum score in the standardized college selection test (Prueba de Selección Universitaria, PSU) for applying to loans and scholarships. Previous research has shown that governmental financial aid increases enrollment in college (Solis, 2017) and in vocational enrolment (Aguirre, 2019; Blanco and Meneses, 2013). Recent

research has shown that the financial aid scheme promotes a substitution between college and vocational education (Blanco and Meneses, 2013; Flores et al., 2020) and that college education enrolment increases has had no impact on wages (Bucarey et al., 2018). This paper contributes by analyzing the causes of the null result in wages found by Bucarey et al. (2018), which can be attributed to the substitutions between college and vocational education (Flores et al., 2020). Our model showed the impact of financial aid, suggesting that students from SH high schools present negative wage impacts if they follow their higher education program in a vocational higher education institution. On the contrary, low income students from vocational high schools show a null or positive impact on wages after vocational higher education enrolment. The analysis also showed that college enrolment has a negative wage impact on low income students from vocational high schools. This pattern is particularly pronounced for students that enroll two or more years after high school graduation. Therefore, results suggest that students who switch educational tracks (from vocational to college, or SH to vocational and, some induced by the government financial aid system), tend to have worse labor market outcomes than students continuing in the same educational track.

2 | THE EDUCATIONAL SYSTEM IN CHILE

Chile has shown important improvements in all educational levels, increasing the overall educational enrolment rate during the last 25 year SIES (2015). Early childhood education net enrolment rate for children between 0-3 has increased from 5.5% in 1990 to 29.1% in 2015, while for ages between 4 and 5 years old it already reaches 90% (CASEN, 2015). The net primary and secondary education enrolment rate reached 93% and 74% respectively that year. The important increase in coverage has been sustained with the expansion of public expenditure and market demand-based subsidy mechanisms. While successful in coverage, challenges remain regarding quality, equity, and preschool coverage. The Chilean school system is ranked in the third last position in PISA performance among the OECD countries and is above the average in the correlation between parental socioeconomic status and test scores OECD (2016). For instance, students in the top 20% of higher socioeconomic status outperform their peers at the bottom 20%, with a gap equal to 3.5 years of schooling OECD (2016). Moreover, on average, students in private schools performed significantly better than students in public schools, while results of students in Chilean public schools are below the performance of students in Latin American public schools OECD (2016)). At the same time, the early childhood care enrolment rate remains low compared to the OECD average, particularly for children age three or lower OECD (2016). Furthermore, at the secondary level, although the gross enrolment rate reaches 99.6%, the net enrolment rate only reaches 73.6%, suggesting a significant overage in this education level, due to important dropout and stopout rates. Although some policies are in place to tackle this issue, there is an important window of opportunity to review these indicators and increased policy effectiveness. Likewise, tertiary education expansion has been explosive, increasing their net enrolment rate coverage from 12.8% in 1990 to 37.4% in 2015, and still increasing (CASEN, 2017). The tertiary education system, including both university and vocational education, is currently reaching nearly 1.3 million students; this growth has been promoted largely by financial aid in the form of loans and scholarships and by the expansion of the private sector SIES (2015). In 2016, a national free tuition policy was introduced for students in the lowest 50% of the population. In 2017, free tuition covered nearly 260 thousand students, which represented over 20% of the total higher education enrolment. Nearly 40% of secondary students attend vocational high schools and over 50% of them will enter

higher education in the short term SIES (2015). The increase in higher education coverage has reduced the importance of vocational secondary training, as over half of vocational high school students will pursue higher education. This suggests the need for a large-scale evaluation and redesign of strategies in this sector. Some research even shows that financial aid provides a strong incentive for attending a university rather than vocational higher education alternatives (Blanco and Meneses, 2013) . Increased coverage also brought new challenges, as the system allowed access to previously excluded segments of the population, which come with different needs and preparation levels. Challenges remain regarding the preparation of graduates for the labor market: according to the Survey of Adult Skills (PIAAC, 2015), Chile ranks among the three lowest OECD countries in adult reading, numeracy proficiency and problem- solving in technology-rich environments. In the matter of social inclusion, the Program for Support and Effective Access to Higher Education (PACE in Spanish) aims to allow access and permanence to higher education amongst vulnerable students and had been scaled up since it was launched in 2014. Preliminary results suggest that although the program shows important degrees of effectiveness, deeper refinements are required to achieve the full potential of this policy (Cooper et al., 2019). Labor market outcomes of higher education students in Chile are informed by the government through "Mi Futuro", an informational web site containing official information on tertiary level education. This web site allows users to contrast the wages of students of vocational higher education versus college education. However, questions remain regarding the trajectories and origins of students. There is no information or research that describes the different labor market outcomes for students of different high schools or for students that did not finish their higher education. This research intends to fill part of this gap and open up new questions regarding educational and occupational trajectories.

3 | DATA CONSTRUCTION AND VARIABLES

To analyze the educational and work trajectories of students, we put together a panel data set of students, following them from age 14 to age 27. The first point of the analysis is a national mandatory standardized test in 8th grade – SIMCE. We also have information on college entry and graduation, as well as wages in the private sector.

| SIMCE and High School

The System of Quality Measurement in Education (or SIMCE by its Spanish acronym) is a government-provided, national, standardized mandatory test, taken by 8th and 10th graders in Chile. The two SIMCE tests (mathematics and language) have an average of 250 points (SD= 50). The test is evaluated using the item response theory or IRT (a methodology where questions are uncorrelated with previous answers) to measure abilities and curriculum mastered at a nationwide level. SIMCE test scores are used by the government to evaluate and categorize schools at a national level but have no consequences for the students. SIMCE tests have parental and teacher questionnaires that provide self-reported information for parents' socio-demographic factors such as maternal education, family per capita income level, and type of school attended, among others. We also have information about high school graduation grades and vocational track in 12th grade.

Higher Education, Graduation and Financial Aid

We have records of entrance into higher education as well as all graduations for cohorts between 2009-2017 in addition to financial aid applications and which students benefited from aid. We would use a binary variable that takes the value of 1 if the students graduated from tertiary education between those dates, and 0 otherwise. We also identify the major and college of graduation and the year of graduation.

TABLE 1   Data Sets Used and Sample Size

VARIABLES	(1) Sample	(2) Mean	(3) Std. Dev.	(4) Min	(5) Max
High School					
Private High School	253495	0.0549676	0.2279174	0	1
SIMCE Test Score	249372	253.167	47.0637	110.95	398.88
Family Income	253495	3.306965	2.93748	1	15
High School Dropout	253495	0.2730389	0.4455215	0	1
High School Repetition	253495	0.1022663	0.3029988	0	1
Female	253495	0.4995049	0.5000007	0	1
Higher Education					
Graduated Vocational	253495	0.1660506	0.3721268	0	1
Graduated University	253495	0.1956725	0.3967183	0	1
Higher Education Stop-out	253495	0.2306397	0.421243	0	1
Vocational Dropout	253495	0.366453	0.4818362	0	1
College Dropout	253495	0.3754117	0.48423	0	1
Vocational/College Student	253495	0.1782047	0.3826857	0	1
HE Major	253495	31.69831	66.32722	0	875
Labor Market					
Worked and Studied College	253495	0.1597389	0.3663644	0	1
Worked and Studied Vocational	253495	0.0511805	0.2203662	0	1
Wages 2017	158300	556328	387306	6	3104246

Wages

Wages come from the National Unemployment Insurance System, which has provided us with the wages of the students between 2015 and 2018 in the private sector. We do not have information regarding workers of the public sector or for informal workers. According to the national representative survey CASEN 2017, we know that governmental workers are 6% of these individuals and a similar proportion of students in the informal sector.
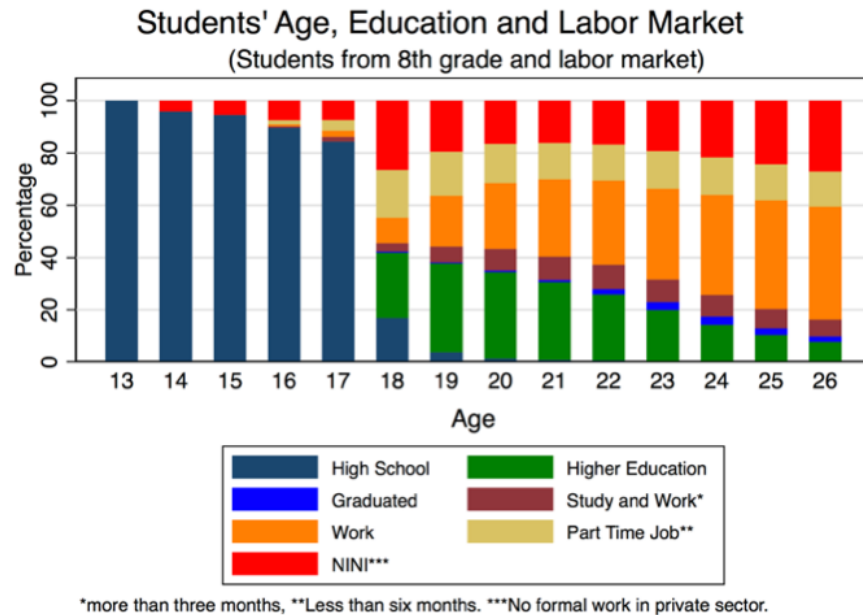
Students' Age, Education and Labor Market
(Students from 8th grade and labor market)

FIGURE 1   Educational and work trajectories

| Financial Aid Applications

TThe Chilean government offers loans and scholarships using a centralized financial aid application system. Students that apply to this system are assigned financial aid according to their academic performance and family income level. Those who rank among the four lowest income quintiles qualify for governmental loans. The inclusion of the financial aid application allows us to compare students from this cohort and from previous cohorts that tried to enroll in higher education. The use of previous cohorts is particularly important as students from vocational high schools enroll in higher education two or more years after finishing high school.

4 | DESCRIPTIVE RESULTS

We start by analyzing the educational and job market trajectories of over 240 thousand students, from 8th grade (the end of middle school) to 9 years after high school graduation. Figure 1 shows that over 14% of students drop out of high school when students are 17 years old; some of them enter the labor market. After 12th grade in high school, most students graduated from high school, while 17% of students continue in high school. We see that 26% of students enter higher education, and by the third year -after high school graduation- over 45% of students study in higher education (36% study and 9% study and work). However, these trajectories are not the same for students from different income group and high school type.

4.1 | High School Educational Type

We can differentiate students by high school educational type. In Chile there are two main high-school educational tracks that start in 11th grade: the Vocational (education that prepares people to work as a technician) and the Scientific-Humanistic tracks. Figure 2

Vocational High School Students
(Students from 8th grade and labor market)

*more than three months, **Less than six months. ***No formal work in private sector.
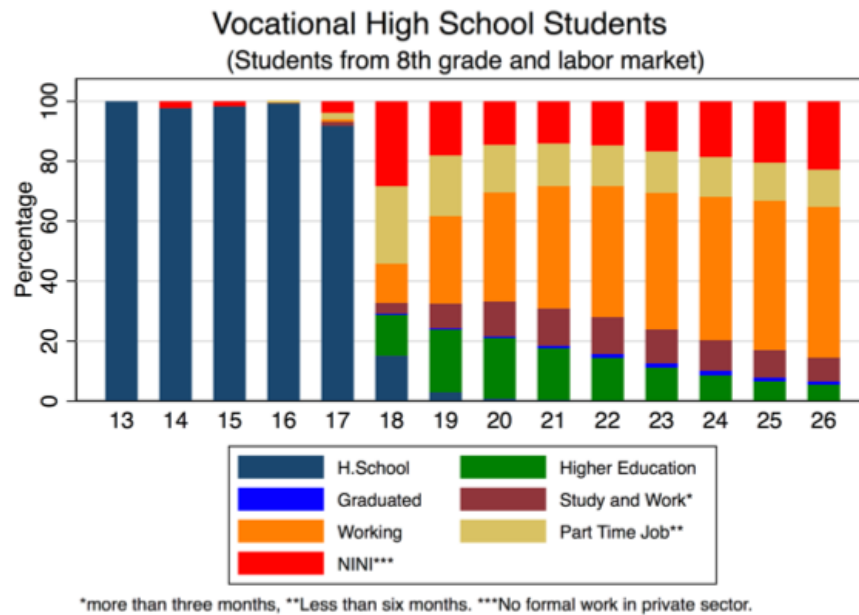
FIGURE 2   Educational and work trajectories of Vocational High School Students

shows educational and work trajectories of vocational high school students (as defined in 11th grade). A majority of these students who attended vocational high schools start work immediately; in fact, by age 20, 72% of those students work (41% full time, 18% part time, 13% work and study). Some students who attended vocational high schools do go to pursue higher education, but some not immediately. When those students are 18, 19% are in higher education (15% study only, 4% work and study). When those students are age 20, 36% of them study in higher education (23% study only, 13% work and study). These results are similar to similar studies conducted in Chile (Rolando et al., 2012).

The experience of students in Scientific-Humanistic institutions is very different, as shown in Figure 3. At 18 years of age, 40% of students are in higher education, with 36% of them studying and only 4% of them working and studying. When students are 20 years old, 56% of them are attending higher education, with 48% only studying and 8% also working. Regarding the labor market, 42% of students work when they are 20 years old; 20% of them work, 14% of them have partial term work, and 8% study and work.

Figures 2 and 3 show important differences in the profiles of students at age 18. While 40% of students in SC schools are studying, only 19% of students in TP schools are studying. While over 40% of students from TP schools work, only 20% of SC graduates work. These differences in initial profiles tend to disappear as time passes, with similar labor market trajectories when they are 26 years old, but with different educational profiles. SC students study in a higher proportion and over longer time periods. This difference in preparation will have an impact later in their future incomes and labor participation.

Figure 4 shows the labor force participation by high school type. We can see that students from vocational high schools have a very fast labor market integration, with over 40% of working at age 18.

Figure 5 shows monthly wages of students by high school type. While students' ages range between 18 and 24 years old, vocational students have higher wages in the labor market. But when students turn 25 and above, this tendency changes, as students from Scientific- Humanistic schools tend to earn more. This could be explained by the fact
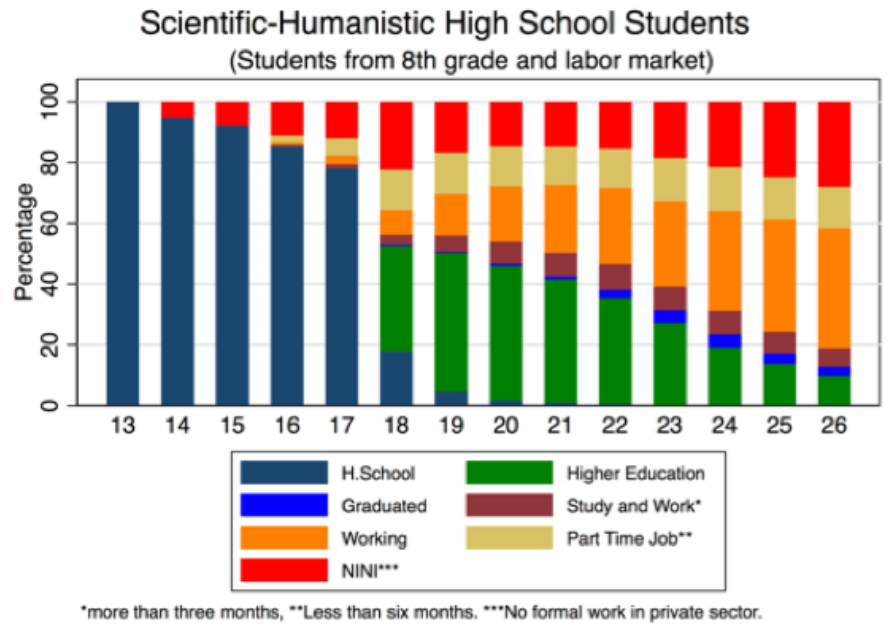
Scientific-Humanistic High School Students
(Students from 8th grade and labor market)

*more than three months, **Less than six months. ***No formal work in private sector.

FIGURE 3 Educational and work trajectories of Scientific-Humanistic High School Students

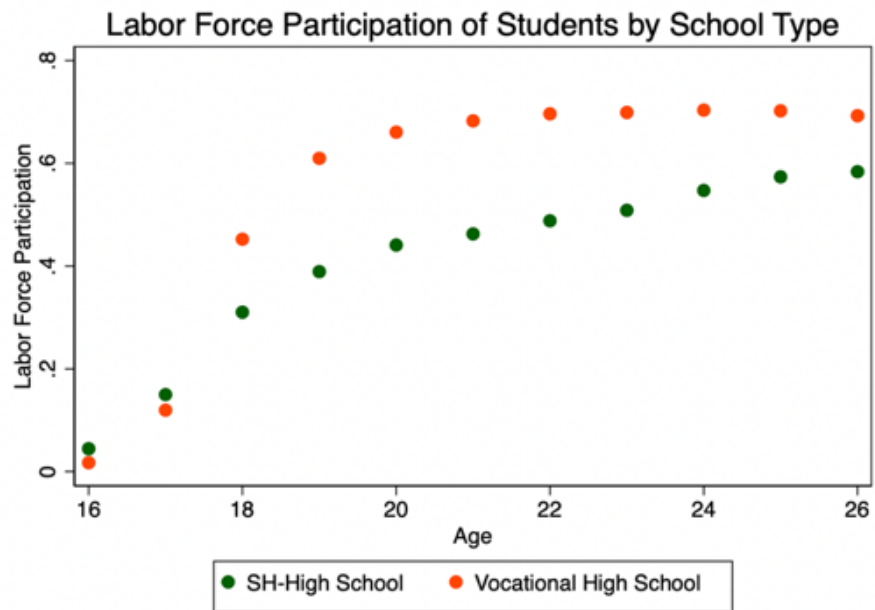## Labor Force Participation of Students by School Type

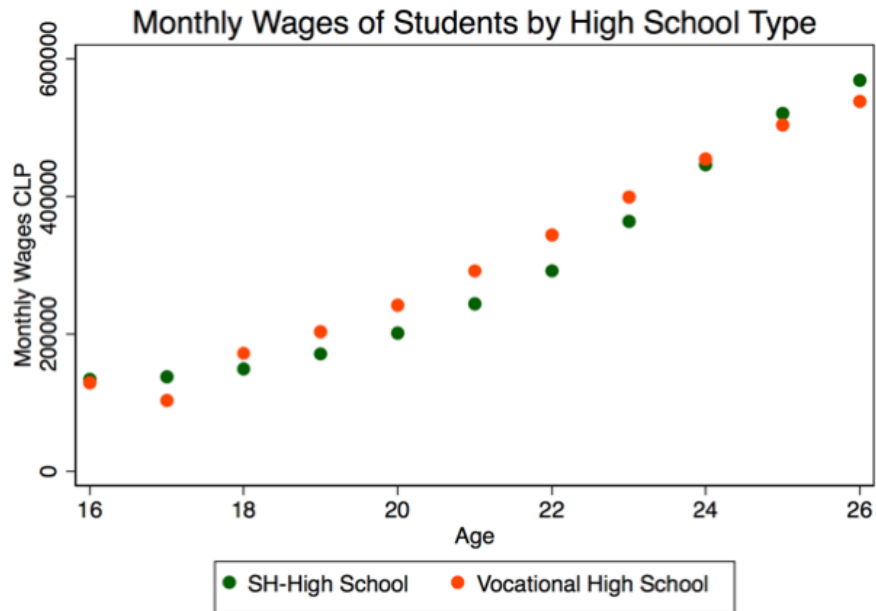**FIGURE 4** Labor Force Participation by HS Type

FIGURE 5   Monthly Wages by HS Type

SH students start graduating from higher education with higher salaries than their TP counterparts.

4.2 | Income Groups

Students can also be differentiated by income. In this case, four income groups of different sizes are described in Table 2.
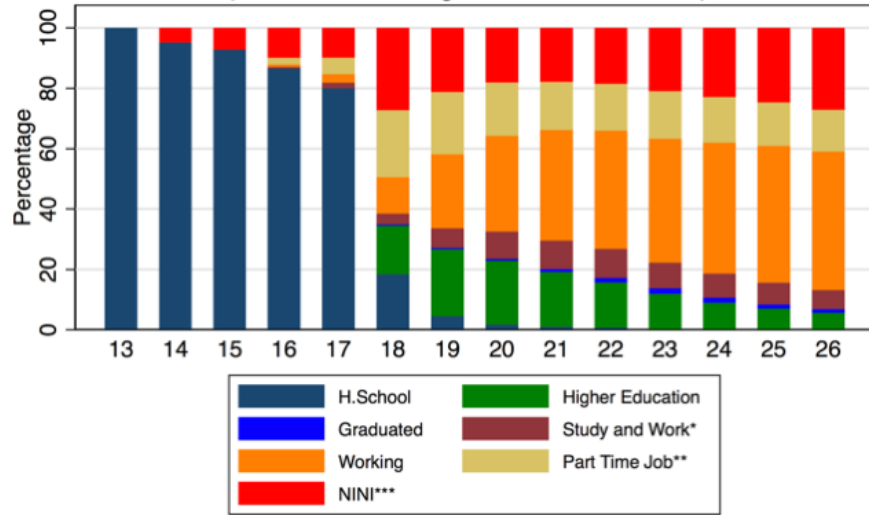
TABLE 2   Income groups and sample size

Variables	Sample	Vocational	Monthly Income (US$)
Low income	145,214	67,873	$307 < X$
Medium Low	91,798	25,725	$307 < X < 1538$
Medium High	10,313	530	$1538 < X < 3078$
High	6,170	132	$X > 3078$
Total	253,495	94,260	

Figure 6 shows educational and work trajectories of low-income students. Lower income students have a higher proportion of dropouts, repetition, lower higher education access, and higher propensity to work compared to their higher income counterparts. While students from medium-low and medium-high income groups have lower dropout rates, and repetition rates, these are still higher compared to higher income students. There is also a pattern in higher education access and work-study. By age 17, over 15% of low-income students have dropped out of high school and 10% of them are working.

Low and medium-low income groups have a higher proportion of students that work during higher education.

Low Income Students:Family income less than US$ 307 monthly
(Students from 8th grade and labor market)

*more than three months, **Less than six months. ***No formal work in private sector.

FIGURE 6   Educational and work trajectories of Low Income Students

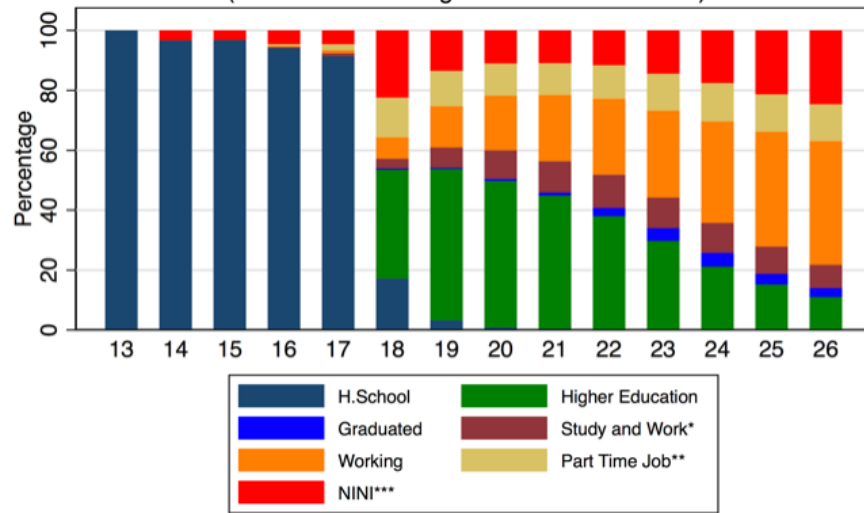## Medium-Low Income: Family income US$ 1538>$>307
(Students from 8th grade and labor market)

*more than three months, **Less than six months. ***No formal work in private sector.

FIGURE 7   Educational and work trajectories of Medium-Low Income Students
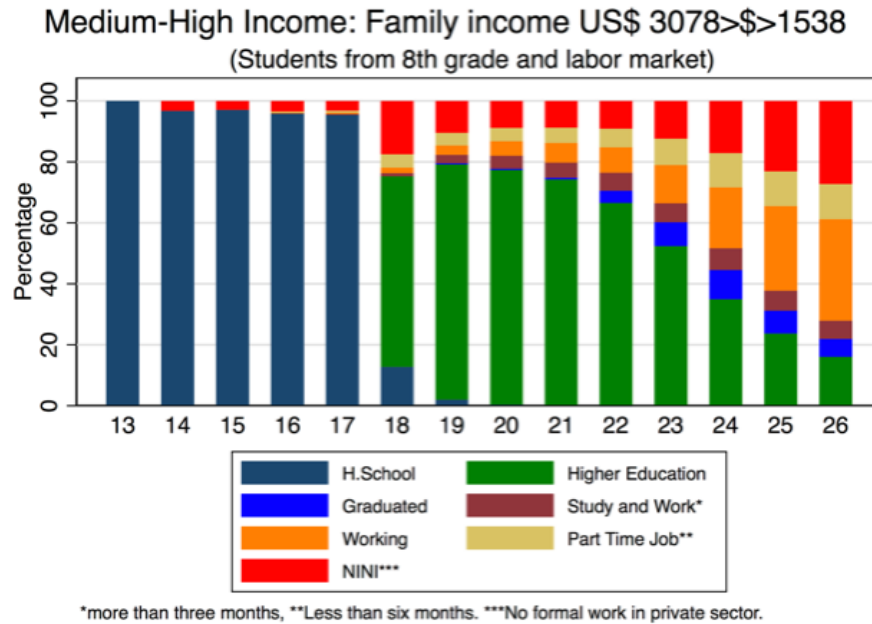
FIGURE 8 Educational and work trajectories of Medium-high Income Students

Figures 8 and 9 show the educational and work trajectories of medium-high and high-income students. High-income students access higher education in a higher proportion and graduate more and faster, compared to other students. Over 80% of high-income students attend higher education at age 19, while less than 20% of low income students attend higher education at that age.

These differences in educational and occupational profiles configure essential patterns that affect labor market outcomes. Figure 10 shows labor force participation of students for each income group. We can see that 40% of low-income students enter the labor force when they are 18 years old, while less than 10% of high-income students enter the labor force at that age.

Figure 11 shows the average monthly wage of students, per income group. We can see that the wages of high and medium-high income students start to grow faster once students become 23 years old. This could be since a high proportion of these students are graduating from college and entering high paying jobs.

Table 3 summarizes the variables per group. Higher income students enter higher education in high proportions, over 90% , while lower income students in lower numbers. We can see that College graduation is positively correlated with income, while vocational graduation is negatively correlated with income. Low income students have a low rate of higher education stop-out. Table 3 presents the percentages from the full sample, while Table 4 presents the same results as a ratio of students that entered higher education.

The results of Table 3 show that there is an important difference between SH and TP high school students. While 70% of SH students enrolled in higher education, only 60% of students from vocational high schools did.

Table 4 shows results of students that enrolled in higher education. We see that graduation rates are correlated with income, while the proportion of students that work and study is negatively correlated with income. The current proportion of stop-out students do not seem to be related with income. Table 4 shows that students from vocational high
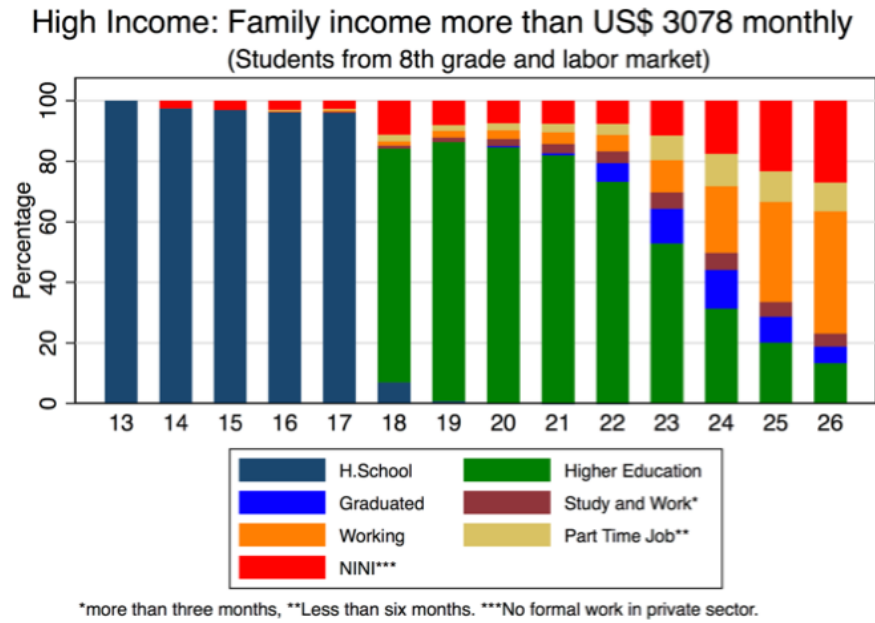
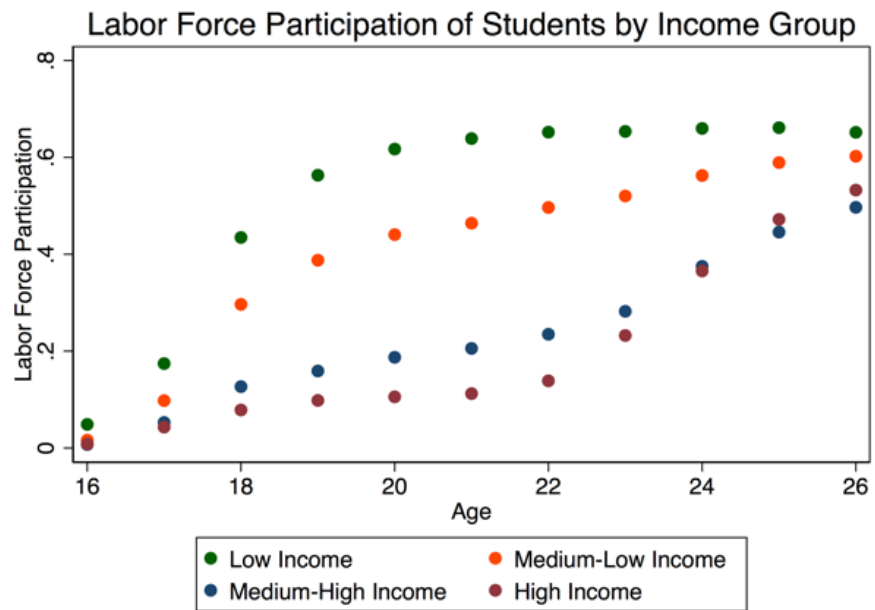**FIGURE 9**   Educational and work trajectories of High-Income Students

FIGURE 10   Educational and Work Trajectories of All Students

FIGURE 11   Monthly Wages of All Students

TABLE 3   Means of variables and groups by 2017

Variables	(1) Low Income	(2) Med-Low Income	(3) Med-high Income	(4) High Income	(5) Vocational HS	(6) SC-H HS
Wage 2017 (1000 CLP)	488	609	852	1,162	538	569
Higher Education	53%	82%	93%	95%	60%	70%
Graduated Vocational	16%	19%	9%	5%	20%	15%
Graduated University	10%	28%	52%	67%	9%	26%
Vocational Dropout	15%	14%	6%	4%	18%	12%
College Dropout	5%	10%	11%	10%	6%	8%
Worked and Studied Coll.	12%	22%	21%	17%	13%	18%
Worked and Studied Voc.	5%	6%	2%	1%	6%	5%
HE Stop-out	17%	31%	33%	31%	20%	25%
HSl Grade Repetition	10%	11%	9%	5%	13%	9%
Female	50%	49%	49%	50%	48%	51%
Vocational/College Student	14%	23%	27%	22%	15%	19%
Private High School	0%	4%	48%	84%	0%	9%
SIMCE Test Score	240	265	295	309	245	258
Financial Aid	23%	34%	15%	3%	23%	37%

schools have a lower graduation rate compared with students from SH high schools. That difference is reflected in an 11% higher dropout rate, while both have similar proportions of stop-outs and students that worked and studied.

TABLE 4 Effectiveness of Higher Education. Ratio over Higher Education Students 2017

Variables	(1) Low Income	(2) Med-Low Income	(3) Med-high Income	(4) High Income	(5) Vocational HS	(6) SC-H HS
Graduated	49%	57%	66%	76%	48%	58%
Vocational					48%	53%
College					48%	62%
Dropout	37%	29%	19%	14%	39%	28%
Student	26%	28%	29%	23%	25%	28%
Worked and Studied	32%	34%	24%	19%	33%	31%
Stop-out	32%	37%	36%	32%	33%	36%

Overall, in this section we have confirmed that enrolment into higher education is related to income, as well as to college graduation. Vocational higher education enrolment is negatively related to income, as well as high school grade repetition. (Table 3). The proportion of students that graduate from higher education has a positive relation to income, while the proportion of dropout students has a negative relationship (Table 4).

Students from vocational high school enroll 10% less into higher education (60% vs 70%) compared to student in SH high schools and also graduate less (48% vs 58%). This lower graduation rate is associated as well to a higher dropout rate (39% vs 28%). When we analyze the success rate of students in vocational versus college higher education, we note that students from vocational high schools have the same graduation rate; students from SH high schools have a higher graduation rate in college (62%) versus vocational higher education (53%).

Income Groups and School Type

Figures 12, 13, 14 and 15 show the labor market trajectories, average number of months worked, wages and total months worked for students per school type and income group. For all income groups, students from vocational high schools show higher labor force participation. On average, students from vocational high schools also work more months per year for all income groups. Consequently, between 2007 and 2017, students from vocational high schools accumulated more months of work experience for all income groups. For students of low and medium-low income, wages of vocational students are either the same or higher, when compared to SH students. For students in the medium-high and high-income groups, wages at age 26 are higher for students from SH high schools.

Table 5 summarizes results on monthly wages and the average number of months worked between 2007 and 2017. Students from vocational schools have over 50% more months worked by 2017 compared to students from SH high schools. This difference occurs in all income levels. On average, higher income groups tend to work less. As vocational students double the work experience by age 26, that could have an impact on the wages and future labor market integration. These results open the question regarding the capacity of SH school to integrate students into the labor force. While many of these students are
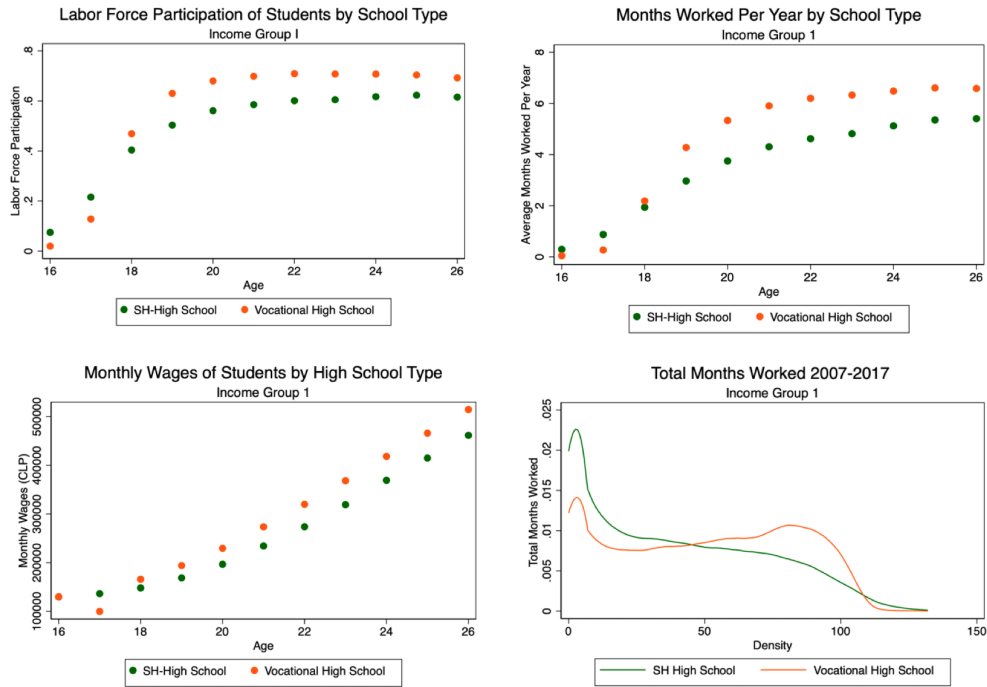
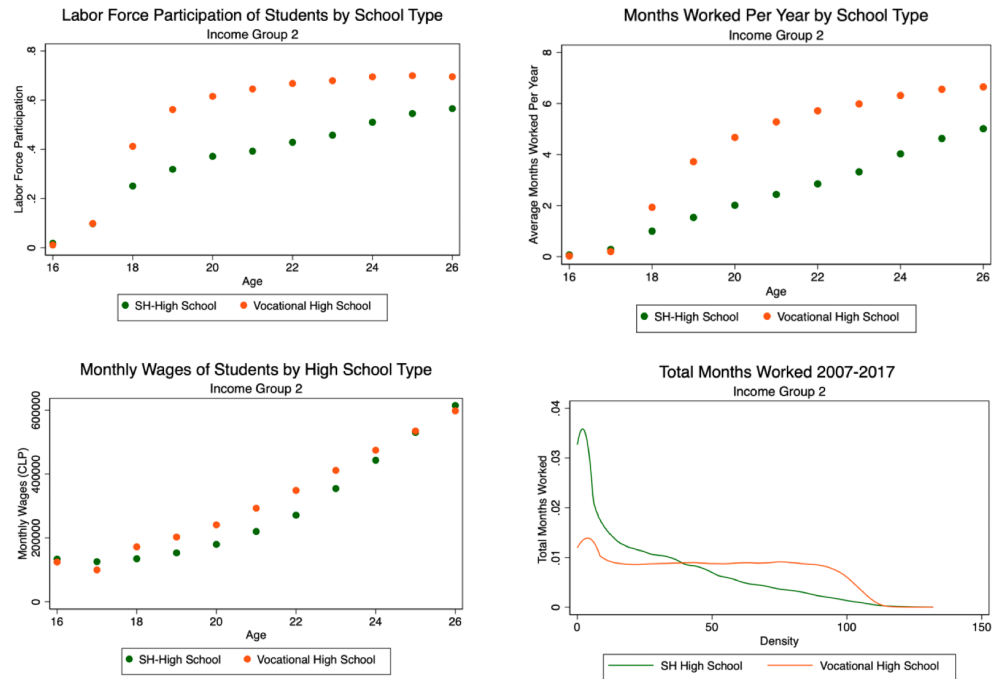FIGURE 12   Labor Force Trajectories Low Income Students

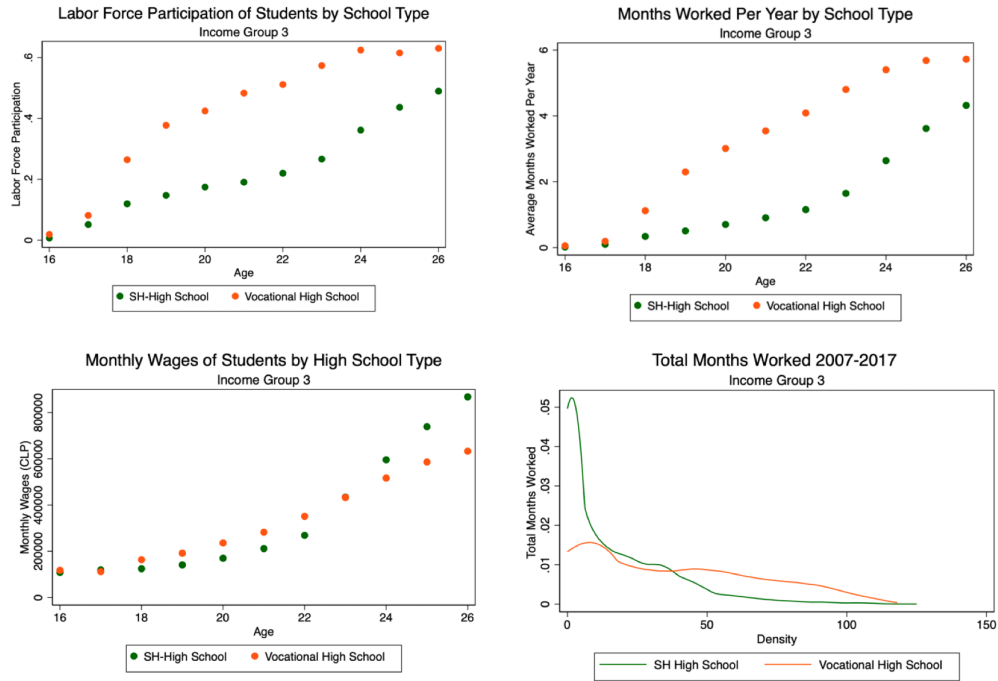FIGURE 13   Labor Force Trajectories Medium-Low Income Students

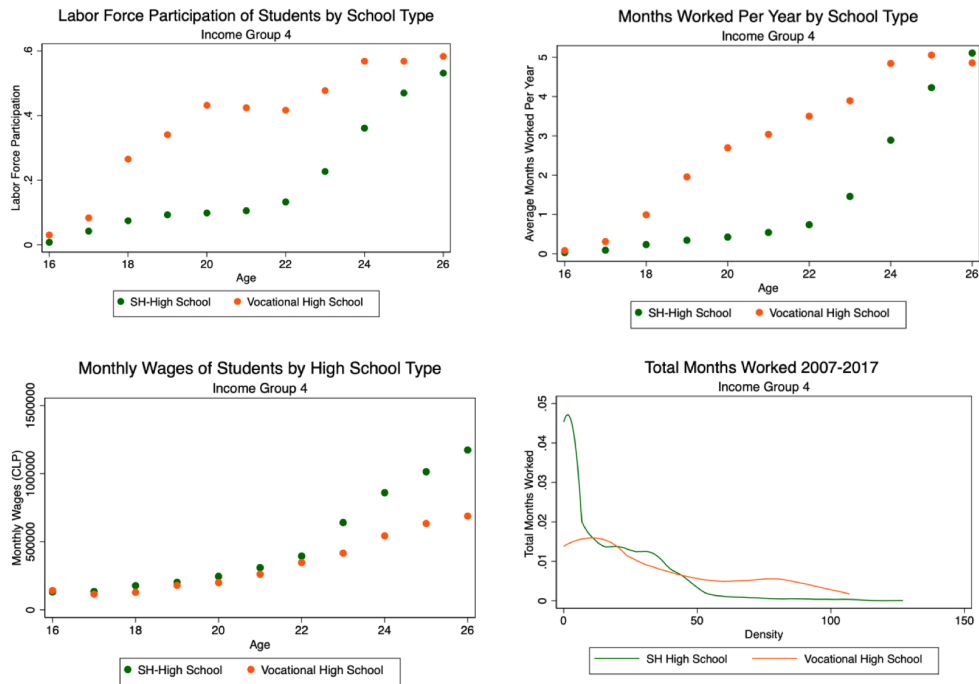**FIGURE 14** Labor Force trajectories Medium-High Income Students

FIGURE 15 Labor Force Trajectories High Income Students

studying, it is possible that some of them have not been integrated successfully into the labor market, even if they were willing to.

TABLE 5 Average Number of Months Worked Between 2007 and 2017

Variables	(1) Full sample	(2) Low Income	(3) Med-Low Income	(4) Med-high Income	(5) High Income
High School Type					
SH	32	39	27	16	16
Vocational	49	50	47	36	31
Total	38	44	33	17	16

The CASEN survey, for 2017, analyzed 26 year old citizens that are not in employed, in education or training (NEET). In Table 6 it is possible to see that 42 % of NEET individuals are students from SH high schools, while only 12% of NEET individuals are from vocational high schools. It could be the case that the SH high schools are more efficient than vocational high schools to enroll students into higher education (Table 3) but are less efficient to integrate students into the labor market.

TABLE 6 Not Employed, Education or Training, CASEN survey 2017

Varibales	Full sample
Special Education	2%
Primary or Less	9%
SH High School	42%
Vocational High School	12%
Vocational HE Dropout	5%
Vocational HE	9%
College Dropout	5%
College	16%
Graduate	0%
Does not answer	1%

5 | METHODS

This paper analyses the labor market outcomes of students using two types of methodologies. From a public policy perspective, we want to obtain results that could nurture the policy discussion, presenting general average findings, but at the same time, offering causal estimations to better analyze current policy decisions. To examine the educational and occupational trajectories of students, we propose OLS regressions models to predict wages at age 26. These results will provide descriptive statistics, propensity estimates, and correlations between different educational variables and labor market and educational outcomes. From a more academic perspective, we want to estimate the causal impact of college and

vocational higher education on students from different school types on wages. We will use a Regression Discontinuity Design (RDD), taking advantage of the strict discontinuity rules for governmental financial aid for technical education. We will distinguish the students that applied for financial aid, the selected and not selected students and estimate the Intent to Treat Effect (ITT) on enrolment, graduation, labor force participation, and yearly wages.

5.1 | OLS Regressions

At age 26, we can analyze market returns of individuals by means of OLS regressions to predict their wages as in equation (1). Educational control variables are high school educational type, high school dropout, high school repetition, vocational dropout, college dropout, currently enrolled in higher education amongst others. The Y work-study variables include students working and studying in different educational types and years of work.

$$Wage_i = \beta_0 + \beta_z \sum HigherEducationDegree_i + \beta_x \sum EducationVariables_i + $$
$$+ \beta_y \sum Others_i + \epsilon_i \quad (1)$$

This regression is conducted for students from four different income groups and students from vocational school education and Scientific-Humanistic (SH) high school education. Equation 1 also controls for family income, maternal education, and the higher educational degree obtained. We also include the variables indicating the quality of the higher education institutions and a dummy variable indicating if there is a match between the subject area of the vocational high school education and subject area of the vocational higher education.

5.2 | RDD for Causal Estimations

We will look for the effect of studying in higher education depending on different school types –SH and vocational education– and different income groups. The group analyzed were students who applied in 2009 for governmental higher education financial aid. This subgroup includes students that graduated high school in 2008 as well as students from previous generations. The inclusion of students from previous generations will allow us to capture the effect of delayed enrolment in higher education. For this group of students, we will use a Regression Discontinuity Design (RDD), taking advantage of the strict discontinuity rules for governmental financial aid for technical education. We will distinguish the students that applied for financial aid, the selected and not selected students, and estimate the Intent to Treat. There are several discontinuity rules to obtain financial aid for higher education in Chile during the years of analysis. In general, to obtain financial aid , students needed to be in the poorest four income quintiles of the population. The Higher Education Loan program had two important discontinuities. First, loan access for college was given to students that obtained above 475 points in the College Selection Test (PSU, which used a scale from 150 to 850). This is the same variable used in other research (Bucarey et al., 2018; Flores et al., 2020; Solis, 2017). The second rule allowed loan access for 2-4 year vocational higher education as analyzed by (Aguirre, 2019). In this particular year, vocational education loans were granted to a student that obtained over 5.3 in their high school grades (in a scale from 1 to 7). Figure 16 describes the describes the rules of loan assignments.

We will use both discontinuities to perform a Regression Discontinuity Design (RD). We follow Cohodes and Goodman (2014), which uses the Sharp RD design to identify the causal effect between the financing structure and the status of the individual. We expect to find differentiated effects for college and vocational education, as the financial benefits of
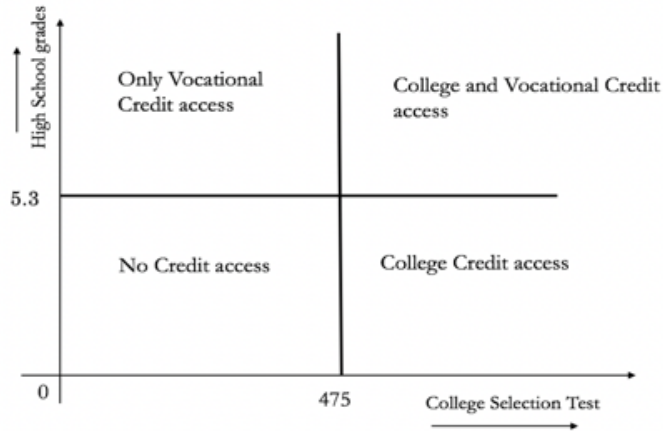
Conditions for Credit Access

FIGURE 16   Conditions for Loan Access

loans vary between types of institutions. We will use these two discontinuities to analyze the performance of these students in higher education enrolment, graduation, labor force participation, and monthly wages.

Vocational Financial Aid. To estimate the causal effect of the loan access for vocational education, we used a RD approach. We use the traditional RD approach, where we observe a binary treatment indicator Eligibility_i, and a forcing variable (GPA) with a related cutoff that describes the two possible treatment conditions ($W = 0$ and $W = 1$) $\text{Eligibility}_i = 1, \text{GPA} >= 5.3$. We observe individual outcomes (Y_i), as we want to estimate the conditional mean of Y at the cut-off score for individuals with and without eligibility.

$$Y_i = \beta_0 + \beta_1 * \text{Eligibility}_i + \beta_2 * \text{Distance}_i * \text{Eligibility}_i + \epsilon_i \qquad (2)$$

where Eligibility_i, is the indicator of eligibility for the analyzed benefit. This variable receives a value of 1 with GPA equal or greater than 5.3. Distance_i is the distance from the individual's score to the threshold score. The incidence of loans on the outcome Y_i is estimated using the parameter β_1. In this methodology we will consider all students that applied and are eligible for the financial aid. Other authors could consider only the students that have less than 475 points in the college selection test to estimate the effect of having only financial aid for vocational education. However, we want to focus in the overall effects of this policy and incentives that creates for students.

$$\text{Eligibility}_i = 0; \text{GPA} < 5.3$$
$$\text{Eligibility}_i = 1; \text{GPA} >= 5.3$$

College Financial Aid. To estimate the causal effect of the loan access for college education we use again the RD approach, where we observe a binary treatment indicator (Eligibility_i). However, we use the forcing variable for college loan access. This is the College Selection Test, with a related cutoff(c) that describes the two possible treatment conditions ($W = 0$ and $W = 1$). In this case we do not impose any rule regarding the GPA. Therefore:

$\text{Eligibility}_i = 1$ if $CollegeSelectionTest >= 475$. We observe individual outcomes (Yi), as we want to estimate the conditional mean of Y at the cut-off score for individuals with and without eligibility.

$$Y_i = \beta_0 + \beta_1 \text{Eligibility}_i + \beta_2 \text{Distance}_i + \beta_3 \text{Distance}_i \text{Eligibility}_i + \epsilon_i \quad (3)$$

where Eligibility_i is the indicator of eligibility for the analysis. This variable receives a value of 1 with if the $CollegeSelectionTests >= 475$. Distance_i is the distance from the individual's score to the threshold score. The incidence of loans on the outcome Y_{ijt} is estimated using the parameter β_1.

$$\text{Eligibility}_i = 0; CollegeSelectionTest < 475$$
$$\text{Eligibility}_i = 1; CollegeSelectionTest >= 475$$

Regression equations (2) and (3) will provide the causal estimates of obtaining financial aid for vocation and college education. The bandwidths selected for the RD were defined using two methods. For the college test, we use the *rdbwselect* command in Stata for the wage outcome variable, and an average value was used for all estimations. For the high school grades, we use the same bandwidth as Aguirre (2019), as no standardized method seemed to find results due to invertibility. The analyses of the continuity of the covariates and threshold densities are attached in appendix I.

6 | OLS ESTIMATIONS RESULTS

Our OLS regression analysis of educational and work trajectories of students is first applied to the full sample and then for each income group of students. We use the variables described in Table 1, as the model controls for the students' major, and family income. Table 7 presents the results, showing in column (1) that there is a positive effective for students who graduated from a vocational high school to attend higher education (college or vocational), resulting in important increases in monthly wages. On the other hand, college dropouts (students that did not obtain a degree) seems to have a negative impact on wages, when differentiated by high school type; there is a small and positive effect of vocational dropouts, suggesting that the labor market does not value college education without the final diploma. Further research should analyze this factor in detail, controlling for years of education and different types of careers.

Work and study experiences proved to be very beneficial, particularly for vocational students, increasing their monthly wages between 47 and 85 thousand CLP. This effect could be related to gaining experience in the labor market while studying. Higher education stop-out seems to have a negative effect on students' outcomes. This negative effect could be due to one or more extra years without participating in the labor market, while their counter parts are still gaining experience. High school grade repetition and dropout seem to have negative effects, as is being female and continuing being an enrolled student at age 26. We also analyze 14 economic sectors of high school vocational training, where the mining sector shows the highest returns. Results in column (2) and (3) showed that there are several differences worth noting between students from different types of education. We see that the wage impact of going to vocational higher education is the same for both types of students, while going to college or university is more profitable for students from scientific humanistic schools. Moreover, there are higher costs of dropping out of college for students from vocational schools and there is a higher positive impact of working while studying. Another impact is a smaller effect of stopping-out and a smaller impact of the SIMCE test score. We also see a higher base level, signaling the higher wage base of vocational high

TABLE 7 OLS Regression Results School Type

Variables	(1) Full Sample	(2) Scientific Humanistic HS	(3) Vocational HS
Vocational High School	38,525***		
Graduated Vocational Higher Education	137,453***	122,846***	125,282***
Graduated College Education	320,017***	331,855***	254,112***
Vocational Dropout	2,782	11,248***	4,726
College Dropout	24,089***	-11,345**	-32,154***
Worked and Studied College	38,715***	47,911***	85,868***
Worked and Studied Vocational	91,221***	75,542***	96,504***
Higher Education Stop-out	-49,318***	-59,368***	-29,701***
High School Dropout	-69,122***	-62,484***	-82,177***
High School Grade Repetition	-49,158***	-49,443***	-45,038***
Female	-110,152***	-97,335***	-100,376***
Vocational/College Student	-90,028***	-111,734***	-76,708***
Private High School	123,613***	113,919***	-13,399
SIMCE Test Score	718.4***	841.0***	539.4***
HS Vocational Training			
Business and Trade			11,673
Construction			15,832*
Metal/Mechanic			56,817***
Electric			59,199***
Mining			224,245***
Design			-35,428**
Chemist			38,666***
Clothing			-50,573***
Food/Nutrition			-33,415***
Social Projects			-22,006**
Hotel Management/Tourism			-37,316***
Wood Industry			-32,654***
Agricultural			-26,172**
Maritime Industry			13,089
Career Controls	YES	YES	YES
Family Income Controls	YES	YES	YES
Constant	319,454***	289,288***	379,225***
Observations	155,861	92,997	62,864
R-squared	0.283	0.341	0.187

*** p<0.01, ** p<0.05, * p<0.1

school education. The following analysis intends to test if this relationship is causal or if higher wage earners self-select into vocational high schools.

7 | REGRESSION DISCONTINUITY RESULTS

This section estimates the labor market benefits of entering higher education. To analyze the causal impact of vocational higher educational, we use a Regression Discontinuity Design (RDD), taking advantage of the two strict discontinuity rules for governmental financial aid –one for technical education and the other one for college education–. From students that applied for financial aid, we distinguish selected and not selected students to estimate the Intent to Treat Effect (ITT) on enrolment, graduation, labor force participation and monthly wages. We also include students from previous cohorts that are applying for financial aid; this group is important because students from vocational high schools tend to enter higher education two or more years after high school graduation. Therefore, instead of repeating the process for the 2009 cohort every year, this paper includes all students that applied to the 2008-2009 financial aid application. The financial aid under analysis is the State Guaranteed loan (CAE in Spanish), that has two discontinuities. The first discontinuity is a grade point average of 5.3 (scale of 1-7), and the second one is 475 points for college Financial aid. The outcome variables are vocational education enrolment, overall higher educational enrolment, months worked between 2007-2017, working in 2017, studying in 2017 and the yearly wage income in 2017. Following other authors, the subgroup of students under analysis are the students that apply to the governmental financial aid.

Vocational Higher Education Financial Aid. Figure 17 shows the impact of financial aid on vocational higher education enrolment, months worked and yearly wages, for the discontinuity of vocational education.

Table 8 shows initial estimates of the positive impact of financial aid on on vocational higher education enrolment (column 1) , higher education in general (column 2) and graduation (column 3), confirming the results obtained by other authors (Aguirre, 2019). Columns 4 to 7 show that the financial aid had no impact on the number of months worked between 2007 and 2017. That financial aid had a positive impact of continuing being a student in 2017; however it had no impact on the probability of working in 2017 and a negative impact on yearly wages in 2017.

TABLE 8 RDD Vocational Financial Aid: All students

Variables	(1) Vocational HE	(2) College	(3) Graduated	(4) Months Worked 2007-17	(5) Studying 2017	(6) Work 2017	(7) Yearly Wage 2017
RD_Estimate	0.0153**	-0.00947	0.00221	0.0203	0.00103	0.00288	-131,328
Observations	139,614	139,614	139,614	139,614	139,614	120,886	83,926

** p<0.05

To perform a more detailed analysis, we run the same regression for students that belonged to the two lowest family income quintiles in the population, separating for students of vocational high schools and SH high schools. We find two important results in Table 9. The increase in enrolment and graduation is driven by students from vocational high schools, and the lower yearly wage results are driven by students from SH high schools from the first two income quintiles. For the contrary, students from vocational high schools
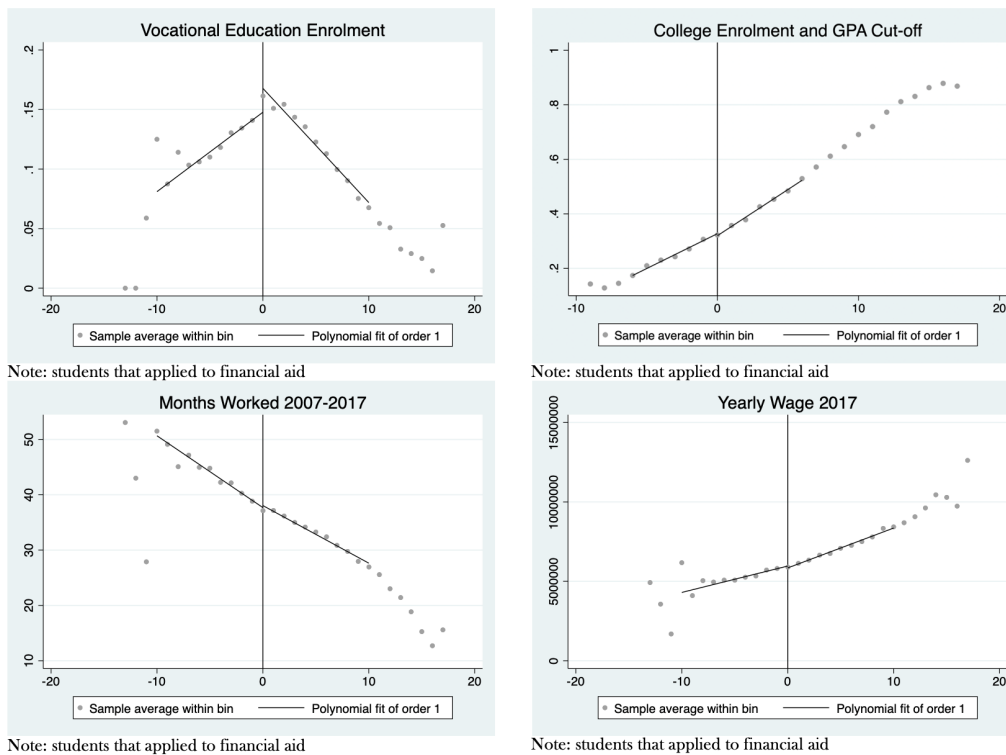
FIGURE 17   Impact of State Guaranteed Loans on Vocational Education: Full Sample

results are not statically significant for wages in 2017. For vocational high school students from the richest income quintile, we find negative impacts of vocational education, but these students represent a very small proportion of the overall population, as vocational students usually are among the lowest income students in the country.

College Education Financial Aid. Following the same logic, we review the results of Flores et al. (2020), Aguirre (2019) and Bucarey et al. (2018). The results in Table 11 and 12 confirm the previous estimations of the OLS regressions, but differences appear, showing how important is college and vocational education in determining wages.

Figure 18 shows the descriptive graphs for the analysed sample showing the impact created by the financial aid, increasing college enrolment and reducing vocational education enrolment. Figure 18 also shows that initially we see no effect on yearly wages.

Table 12 repeats the analysis for students from the two lowest income quintiles. Most of the results in Table 12 are not statistically significant due to the sample size. However, the two most notable results show a lower number of months worked by vocational students, a higher proportion of these students working and the lower wages that they obtained.

On the contrary, results presented in Table 13 are statistically significant and relevant. The negative results on yearly wages are associated with students from previous cohorts that access college education, who correspond mostly to vocational high school students. These results suggest that there is a negative impact for these students if they change educational tracks from vocational high schools to college or university education.

Figure 19 show the same results, evidencing lower wages for vocational students from previous (older) cohorts of students. The results of this section corroborated previous research on the impact of financial aid on enrolment but also enhanced current knowledge regarding the labor market implications of these effects. While financial aid for vocational

TABLE 9   RDD Vocational Financial Aid (Polynomial Degree 1, Bandwidth=6)

Variables	Vocational HE		College		Graduated	
	SH	Vocational	SH	Vocational	SH	Vocational
All Q I-IV	0.011	0.0266**	-0.00654	-0.0104	-0.0188	0.0101*
	-0.00841	-0.013	-0.00873	-0.0113	-0.0134	-0.00543
Quintile I & II	0.00242	0.0227	-0.00268	-0.0094	-0.026*	0.0131**
	-0.0102	-0.0144	-0.00998	-0.0122	-0.016	-0.00654
Quintile III & IV	0.0340**	0.0416	-0.0142	-0.0173	0.00427	0.00182
	-0.0147	-0.0299	-0.017	-0.0291	-0.0246	-0.00933

Variables	Months Worked 2007-17		Work 2017		Work 2017	
	SH	Vocational	SH	Vocational	SH	Vocational
All Q I-IV	0.101	-0.0217	0.0137	0.000546	-214,000	-106,551
	-0.764	-0.624	-0.0131	-0.00916	-174,930	-111,128
Quintile I & II	-0.441	0.18	-7.16E-05	0.00443	-423,538**	2,248
	-0.926	-0.715	-0.0155	-0.0106	-199,473	-124,475
Quintile III & IV	1.268	-0.648	0.0461*	-0.0112	288,046	-425,466*
	-1.32	-1.265	-0.0247	-0.0184	-358,744	-238,670

*** p<0.01, ** p<0.05, * p<0.1

TABLE 10   RDD Vocational Financial Aid Per high school cohort, (Polynomial Degree 1, Bandwidth=6)

Variables	Vocational HE		College		Graduated	
	SH	Vocational	SH	Vocational	SH	Vocational
Graduated 2008	0.0126	0.0282	-0.0011	0.00852	-0.0216	0.0156
	-0.0104	-0.0179	-0.0102	-0.0123	-0.0147	-0.0183
Previous Cohorts	0.00957	0.0266	-0.0228	-0.0361*	0.00208	0.000364
	-0.0143	-0.0189	-0.0158	-0.0187	-0.00215	-0.00278

Variables	Months Worked 2007-17		Work 2017		Yearly Wage 2017	
	SH	Vocational	SH	Vocational	SH	Vocational
Graduated 2008	0.241	-2.189*	0.0109	0.0126	-303,885	62,883
	-0.835	-1.167	-0.0145	-0.0172	-194,943	-223,096
Previous Cohorts	1.288	-1.032	0.0193	-0.0300*	-19,803	-274,197
	-0.842	-1.141	-0.0135	-0.0158	-164,894	-183,248

*** p<0.01, ** p<0.05, * p<0.1

TABLE 11   RDD College Financial Aid: All students (Polynomial Degree 1)

Variables	(1) Vocational HE	(2) College	(3) Graduated	(4) Months Worked 2007-17	(5) Studying 2017	(6) Working 2017	(7) Yearly Wage 2017
RD_Estimate	-0.0833***	0.172***	0.00982	-2.509***	0.00198	-0.00254	-151,728
	-0.00808	-0.00765	-0.00893	-0.594	-0.00941	-0.00968	-112,215
Observations	181,996	181,996	181,996	181,996	181,996	162,878	111,888

*** p<0.01, ** p<0.05, * p<0.1

Note: students that applied to financial aid

Note: students that applied to financial aid

Note: students that applied to financial aid

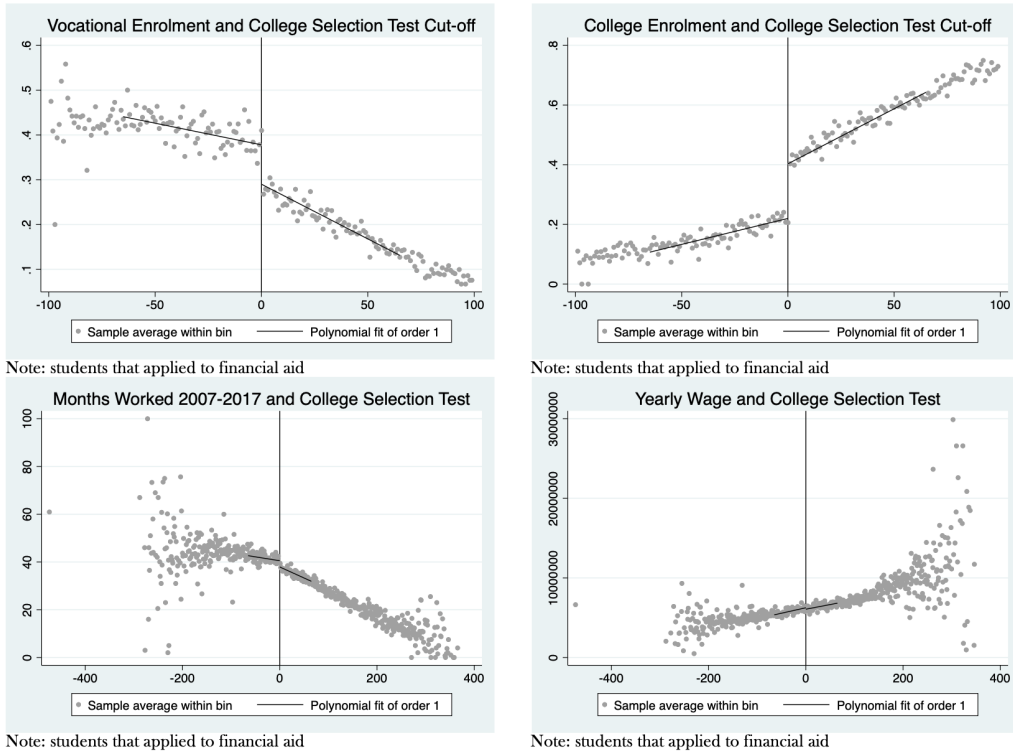

Note: students that applied to financial aid

FIGURE 18   Impact of State Guaranteed Loans on College Education: Full Sample

TABLE 12   RDD College Financial Aid (Polynomial Degree 1)

Variables	Vocational HE		College		Graduated	
	SH	Vocational	SH	Vocational	SH	Vocational
All Q I-IV	-0.0833***	-0.0812***	0.168***	0.172***	0.00105	0.0139
	-0.0101	-0.0136	-0.00974	-0.0123	-0.0113	-0.0114
Quintile I & II	-0.0829***	-0.0920***	0.175***	0.180***	0.004	0.00727
	-0.0119	-0.0151	-0.0111	-0.0133	-0.0133	-0.0127
Quintile III & IV	-0.0753***	-0.0279	0.138***	0.137***	0.0107	0.0227
	-0.0188	-0.0314	-0.0201	-0.031	-0.0266	-0.0157
	Months Worked 2007-17		Work 2017		Yearly Wage 2017	
Variables	SH	Vocational	SH	Vocational	SH	Vocational
All Q I-IV	-2.555***	-2.716***	-0.0142	-0.00314	-280,260*	-81,755
	-0.686	-0.81	-0.0116	-0.0116	-147,718	-155,403
Quintile I & II	-2.733***	-2.657***	-0.00827	-0.00994	-300,460*	-10,495
	-0.813	-0.892	-0.0136	-0.013	-169,676	-170,193
Quintile III & IV	0.927	-4.900***	0.0198	-0.0273	38,728	-480,425
	-1.449	-1.508	-0.0276	-0.0217	-382,953	-298,285

*** p<0.01, ** p<0.05, * p<0.1

TABLE 13   RDD College Financial Aid Per-cohort: (Polynomial Degree 1, Bandwidth=65)

Variables	Vocational HE		College		Graduated	
	SH	Vocational	SH	Vocational	SH	Vocational
Graduated 2008	-0.0636***	-0.0604***	0.157***	0.144***	-0.0052	0.0211
	-0.0118	-0.018	-0.011	-0.0146	-0.0155	-0.0165
Previous Cohorts	-0.134***	-0.107***	0.195***	0.207***	0.000504	-0.00152
	-0.0194	-0.021	-0.0198	-0.0205	-0.00373	-0.00317
	Months Worked 2007-17		Work 2017		Yearly Wage 2017	
Variables	SH	Vocational	SH	Vocational	SH	Vocational
Graduated 2008	-2.56***	-2.723***	-0.0144	-0.00322	-223,166	242,078
	-0.686	-0.809	-0.0116	-0.0116	-208,776	-226,085
Previous Cohorts	-5.1***	-4.213***	-0.024***	-0.00391	-354,819*	-391,715*
	-0.366	-0.433	-0.00614	-0.00625	-207,834	-212,750

*** p<0.01, ** p<0.05, * p<0.1

higher education has negative results in terms of future wages for students from SH high schools, it has null effects for students from vocational high schools. The effect of college higher education financial aid is reverse, showing negative effects for students from vocational high schools from older generations.
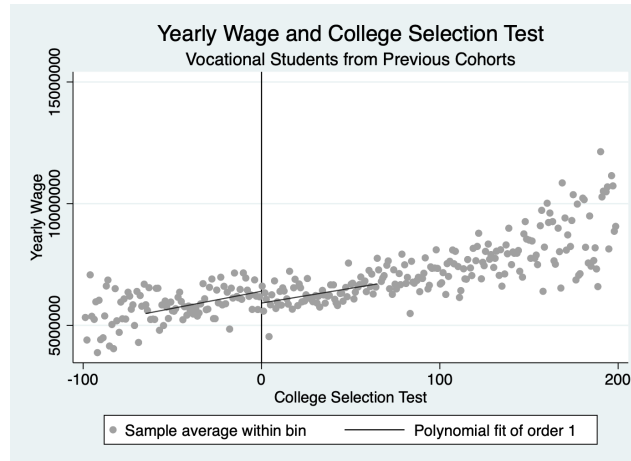

FIGURE 19 Impact of State Guaranteed Loans on Wages: Vocational Students from Previous Cohorts

These results not only suggest that the financial aid rules could be stricter, but also show negative effects for students changing career paths and educational tracks. While students from vocational high schools benefit from vocational higher education enrolment, their outcomes are less clear if they continue in college education at a university. These results could be associated with previous research evidence that showed that vocational high school students had lower educational performance in higher education after a track change (Farías and Sevilla, 2015). Moreover, a similar pattern in presented by SH students, who obtained negative results when enrolling into vocational education at the analyzed discontinuities. These track changes could explain the overall negative results found by (Bucarey et al., 2018). As college financial aid promotes a switch of tracks in favor of university education (Blanco and Meneses, 2013; Flores et al., 2020), students from vocational high schools are pushed to change tracks and thus under-preform in the educational sector and later in the labor market. These findings could generate some concerns, as other authors (as Hanushek et al. (2017)) have found that the wage gaps between individuals from vocational education and general education increase during their life time. Further research should be conducted on the long-term impact of these policies and the wages of these students.

8 | CONCLUSIONS

This paper reviewed the educational and labor market trajectories of low-income students in Chile, identifying differential effects for students from vocational (TP) and scientific-humanistic (SH) high schools. Descriptive findings showed that a significant proportion of low-income students drop-out of high school and enter into the labor market, never attending higher education. This group of students should be the focus of further research and public policies. The labor market analysis shows that vocational high school students have higher probability to get into the labor market, but they show a small wage advantage over SH students, which fades away when college students start to graduate. Further work should be done analyzing the labor market integration of male and female students,

from different high school types. OLS regressions showed that once students attend higher education, both types of students benefit from college and vocational higher education, but students from SH high schools tend to receive higher returns from college education. Using the RDD design and two discontinuity rules in the governmental financial aid assignation, we confirmed that financial aid has a positive impact on vocational and college enrolment. Vocational higher education has a negative wage impact on students of SH high schools, while a null or positive impact on wages of low-income students from vocational high schools. The RDD also showed that college enrolment has a negative wage impact on students that delay college enrolment, and particularly those who come from vocational high schools. Overall, the change in educational tracks seems to have negative effect, reducing the educational and labor market outcomes. The long-term impacts of discontinuities in the government financial aid policies seem to have a negative effect when stimulate, as it is expected to have, a switch between educational tracks.

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