Primary and Secondary Educational Performance and Access to University Education. The Use of Ranking in the Chilean Case.

Abstract

This article contributes new evidence regarding the determinants of students' academic achievement. By estimating an educational production function, we can note, that students' educational performance measure about their relative position amongst their pears (ranking), their score secondary education grades and their standardized test (SIMCE) scores is directly influence to university entrance exam (PSU) outcomes.

Coinciding with other studies, students from private schools show greater achievement than those from private subsidized and public schools, however, the incorporation of relative school performance measurements recognizes this weakness, and indicates that good students, regardless of the school they come from, have good PSU results.

Key Words: academic achievement, ranking, education, PSU, SIMCE.

JEL Classification: I21, I23, I24, I28

I. Introduction

Beginning in the 1980s, the process of globalization was characterized by a series of simultaneous and sometimes contradictory events, which affected the development of higher education (Clavero, 2006). Amongst them, the significant increase in higher education institutions and their academics (UNESCO, 1995), as well as the rise and diversification of the student population stand out. Regarding enrollment, the World Banks estimates that in the year 2000 there was a student population of 100 million, and that by 2025, it will reach 150 million. This significant increase cannot simply be explained by population growth. It reflects the impact of economic and social policies that have been greatly propelled by economic priorities associated with technological changes, globalization and growing international competition (Clancy and Goastellec, 2007).

In terms of the processes that affected higher education institutions, challenges concerning quality, the multidisciplinary nature of academic programs, the use of ICTs and the assimilation of research into teaching stand out (Díaz, 1996). In this sense, the challenges facing quality have made up a relevant factor in higher education; because of this, studies on academic achievement have become key, as they permit understanding the relevant variables that affect quality and equity in higher education. Following this line, the measurement of potential academic achievement of future students of higher education is of great importance (Geiger and Cooper, 1995; Díaz *et.al.,* 2002; and Garbanzo, 2007). Some authors have found evidence that there is a strong relationship between primary and secondary educational performance and later achievement in university. Prominent among them is Aitken's (1982) study, which found an important correlation between the outcomes of higher education entrance exams and obtained academic results. In addition, García and San Segundo (2001) found that score secondary education have a positive very significant relationship with academic achievement. On the other hand, Salonova *et.al.* (2005) highlighted that students' satisfaction with their university program and their order of preference in the selection process are directly related to academic achievement. Meanwhile, Rodríguez, Fita and Torrado (2004) concluded that those students who entered their first choice of program, in general, obtained better results than other students. With this, it becomes obvious that the entry mechanisms for higher education are relevant for later university success. Along these lines, Latin American countries are characterized for having diverse higher education admission systems, which vary from direct entry once secondary education studies are complete to the use of admission exams

(Juarros, 2006). In the Chilean case, access to the traditional universities requires taking a standardized test: the university selection test (*prueba de selección universitaria*, or PSU). However, scores obtained on this exam have shown evident gaps depending on the student's socioeconomic level or the type of secondary school they graduated from and these scores had raised serious doubt on its validity as a fair element of selection and prediction of future academic achievement (Muñoz y Redondo, 2013). Because of this, higher education institutions have worked on perfecting the entry system, incorporating other indicators of academic performance, such as secondary education grades (*notas de enseñanza media* or NEM) and their relative ranking, complementing the scores obtained on the higher education admissions tests, which is in tune with proposals by Aitken (1982) and García and San Segundo (2001). Along these lines, our study contributes by showing new statistical evidence that the student's systematic academic behavior during his primary and secondary school experience is reflected in their PSU score, and therefore in their possibility of access to tertiary education. This is done by incorporating new measurements of the students' relative performance during their primary and secondary education, in addition to secondary education grades, as relative factors for explaining PSU scores. In this sense, we are interested in recognizing variables of academic efficiency that have a better predictability capacity of the admission system, as well as increasing the system's fairness.

Our hypothesis is that the new performance measurements can obtain information that is currently not being recognized by the admission system, which would contribute to better explaining PSU performance, and at the same time, have the advantage of not being determined by socioeconomic factors. Its foundation is based on the idea that talents are equally distributed amongst the rich and poor (Gil, 2006). Rahmer, Miranda and Gil (2013) sustain that class rank is presented as an instrument that increases social inclusion within the system, incorporating more students from establishments with greater indexes of vulnerability, who did not gain access to universities before this indicator was included in the admission process. It is possible to observe the student's systematic academic behavior through an internal measurement, such as the NEM, and a complimentary external measurement, for instance obtained scores on the SIMCE[1] standardized tests, which all Chilean students must take (Meckes, 2007). In our study, we consider obtained scores from the SIMCE taken 2 and 4 years prior to the PSU (in 10^{th} and 8^{th} grades, respectively). Although the NEM have shown to

1 This is a standardized test that is applied to all students across the country to evaluate their learning results in different areas (Language and Communication, Mathematics, Natural Sciences, History, Geography and Social Sciences and English). The tests are given in 2^{nd}, 4^{th}, 6^{th}, 8^{th} and 10^{th} grades.

be a good predictor of performance, they present bias. While all schools use the same grading scale (from 1.0 to 7.0), results are not comparable between institutions. This is why the use of a relative measurement (ranking) has been incorporated as a more adequate way of measuring cognitive as well as non-cognitive skills, such as study habits (Contreras, Gallegos and Meneses, 2009). That is to say, belonging to the group of students with the best grades in the school can be associated to superior cognitive and non-cognitive skills. Furthermore, the authors sustain that relative position could mostly capture information regarding non-cognitive skills that would have a positive effect on first year university performance. Following this same argument, and in the pursuit of recognizing and evaluating other measurements of cognitive and non-cognitive skills, our study proposes using the SIMCE test. This standardized test allows for the comparison of students from different establishments, which nevertheless continue to show levels of inequality in the Chilean education system. Therefore, if a measurement of SIMCE score ranking is used within each establishment, it would be possible to compare students, regardless of their school of origin. This way, the students' performance during different stages of their primary and secondary education can be captured by these additional measurements of relative skills, providing a good way of improving the model's predictive capacity and perfecting the university selection system.

This article is organized in the following manner. Section two presents a brief explanation of literature on academic achievement, as well as primary and secondary performance and the higher education admission system in Chile. Section three presents the study methodology, including the construction of relative performance and the estimation model. Section four presents the statistical description of the data, results of estimations and their respective analysis. Finally, section five presents the study's conclusions.

II. Academic achievement and the higher education admission system

Academic achievement can be understood as a multifactorial phenomenon, as it depends on personal, social and institutional variables (Edel, 2003; Garbanzo, 2007). Therefore the inclusion of cognitive, emotional and socioeconomic variables seek to develop models that allow for better making decisions regarding educational propriety, equity and quality. Along these lines, several studies have incorporated variables associated with these dimensions, such as: secondary education performance, State tests, university entrance exams, intellectual aptitude tests psychosocial factors on consumption of alcohol and other types of substances,

personality traits, factors associated with emotional state to studies, family composition, vocational interest, study habits, among others, that can indicate academic performance (Garbanzo, 2007; Carrión, 2002; and Valle *et.al.*, 1999).

One of the objectives of the higher education admission system is to predict the academic performance that students will have in tertiary education, with the purpose of selecting the best students. However, Clancy and Goastellec (2007) recognize that, historically, three patterns of admission to higher education have been identified: inherited merit, equal rights, and equity or equal opportunities. Inherited merit depends on certain socioeconomic conditions of the student, and has favored more well-off social groups (Roemer, 1998). During the 20th century, as a consequence of the demographic, economic, political and ideological pressures effecting higher education, and specifically the access to higher education, this criteria slowly begins to be abandoned, being replaced by equal rights, which allowed access to a greater number of students, regardless of their social origin. However, despite these changes, access to higher education is still conditioned by inherited merit. Because of this, in the last decades, access to higher education has been characterized by an emphasis on equal opportunities, recognizing that it is necessary to consider the differences in the applicants' structure of opportunities to the higher education system. In this sense, the admission process supposes that talents are randomly distributed among all social groups, forcing the higher education institutes to seek out these talents (Gil, 2006; Clancy and Goastellec, 2007; Rahmer, *et.al.,* 2013).

The Chilean case and revision of empirical studies

For 50 years, access to Chilean higher education has been based on a standardized test that students take once they finish high school or secondary education. From 1963 to 2002, students took the Academic Aptitude Test (*Prueba de Aptitud Académica* or PAA). Currently, they take the PSU, in which they must take the obligatory sections of language and communication, and mathematics, as well as the optional sections that depend on their preferred study program. Without a doubt, this test replicates the inequalities of the school system (Pearson, 2013), and does not comply with the challenges of the university selection system (Meneses and Toro, 2012). Despite the relevance of this topic, studies done in Chile on factors that explain achievement in higher education are scarce and have disparate results. Vial and Soto (2002) established a positive correlation between the weighted admission score and university performance, measured by the grade point average

obtained in university and graduation rates. The same result was found by Fisher and Repetto (2003), recognizing the explanatory capacity of the selection system variables, concluding that those that have greater incidence are the specific physics test (*prueba específica de física* or PEF), the specific mathematics test (*prueda específica de matemáticas* or PEM), secondary education grades (NEM) and the quality of the school of origin. Additionally, they suggested that the change from the PAA to the PSU could decrease the predictive capacity of the system, and that the NEM are not comparable between different types of schools. For their part, Aravena, del Pino and San Martín (2002) cast doubt on the formers' results, since the scores obtained on the PAA only explained 10% of university performance. Along these lines, Cooper (2004) concludes that the result of the PAA test and NEM have a low correlation with university performance, and that the most important factor is the PEM score. Meanwhile, Bastías *et.al.* (2000) find that the most important variable for explaining academic performance corresponds to secondary education grades, followed by the specific biology test, having completed secondary education in the Metropolitan Region and previous university studies. Contreras *et.al.* (2009) conclude that in Chile, being amongst the best graduating students from ones school (ranking) implies better university performance, surpassing the effect of university selection tests, and even secondary education grades. However, Reyes and Torres (2009) conclude that secondary education grades (NEM) and the university selection tests (PSU) have the greatest relative weight. Regarding the PSU exam, the (2013) Pearson report challenges its validity based on four reasons. First, it fails to predict university performance; second, it does not measure the capacity for reasoning on acquired contents; third, it presents discrimination towards certain types of schools, for example, technical and/or professional; and fourth, there is a high inverse correlation generated between the index of vulnerability and PSU scores. In addition, the reports sustains that the PSU increases or at least maintains the socioeconomic gap that exists in the educational system, and society in general, as instead of aptitude it evaluates contents, which are variables associated to school type or access to alternative means of education, such as pre-university classes. Because of the criticism that has been raised regarding the higher education admission system, the Council of Rectors of Chilean Universities (CRUCH) has proposed improving this admission system and complimenting it by including school ranking. Specifically, this allows for measuring the student's relative position in comparison with their fellow classmates, therefore lowering the relative weight of the socioeconomic and school type variables. For example, a student that is among the first places in their class, in a context of vulnerability,

shows capacity for effort, which could be replicated in tertiary education. Because of this, academic achievement prior to university has become one of the indicators with the greatest predictive capacity, and has a lot to do with the quality of the educational institution from which the students come (Díaz *et.al.,* 2002). For their part, the scores obtained on the university admissions tests show an elevated predictive value of students' academic achievement. In this case, Toca and Tourón (1989) found that in those countries that have a rigorous admission process for higher education, students show greater levels of efficiency and quality. Carrión and Montero(2002), Villalobos and Valverde (2007) coincide with these results, and sustain that the score on the university admissions test is fundamental. Along these lines, Herrera *et.al.* (1999) confirm that the variables that most explain academic achievement, in order of importance, are: performance prior to entry to the university, study habits, class attendance, satisfaction with the selected study program, age, mother's educational level, attitude towards the university-professors-classmates, self-efficiency and father's education level. Meanwhile, Ibarra and Michalus (2010) found that the most significant variables for explaining academic performance are higher school grade point average, the institution where they went to high school, and the number of assignments passed during the first year of tertiary education, the latter being the most relevant factor. Finally, Martínez-Padilla and Pérez-González (2008) found that one of the most significant variables was grade point average achieved during secondary education. As a way to include this factor, beginning with the 2013 admission process, the CRUCH decided to incorporate grade ranking as a new weighting factor in the university entrance process. Universities were able to freely weigh this factor, as long as PSU scores are considered for at least 50%, and secondary education grades (NEM) at least 10%.

The incorporation of ranking in the university admissions system

The unequal social composition of students in higher education is caused by the country's enormous social inequality, which is explained by the effect that the students socioeconomic conditions (Contreras, Corbalán and Redondo, 2007). Therefore, according to Meneses and Toro (2012), there are two challenges that the university selection system faces: 1) improving the models predictive capacity, and 2) increasing the systems equity. One variable that could produce both effects is students' relative achievement or ranking during their primary and secondary education. The introduction of this factor is based on the idea that talents are equally distributed amongst rich and poor, and therefore in all schools there are children with the talents required to

successfully complete university studies, regardless if they are private subsidized, public or private paid schools (Gil, 2006). Larroucau, Ríos and Mizala (2015) and Gil, Paredes and Sánchez (2013) argue that a large part of ranking's effect is the inclusion of good students from families with lower incomes. Who attend public and/or private subsidized schools. Therefore, the addition of ranking, according to secondary education grades, favors social inclusion and greater equity, and at the same time, allows universities to receive the best students, increasing retention rates and the efficiency of the teaching learning processes. In this sense, the lack of social equity is expected to be corrected and the quality of the higher education system improved. Gil and del Canto (2012) analyze what the Universidad de Santiago de Chile has done. They have been pioneers with their preparation program, motivating the use of NEM ranking in the admissions process, finding that those students who are within the top 10% of grade point averages in their class obtain better grades at university and graduate earlier than their peers from similar socioeconomic levels, but do not belong to the top 10% of academic performance. This program was also analyzed by Koljatic and Silva (2013), who concluded that the beneficiaries of the program are able to overcome academic gaps during their second year, and graduate only one year later. These results coincide with the experience of other universities, such as the Pontificia Universidad Católica de Chile (Gil *et.al*, 2013), the Universidad Católica de Temuco and the Pontificia Universidad Católica de Valparaíso (Contreras *et.al*, 2009). At an international level Horn's (2012) study stands out, where the use of ranking in the U.S. states of Texas, California and Florida was analyzed. The results found that higher ranked students in secondary education are guaranteed entrance to higher education. In this sense, the study shows that the use of ranking in the higher education entrance process also increases the students' expectations, and motivates them to apply. In addition, Long, Saenz and Tienda (2010) find that the existence of ranking in the higher education selection process has increased applications from under-represented minorities. It is also observed that the use of ranking increases diversity (ethnic and racial), and incorporates vulnerable students (Horn and Flores, 2003; and Atkinson and Pelfrey, 2004). Despite these important findings, the following two limitations are observed in the studies. First, the ranking measurement only refers to NEM, ignoring other measurements of academic performance. Second, the majority of the studies done do not explain the relative position of all of the students in the population. In this sense, there are studies that limit their analysis of ranking only to the top 5%, 10%, 15% and/or 20%, not including the rest of the study population.

III. Methodology

Empirical description of the function of educational production.

Our study proposes to complement the research carried out by Contreras (2001), Contreras *et.al.* (2009), Castro, *et.al.* (2011), and Muñoz and Redondo (2013), by estimating the function of individual educational production. This is done by incorporating two variables: the students' socio-demographic characteristics and relative academic performance. The latter seeks to incorporate the students' academic history as a principal and predictive factor of their future achievement, by using their secondary education grades (their grade point average from 4 years of secondary education), and two standardized tests taken by the students during their primary and secondary education, the SIMCE test taken in eighth grade (last year of primary education) and the SIMCE test taken in tenth grade (second year of secondary education). In general terms, the following model is proposed:

$$PSU\ Score_i = f\left(T_i; E_i; R_{NEM}; R_{SIMCE\,06}; R_{SIMCE\,04}\right) \quad (1)$$

Where:

$PSU\ Score_i$: Average score obtained by the students in both the mathematics and language and communication PSU $test_i$.

T_i : Type of school that the student attends i.

E_i : Student's family's socio-demographic characteristics i

R_{NEM} : Relative position, according to student's NEM i.

$R_{SIMCE\,06}$: Relative position, according to student's 10th grade SIMCE score i .

$R_{SIMCE\,04}$: Relative position, according to student's 8th grade SIMCE score i .

According to empirical evidence, the expected results of this function of production indicate that in more efficient schools, students have higher achievement (Gallegos, Chumacero, Paredes, 2016). This premise

assumes that private schools are more efficient than private subsidized schools, which are in turn more efficient than public schools. It is also expected that the students' socio-demographic characteristics and relative skills, which is measured by ranking or relative position according to NEM, $SIMCE_{06}$ and $SIMCE_{04}$, have a positive relationship. The dependent variable of this study corresponds to the student's average PSU ("*prom_psu*"), obtained as a simple average of the obligatory language and communication and mathematics tests that the student took in the 2009 version of the exam. The explanatory variables include characteristics that are both socio-demographic in nature, as well as those associated with the student's academic performance. Among the former, there are personal variables (gender), those related to their family environment (parents' education level, household income), and characteristics associated with the secondary education establishment from which they graduated (type and location). The description of these variables can be found in Table2.

Table 2. Description of socio-demographic variables.

Name of variable	***Description***
1. Personal variables	
Genero	dummy variable, assigning a value of 1 if the student is female, 0 if male
2. Family environment variables	
Parents' education (greater level of education reached by one of the two parents):	
educ_nm	dummy variable assigned a value of 1 if one of the parents' maximum levels of education is high school level, 0 any other case.
educ_si	dummy variable assigned a value of 1 if one of the parents' maximum levels of education is undergraduate level; 0 any other case.
educ_sc	dummy variable assigned a value of 1 if one of the parents' maximum levels of education is undergraduate level (complete); 0 any other case.
educ_sp	dummy variable assigned a value of 1 if one of the parents' maximum levels of education is graduate level (complete); 0 any other case.
	As a category for comparison, those cases in which one of the parents' had only reached the elementary level were maintained (*educ_nb*).
Student´s nuclear family's level of income:	
quin2	dummy variable assigned a value of 1 if monthly income is between ($200,000 - $400,000); 0 any other case.
quin3	dummy variable assigned a value of 1 if monthly income is between ($400,000 - $800,000); 0 any other case.
quin4	dummy variable assigned a value of 1 if monthly income is between ($800,000 - $1,600.000); 0 any other case.
quin5	dummy variable assigned a value of 1 if monthly income is between ($1.600.000 – and up); 0 any other case.
	As a category for comparison, those cases whose monthly income was equal

	to or less than $200,000 were maintained (*quin1*).
3. Variables associated to the secondary school from which they graduated	
Establishment´s dependence	
PS *PP*	dummy variable assigned a value of 1 if the student graduated from a voucher school; 0 any other case. dummy variable assigned a value of 1 if the student graduated from a private school; 0 any other case. As a category for comparison, those cases of students who graduated from public schools were maintained (*mun*).
Establishment´s location	
Urb	dummy variable assigned a value of 1 if the establishment is located in an urban zone; 0 if it is located in a rural zone.

Source: author elaborated.

Amid the explanatory variables that describe information about the student's performance or achievement are measurements of ranking or relative position compared with other students from the same establishment who took the PSU the same year. Three instruments were used for this ranking measurement: NEM, SIMCE taken in 10th grade and SIMCE taken in 8th grade. The objective behind this was to isolate the effect of "school type" and identify, within each one of them, the students who had constantly shown best academic performance throughout their educational career ("talented students"). Table 3 describes the variables associated with this group.

Table 3. Description of variables associated to student's academic performance

Variable name	*Description*
Secondary education grades (NEM)	
nem_1 hasta nem_10	dummy variables assigned a value of 1 if the students is among the i-ésimo decile of their classmates peers, where i takes on the values 1 to 10, 1 being the decile where the students with the lowest NEM are located, and 10 being the decile where the students with the highest NEM are located; 0 any other case. For the purpose of estimating, the 1st decile was maintained as the category of comparison.
10th Grade SIMCE (SIMCE06): average SIMCE score (mathematics and language tests)	
s06_1 hasta s06_10	dummy variables assigned a value of 1 if the students is among the i-ésimo decile of 10th grade SIMCE scores amongst their classmates, where i takes on the values of 1 to 10, where 1 is the decile in which the students with the lowest scores are located and 10 the decile with the students with the highest scores; 0 any other case. For the purposes of estimating, the 1st decile was maintained as the category of comparison.
8th Grade SIMCE (SIMCE04): average SIMCE score (mathematics and language tests)	
s04_1 hasta s04_10	dummy variables assigned a value of 1 if the students is among the i-ésimo decile of 8th grade SIMCE scores amongst their classmates, where i takes on the values of 1 to 10, where 1 is the decile in which the students with the lowest scores are located and 10 the decile with the students with the

	highest scores; 0 any other case. For the purposes of estimating, the 1st decile was maintained as the category of comparison.

Source: author elaborated.

The incorporation of measurements of academic performance that include SIMCE scores, and not only NEM, is justified by the high correlation between PSU score and these tests (MINEDUC, 2012). Given this, and according to the data presented in Table 4, a high correlation is observed among these variables, especially between PSU score and results from the 2006 SIMCE test (corresponding to 10th grade).

Table 4. Correlation between PSU and SIMCE scores.

	SIMCE 2004	*SIMCE 2006*	*PSU Score 2009*
SIMCE 2004	1.0000		
SIMCE 2006	0.5986	1.0000	
PSU Score 2009	0.6365	0.8163	1.0000

Source: Author elaborated based on data from MINEDUC and DEMRE.

According to Contreras (2001) and Meneses (2008), the school selection process is not random, and is directly affected by the sociodemographic characteristics of the student's family. Therefore, carrying out estimations under ordinary least squares (OLS) over a non-random sample generates biased coefficients. To solve this problem of biased selection, we followed Contreras's (2001) proposal, in which the he argues the use of instrumental variables in a two-stage least squares process, TSLS. In the first stage, a logit multinomial model is proposed in order to determine the probability of choosing a particular school, for which variables of both supply and demand were utilized. Within the instrumental variables of offer, a measurement of competition among school type was calculated by the percentage of students registered in private subsidized or private paid schools in the city (*"perc_vs"* and *"perc_prs"*). On the demand side, a variable associated with the number of members of the household ("p_house") and two dummy variables of the parents' perception of the proximity and prestige of their child's school ("*proximity"* and *"prestige"*) were used. With the estimation of this model, the probabilities of choosing a private subsidized or private paid school were obtained, and a second stage was then incorporated in order to estimate the relationship between student's performance on the PSU, a group of socio-demographic factors, and the previously described rankings.

The data

This study worked with the cohort of students that applied to Chilean universities in 2009 (which is to say, those students who were in 12th grade or fourth year of secondary education in 2008). Their SIMCE test results correspond to the years 2004, when they were in eighth grade, and 2006, when they were in their second year of secondary education. This information, together with the students' characteristics, comes from the official sources of the Ministry of Education (MINEDUC) and DEMRE[2]. After combining the databases from both sources and debugging the data, the simple was composed of 104,187 students, of which de 42,589 graduated from public schools (40.9%), 50,267 from private subsidized schools de (48.2%) and only 11,331 came from private schools (10.9%). Tables 5 and 6 present the descriptive statistics of the main variables of the sample, considering a separation by school type. The former shows the statistics for the dependent variable and the socio-demographic variables, while the latter presents the statistics of the measurements of ranking, which were calculated based on the databases provided by DEMRE, just as carried out by Gallegos and Meneses (2007). In Table 5, the marked difference amongst types of establishments regarding obtained PSU scores and socio-demographic characteristics can be observed. Specifically, students from private schools are characterized as obtaining PSU scores well above those from the other types of schools, as well as mostly belonging to the quintile with the highest income and whose parents have reached higher education (over 70%). Later, these characteristics begin to decrease as we move to private subsidized schools and public schools. Students from public schools have an average PSU score of under 500 points, mainly belong to the first quintiles and mostly have parents who have only achieved high school educations. It is worth mentioning that the three school types present similar extreme cases regarding PSU scores. The only transversal characteristic among students from the three types of establishments is gender (more than half are female) and the location of schools in urban areas.

Table 5. Variable's main descriptive statistics.

	Average				**Standard deviation**			
	ALL	**MUN**	**PS**	**PP**	**ALL**	**MUN**	**PS**	**PP**
prom_psu (*)	506.78	472.56	507.97	630.15	103.94	96.51	92.85	80.39
genero	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

2 Department of Educational Evaluation, Measurement and Registry of the Universidad de Chile.

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
urb	0.97	0.97	0.97	0.98	0.16	0.16	0.17	0.12

(*)The minimum PSU scores obtained in public, voucher and private schools are 184, 190.5, and 274.5, respectively. Meanwhile, the maximum scores are 831, 836, and 845.5, respectively.
Source: author elaborated based on data from MINEDUC and DEMRE.

Meanwhile, when analyzing the ranking levels, the proportions distributed in each decile are similar amongst the three types of establishments.

Table 6. Main descriptive statistics of the variables associated to academic performance

	Average				**Standard Deviation**			
	ALL	**MUN**	**PS**	**PP**	**ALL**	**MUN**	**PS**	**PP**
nem_1	0.143	0.138	0.147	0.144	0.350	0,344	0.354	0.351
nem_2	0.106	0.109	0.104	0.105	0.308	0,312	0.305	0.307
nem_3	0.104	0.104	0.104	0.108	0.306	0,306	0.305	0.310
nem_4	0.099	0.100	0.098	0.098	0.299	0,300	0.298	0.298
nem_5	0.094	0.095	0.094	0.092	0.292	0,293	0.291	0.290
nem_6	0.100	0.098	0.101	0.103	0.300	0,297	0.302	0.304
nem_7	0.098	0.100	0.096	0.100	0.297	0,300	0.294	0.300
nem_8	0.091	0.091	0.092	0.091	0.288	0,287	0.289	0.287
nem_9	0.092	0.090	0.093	0.093	0.289	0,286	0.291	0.290
nem_10	0.073	0.076	0.072	0.066	0.260	0,265	0.258	0.249
s06_1	0.111	0.108	0.112	0.115	0.314	0,311	0.315	0.320
s06_2	0.098	0.099	0.098	0.098	0.298	0,298	0.297	0.298
s06_3	0.101	0.100	0.102	0.101	0.301	0,300	0.302	0.301
s06_4	0.099	0.099	0.099	0.099	0.299	0,299	0.298	0.298
s06_5	0.097	0.097	0.097	0.096	0.296	0,297	0.296	0.294
s06_6	0.103	0.103	0.103	0.105	0.304	0,303	0.304	0.306
s06_7	0.101	0.101	0.102	0.103	0.302	0,301	0.302	0.304
s06_8	0.099	0.099	0.099	0.097	0.298	0,299	0.298	0.296
s06_9	0.101	0.101	0.101	0.102	0.302	0,301	0.302	0.303
s06_10	0.090	0.093	0.088	0.084	0.286	0,290	0.284	0.278
s04_1	0.111	0.108	0.112	0.116	0.314	0,311	0.316	0.320
s04_2	0.098	0.099	0.098	0.098	0.298	0,298	0.297	0.298

s04_3	0.101	0.101	0.101	0.101	0.301	0,301	0.302	0.301
s04_4	0.099	0.099	0.099	0.099	0.298	0,299	0.298	0.298
s04_5	0.097	0.098	0.097	0.095	0.296	0,297	0.296	0.293
s04_6	0.103	0.102	0.103	0.104	0.304	0,303	0.304	0.306
s04_7	0.101	0.101	0.101	0.103	0.302	0,301	0.302	0.304
s04_8	0.098	0.099	0.098	0.098	0.298	0,298	0.298	0.297
s04_9	0.101	0.101	0.102	0.102	0.302	0,302	0.302	0.302
s04_10	0.090	0.092	0.089	0.085	0.286	0,290	0.284	0.278

Source: author elaborated based on data from MINEDUC and DEMRE

IV. Results and analysis of the estimates.

In a first stage, we estimate the logit multinomial model (results presented in Table 7), and then in a second stage, we estimate the equation (2) for all of the students, in which the variables *"pps"* and *"ppp"* correspond to the probabilities of choosing a private subsidized school or a private paid school, respectively, obtained in the first stage.

Table 7. Logit multinomial model estimation.

School type	**Coefficient**	**Std.err.**	**estad.z**
Voucher			
const	-3.40	0.04	-85.60
educ_nm	0.40	0.02	16.06
educ_si	0.82	0.03	28.11
educ_sc	0.89	0.04	24.56
educ_sp	0.99	0.08	12.58
quin2	0.49	0.02	26.27
quin3	0.95	0.02	39.15
quin4	1.43	0.04	34.88
quin5	1.87	0.09	20.96
porc_ps	5.33	0.04	121.30
porc_pp	1.96	0.08	26.06
p_hogar	-0.09	0.01	-17.20
cercania	0.18	0.02	10.43
prestigio	0.31	0.02	18.84
Private			
const	-8.24	0.24	-34.77
educ_nm	1.01	0.22	4.70
educ_si	2.35	0.21	11.00
educ_sc	2.81	0.21	13.14
educ_sp	3.06	0.23	13.58
quin2	1.54	0.12	12.62

quin3	3.18	0.12	27.40
quin4	5.14	0.12	43.22
quin5	7.13	0.14	50.81
porc_ps	3.02	0.10	29.51
porc_pp	5.55	0.11	48.89
p_hogar	-0.23	0.01	-17.35
cercania	0.09	0.04	2.32
prestigio	0.52	0.04	14.68
Log likelihood	-62836.732		
LR chi2 (26)	74078.03		
Prob > chi2	0.0000		
Pseudo R2	0.3709		

Source: author elaborated based on data from MINEDUC and DEMRE

$$prom_{psui} = ¿$$

$$\alpha + \beta_1 pps + \beta_2 ppp + B_3 urb + \beta_4 educ_{nm} + \beta_5 educ_{si} + \beta_6 educ_{sc} + \beta_7 educ_{sp} + \beta_8 genero + \beta_9 quin2 + \beta_{10} quin3 + \beta_{11} qu$$

… (2)

The results of the equation (2) estimates for the entire simple of students are presented in Table 8, where it is possible to observe a standard behavior as that found in the literature. All of the models explicative variables end up being statistically significant at 1%, therefore each one of them impact on the average PSU score obtained by the students. Specifically, all of the variables directly affect PSU score, except for gender, which shows a negative sign. That is to say, if the student is female, her average PSU score is reduced by 14.08 points in comparison with her male counterparts. Parents' educational level, which may reflect the level of education that student's receive in their home, also differentially affects their children's' achievement on the PSU. Those who come from homes with parents who have greater educational levels present higher PSU scores that those whose parents have lower educational levels. Likewise, the families' income levels presented similar results.

Table 8. Two-Stage MCO estimations explaining average PSU score.

	coef.	std.err.	estad. T			coef.	std.err.	estad. T
constante	313.17	1.60	195.24		*s06_2*	15.60	0.92	16.88
pps	8.25	1,00	8.26		*s06_3*	23.22	0.95	24.56
ppp	116.56	2.52	46.31		*s06_4*	30.50	0.98	31.25
urb	30.51	1.28	23.78		*s06_5*	36.76	1.01	36.54
educ_nm	22.65	0.69	32.96		*s06_6*	43.11	1.02	42.45
educ_si	50.27	0.84	60.14		*s06_7*	50.09	1.05	47.87
educ_sc	60.91	0.99	61.26		*s06_8*	58.39	1.08	53.91
educ_sp	63.81	1.51	42.25		*s06_9*	67.37	1.12	60.00
genero	-14.08	0.42	-33.49		*s06_10*	86.80	1.24	70.08
quin2	22.26	0.55	40.35		*s04_2*	13.83	0.92	14.99
quin3	40.09	0.71	56.35		*s04_3*	20.30	0.94	21.55
quin4	41.94	1.20	34.82		*s04_4*	27.32	0.97	28.15
quin5	36.09	2.06	17.52		*s04_5*	31.24	0.99	31.41
nem_2	8.50	0.84	10.11		*s04_6*	37.12	1.00	37.04
nem_3	15.08	0.85	17.73		*s04_7*	40.83	1.03	39.76
nem_4	22.25	0.87	25.56		*s04_8*	47.22	1.06	44.65
nem_5	26.35	0.89	29.49		*s04_9*	54.08	1.09	49.78
nem_6	30.50	0.89	34.44		*s04_10*	68.74	1.19	57.89
nem_7	38.98	0.91	43.02					
nem_8	46.59	0.94	49.62		*F(39,104147)*	3839,44		
nem_9	55.27	0.96	57.47		*Prob > F*	0,0000		
nem_10	73.26	1.08	67.79		*R2 ajustado*	0,5896		

Source: author elaborated based on data from MINEDUC and DEMRE

Regarding the effect that the establishment from which they complete their secondary education has on PSU score, it can be observed that those who come from urban schools have an average PSU score 30.51 points higher than those who attended rural schools. In addition, the effect of school type (public, private subsidized or private paid) is shown to be a significant factor when analyzing PSU achievement, again showing that students from private paid schools have better results on the PSU compared with those from private subsidized and public schools, and those students from private subsidized schools show an advantage over those from public schools. Evaluating the effects of ranking measurements on PSU points, some interesting results are identified. First, the ranking classification, whether it be via NEM or SIMCEs, shows that as we move towards the highest decile, in other words, the one that groups together the students with best academic performance amongst their peers, the positive effect on PSU scores increases. Second, the student's results on

the SIMCE taken in 10th grade has a greater impact on PSU scores than the NEM and the SIMCE taken in 8th. Furthermore, the student's relative position on the SIMCE taken in 8th grade better explains PSU scores than PSU the NEM. This effect is interesting to address, as the current Chilean university selection has considered NEM as a mechanism of observing the student's past academic performance. Meanwhile, although these estimates confirm this relationship, they show that the student's achievement on the SIMCE standardized tests better explain their future performance, especially the SIMCE taken in 10th grade. As it has been found that there are significant differences depending on type of establishment, Table 9 presents the obtained estimate results separated by establishment type. All of the estimated coefficients were statistically significant at 1% (with the exception of a couple of coefficients from the equation from private paid establishments).

Table 9. Two-Stage MCO estimations explaining average PSU score for each type of establishment (estimated coefficients).

	Public	**Voucher**	**Private**
constant	297.29	328.44	456.78
urb	45.04	26.39	14.64
educ_nm	19.03	24.04	-6.20(*)
educ_si	49.61	50.80	0.04(*)
educ_sc	62.22	65.74	14.02(*)
educ_sp	82.89	69.19	18.97(*)
genero	-14.55	-12.03	-20.65
quin2	20.73	20.25	24.37
quin3	42.07	37.94	30.52
quin4	65.17	51.17	42.09
quin5	66.42	61.78	59.86
nem_2	7.89	8.53	17.67
nem_3	13.14	15.12	25.96
nem_4	20.62	22.04	37.10
nem_5	22.25	27.64	44.41
nem_6	25.36	32.65	45.46
nem_7	36.66	39.51	55.64
nem_8	41.70	47.89	66.21
nem_9	51.39	56.44	74.34
nem_10	71.10	74.07	90.25
s06_2	14.12	16.63	19.51
s06_3	24.18	22.31	25.61
s06_4	31.95	29.68	30.47
s06_5	38.02	35.88	38.99
s06_6	43.99	42.73	43.35
s06_7	51.41	49.59	49.09
s06_8	61.00	57.30	57.73
s06_9	70.51	66.13	63.82
s06_10	91.93	86.63	75.84
s04_2	14.40	13.98	13.58
s04_3	20.63	20.28	20.04
s04_4	28.67	27.35	24.73
s04_5	31.59	33.20	25.62
s04_6	38.22	38.39	29.48
s04_7	42.21	41.72	33.42
s04_8	50.26	47.52	38.99
s04_9	56.29	54.82	45.57
s04_10	72.40	69.56	59.82
	F(37.42551)	F(37.50229)	F(37.11293)
	1103,.8	1475.85	376.35
Prob > F	0.0000	0.0000	0.0000
R2 adjusted	0.4893	0.5205	0.5507

Note: (*) Statistically non-significant coefficients (p value > 0,05).

Source: author elaborated based on data from MINEDUC and DEMRE.

Table 9 confirms that those students who attend urban schools have higher scores on the PSU test. However, this effect is greater for public schools, as rural areas tend to have greater presence of these types of establishments; private paid and private subsidized schools have scarce presence in these zones (Chumacero, Paredes and Gallegos, 2016). Regarding the gender variable, it is observed that if a students is female, her PSU scores are reduced when compared with her male counterparts. This is particularly true at private subsidized establishments. It can be observed that the variables of parents' educational level and the family's income level positively and significantly affect performance. This effect is different depending on school type. In private subsidized, parents' educational level does not generate a significant effect on PSU results, while in private subsidized and public schools, this factor is relevant. It is worth noting that there is an important increase in PSU scores of students from public schools in which one parent has completed a tertiary degree, scoring 82.89 points higher than students whose parents have only completed secondary education. Another effect worth pointing out is that of income level, as it is observed that this positively and mainly affects those who attend public schools. By concentrating the effects of ranking measurements on average PSU scores, in general it can be observed with the three ranking measurements, as we approach the highest decile, or the group of students with best academic performance, the students, PSU scores are higher than those in the group with lower performance. Examining the effect of ranking according NEM, as we move towards the highest decile, we observe a positive effect on PSU scores, especially among students from private schools. However, when observing the effects of relative position related to SIMCE scores, some matrixes are generated, and they are interesting to consider, especially among students from public schools. Examining the results associated to ranking by 10^{th} grade SIMCE, a marked improvement in PSU scores can be observed for the group with best achievement. This is especially true for students from public schools, where the highest decile had an average PSU score 91.93 points higher than their peers in the lowest decile, while in private subsidized schools this difference was 86.63 points, and in private paid schools 75.84 points. This difference in favor to public's students is show from to sixth decil, however from decil 3 to 5 they are only exceed to private subsidized school's student. Similarly, when controlled by 8th grade SIMCE performance, talented students from public schools show a greater increase in their PSU scores in relation to their peers. These results make us wonder if the traditional Chilean universities' current selection system, is

using all of the necessary information in order to carry out a fair and efficient selection process that does not discriminate students based on the type of school they attended, and that does select the best students, ensuring that they successful in making it to higher education.

V. Conclusions.

The way that universities select students has been studied in literature, considering optimizing the processes and ensuring that the students that enter the system will be able to positively perform once in. In the Chilean case, the use of a standardized test, the PSU, has been criticized, mainly because of its strong discrimination towards students from lower social strata and whose have lower learning opportunities. Because of this, in the last few years more fair ways of entrance to higher education have been sought out, including the incorporation of ranking by secondary education grades (NEM), which seeks to give greater opportunities to the best students from different establishments. In other words, its objective is to allow the most talented students from each establishment to enter higher education, even when they cannot obtain excellent scores on the PSU.

This study confirms that the students that are located in the highest deciles in their school, regarding grades, are capable of increasing their PSU score compared with the students in the lowest deciles. This effect is much more marked in students in private schools. However, by incorporating relative measurements based on SIMCE scores, it is shown that the explicative level of these complementary measurements is greater than that based exclusively on NEM. On one hand, this is explained by the high correlation between SIMCE tests and PSU score. But on the other hand, carrying out a more in depth statistical analysis, we have found that ranking by SIMCE test is a measurement that favors all students, regardless of the type of school they attend, but whose impact is more marked in students from public schools. This last proposal is very important, as it demystifies the students who graduate from the public school system by providing evidence that improvements in academic performance that can be obtained by the most talented students that come from these establishments are much higher when than those from their peers. This could mean that these students may have characteristics other than cognitive skills that help them give greater effort, which in turn could have positive impacts on their higher education career. These results are interesting to address, as the current Chilean university selection system has only considered the NEM as a mechanism for observing a student´s

past academic achievement. While the estimates presented in this article confirm this as valid, they also show that the student's achievement in the standardized SIMCE tests, especially the 10th grade SIMCE test, have a greater influence on future performance. Therefore, considering a wider range of aspects related to the student's past academic performance may help create a better university selection system.

References.

Aitken, N. (1982). College student performance, satisfaction, and retention: Specification and estimation of a structural model, Journal of Higher Education, 53(1), 32 – 50.

Aravena, R., Del Pino, G. y San Martín, F. (2002). Sobre la capacidad predictiva de la Prueba de Aptitud Académica, Statistica et Societatis, 1, Facultad de Matemáticas, Departamento de Estadística, Pontificia Universidad Católica de Chile.

Atkinson, C. y Pelfrey, P. (2004). Rethinking admissions: US public universities in the post-affirmative action age. CSHE.11.04, Center for Studies in Higher Education, Berkeley.

Bastías, G., Villarroel, L., Zúñiga, D., Marshall, G., Velasco, N. y Mena, B. (2000). Desempeño académico de los estudiantes de medicina: ¿Un resultado predecible?, Revista Médica de Chile, 128 (6), 671 – 678.

Carrión, E. (2002). Validación de características al ingreso como predictores del rendimiento académico en la carrera de medicina. Revista Educación Médica Superior, 16 (1), 5 – 18.

Castro,C., Meneses, F., Paredes, R. y Silva, M. (2011). University selection: Using high school ranking to enhance prediction and diversity, Working paper Escuela de Ingeniería, Pontificia Universidad Católica de Chile.

Chumacero, R., Paredes, R. y Gallegos, J. (2016). Competition pressures and academic performance in a generalized vouchers context", Estudios de Economía, forthcoming 2016.

Clancy, P. y Goastellec, G. (2007). Exploring access and equity in higher education: Policy and performance in a comparative perspective, Higher Education Quarterly, 61(2), 136 – 154.

Clavero, J. (2006). Educación superior: tendencias y desafíos, Educación Médica, 9(1), 10 – 14.

Contreras, D. (2001). Evaluating a voucher system in Chile: Individual, family and school characteristics. Documento de trabajo N°175, Facultad de Ciencias Económicas y Administrativas, Departamento de Economía, Universidad de Chile.

Contreras, M., Corbalán, F. y Redondo, J. (2007). Cuando la suerte está echada: estudio cuantitativo de los factores asociados al rendimiento en la PSU, REICE: Revista Electrónica Iberoamericana sobre Calidad, Eficacia y Cambio en Educación, 5(5), 259 – 263.

Contreras, D., Gallegos, S. y Meneses, F. (2009). Determinantes de desempeño universitario: ¿Importa la habilidad relativa?", Calidad en la Educación, 30, 17 - 48.

Cooper, D. (2004). Predictibilidad de la Prueba de Aptitud Académica en el rendimiento de los ingenieros comerciales de la Universidad de Santiago de Chile. Presentado en Encuentro Nacional de Facultades de Administración, ENEFA, Arica, Chile.

Díaz, Á. (1996). Dos miradas sobre la educación superior: Banco Mundial y la UNESCO, Momento económico, 83(1), 2 – 7.

Díaz, M., Peio, A., Arias, J., Escudero, T., Rodríguez, S. y Vidal, G. (2002). Evaluación del rendimiento académico en la enseñanza superior. Comparación de resultados entre alumnos procedentes de la LOGSE y del COU, Revista de Investigación Educativa, 2(20), 357 – 383.

Edel, R. (2003). El rendimiento académico: Concepto, investigación y desarrollo, REICE, Revista Electrónica Iberoamericana sobre Calidad, Eficacia y Cambio en Educación, 1(2), 1 – 15.

Fisher, R. y Repetto, A. (2003). Método de selección y resultados académicos: Escuela de Ingeniería de la Universidad de Chile, Estudios Públicos, 92, 229 – 250.

Gallegos, J., Chumacero, R. y Paredes, R. (2016). School choice and switching costs, El Trimestre Económico, forthcoming 2016.

Gallegos, S. y Meneses, F. (2007). ¿Es eficiente el sistema de ingreso a la Universidad? El uso del ranking en la universidad Católica de Chile. Disponible en http://www.ideaseneducacion.cl/wp-content/uploads/2008/07/paper-puc-sistema-de-ingreso3.pdf (rescatado en marzo de 2016)

Garbanzo, G. (2007). Factores asociados al rendimiento académico en estudiantes universitarios, una reflexión desde la calidad de la educación superior pública, Revista Educación, 31(1), 43 – 63.

García, M. y San Segundo, M. (2001). Indicadores de resultados docentes de las universidades. XII Jornadas de la Asociación de Economía de la Educación.

Geiger, M. y Cooper, E. (1995). Predicting academic performance: the impact of expectancy and needs theory. Journal of Experimental Education, 63(3), 251 – 262.

Gil, F. (2006). Acceso a las universidades: Una propuesta. Cuadernos del Foro Nacional Educación Calidad para Todos, Chile, UNESCO.

Gil, F. y del Canto, C. (2012). El caso del programa propedéutico en la Universidad de Santiago de Chile (USACH)", Pensamiento Educativo. Revista de Investigación Educacional Latinoamericana, 49(2), 65 – 83.

Gil, F., Paredes, R. y Sánchez, I. (2013). El ranking de las notas: inclusión con excelencia. Centro de Políticas Públicas UC, 60, 1 – 19.

Herrera M., Nieto, M., Rodríguez, M. y Sánchez, M. (1999). Factores implicados en el rendimiento académico de los alumnos Universidad de Salamanca. Revista de Investigación Educativa, 17(2), 413 – 421.

Horn, C. (2012). Percent plan admissions: Their strengths and challenges in furthering an equity agenda, Pensamiento Educativo, 49 (2), 31 – 45.

Horn, C. y Flores, S. (2003). Percent plans in college admissions: A comparative analysis of three states' experiences, Cambridge, MA: The Civil Rights Project at Harvard University.

Ibarra, M. y Michalus, J. (2010). Análisis del rendimiento académico mediante un modelo Logit, Ingeniería Industrial, 9(2), 47 – 56.

Juarros, M. (2006). ¿Educación superior como derecho o como privilegio? Las políticas de admisión a la universidad en el contexto de los países de la región. Andamios, 3(5), 69 – 90.

Koljatic, M. y Silva, M. (2013). Opening a side-gate: engaging the excluded in Chilean higher education through test-blind admission, Studies in Higher Education, 38(10), 1427 – 1441.

Larroucau, T., Ríos, I. y Mizala, A. (2015). Efecto de la incorporación del ranking de notas en el proceso de admisión a las universidades chilenas, Pensamiento Educativo. Revista de Investigación Educacional Latinoamericana, 52(1), 95 – 118.

Long, M., Saenz, V. y Tienda, M. (2010). Policy transparency and college enrollment: Did the Texas top ten percent law broaden access to the public flagships?, The Annals of the American Academy of Political and Social Science, 627(1), 82 – 105.

Martínez-Padilla, J. y Pérez-González, J. (2008). Efecto de la trayectoria académica en el desempeño de estudiantes de ingeniería en evaluaciones nacionales, Formación Universitaria, 1(1), 3 – 12.

Meckes, L. (2007). Evaluación y estándares: logros y desafíos para incrementar el impacto en calidad educativa, Revista Pensamiento Educativo, 40(1), 351 – 371.

Meneses, F. (2008). Evaluación del sistema de vouchers chileno por medio de la prueba de selección universitaria (PSU). Comparación de metodologías y variables de exclusión. Seminario de Título de Ingeniero Comercial Mención Economía, Departamento de Economía, Pontificia Universidad Católica de Chile.

Meneses, F. y Toro, J. (2012). Predicción de notas en derecho de la Universidad de Chile: ¿sirve el ranking?, Revista ISESS, 10, 43 – 58.

MINEDUC. (2012). Inclusión del ranking de notas en el proceso de admisión 2013: posibles efectos en la equidad de acceso a la educación superior, Serie Evidencias, 1(7), 1 – 10.

Montero, E., Villalobos, J. y Valverde, A. (2007). Factores institucionales, pedagógicos, psicosociales y sociodemográficos asociados al rendimiento académico y a la repetición estudiantil en la Universidad de Costa Rica: Un análisis multinivel. RELIEVE, 13(2). Disponible en http://www.uv.es/RELIEVE/v13n2/RELIEVEv13n2_5.htm (rescatado en junio 2016)

Muñoz, P. y Redondo, A. (2013). Desigualdad y logro académico en Chile, Revista CEPAL, 109, 107 – 123.

Pearson. (2013). Evaluation of the Chile PSU - Final Report. Disponible en http://portales.mineduc.cl/usuarios/mineduc/doc/201301311057540.Chile_PSU-Finalreport.pdf (rescatado en marzo 2016).

Rahmer, B., Miranda, R. y Gil, F. (2013). Programa de acceso inclusivo, equidad y permanencia de la Universidad de Santiago de Chile: Una política de acción afirmativa, En publicación de la III Conferencia Latinoamericana sobre el Abandono en la Educación Superior (CLABES). México DF.

Reyes, A. y Torres, M. (2009). La PSU y otros factores de rendimiento y éxito académico universitario. El caso de la Pontificia Universidad Católica de Valparaíso. Memoria de Titulación, Escuela de Ingeniería Comercial, Pontificia Universidad Católica de Valparaíso, Valparaíso, Chile.

Roemer, J. (1998). Equality of opportunity. Harvard University Press. Unite States of America.

Rodríguez, S., Fita, E. y Torrado, M. (2004). El rendimiento académico en la transición secundaria-universidad, Revista de Educación, 334, 391 – 414.

Salanova, M., Martínez, I., Bresó, E., Llorens, S. y Grau, R. (2005). Bienestar psicológico en estudiantes universitarios: facilitadores y obstaculizadores del desempeño académico, Anales de Psicología, 21(1), 170-180.

Toca, M. y Tourón, J. (1989). Factores del rendimiento académico en los estudios de arquitectura, Revista de Investigación Educativa, 14(7), 31 – 45.

UNESCO. (1995). Documento de política para el cambio y el desarrollo en la Educación Superior. Organización de las Naciones Unidas para la Educación, la Ciencia y la Cultura, París.

Valle, A., González, R., Núñez, J., Martínez, S. y Pineñor, I. (1999). Un modelo causal sobre los determinantes cognitivo-motivacionales del rendimiento académico, Revista de Psicología General Aplicada, 52(4), 499 – 519.

Vial, B. y Soto, R. (2002). ¿Predice la PAA el rendimiento o éxito en la Universidad, Revista Administración y Economía, 48, 24 – 27.