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Can higher education admission be more equitable? Evidence supporting the inclusion of relative ranking in the process

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ABSTRACT

Many higher education systems require students to take admission exams, which are considered good predictors of academic performance. However, in Latin America, their use has been criticised for promoting socioeconomic segregation and favouring students of higher socioeconomic levels. This research complements the higher education admission process by using alternative measures of relative performance that promote greater equity in the system and allow access to higher education for more vulnerable sectors. A longitudinal study of students in Chile taking the University Selection Test (P.S.U.) and estimations of ordinary least squares (O.L.S.) in two stages were conducted. We found that the use of new measures of performance allows those more vulnerable students from public schools to reach equal and/or superior levels of relative performance than their peers from private schools. The practical implications of this research relate to recognising that good students can also attend public schools and that those students who have the capability can enter higher education, independent of their economic situations.

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1. Introduction

Since the 1980s, globalisation has impacted the development of higher education, resulting in a significant increase in the number of higher education institutions and academics, as well as the diversification of the student population (Kenno et al., 2020; Rossi, 2010). These changes have driven new challenges in higher education, especially those related to equity in the admission system. This study proposes a new academic performance measure that can be used in the admission process, allowing the recognition of students' capabilities based on their relative school performance while controlling for sociodemographic characteristics.

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Identifying academic potential in future students is crucial for the higher education system and has, in fact, been one justification behind the application of admission tests (Garbanzo, 2007; Geiger & Cooper, 1995; Zwick, 2019). However, evidence has shown inconclusive results about their benefits since these admission tests are conditioned to students' sociodemographic characteristics (Mahlangu, 2020; Niessen et al., 2018; Zwick, 2012). Furthermore, Aitken (1982), Alnahdi (2015), Evans (2013), and Sulphey et al. (2018) demonstrated that students' performance in higher education is closely linked to their academic performance in secondary education; thus, it is essential to complement higher education admission systems in such a way as to encourage the entry of talented students and increase access for traditionally underrepresented groups (Jia & Ericson, 2017; Koljatic & Silva, 2013, Santelices et al., 2019).

Higher education systems have diverse admission processes, including direct entry via the use of admission tests (Juarros, 2006; Mainieri, 2017). However, since school education systems are highly segregated, higher education admission systems are incapable of ensuring a system based on equity and students' academic merit (Brunner & Miranda, 2016). For example, many private school students have access to a better school curriculum and, thus, perform better in higher education entrance exams, to the disadvantage of students from public schools (Beyer, 2009; Pearson, 2013). Is it possible to introduce new elements into the admission system to make it more equitable? Some authors have explored the potential of high school data, such as grades or ranking, as an additional source of information for higher education access; however, in general, the evidence is inconclusive (Beyer, 2009; Brunsma et al., 2012; Pearson, 2013).

The present study aims to introduce another layer into this discussion by proposing a new academic performance measure based on a student's school academic trajectory compared to their peers, which can be used along with other higher education admission criteria. In particular, our measure recognises students' capabilities regardless of their sociodemographic characteristics. To empirically evaluate this new measure, we studied the case of Chile's higher education admission system. The educational system in Chile has several characteristics that make it an interesting case study. For instance, the school system is highly segregated (Santelices et al., 2019). There are three types of schools: private, semi-private (private with public funding), and public, with most vulnerable students attending those in the latter categories, resulting in lower probabilities that they will obtain good scores in the university admission tests (Santelices et al., 2019). Access to higher education is mainly based on performance via a standardised admission test; thus, since socioeconomic variables dictate the type of education obtained during the school period and students' subsequent performance in the admission test, the system becomes highly inequitable. To reduce this gap, an additional variable—a ranking measure—was added to the system in the last few years as a complement to students' average high school grades.

We contribute to the current literature by proposing a new complementary academic performance measure that allows the system to recognise students' academic trajectory regardless of their socioeconomic background. This ranking measure is based on national standardised school tests taken during the student's life, and not just high school grades like the current ranking measure.

1.1. Admission systems to higher education and equity

The purpose of establishing an admission process for higher education is to select the best students, supposing that those students who achieve a better performance will have the most potential to successfully fulfil the demands of higher education (Marshall & Case, 2010; McCowan, 2016; Pearson, 2013). Accordingly, higher education admission systems in many countries require the application of national standardised tests together with the use of other complementary measures of academic performance (Espinoza, 2017; McCowan, 2016; Walker, 2020).

In the United States, for example, the university admission system requires that students sit either the Scholastic Aptitude Test (S.A.T.) or/and the American College Testing (A.C.T.), the aim of which is to measure students' capacity for analysis and problem resolution. However, evidence has shown that these tests are positively correlated with students' socioeconomic levels (Zwick, 2012, 2019). In the United Kingdom, students must also sit exams that allow for university admission, the A levels, which normally occur during the last years of high school. It is also observed here that wealthier families can invest in private schools of better quality that allow them access to selective universities. This greater investment in private schools can reach three times the budget assigned for a student that attends a public school (Marginson, 2016).

The panorama in Latin America is similar. On finishing high school in Brazil, students must sit a national exam, the E.N.E.M., which is complemented with other tests required by each university. Similar to many Latin American countries, the Brazilian higher education system shows a strong tendency towards social stratification (Dias & Brito, 2008). In Ecuador, students must also sit a single examination, the National Exam of Higher Education, which is characterised by being a test of aptitudes. However, despite public policy efforts to democratise entrance into higher education, high levels of social stratification have been observed (Pesántez et al., 2015; Villalobos et al., 2017).

In Chile, to enter higher education, students must sit a standardised national examination, the University Selection Test (P.S.U.), when they finish high school. This selection test primarily evaluates subject area knowledge and was applied for the first time in 2003 to replace the Test of Academic Aptitudes (P.A.A.), whose objective was to measure aptitudes or abilities. Accordingly, the P.S.U. was implemented in an effort to correct the effects of the socioeconomic differences that its predecessor generated (Villalobos et al., 2017). However, as a test based on subject knowledge rather than ability, it actually increased the effects of economic segregation in the Chilean educational system (Chumacero et al., 2016). This is shown in the fact that students with more resources can access better and greater opportunities to prepare for the examination, leaving them in a better position than students with fewer resources (Beyer, 2009; Koljatic & Silva, 2013; Pearson, 2013). Furthermore (mostly public) schools with higher levels of vulnerability tend to cover a smaller proportion of the curriculum content (Pearson, 2013) due to, among other causes, possessing less qualified (Meckes & Bascopé, 2009; Ortúzar et al., 2009) or less flexible teachers (Paredes & Paredes, 2009), as well as a lack of administrative efficiency (Paredes & Paredes, 2009). At the same time, these institutions must deal with a wide range and intensity

of psychosocial issues that require professional resources in their management, contributing to an eventual disadvantage in the teaching-learning processes (González et al., 2017). Thus, our first hypothesis is:

> Hypothesis 1: Students from private schools obtain higher scores in a standardised admission test than their peers from public schools.

Considering that this is a common phenomenon, policies for student inclusion in higher education are marked by the dichotomy between equity, that is, the system's capacity to give the same access opportunities to students of different socioeconomic levels, and equality, which refers to the system's capacity to give the same access results to students of diverse social origins (Dubet, 2004; Rawls, 1979; Sen, 2009).

To counteract the inequality produced by university access via standardised tests that are powerfully biased towards students' socioeconomic opportunities, admission systems have been complemented with the use of other measures that can reflect students' aptitudes and knowledge in the long term or throughout their academic trajectory. One of them corresponds to the consideration of students' performance during their high school career, which can be understood as an indicator of long-term academic performance that does not reproduce the socioeconomic gaps of the admission tests. However, the great disadvantage of high school grades is that they are not comparable between establishments (Contreras, Meneses, & Gallegos, 2009; MINEDUC, 2013).

One way to offset this problem is the incorporation of a ranking of high school grades. This ranking seeks to reward students' performance relative to their particular context, that is, to provide opportunities to those who stand out from their peers. In this way, the incorporation of ranking as a selection measure seeks greater inclusion for groups that are under-represented in quality selective education by diminishing the weighting of standardised tests in the distribution of opportunities that are sensitive to sociodemographic factors such as wealth, education, race, and gender (Bellei, 2013; Contreras et al., 2009; MINEDUC, 2012).

The incorporation of these elements in the Chilean case has led to dissimilar results. On one hand, the Studies Centre of the Ministry of Education (MINEDUC, 2013) found that rankings based on high school grades favoured students from private, fee-paying schools, while, on the other hand, Larroucau et al. (2015) observed that this selection measure favoured students from public and semi-private schools, thus promoting greater equity in the system (Villalobos et al., 2017). To explain these results, Rodríguez and Jarpa (2015) proposed that schools' internal evaluation systems in Chile are conditioned to their own policies of assignment and levels of demand. In addition, they discovered that in public schools, attended mainly by students with high vulnerability, the evaluation systems and their results show a reduced predictive capacity between high school grades and the P.S.U. Considering these insights, our second hypothesis is:

> Hypothesis 2: Students from private schools ranked according to high school scores achieve a higher performance in higher education admission tests than their peers from public schools.

Evidence has shown a high correlation between the ranking based on high school scores and PSU scores, favouring students from private schools and those with parents with higher levels of schooling and income (Rodríguez & Padilla, 2016). It has also been

observed that students with the same high school score average can have dissimilar rankings, thus affecting the validity of this selection variable. Furthermore, for a certain type of school, an increase in high school scores was observed that could not be explained by increased learning from the students, which to some extent distorts the calculation of ranking among them (Fajnzylber et al., 2018).

As such, in search of a more objective measurement of student capabilities that does not reproduce the segregation of the Chilean school system, our study proposes the use of standardised national tests during the whole school period to obtain a ranking measurement. The use of tests as evaluation instruments counts on broad technical and methodological development that permits the measurement of observable or latent traits of a study population with a high degree of precision (Tristán & Pedraza, 2017). Despite this, there has been considerable debate about the validity and trustworthiness of standardised tests as an efficient evaluation mechanism; however, this could be explained by the limited role that has been given to the concept of objectivity in the development of these tests (Newton & Baird, 2016; Padilla et al., 2006).

For Muñoz-Comonfort et al. (2014), the use of standardised tests has the advantage of producing predictions and proposing remedial measures for students. Along these lines, Herman and Golan (1993) argued that this type of evaluation allows the teachers of each school to propose strategies that permit innovations to promote better performance among their students. In Chile, the use of standardised tests has been developing since the latter years of the 1980s and is known as the System of Measurement of the Quality in Education (S.I.M.C.E.). It is currently carried out in the 2nd, 4th, 6th, and 8th grades of primary school and the 2nd and 3rd grades of high school. The S.I.M.C.E. tests ostensibly aim to contribute to improving the quality and equity of Chilean education and report on the performance of students in different areas, as well as the sociodemographic conditions of each student and their family (Ramírez, 2011). However, these tests have been criticised for associating quality with results obtained and for having a high degree of economic segregation, as students from private schools demonstrate better performance than their more vulnerable peers (Campos & Guerrero, 2016; Flórez, 2013; Murnane et al., 2017; Vergara et al., 2020).

Notwithstanding these criticisms, the S.I.M.C.E. tests can significantly contribute to these objectives, inasmuch as they are valued as a source of support and pedagogical guidance for teachers, who have the greatest potential for impacting students' learning and, thus, improving the quality of education (Barber et al., 2010). Considering a ranking measurement based on the S.I.M.C.E. tests, our third hypothesis is:

> Hypothesis 3: The use of relative ranking based on national standardised school tests (S.I.M.C.E.) allows the recognition of students' academic talent, regardless of their socioeconomic conditions.

2. Methodology

2.1. Study data

This study used data from a cohort of students that applied to Chilean universities during 2009. This information, along with each students' socioeconomic

characteristics was derived from the MINEDUC and DEMRE.[1] The five-year longitudinal data comprised P.S.U. scores (scores from the admission tests), N.E.M. scores (high school grades), students' sociodemographic characteristics, and the score reached by each student and their classmates in the standardised national S.I.M.C.E. tests when they were in the 8th and 10th grades of primary school and high school, respectively. Data was collected from 104,187 students, of whom 42,589 graduated from public schools (40.9%), 50,267 from private schools with public funding (or semi-private) (48.2%), and 11,331 from private schools (10.9%). This aspect is particularly relevant in Chile since these three school types are highly associated with socioeconomic stratification.

2.2. Empirical model and variables

When modelling a production function in education, it is necessary to define some prior considerations that are in accordance with the characteristics of the educational system itself (Contreras, 2001; Contreras et al., 2009; Santelices et al., 2019). When estimating such a production function, the problem of selection bias arises since the distribution of the students from each type of school is not random; rather there are specific characteristics of the students and their families that determine the type of school the student attends. Therefore, any estimation that is performed without consideration of this problem will generate biased parameters as they will be representative of that type of student and not the generality (Chubb & Moe, 1990; Contreras, 2001; Contreras et al., 2009; Muñoz & Redondo, 2013). A multinomial model was developed to estimate the probability of choosing a private or semi-private school, which was used to estimate a model of least squares in two stages. It was, therefore, expected that this variable will be correlated with the choice of school and not with its performance (Contreras, 2001; Contreras et al., 2009).

Considering the student's type of school as the dependent variable (private, semi-private, or public), the explanatory variables included those from the supply side, such as proportion of private and public funding, and from the demand side, such as the number of members of the family group, level of schooling and income of the parents, perception of quality, and proximity (Equation (1)).

$$Mlogit_i = f(Gender_i;\ Edu_{lev_{i,j}};\ Quin_{2-5_{i,j}};\ Mem_{fam_{i,j}};\ Opp_{sch_{semij}};\ Opp_{sch_{privj}};\ Prest_j;\ Close_{i,j}) \quad (1)$$

where $Gender_i$, is a dummy variable that takes the value 1 if the student is a female and 0 otherwise; $Edu_{lev_{i,j}}$ is the highest educational level achieved by the parents of $student_i$ who attends school j; $\text{Quin}_{2-5_{i,j}}$ represents the family income quintile where the first quintile is the comparison base; $Mem_{fam_{i,j}}$ is the number of family members; $Opp_{sch_{semi\ j}}$ is a dummy variable taking value 1 if there is a semi-private school in the community where student i lives. Similarly, for a private school with the variable $Opp_{sch_{priv\ j}}$ $Prest_{i,j}$ is a dummy variable that takes value 1 when the parents perceive the school as a quality institution, and 0 otherwise; $Close_{i,j}$ represents parents' perceptions about the closeness of the chosen school.

We used the probabilities estimated in the first stage as instruments in the second stage. In this second stage, we estimated an ordinary least squares (O.L.S.) model to explain the score achieved by the student in the P.S.U., explained by

Table 1. Description of variables.

Variables	Description
Prom_psu	Average scores of mathematics, language, and communication tests.
urb	Dummy variable that takes value 1 if the establishment is located in an urban area and 0 if it is rural.
gender	Dummy variable that takes value 1 if the student is female and 0 otherwise.
pps	Probability of the student attending a semi-private school (IV from first stage).
ppp	Probability of the student attending a private school (IV from first stage).
educ_nm	Dummy variable that takes value 1 when one of the parents completed secondary schooling and 0 otherwise.
educ_si	Dummy variable that takes value 1 if one of the parents completed some higher education and 0 otherwise.
educ_sc	Dummy variable that takes value 1 if one of the parents fully completed higher education and 0 otherwise.
educ_sp	Dummy variable that takes value 1 if one of the parents completed postgraduate study and 0 otherwise. A comparison category was established when one of the parents completed only primary schooling (educ_nb).
quin2	Dummy variable that takes value 1 if monthly household income is between $200,000 and $400,000 and 0 otherwise.
quin3	Dummy variable that takes value 1 if monthly household income is between $400,001 and $800,000 and 0 otherwise.
quin4	Dummy variable that takes value 1 if monthly household income is between $800,001 and $1,600.000 and 0 otherwise.
quin5	Dummy variable that takes value 1 if monthly household income is $1,600,001 or more and 0 otherwise. A comparison category was established when monthly household income was equal to or less than $200,000 (quin1).
nem_2 to nem_10	Dummy variable that takes value 1 if the student is located in the i-th decile according to his or her NEM, in which i takes value 1 for students with the lowest ranking, 10 for those with the best ranking, and 0 otherwise. For the effect of the estimation, decile 1 was left as a category for comparison.
s10_2 to s10_10	Dummy variable that takes value 1 if the student is located in the i-th decile according to his or her SIMCE score of tenth grade, in which i takes value 1 in those students with lower ranking, 10 for those with better ranking, and 0 otherwise. For the effect of the estimation, decile 1 was left as a category for comparison.
s08_2 to s08_10	Dummy variable that takes value 1 if the student is located in the i-th decile according to his or her SIMCE score of eighth grade, in which i takes value 1 in those students with lower ranking, 10 for those with better ranking, and 0 otherwise. For the effect of the estimation, decile 1 was left as a category for comparison.

Source: Prepared by the authors.

sociodemographic and academic variables, including our proposed ranking measure and the instruments from the first stage (Equation [2]). In Table 1, we describe each variable.

$$Prom_{psu}i = \alpha + \beta_1\ urb + \beta_2\ gender + \beta_3 pps + \beta_4 ppp + \beta_5\ educ_n m + \beta_6\ educ_s i + \beta_7\ educ_{sc} + \beta_8\ educ_{sp} + \beta_9\ quin2 + \beta_{10}\ quin3 + \beta_{11}\ quin4 + \beta_{12}\ quin5 + \beta_{13}\ nem_2 + \ldots + \beta_{21} nem_{10} + \beta_{22}\ s10_2 + \ldots + \beta_{30} s10_{10} + \beta_{31}\ s08_2 + \ldots + \beta_{40}\ s08_{10} + \mu_{i,j} \quad (2)$$

3. Results and discussion

3.1. Descriptive statistics

From the data, regarding distribution, 97% of the students attended urban schools, and 56% were women. We also observed that 75% of the students' parents who attended private schools had high levels of education, completing either higher education or postgraduate study. On the contrary, 77% of the students who attended public

Table 2. Descriptive statistics.

	Mean				Standard deviation			
Variables	All	Public	Semi-private	Private	All	Public	Semi-private	Private
Prom_psu	506.78	472.56	507.97	630.15	103.94	96.51	92.85	80.39
urb	0.97	0.97	0.97	0.98	0.16	0.16	0.17	0.12
gender	0.56	0.56	0.57	0.51	0.50	0.50	0.50	0.50
educ_nb	0.12	0.20	0.08	0.002	0.33	0.40	0.27	0.04
educ_nm	0.47	0.57	0.48	0.05	0.50	0.50	0.50	0.21
educ_si	0.21	0.16	0.26	0.20	0.41	0.36	0.44	0.40
educ_sc	0.16	0.07	0.15	0.55	0.37	0.25	0.36	0.50
educ_sp	0.03	0.01	0.02	0.20	0.18	0.08	0.14	0.40
quin1	0.39	0.57	0.33	0.01	0.49	0.49	0.47	0.09
quin2	0.28	0.28	0.33	0.03	0.45	0.45	0.47	0.18
quin3	0.17	0.12	0.23	0.13	0.38	0.32	0.42	0.33
quin4	0.09	0.03	0.09	0.30	0.28	0.16	0.29	0.46
quin5	0.07	0.004	0.02	0.53	0.25	0.06	0.14	0.50

Source: Prepared by authors with data from the MINEDUC and DEMRE.

schools had parents that had only finished secondary education. In terms of the students' socioeconomic stratification, 85% of the students attending public schools belonged to the first two quintiles of income, and only 3.4% to the fourth and fifth quintiles. This contrasted with the private school students, 83% of whom belonged to the fourth and fifth quintiles.

Regarding the results obtained in the admission tests, we saw that students from private schools achieved higher scores in the P.S.U. test (630.15), in comparison with those from semi-private schools and public schools, with 507.97 and 472.56 points, respectively. The average score among public-school students was less than 475 points, which is the minimum required to apply to the higher education system (see Table 2).

3.2. Estimation and analysis of results

In terms of the decision to choose a private or semi-private school, it was observed that there was a positive relationship between the level of schooling and income level (Table 3). Further, the number of members of the family negatively affected the probability of choosing a school of these types. Finally, it was observed that the perception of quality increased the probability of choosing these types of school, while the proximity of other schools diminished that probability.

Since Equation (1) was estimated only to obtain the instruments for Equation (2), we focused our analysis on the latter. The results of Equation (2) are listed in Table 4, where urban schools demonstrated a superior performance of 33 points above rural schools. In terms of students' genders, women obtained an average of 14 points less than male students. Moreover, students who attended private and semi-private schools achieved an average of 79.11 and 16.74 points more than their public-school peers. These results support hypothesis 1, in which students attending private schools obtain higher scores in the P.S.U.

Regarding the effect of parents' education level on students' admission test scores, the greater the level of schooling, the higher the average P.S.U. score. Considering the effect of the parents having completed primary school as a base for comparison, it

Table 3. Probability of choosing a private or semi-private school.

	Semi-private		Private	
	Coefficient	Standard deviation	Coefficient	Standard deviation
constant	−3.6819 (**)	0.4310	−8.9991 (**)	0.2415
gender	0.1199 (**)	0.0156	−0.0362 (**)	0.0337
educ_nm	0.4063 (**)	0.0244	1.0415 (**)	0.2139
educ_si	0.8667 (**)	0.0290	2.4506 (**)	0.2117
educ_sc	0.9481 (**)	0.0358	2.9473 (**)	0.2122
educ_sp	1.0383 (**)	0.0776	3.1925 (**)	0.2239
quin2	0.4952 (**)	0.0185	1.5336 (**)	0.1206
quin3	0.9508 (**)	0.0240	3.1521 (**)	0.1147
quin4	1.4195 (**)	0.0409	5.0708 (**)	0.1177
quin5	1.7741 (**)	0.0879	6.9162 (**)	0.1382
$Opp_{sch_{semi}}$	3.3385 (**)	0.0715	−2.6180 (**)	0.1039
$Opp_{sch_{priv}}$	1.9910 (**)	0.0752	5.8047 (**)	0.1152
Mem_{fam}	−0.0198 (**)	0.0024	−0.0671 (**)	0.0088
Prest	0.2955 (**)	0.0235	0.8244 (**)	0.0604
Close	−0.2237 (**)	0.0157	−0.8007 (**)	0.0344
LR Chi2 (26)	73063,49			
Prob > Chi2	0.00			
Pseudo R2	0.3651			

(**)Coefficients are statistically significant at 1%.
Source: Own elaboration.

was observed that when the parents had finished high school, there was an increase of 21.29 points in students' P.S.U. scores. Meanwhile, for those parents with incomplete tertiary studies, their children's P.S.U. scores averaged 49.26 points above those whose parents had only finished primary education. Finally, children of parents who had completed higher education and post-graduate studies obtained 62.93 and 68.48 more points, respectively, than those students whose parents had only finished primary school. A greater standard deviation was also observed when the level of schooling was higher, with a decreasing effect.

As indicated, the system of admission to Chilean universities presents important levels of economic segregation that are observed when considering the positive and significant effect of family income measured in quintiles. Compared with quintile 1, which grouped those families with the lowest incomes, it was found that students belonging to quintile 2 achieved 21.07 more points. For students belonging to quintiles 3, 4, and 5, the gap increased, and they achieved 40.03, 52.98, and 66.29 more points, respectively, than the more vulnerable students belonging to quintile 1. In addition, a greater standard deviation was observed with a higher level of income, with a decreasing effect.

In relation to the measures of academic talent, the effect of ranking based on students' average high school grades positively affected students' performance in the P.S.U. Considering decile 1, which grouped students of lower relative performance, as a base for comparison, it was observed that students in decile 2 achieved 9 more points. As we advanced through the relative location to decile 10, increasing levels were observed, up to a maximum of 74 points above those students in decile 1.

When the measure of relative academic performance was constructed from the scores obtained in the S.I.M.C.E. tests in the 8th and 10th grades, a positive relationship was observed between academic ranking and the students' performance in the P.S.U. Considering the 10th-grade S.I.M.C.E. test and, as a base for comparison, the students from decile 1, which grouped students with lower relative performance, it

Table 4. PSU scores through two-stage least squares models (2SLS).

	Coefficient	Standard deviation		Coefficient	Standard deviation
constant	306.9151 (**)	1.5406	s10_2	16.0919 (**)	0.8995
urb	32.9958 (**)	1.2508	s10_3	23.5034 (**)	0.9206
gender	−14.1215 (**)	0.4099	s10_4	30.7154 (**)	0.9511
pps	16.740 (**)	0.4488	s10_5	37.2630 (**)	0.9803
ppp	79.111 (**)	0.9996	s10_6	43.4085 (**)	0.9891
educ_nm	21.2932 (**)	0.6603	s10_7	50.4993 (**)	1.0197
educ_si	49.2602 (**)	0.7878	s10_8	59.0226 (**)	1.0558
educ_sc	62.9253 (**)	0.9279	s10_9	68.0386 (**)	1.0941
educ_sp	68.4800 (**)	1.4218	s10_10	87.9800 (**)	1.2072
quin2	21.0963 (**)	0.5248	s08_2	14.0349 (**)	0.8988
quin3	40.0258 (**)	0.6581	s08_3	20.5494 (**)	0.9177
quin4	52.9768 (**)	0.9407	s08_4	27.6679 (**)	0.9457
quin5	66.2994 (**)	1.2497	s08_5	31.7840 (**)	0.9695
nem_2	9.2262 (**)	0.8183	s08_6	37.5099 (**)	0.9764
nem_3	15.4712 (**)	0.8288	s08_7	41.2465 (**)	1.0006
nem_4	23.0425 (**)	0.8481	s08_8	48.0219 (**)	1.0302
nem_5	27.0340 (**)	0.8709	s08_9	54.7617 (**)	1.0594
nem_6	30.7025 (**)	0.8633	s08_10	70.0795 (**)	1.1575
nem_7	39.8942 (**)	0.8831			
nem_8	46.8923 (**)	0.9148	F(39,104147)	4144,18	
nem_9	55.7373 (**)	0.9372	Prob > F	0.000	
nem_10	73.9871 (**)	1.0538	R2 adjusted	0.6047	

(**)Coefficients are statistically significant at 1%.
Source: Own elaboration.

was revealed that those students located in decile 2 achieved 16 more points. As we advanced in the relative location to decile 10, ever-increasing levels were observed, up to a maximum of 88 points above the students in decile 1. We observed a similar result when considering the S.I.M.C.E. test from the 8th grade and the students from decile 1 as a base for comparison; students located in decile 2 obtained more 14 points than their peers in decile 1. As we advanced in the relative location to decile 10, increasing levels were observed, up to a maximum of 70 points more than those students located in decile 1.

Taking the estimation proposed in (2) and widening the analysis by separating by type of school (Table 5) revealed that those students who attended urban public schools achieved 45 additional points compared to students of rural public schools. This difference was lower for students in semi-private and private schools, with 26 and 16 additional points, respectively. In relation to gender, it remained the case that male students obtained higher P.S.U. scores than female students; this effect also increased in private schools.

The level of schooling and income of the parents significantly and positively affected students' performance. For instance, a greater level of parental schooling generated better student results in the P.S.U., with a much greater impact shown on students from public schools. Taking those parents that only reached primary education as a base for comparison, it was observed that those students whose parents only finished high school achieved 18 additional points, which is in contrast with private school students in which the score was reduced by 5 points if the parents had only finished high school. As we advanced in the location relative to the parents' education, students from public schools whose parents completed postgraduate education achieved 83 more points than their peers with parents who only completed primary

Table 5. PSU score by school type.

	Public	Semi-private	Private		Public	Semi-private	Private
constant	297.3347 (**)	328.2943 (**)	454.3086 (**)	s10_2	14.3315 (**)	16.7875 (**)	19.1258 (**)
urb	45.2540 (**)	26.3192 (**)	15.5341 (**)	s10_3	23.9823 (**)	22.5402 (**)	25.1686 (**)
gender	−14.6395 (**)	−12.1261 (**)	−20.6495 (**)	s10_4	31.9089 (**)	29.5451 (**)	30.3008 (**)
educ_nm	18.8158 (**	23.9742 (**)	−4.6266 (**)	s10_5	38.1065 (**)	36.0101 (**)	38.4615 (**)
educ_si	49.4114 (**)	50.7656 (**)	1.6362 (**)	s10_6	44.0282 (**)	42.4744 (**)	42.9180 (**)
educ_sc	61.98974 (**)	65.7228 (**)	15.7160 (**)	s10_7	51.4203 (**)	49.5559 (**)	48.8894 (**)
educ_sp	82.6407 (**)	69.4388 (**)	20.6544 (**)	s10_8	60.9440 (**)	57.3035 (**)	57.1193 (**)
quin2	20.6581 (**)	20.3142 (**)	23.9186 (**)	s10_9	70.6431 (**)	66.1452 (**)	63.6603 (**)
quin3	42.1520 (**)	38.0030 (**)	30.8663 (**)	s10_10	92.0203 (**)	86.4419 (**)	75.6494 (**)
quin4	64.7134 (**)	51.2826 (**)	42.4835 (**)	s08_2	14.1188 (**)	14.0349 (**)	13.3431 (**)
quin5	64.3748 (**)	61.9321 (**)	60.2605 (**)	s08_3	20.6800 (**)	20.3011 (**)	20.0263 (**)
nem_2	7.7560 (**)	8.7727 (**)	17.7147 (**)	s08_4	28.5188 (**)	27.4263 (**)	24.3856 (**)
nem_3	13.1839 (**)	15.2789 (**)	25.9311 (**)	s08_5	31.4135 (**)	33.1210 (**)	25.5845 (**)
nem_4	20.7442 (**)	22.2291 (**)	37.3328 (**)	s08_6	38.0602 (**)	38.4676 (**)	29.5664 (**)
nem_5	22.3774 (**)	27.7181 (**)	44.4688 (**)	s08_7	42.1496 (**)	41.7447 (**)	33.2704 (**)
nem_6	25.4836 (**)	32.6276 (**)	45.5760 (**)	s08_8	49.9504 (**)	47.8982 (**)	39.0030 (**)
nem_7	36.8332 (**)	39.8457 (**)	55.6122 (**)	s08_9	56.2521 (**)	54.9968 (**)	45.2269 (**)
nem_8	41.9349 (**)	47.9529 (**)	66.4299 (**)	s08_10	71.9895 (**)	69.8965 (**)	59.3985 (**)
nem_9	51.4112 (**)	56.5043 (**)	74.5161 (**)				
nem_10	71.0548 (**)	73.9625 (**)	90.4524 (**)		F(37,43195)	F(37,50888)	F(37,11418)

(**)Coefficients are statistically significant at 1%.
Source: Own elaboration.

schooling. A similar result, but on a smaller scale, was observed among students of semi-private schools and, to a lesser degree, those from private schools.

Regarding the students' family income levels, a positive and significant effect was observed in the P.S.U. scores, although this effect stood out for public-school students in comparison to their peers, especially those in the fourth and fifth quintiles. Considering quintile 1 as a base for comparison, it was observed that students who attended private schools and whose parents belonged to quintile 2 achieved 24 more P.S.U. points. However, dissimilar results were observed with respect to quintiles 3, 4, and 5, where the effect among students who attended public schools was greater than among their peers, achieving 42, 65, and 64 points more than those students located in quintile 1.

The effect of the ranking, based on the grade average, for each quintile mainly favoured students who attend private and semi-private schools over and above students from public schools. In the case of public school students, the best ranked (decile 10) was 71 points above their peers from the first decile; however, the best ranked semi-private school student was slightly higher, at 74 points; among private schools, the gap was even larger, with 90 extra points. These results support our second hypothesis, although when the measure of academic performance was constructed with the score obtained in the S.I.M.C.E. tests of 8th and 10th grades, dissimilar results were observed between students.

On considering the effect of the measures of relative performance based on the S.I.M.C.E. test and the type of school, it was observed that the 10th-grade students that attended private schools and were located in deciles 2 and 3 achieved 19 and 25 points more than their peers located in decile 1; as we advanced in the relative location to decile 10, a positive and significant relationship was observed. On the other hand, observing the behaviour of students from public schools from decile 4 showed

that these students achieved levels of performance that were growing and superior to their peers from private schools, and achieved an average of 92 points more than their peers from public schools located in decile 1. A similar tendency was observed when the S.I.M.C.E. test of 8th grade was employed, in which those students located in decile 4 of public schools reached performance levels that were growing and superior to their peers from private schools and achieved 72 points more than their peers from public schools located in decile 1.

These results supported hypothesis 3; thus, the use of relative ranking based on national standardised tests (S.I.M.C.E.) allows for the recognition of students' academic talent regardless of their sociodemographic condition. It is only through incorporating these two measures of relative ranking and national standardised tests (S.I.M.C.E.) that a student from a public or semi-private school demonstrates a higher level of productivity than their peers in a private school.

4. Conclusions and policy implications

Admission systems into higher education have been the focus of research due to their importance in providing and identifying future students' academic potential. In Chile, the use of a standardised admission test, the P.S.U., has been strongly criticised, mainly for its considerable discrimination against the most vulnerable students, whose opportunities for learning are greatly disadvantaged compared to students from private schools. Consequently, over the last few years, the higher education selection and admission system has been improved in search of greater equality and social justice, allowing the most talented students to enter university.

This study proposes alternative measures of relative academic performance that can promote greater equity in the higher education admission system, allowing students with academic capabilities to enter higher education regardless of their socioeconomic situation. The S.I.M.C.E. test, applied in the 8th and 10th grades, was used as a method of observing the performance of each student over time. In using these performance measures, it was observed that students with academic capabilities might also attend public schools and that there is greater productivity as the level of schooling and incomes of the parents increased.

Despite the criticisms mentioned regarding the use of the S.I.M.C.E. test for students attending public schools, this effect is annulled when the score obtained is relativised with that of their schoolmates since we are interested in the relative distribution of the student, independent of the score obtained in the test itself. The contribution of this study lies in its identification of measures of students' relative efficiency independent of their socioeconomic condition, especially in recognising that talents are distributed randomly across both private and public schools. This result allows us to demonstrate that good students are distributed independently of their socioeconomic condition, which is one of the basic suppositions of those who defend the use of measures of relative ranking as a variable for entry into higher education. This would allow for better opportunities for under-represented groups.

This study has some limitations. It did not examine additional variables related to the student, such as motivation and family expectations, or related to the school,

such as the amount of resources and educational model. However, the measurement that we propose allows us to tackle the problems and challenges of the current system of entry into Chilean higher education by widening the use of ranking with the aim of recognising the effort and quality of student entering higher education.

Note

1. The MINEDUC is the Ministry of Education of Chile. The DEMRE is the Department of Evaluation, Measurement and Educational Registry, which is a technical body at the University of Chile responsible for the development and construction of measurement instruments for higher education admission.

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