PEL Pensamiento Educativo. Revista de Investigación Educacional Latinoamericana
2019, 56(1), 1-19

Pontificia Universidad Católica de Chile
Facultad de Educación

Gender Gap in University Admission Test in Chile: What is Happening at the Top and Bottom of the Test Score Distribution?

Brechas de género en los resultados de pruebas de selección universitaria en Chile. ¿Qué sucede en los extremos superior e inferior de la distribución de puntajes?

Karina Díaz[1], Javiera Ravest[2] y Juan Pablo Queupil[3]

[1] Teachers College, Columbia University, Graduate School of Education
[2] Universidad de Chile
[3] Centro de Estudios en Educación y Aprendizaje Basado en la Comunidad, Universidad Católica Silva Henríquez

Abstract

Transition to tertiary education is a key step for students, which usually involves the application of admission tests. In general, when contrasting different groups of people —mainly based on socio-economic variables—, analyses of this type of evidence are mostly concentrated on average test scores, in which few studies incorporate gender perspective. In this sense, this study focuses on the Chilean context, concentrating the analysis in the upper tail of the scores —where actual university admission is occurring—, and lower —where potential lack of learning opportunities is exposed— of the University Selection Test (PSU). At the same time, gender gaps are compared for the 2014-2018 period in the aforementioned top and bottom zones of the test scores distribution. Results indicate that there are persistent gaps that limit the possibilities for women to pursue university careers in areas related to science, technology, engineering and mathematics. Therefore, it is important that both, public and university policies, consider affirmative actions that may address these issues, considering the ongoing higher education reform and possible changes into the Chilean university admission system.

Keywords: gaps, gender perspective, higher education, transition, university admission test

Post to:
Karina Gabriela Díaz Yáñez
Teachers College, Columbia University,
360 W 119th St, Apt 4A, New York, NY 10026, USA,
kgd2118@tc.columbia.edu
Díaz agradece al Ministerio de Educación y al Departamento de Evaluación, Medición y Registro Educacional (DEMRE), de la Universidad de Chile, por facilitar las bases de datos del proceso de admisión a la educación superior universitaria vía Prueba de Selección Universitaria, PSU.

ISSN: 0719-0409 DDI: 203.262, Santiago, Chile
doi: 10.7764/PEL.56.1.2019.5

Resumen

El tránsito a la educación terciaria es una etapa clave para las y los estudiantes, y suele involucrar la aplicación de pruebas de admisión universitaria. En general, cuando se analiza el desempeño en este tipo de evaluaciones, se utilizan variables socioeconómicas para explicar diferencias centradas en las medias de distintos subgrupos, donde la perspectiva de género es relativamente incipiente. En ese sentido, este estudio se focaliza en el contexto chileno, analizando las brechas de género entre mujeres y hombres en la cola superior de los puntajes —donde se define la selección para estudios universitarios—, e inferior —donde se exponen potenciales faltas de oportunidades de aprendizaje— de la Prueba de Selección Universitaria, PSU. A su vez, se comparan estas brechas de género para el período 2014-2018 en los tramos mencionados de la distribución de puntajes. Los resultados indican la existencia de brechas persistentes que limitan las posibilidades de las mujeres para proseguir carreras universitarias en instituciones competitivas y/o áreas ligadas a las ciencias, tecnología, ingeniería y matemáticas. Por ello, es relevante que la política pública y universitaria considere acciones afirmativas complementarias para superar esta situación, teniendo en cuenta la reforma de educación superior en curso y los posibles cambios al sistema de admisión universitario chileno.

Palabras clave: admisión universitaria, brechas, educación superior, género, prueba de selección universitaria

Introduction

Around the world, women tend to be sub-represented in the different spheres of the social, laboring, economic and educational world (International Labour Organization, ILO, 2017; World Economic Forum, 2017). This last dimension observes what happens in educational evaluations as well as in the access to certain majors (Jurajda & Münich, 2011). In this regard, the small presence of women in the fields of science, technology, engineering and mathematics (from now on, STEM[1]); as well as in other fields of the social sciences (Ganley, George, Cimpian & Makowski, 2018) has been observed. This has become a concerning issue in the last few years, raising from the positioning of gender discussions – added to the recent feminist movements in different countries – which have manifested the need to have more diversity in higher education and to attract the best of talents, regardless of their gender, towards the constitution of the work force (Villaseñor, Celis, Queupil, Pinto & Rojas, in press).

Then, it is necessary to make the editorial disagreement explicit towards the binary conception of gender. Additionally, the authors agree that the use of gender as a concept must reject biological explanations such as that the diverse forms of feminine subordination are due to the capacity to give birth and their "lesser muscular strength". In this way, gender is understood as a cultural construction, that is to say, "social construction of ideas regarding appropriate roles for men and women … according to this definition is a social category imposed over a sexed body" (Scott, 1996, p. 272). However, the quantitative nature of this study and the availability of data, force us to adopt this binary notion, analytically.

In this sense, studying the gender differences in higher education would allow us to understand a part of the origins of inequality. From there, it would be possible to improve the current understanding of how learning is displayed and thus, to foster it. (Organisation for Economic Co-operation and Development, OECD, 2009). Regarding the results of large-scale educational assessments, the national and international experiences show that important gaps occur among the areas of language and mathematics, as the performances vary according to sex (Arias, Mizala & Meneses, 2016; Lietz, 2006; Mann & DiPrete, 2016).

Likewise, the evidence points out that gender discrimination is the most important factor to explain these gaps, as they respond to the characteristics of the educational system and of gender equality in society, not to biological factors (Hyde, 2014). In this context, the results of the assessment show the

[1] Acronym for the English words: science, technology, engineering and mathematics.

impact of certain social and cultural practices, as well as the expectations that shape stereotypes in the individual socialization process (Legewiea & DiPrete, 2012; Lewis & Sekaquaptewa, 2016). That said, regarding stereotypes, these are born from the imposition of roles and different beliefs according to sex: "These beliefs, the socialization process and the individual processes promote the emergence of differentiated behaviors between men and women, and in consequence, these stereotypes are maintained" (Castillo & Montes, 2014, p. 1444)." Similarly, Barberá, Candela & Ramos (2008) signal that this type of socialization affects personal interests, which subsequently determine the decisions that people make regarding their professional path and life.

In the case of Chile, important efforts have been made to reduce this gap (Agencia de Calidad en la Educacion, ACE, 2016) with some concrete results, mostly focused on improving teachers' practices that tend to hamper the learning process in women, interacting more with them, or using female examples in class, to name a few. For example, after the application of the Sistema de Medicion de la Calidad de la Educacion, SIMCE 2017[2] (System for the Measurement of Quality of Education, SIMCE), the Chilean Ministry of Education, Mineduc (2018) announced a significant decrease of this gap in mathematics, explained in part by the expectations of male and female students to enter higher education. Nonetheless, these measures have focused on studying the difference between the statistical means of performance by group. Therefore, to understand this phenomenon in a better way, and to deal with it appropriately, more evidence is still needed.

Considering the above, it is valid to question what is happening with high-risk tests, such as those that grant access to higher education. In this aspect, it is worth noting the role of the Chilean Sistema Unico de Admision (Single Admission System, from now on SUA), which gathers the majority of Chilean private and public universities[3]. This centralized system is based on scores obtained by female and male PSU applicants, which is a key aspect concerning entering higher education and scholarship granting.

Despite this background and evidence, there must be additional research on the role of the PSU as an instrument that reflects and evidences the origin of gender gaps in university cohorts, particularly because, as it has been stated, existent studies focus on the means of the test (Arias et al., 2016) and socioeconomic aspects (Koljatic & Silva, 2010).

In this sense, as research objective, this study aimed at dealing with this problematic, which is how the PSU evinces gender gaps, offering a more complete perspective to answer the research question: "What happens with the top and bottom extremes in the distribution of PSU scores when men and women are considered separately?

Then, we will observe what happens in a standard deviation below the mean, and a standard deviation above the mean (see Figure 1) in the PSU tests of Mathematics and Spanish Language for the admission processes 2014 to 2018. That is, the gender gaps in both the bottom and top scores of these two tests, which are mandatory for everyone who applies to higher education in Chile. It is presumed that this phenomenon has implications for the students' academic path and public policies, understanding that obtaining low scores does not allow to access to the higher education system. However, obtaining higher scores in competitive majors may decrease the chances of entering university for certain applicants, among them women who pursue programs of study in elite higher education institutions.

Background

Unequal access to university programs according to sex. Individual choice?

Research has shown and proved that women and men share the same biological base for comprehension and dominion of different types of knowledge, even at the highest level (Spelke, 2005). However, there are different types of performances according to sex, which can be explained due to either hostile or openly

[2] To obtain more information about this topic, visit this page web from MINEDUC in http://www.agenciaeducacion.cl/evaluaciones/que-es-el-simce/

[3] According to the official SUA website (http://sistemadeadmision.consejoderectores.cl) in 2018 the system gathered 41 out of 61 universities from the country.

stereotyped environments (Oswald & Harvey, 2000; Rivardo, Rhodes, Camaione & Legg, 2011), as well as expectations and roles that are transmitted implicitly and systematically (González, 1999; Robinson & Lubienski, 2011). For example, national and international evidence shows that in general men are unfavorable disposed towards reading, and therefore, they show a lower performance in those evaluations (ACE, 2016; OECD, 2015). This tightness can be explained in terms of affective and motivational factors (Fernández & Hauri, 2016), influenced by patriarchal socialization and the transmission of values associated to masculinity (Martinez & Bivort, 2013).

This carries future implications, as there are certain 'individual' decisions about professional careers that respond to these heteronormative social expectations concerning what each gender must be (Espinosa, 2010; Rosado, 2012; Ruiz & Santana, 2018; Scott, 1996). What is more, Robinson & Lubienski (2011) state that men are four times more prone to choose a quantitative major than women with a similar performance in mathematics. For their part, Barberá et al. (2008) by studying cases from Psychology and Engineering programs, stated that although these are programs that demand competences which are not determined by gender, there are still misalignments as Psychology programs are linked towards feminine stereotypes, and Engineering programs are still linked to masculine archetypes.

On the other hand, there are still university programs characterized by either a mainly masculine or feminine presence, depending on each case. This seems to be the case with programs related to healthcare and reproduction, for example, which are most commonly attributed to women, whereas other programs which are more technical, or management related are linked to men. In this context, a relationship is expected, between the structure of the systems of access to university and the individual choice of university programs. In this regard, research has unveiled the impact of the systems based on standardized tests, where women and men show disparate performance. On an international scale, a study conducted by Jurajda & Münich (2011) analyzed the results of multiple university admission tests. They showed that, although high-performance women at school did not avoid applying to prestigious institutions or university programs considered masculine, men obtained better results in the tests. At the same time, Ors, Palomino & Peyrache (2013) also pointed out the competitive element in testing when stating that in admission tests for postgraduate studies in France, women evinced poorer results and a low rate of access to the programs, even when they had higher rates of retention.

In Chile, the study conducted by Arias et al. (2016) showed that the results observed in the mathematics tests (SIMCE and PSU) could be underestimating the real cognitive abilities of women, who could be subjected to a 'psychological threat'[4] when they take these tests, by embracing a negative stereotype of being aversive to competitive instances. For their part, Gándara & Silva (2016) observed the influence of the place of origin – understood as the type of school attended (unisex, women-only or men-only)—in the results of Science PSU. Once again, men presented high results than women, even when variables such as socioeconomic background and school type were controlled.

Predictably, there are gender gaps concerning access to STEM programs, which tend to be better-paid and highly prestigious (Arias et al., 2016; Gándara & Silva, 2016), which coincides with international evidence (Good, Aronson & Harder, 2008; Niederle & Vesterlund, 2010). Despite this, women who access higher education present higher marks and a first-year retention rate significantly higher than men, both in STEM and not STEM programs (Arias et al., 2016). Due to this, institutions have developed affirmative policies to increase the presence of women in certain STEM programs which have been masculinized, such as some Engineering programs (Priority Access Program for Gender Equality, PEG, 2018 (Programa de Ingreso Prioritario de Equidad de Género, PEG, 2018; Pontificia Universidad Católica de Chile, PUC, 2017). On the international sphere, this type of initiative seems to be more numerous and diverse for these types of programs, such as the case of the universities in Spain, which consider workshops and activities gender stereotype-free. Likewise, they also organize events in which they invite professional and academic women as role models, among other strategies (Paderewski et al., 2016). Similarly, in the USA, there are different initiatives, both from the government and private agents, which seek to promote the participation of women in STEM programs through scholarships and special programs (Society for Canadian Women in Science and Technology, SCWIST, 2019; The New York Academy of Sciences, 2016).

[4] This could be a situation in which a person belonging to a discriminated social group is in risk of confirming a negative stereotype as a characteristic of his/her own regarding their belonging group (Steele and Aronson 1995, cited in Arias et al., 2016).

New perspectives in the study of gender gaps in standardized testing

In this aspect, recent tendencies show that, at an additional level, gender gaps have been decreased as seen in different measurement test (Lietz, 2006). Then, to better understand the potential empirical differences, it is important to analyze the behavior of high-risk tests that measure skills o competences. Specifically, the extreme values in the score distribution, that is to say the top or bottom sections. In general, gender differences in tests results are small in the middle range of the distribution of skills and increases in higher levels of success. In addition, it has been observed that the scores obtained by men are vary more in both extremes of the distribution, which leads to the presence of more men in the top and bottom sections of performance. (Baye & Monseur, 2016; Deary, Graham, Wilson, Starr & Whalley, 2003; Ellison & Swanson, 2010; Halpern et al., 2007; Hyde & Mertz, 2009; Strand, Deary & Smith, 2010).

Then, as stated by Hyde, Lindberg, Linn, Ellis & Williams (2008), even though these phenomena have been observed, the causes have not been completely elucidated. Additionally, Penner (2008) claims that the generalized belief of higher variance or score variability in men is arguable, as this occurs in geography-specific areas of some countries. Also, it is due to, mostly, sociocultural factors that change; therefore, it is not possible to be understood as a universal phenomenon. In fact, Guiso, Monte, Sapienza and Zingales (2008), by analyzing the data from the PISA[5] test in 2003, observed a substantial advantage for women in the 99 percentile[6] in culturally diverse countries such as Iceland, Thailand and the United Kingdom.

Other studies by Machin & Pekkarinen (2008) have also researched the score variability to characterize educational performance in a precise manner in the results of the PISA test 2003 in 41 countries. Their observations coincide with those of Guiso et al. (2008), as they could not determine the phenomenon of higher male variability of scores as universal. In terms of reading, these authors detected that in all the participating countries, the results by women were higher, although in 35 countries the results by men presented higher variance. In turn, the overall performance of men in the mathematics test is higher, and in 37 countries they presented higher variability in their scores.

Lakin (2013) evaluated these differences in four cohorts of different years in the United States for the CAT[7] in three domains (verbal, quantitative and non-verbal), also finding consistent evidence that men presented higher variability in their scores. Thus, the most relevant finding of this research was that the advantage of men in the top section of the score distribution in the quantitative mastery seemed to increase through time. For their part, Ellison & Swanson (2010), when studying the AMC[8] data – considered a highly competitive educational assessment—observed that gender gap in the 99 percentile showed a male-female proportion of 10 to 1.

Additionally, they concluded that men with high performance came from varied contexts, meanwhile women in the same position came from a small group of elite schools. This suggests that American women with remarkable mathematical skills do not fully develop their talents to reach the top extremes of these abilities, which implies the inclusion of other variables for a more complete understanding.

Other studies that tackle this issue include other variables, such as the parents' education level (Contini, Di Tommaso & Mendolia, 2017; Penner & Paret, 2008), ethnic or racial origin (Good, Aronson & Inzlicht, 2003; Penner & Paret, 2008), geographic zone (Contini et al., 2017), and household income (Good et al., 2008).

Thus, the hypothesis that high score variability in educational assessment by men is consistent, although not entirely (Hyde & Mertz, 2009), as there are countries which show different patterns, which can be due to cultural differences (Guiso et al., 2008), or as an effect of public policies for equality (Butler, 2004).

---

[5] Programme for International Student Assessment, known in Spanish as *Programa Internacional para la Evaluación de Estudiantes*, headed by the Organization for Economic Co-operation and Development (OECD).

[6] Percentile is a value in which a determined proportion of the population is found below the number. For example, if a student is classified in percentile 99, it means that the student is over the 99% of the students who took that test.

[7] Cognitive Abilities Test is an evaluation of problem-solving skills and reasoning of American students, carried out at the end of the secondary education process.

[8] Acronym in English for American Mathematics Competitions, which is, a series of curricular measurements about problem-solving skills and mathematical knowledge in primary and secondary education students.

In this sense, it is relevant to learn about this phenomenon in particular contexts, especially in the top segment of the score distribution in high-risk assessment: in this case, the "zone of decisions in university registration", which later impacts the educational and occupational structure (Godoy & Mladinic, 2009) and the salary gap (OECD, 2018a).

It is also relevant to consider the bottom segment of the distribution, the zone where possible fallacies and inequalities are seen in the social opportunities and educational learning (Chain, Cruz, Martínez & Jácome, 2003; Contreras & Macías, 2002). Specifically, in the case of the PSU test, this is normalized in 500 points, with a standard deviation of 110 points (DEMRE, 2018), as seen in Figure 1, where the top segment includes scores over 613 points and under 400 points for the bottom segment.

Finally, it is worth studying the areas of math and language specifically, as these are often considered fundamental and cross-sectional for a successful performance in the labor and academic life (OECD, 2018b; United Nations Educational, Scientific and Cultural Organization, UNESCO, 2015), besides being both mandatory for all the applicants that take the PSU test.

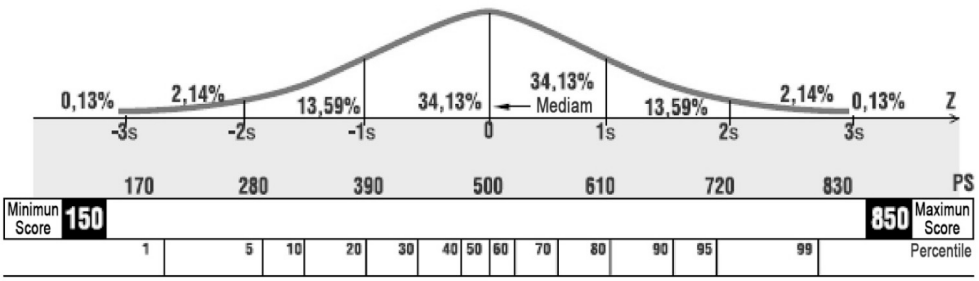

Figura 1. PSU score distribution curve.
Source: DEMRE, 2018a.

The PSU test and its role in the Chilean university admission system

The Chilean higher education system is complex and highly stratified. Currently, a reorganization is taking place after the explosive derailment of the educational market with the promulgation of the General Law for Universities (Ley General de Universidades) in 1981. This started the process of privatization of higher education (Espinoza, 2017). In this regard, Sanhueza & Carvallo (2018) consign the hierarchic organization of the higher education institutions in the country, according to their orientation to either the elite or the general public, and they identify: professional institutes (IP), technical training centers (CFT), private universities and public universities.

Because of this expansion and deregulated access, social mobilization cycles have been developed to demand a democratization of the access to higher education and an improvement in the quality of the education provided by these institutions. Specific crises such as the high school student demonstrations in 2006 and university students in 2011 introduced a "general objection to the neoliberal-subsidiary modernization of the Chilean higher education system") (Sanhueza & Carvallo, 2018, p. 253), questioning the alleged promise of social advancement after completing tertiary studies. These movements and the imminent collapse of certain institutions (Riquelme & Guerra, 2013), among other aspects, prompted a series of educational reforms that sustained the programmatic agenda of Michelle Bachelet's second government period. Thus, initiatives such as Gratuity (Gratuidad), a New Teaching Career (Nueva Carrera Docente) and the Program of Accompaniment and Effective Access (Programa de Acompañamiento y Accesso Efectivo; PACE), showed the institutional interest to widen the access to university for groups previously excluded, expressed in a rearrangement of the educational market rules, although without questioning or altering its market-oriented substation (Sanhueza & Orellana, 2018).

Because of this, the study focuses on both private and public universities, gathered in the centralized admissions system to universities known as SUA[9], managed by the Department of Evaluation, Measurement

[9] That is to say, technical (IP and CFT) institutions are excluded, and universities which do not belong to SUA. This exclusion responds to practical criteria, particularly, the availability of grouped data.

and Educational Registration (Departamento de Evaluación, Medición y Registro Educacional, DEMRE) of Universidad de Chile. In 2018, 41 universities used this system, which combines and weighs the following factors of individual selection: the scores obtained in the PSU tests, the score obtained from High School Grades (Notas de Enseñanza Media, NEM), and a Ranking score determined from these grades (DEMRE-SUA, 2018a). It is worth noting that "each university is responsible for determining the norms, requirements and selection elements to enter the different programs they offer, and they defined the weightings that they deem adequate according to the agreed norm" (Larroucau, Ríos & Mizala, 2015, p. 97).

In 2018, the total number of students registered in undergraduate programs in the institutions grouped in the SUA, corresponds to a 27,7% of the total of higher education institutions (Servicio de Información de Educación Superior, SIES, 2018). Considering the relevance that PSU has for those students finishing high school, this annually-administered test is a key instance on a national scale. For the 2018 admission process, data indicate that 262.048 people took the test, out of which 139,424 were women and 122,624 were men (DEMRE, 2018).

The PSU is surrounded by criticism of its technical aspects since it was first implemented: its predictive validity has been questioned, as well as the fact that it only assesses the minimum mandatory contents of the scientific-humanistic (Koljatic & Silva, 2010). This aspect is what generates a disadvantage for the population who does not belong to this area, such as students from technical-vocational schools, those from previous graduated classes, and foreigners. Additionally, different studies have shown the influence of economic variables in the results observed in these tests, in which male and female students from a low socioeconomic background or coming from public schools obtain worse results (Contreras, Corbalán & Redondo, 2007; Koljatic & Silva, 2010; Mayol, Araya, Azócar & Azócar, 2011). Considering this information, this study includes the characteristics of the educational institutions in the analysis, as this can prove to be relevant in terms of factors in the behavior of gender gaps.

Methodology

Utilized data

The main sources of information correspond to the databases for the results of Mathematics and Language PSU tests for the admission processes from 2014 to 2018[10], provided by the Mineduc[11] and DEMRE. During the test registration, questionnaires were used to obtain contextual information of the applicants and their schools. This allowed us to characterize and analyze the results obtained with a wider view. The analysis of gender gaps considered the characteristics of the schools in terms of the type of education they provide and their administrative unit, which was used to discuss their implications in the higher education system.

Then, the administrative unit of the Chilean schools is divided into three big categories: municipal-owned (from now on Mu, also known as public schools), subsidized (from now on PS, those who receive money from the public and private sector) and private (from now on PP). In terms of the type of education they provide, Chilean high schools are classified into: humanistic-scientific (from now on, HC), of a general character, and technical-vocational (from now on TP), which are work-oriented. Combining these distinctions, and considering the variable of gender (male/female, according to the binary conception adopted for this study), Chilean students can be classified into five groups according to their school type:

- HC-Mu,
- HC-PS,
- HC-PP,
- TP-Mu, y
- TP-PS.

[10] For practical purposes, a year will be understood as the admission process. For example, "year 2017" refers to the admission process 2017.

[11] Through the Statistical Unit from the Center of Studies from the Planning and Budget Department (*Unidad de Estadística del Centro de Estudios de la División de Planificación y Presupuesto)* from this institution.

It is worth stating that in the country[12] there are no private TP schools.

In this way, the analysis considered two categorical variables: gender and school type; and two continuous variables: the PSU scores in Mathematics and Language tests. The total sample consisted of 1,235,936 participants with valid information[13] for 2014 to 2018 cohorts. Tables 1 and 2 show the distribution of students according to sex and school type for the stated years.

Table 1
Students' distribution for the investigation according to sex.

Sex	Year					Total
	2014	2015	2016	2017	2018	
Men	107.546	114.762	116.454	119.022	120.941	578.725
	47%	47%	47%	47%	47%	47%
Women	121.502	129.389	132.369	136.057	137.894	657.211
	53%	53%	53%	53%	53%	53%
Total	**229.048**	**244.151**	**248.823**	**255.079**	**258.835**	**1.235.936**

Source: by the authors based on data delivered by Mineduc and DEMRE.

Table 2
Students' distribution for the investigation according to type of educational institution.

Type of Institution	Year					Total
	2014	2015	2016	2017	2018	
TP-PS	31.075	32.820	32.791	32.867	32.027	161.580
	14%	13%	13%	13%	12%	13%
TP-Mu	32.699	35.612	35.548	37.877	38.141	179.877
	14%	15%	14%	15%	15%	15%
HC-Mu	47.639	50.107	50.445	51.822	52.910	252.923
	21%	21%	20%	20%	20%	20%
HC-PS	92.386	99.390	103.603	105.714	108.371	509.464
	40%	41%	42%	41%	42%	41%
HC-PP	25.249	26.222	26.436	26.799	27.386	132.092
	11%	11%	11%	11%	11%	11%
Total	**229.048**	**244.151**	**248.823**	**255.079**	**258.835**	**1.235.936**

Source: by the authors based on data delivered by Mineduc and DEMRE.

Analytic aspects

In order to identify the existent gaps in the extreme segments of the distribution, the presence of men and women was studied in these ranges, by using the men/women ratio as an indicator of the gender gap (Ellison & Swanson, 2010; Guiso et al., 2008). In this way, the men/women ratio (from now on M/W) was examined in the top and bottom extremes of the respective distributions for each cohort. For this, the top and bottom extremes were defined as a standard deviation over the mean (85 percentile) and under it (15 percentile) which translates to scores over 613 and under 400 points, respectively. According to literature, the difference of the standard deviation in standardized test is significant and relevant to observe (Hedges & Nowell, 1995; Mizala & Romaguera, 2000). In practice, the PSU scores define a high

[12] Delegated administration exists in semi-private institutions, but it has not been included in the data.
[13] Cases with incomplete information, PSU score from current year 0, or inexistent data, were eliminated.

consequence threshold for the Chilean context. In fact, a 400-point score in Mathematics and Language PSU test does not allow a student to apply to any program within the SUA. On the other hand, a score over 600 points is potentially beneficial to apply to universities and other more selective programs[14], besides being a decisive factor for scholarship granting (Koljatic & Silva, 2010).

The corresponding top and bottom percentiles were determined from the complete sample, obtaining subsamples of students for each extreme of each PSU test. Table 3 shows the number of students included in these subsamples. From this, the M/W ratio was analyzed throughout time for the Language and Mathematics tests, respectively.

Table 3
Subsamples considered for each test

Type of Institution	PSU Language		PSU Mathematics	
	Top	Bottom	Top	Bottom
TP-PS	5.891	39.769	3.492	37.102
TP-Mu	5.056	54.054	2.551	49.049
HC-Mu	36.957	44.528	33.501	46.673
HC-PS	90.154	53.015	88.848	60.091
HC-PP	60.052	4.313	70.765	5.001
Total	**198.110**	**195.679**	**199.157**	**197.916**

Source: by the authors based on data delivered by Mineduc and DEMRE.

As previously stated, both the administrative unit as well as the school type of male and female students are relevant factors that help explaining the difference in results of standardized tests like PSU (García, Labarca, Cornejo, Villarroel & Gil, 2017).

The methodology followed in this research assumes that the differences in PSU scores between men and women are real and not attributable to the differential item functioning (DIF)[15]. This assumption represents a limitation for this study, as it is possible that an item in the Mathematics or Language tests is biased, posing a disadvantage to women (Gándara & Silva, 2016), and therefore, some of the observed differences can be due to these biases.

On the other hand, as previously discussed, context-related variables such as household income, educational level of the parents and school type, can affect the observed gaps (Contini et al., 2017; Ellison & Swanson, 2010; Good et al., 2008; Penner & Paret, 2008). In this manner, an analysis was conducted regarding the gaps considering the administrative unit and school type. Nonetheless, due to its explorative nature, the analysis did not incorporate all the context-specific variables, such as household income and educational level of the parents, which could show interesting patterns concerning gender gaps over time. Last, the present methodology attempts to present in a descriptive manner the current gender gaps at the PSU level, but it does not try to determine which are the factors that can explain them.

Results

Concerning the results obtained in the PSU tests grouped according to sex, table 4 presents the means and standard deviation (SD) of the total sample for Mathematics and Language tests for the 2014 to 2018 cohorts.

[14] According to the offer of degrees and available slots, only students who get an average of at least 450 between Language and Mathematics can apply for the process. At the same time, several universities and/or degrees require a score of 600 (including other factors, such as Science and History PSU, high school grades, etc.) (DEMRE-SUA, 2018b).

[15] An item is classified as DIF when students with the same degree of ability show different probabilities of answering an item correctly, due to the group to which they belong (Hambleton, Swaminathan & Rogers, 1991).

Table 4
Language and Mathematics PSU accoding to sex statistical description. Years 2014-2018

PSU Mathematics					PSU Language				
Year	**Sex**	**Mean**	**S.D**	**W/M difference**	**Year**	**Sex**	**Mean**	**S.D**	**W/M difference**
2014	Men	516,98	111,19	30,27***	2014	Men	504,27	111,31	5,05***
	Women	486,71	105,72			Women	499,22	106,14	
2015	Men	515,26	112,56	27,34***	2015	Men	504,27	110,81	5,73***
	Women	487,92	105,80			Women	498,54	106,99	
2016	Men	511,47	113,06	20,32***	2016	Men	501,33	112,29	0,08
	Women	491,15	104,94			Women	501,25	105,92	
2017	Men	510,91	112,99	19,36***	2017	Men	500,05	111,25	-1,83***
	Women	491,55	105,46			Women	501,88	106,32	
2018	Men	515,62	109,4	16,31***	2018	Men	506,04	110,87	0,88**
	Women	499,31	102,95			Women	505,16	106,27	

Note: * *p-value* ≤ 0.1; ** *p-value* ≤ 0.05; *** *p-value* ≤ 0.01.
Source: by the authors based on data delivered by Mineduc and DEMRE.

The first aspect that can be observed is a sustained presence mostly of women that sit both tests, as women surpassed men by 13,956 in 2014, and almost by 17,000 in 2018. In fact, in all the analyzed cohorts, men constitute around a 47% of applicants, whereas women constitute the other 53% or more. Another important point is that there has been a sustained increase in the number of applicants who sit the PSU, either men or women. Thus, the lapsus between the years 2014 and 2018 shows that there were 13,395 more men and 16,392 more women that registered for the test.

Also, it has been observed that for the complete cohorts there are minor gender differences around the means, even considering that PSU is standardized at 500 points (DEMRE, 2018). In accordance to the tendencies exposed in the background information for this study, women in average show lower results in Mathematics, even when this gap shows a declining tendency, from 30 points in 2014 to 16 points in 2018. On the other hand, women present similar results to men in the Language test. In this case, the largest gap was of 6 points in 2015, but interestingly enough, in the admission process of 2017, the gap was in favor of women for almost 2 points.

In turn, the standard deviation shows a larger dispersion for men in both tests, although it is larger in Mathematics when compared to the Language test, which holds true for all cohorts. In fact, the minor difference by gender was of 3.82 points for Language in 2015 and the largest gap in terms of standard deviation was of 8.12 points for Mathematics in 2016. In this sense, the phenomenon of higher variability in the scores obtained by men has been persistently noted.

In terms of the analysis of the M/W ratio, it is worth noting as a reference point that a M/W ratio equal to 1 implies that there are no gaps in the scores between men and women; whereas a M/W ratio below 1 expresses a gap that favors women, and a M/W ratio over 1 means that the gap favors men.

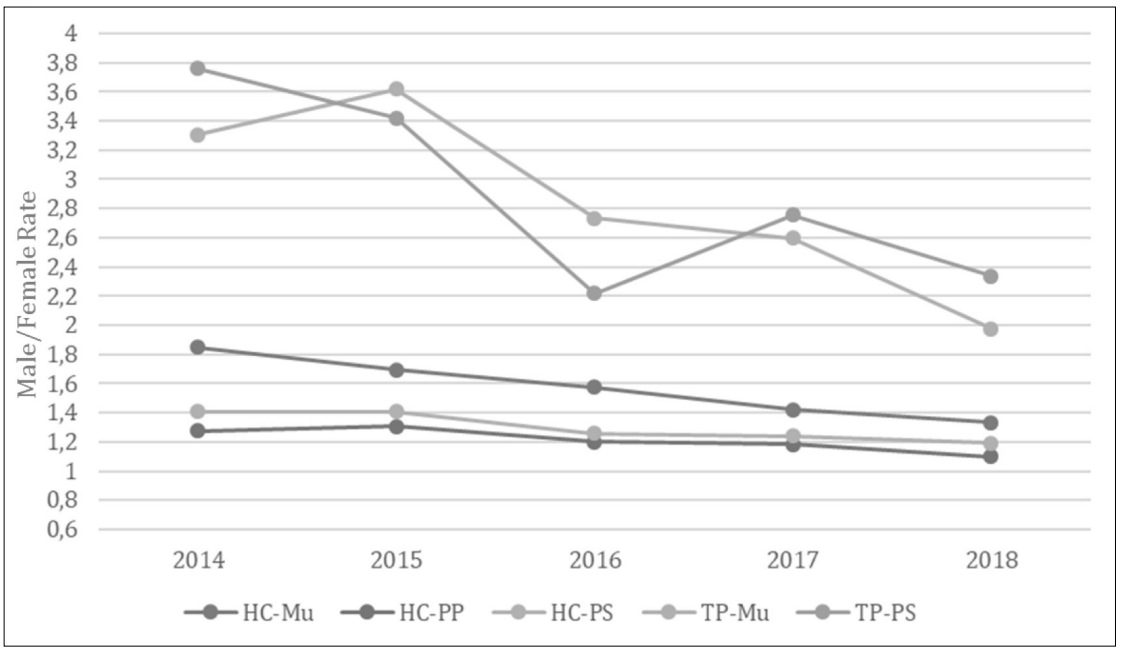

Figure 2. Top M/W rate PSU Mathematics test, according to educational institution type between 2014-2018.
Source: by the authors

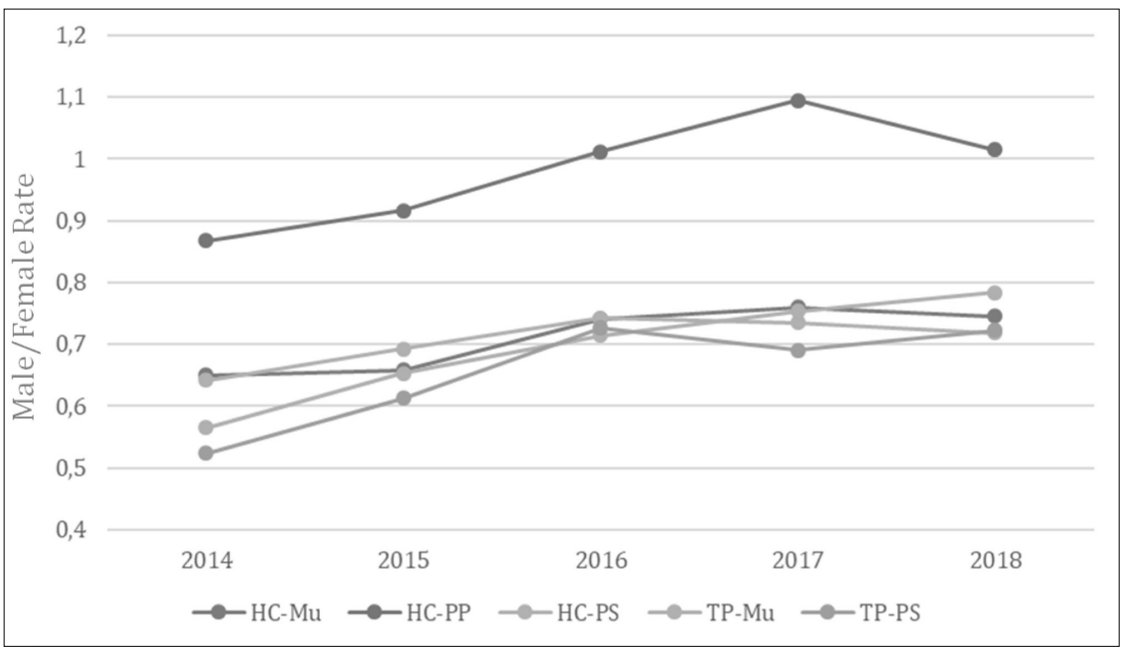

Figure 3.Bottom M/W rate PSU Mathematics test, according to educational institution type between 2014-2018.
Source: by the authors

Thus, in the case of Mathematics, the M/W ratio for the top extreme borders is 1.3 in private and subsidized HC schools (see Figure 2). However, said ratio increases considerably in the case of TP schools, in which in average a ratio of 2,8 is observed for the analyzed cohorts, even reaching a 3,8 value in 2014—in the case of subsidized schools—and 3,6 in 2015 for the public schools. This suggests that the gap that favors men with high performances—that is, the superior segment of the score distribution—is even higher in those schools.

Nonetheless, and as Figure 2 shows, the gender gap in top extreme of the Mathematics test has decreased steadily over time. This decline is cross-sectional to all the analyzed school types. However, those students that come from private and subsidized HC schools present an important gap reduction, showing a tendency to equality (M/W ratio close to 1) in the last few years, and always under the M/W threshold = 1.5, unlike schools of the same type, but public, which presented values over this threshold in 2014 and 2016. It is noteworthy that, although the tendency to reduce the gap in the top distribution is higher in both public and subsidized TP schools, its behavior is more erratic, showing highs and lows, and lately a M/W ratio very close to 2,5, which equals a ratio almost twice the value of other analyzed schools.

In terms of the M/W ratio for the bottom extreme segment, as seen in Figure 3, except private HC schools and subsidized TP schools, it seems to increase or sustain itself in the analyzed cohorts. In the case of the first years, it is the only one that it is close to or over the M/W ratio equal to 1 (in 2017), whereas for the rest of the analyzed years it is between the values of 0.5 and 0.75, with more women in this segment of the distribution. In any case, all the school types show certain stability for the bottom segment cases.

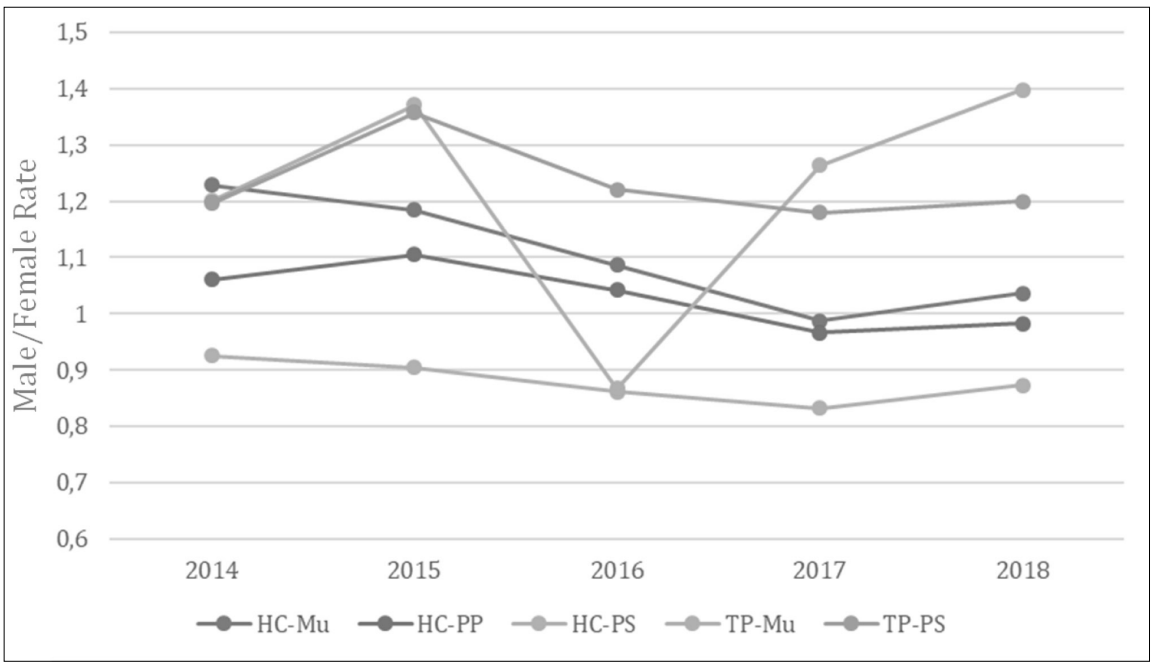

Figure 4. Top M/W rate PSU Language test, according to educational institution type between 2014-2018. Source: by the authors

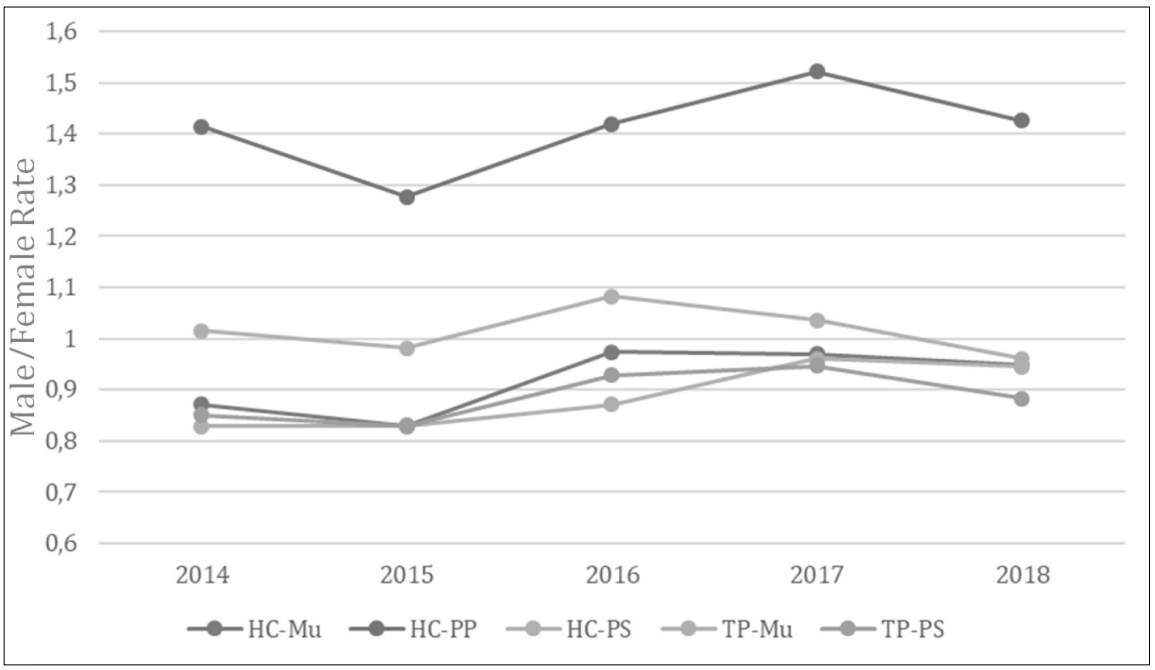

Figure 5. Bottom M/W rate PSU Language test, according to educational institution type between 2014-2018.
Source: by the authors.

On the meanwhile, the Language PSU test shows a rather different scenario in which the scores from the extreme segments are analyzed in detailed (see Figures 4 and 5). Thus, it is observed that the M/W ratio is found systematically low or close to a value of 1.5, regardless of the school type and level of performance being top or bottom. In particular, there is a higher presence of women in the bottom level of performance when the M/W ratio is observed to be below 1, with the exception of private HC schools, in which the value borders or goes over 1.4, and to a smaller extent, in the subsidized schools, bordering M/W = 1. This value decreases for the year 2015, then slightly increasing in the other analyzed years.

As a counterpart, in terms of the analysis of the top or bottom performances, the largest variation throughout time is found in the public TP schools, in which the ratio fluctuates between the values of 1.2 and 1.4 but becomes closer to 0.8 in 2016. A similar phenomenon occurs with subsidized TP schools, stabilizing in 1.2. The rest of the school types present ratios close to 1, public and private HC schools in particular, whereas subsidized HC schools have stabilized around 0.9, that is to say, they slightly favor women.

Considering both Language and Math tests, it is observed that the HC schools show a higher downward trend or is stable in both gaps, both in the top and bottom segments of the distribution, where some of them are close to the value W/M =1. TP schools present an upward trend, but becoming closer to a ratio of 1, even when the public and subsidized TP schools present a higher variation and downward trend for the Mathematics test in the top segments of the scores.

These results have consequences for the female and male students, in particular when they are superimposed with the characteristics of their schools. This in turn leads to implications for institutional and public policies for secondary and tertiary education.

Discussion

The Service of Education About Higher Education, in its 2017 gender gap report about tertiary education, exposed that although women enrollment has increased[16], there are still tendencies that established a difference between women and men when it comes to university degree election (Servicio de Información de Educación Superior, SIES, 2017). In this sense, the results from this study might deliver some explanations about this issue. As a matter of fact, overall and accordingly with previous data, preceding results and analyses show persistent gender gaps seen in the Language and Mathematics PSU tests, analyzing M/W ratio, particularly in the upper and bottom extremes of the score distribution curve, in which the decision making of continuing studying and a potential lack of learning opportunities[17] are found, respectively.

It is important to mention that there are differences between the behaviors of the analyzed tests. First of all, the Mathematics test gap seems to be decreasing, since the results show that there is a reduction tendency in the upper and lower extremes of the distribution, considering that the M/W ratio tends to 1, which is understood as the absence of gender gap. However, this reduction is not transversal to all educational institutions. For example, the lowing tendency is more noticeable and clearer in HC rather than in TP; the latter tendency shows a much more remarkable decrease in the most competitive extreme of the distribution. When considering the socio-economic characteristics of TP institutions, results show conditions attributable to the socio-economic extraction, as observed by Ellison & Swanson (2010). In other words, gap increases in institutions with lower economic resources, experimenting disadvantages, which we will call "structural".

Secondly, and similarly, Language PSU gap has reduced throughout the last four years. However, just as in Mathematics, the gap lowering tendency in the extremes of the distribution is seen only in HC institutions, excluding private facilities located at the bottom of the score distribution. Again, influence of the socio-economic factor is observed, exposing the need of further research. At the same time, these future studies should incorporate the influence of territorial variables, since they might affect the gap behavior similarly.

Thus, a gap reduction is corroborated, with differences depending on the type of educational institution. This phenomenon is particularly relevant when scores to apply for SUA universities are considered: on the one hand, minimum score for any type of application process is of 450 average between Mathematics and Language, while minimum scores for certain universities and high selectivity degrees usually border 700 points (DEMRE-SUA, 2018b). In this way, considering gender gaps studied in the upper and bottom extremes from the distribution consider scores under 400 and over 613, respectively, it is possible to infer that the score segment in which application and selection decision actually occurs, there is still an important gender gap which do not favor women, particularly those coming from TP institutions. As mentioned previously, there is a high chance of TP women been the most excluded from competitive high prestige and incomes careers, due to this entrance barrier attributed to the standardized evaluation process.

With these results, it can be hypothesized that potentially a smaller number of women are entering STEM degrees, which has implications if the public Chilean policies. Moreover, considering the current process of higher education reform (Law N° 21,091, 2018), these elements have an impact, especially in aspects such as gratuity, equity and diversity which are desirable in the Chilean higher education system (Queupil & Durán, 2018). As pointed our before, some national institutions have developed affirmative initiatives to evade this adverse scenario for women, particularly in certain degrees with are highly masculinized. For instance, the Priority Access Program for Gender Equality, PEG, 2018 (Programa de Ingreso Prioritario de Equidad de Género), PEG, 2018; Pontificia Universidad Católica de Chile, PUC, 2017 and the Program Engineering Women UC (Mujeres Ingenieria UC) (PUC, 2017) save additional

[16] In 2017, women represented 52.4% of the undergraduate enrollment total (SIES, 2017).

[17] Regarding this potential "lack of opportunities", in no way the authors assume that the PSU test measures all learning possibilities and/or the quality of education received from an educational institution. It is important to remember that this instrument evaluates high school minimum compulsory contents (MCC) in HC, in six specific subjects. These results do not reflect school learning as a whole. However, a low PSU score reflects weakness of some aspects – individual or collective- regarding incorporation and posterior reproduction of MCC for the assessment process. Its relevance at the individual level are important: as said before, an average between Mathematics and Language below 450 does not allow students to apply to any of the programs offered by SUA universities.

slots for women who had a score just below de admission limit. Following these examples, other similar programs have been implemented to attract women into applying for engineering in universities outside of the capital city (Ingeniería 2030, 2018; Universidad Austral de Chile, 2018), reflecting the increasing need of special programs to counteract certain admission barriers forbidding women to follow highly selective majors in Chile, such as the STEM programs. Also, it is relevant to mention that the Chilean law will implement a progressive program to progressively increase the requirements to pursue careers in Pedagogy (Law N° 20.903, 2016). There programs have been labeled as highly feminized (González, 2011), although the composition of their cohorts may suffer changes if PSU gaps which have been detected persist. Thus, evidence shown in this study cannot be ignores when it comes to developing or improving the higher education system.

Debate regarding the PSU technical aspects have existed since its creation, as well as the questioning of quality and pertinence of the test and its potential detrimental effects for certain population groups, such as the TP institutions (Farías y Carrasco, 2012; Koljatic & Silva, 2006; 2010; Manzi, Bosch, Bravo, del Pino, Donoso, Martínez, & Pizarro, 2010), this study actually corroborates that in this test women are in disadvantage within a context of higher education reform that, among others, is looking for a reformulation and unification of the higher education access system, including universities, CFT and IP. Hopefully, this scenario will dimension persistent gender gap found in test scores when entering tertiary education, especially the ones originated by the type of education institution. If this issue is not solved or approached, it is possible that the social inequities of the country will continue to grow.

This study corroborates a widely known phenomenon, contributing with new data, encouraging further research to include socio-economic and territorial variables to explain thoroughly, this gap between men and women. Without a doubt, the gaps found at the extreme of the curve of the results allow to explain in part, the social inequities. In this way, these results support the hypothesis that the sub-representation of women in STEM areas, or in elite programs, is not due only to individual factors: there are, on the one hand, sexist practices and social structures which transfer stereotyped values, with concrete expressions such as the gaps exposed in this study; while on the other hand, material barriers prevail for these women, because of their origin. The observed gap tends to increase in the TP field, allowing a deepening of the inequities between men and women in lower socioeconomic status.

Overall, this exploratory research and its results support the need to adopt an intersectional view regarding the differences within gender in education, including new variables to completely understand the phenomenon, since the analysis tools allow this. At the same time, data collection processes should include non-binary social categories in administrative records. Without a doubt, massive data analysis can and must include the complexity of human diversity, which has the potential of improving quality of life conditions, promoting a democratized process to access the diverse social spaces.

The original article was received on October 15th, 2018
The revised article was received on February 24th, 2019
The article was accepted on March 13th, 2019

Referencias

Agencia de Calidad en la Educación, ACE. (2016). *Buenas prácticas en la reducción de las brechas de género en resultados Simce de Comprensión de Lectura y Matemática IIº medio.* Santiago de Chile: Autor.

Arias, O., Mizala, A., & Meneses, F. (2016). *Brecha de género en matemáticas: el sesgo de las pruebas competitivas (evidencia para Chile)* (Proyecto FONDECYT 1140834). Santiago de Chile: FONDECYT.

Barberá, E., Candela, C., & Ramos, A. (2008). Elección de carrera, desarrollo profesional y estereotipos de género. *Revista de Psicología Social*, *23*(2), 275-285. https://doi.org/10.1174/021347408784135805

Baye, A. & Monseur, C. (2016). Gender differences in variability and extreme scores in an international context. *Large-scale Assessments in Education, 4*(1). https://doi.org/10.1186/s40536-015-0015-x

Butler, J. (2004). Will girls be left behind? Gender differences and accountability. *Journal of Research in Science Teaching*, *41*(10), 961-969. https://doi.org/10.1002/tea.20051

Castillo, R. & Montes, B. (2014). Análisis de los estereotipos de género actuales. *Anales de Psicología. Universidad de Murcia, 30*(3), 1044-1060. https://doi.org/10.6018/analesps.30.3.138981

Chain, R., Cruz, N., Martínez, M., & Jácome, N. (2003). Examen de selección y probabilidad de éxito escolar en estudios superiores: estudio en una universidad pública estatal mexicana. *Revista Electrónica de Investigación Educativa*, *5*(1), 1-17. Recuperado de https://redie.uabc.mx/redie/article/view/72/1255

Contini, D., Di Tommaso, M., & Mendolia, S. (2017). The gender gap in mathematics achievement: Evidence from Italian data. *Economics of Education Review*, *58*, 32-42. https://doi.org/10.1016/j.econedurev.2017.03.001

Contreras, M., Corbalán, F., & Redondo, J. (2007). *Cuando la suerte está echada: estudio cuantitativo de los factores asociados al rendimiento en la PSU.* Recuperado de http://www.opech.cl/bibliografico/calidad_equidad/Estudio_sobre_la_PSU_Contreras_Corbalan_Redondo.pdf

Contreras, D. & Macías, V. (2002). Desigualdad educacional en Chile: geografía y dependencia. *Cuadernos de Economía, 39*(118), 395-421. https://doi.org/10.4067/s0717-68212002011800005

Deary, I., Graham, T., Wilson, V., Starr, J., & Whalley, L. (2003). Population sex differences in IQ at age 11: The Scottish mental survey 1932. *Intelligence*, *31*(6), 533-542. https://doi.org/10.1016/s0160-2896(03)00053-9

Departamento de Evaluación, Medición y Registro Educacional, DEMRE. (2018). *Informe técnico Prueba de Selección Universitaria.* Recuperado de https://psu.demre.cl/estadisticas/documentos/informes/2018-informe-tecnico-psu.pdf

Departamento de Evaluación, Medición y Registro Educacional, DEMRE-Sistema Único de Admisión, SUA. (2018a). *Normas y aspectos importantes del proceso de admisión 2019.* Recuperado de http://psu.demre.cl/publicaciones/pdf/2019-18-05-31-normas-p2019.pdf

Departamento de Evaluación, Medición y Registro Educacional, DEMRE-Sistema Único de Admisión, SUA. (2018b). *Oferta definitiva de carreras, vacantes y ponderaciones proceso 2019.* Recuperado de http://www.psu.demre.cl/publicaciones/2019/2019-18-09-13-cruch-oferta-carreras-vacantes-ponderaciones-p2019

Ellison, G. & Swanson, A. (2010). The gender gap in secondary school mathematics at high achievement levels: Evidence from the American mathematics competitions. *Journal of Economic Perspectives*, *24*(2), 109-128. https://doi.org/10.1257/jep.24.2.109

Espinosa, C. (2010). Diferencias entre Mens y Womenes en educación matemática: ¿Qué pasa en México? *Investigación y Ciencia, 46*, 28-35. Recuperado de https://www.uaa.mx/investigacion/revista/archivo/revista46/Articulo%204.pdf

Espinoza, O. (2017). Privatización de la educación superior en Chile: consecuencias y lecciones aprendidas. *EccoS Sao Paulo, 44*, 175-202. https://doi.org/10.5585/eccos.n44.8070

Farías, M. & Carrasco, R. (2012). Diferencias en resultados académicos entre educación técnico-profesional y humanista-científica en Chile. *Calidad en la Educación, 36*, 87-121. https://doi.org/10.4067/s0718-45652012000100003

Fernández, M. & Hauri, S. (2016). Resultados de aprendizaje en La Araucanía: la brecha de género en el Simce y el androcentrismo en el discurso de docentes de lenguaje y matemática. *Calidad en la Educación, 45,* 54-89. https://doi.org/10.4067/s0718-45652016000200003

Gándara, F. & Silva, M. (2016). Understanding the gender gap in science and engineering: Evidence from the Chilean college admissions tests. *International Journal of Science and Mathematics Education, 14*(6), 1079-1092. https://doi.org/10.1007/s10763-015-9637-2

Ganley, C., George, C., Cimpian, J., & Makowski, M. (2018). Gender equity in college majors: Looking beyond the STEM/Non-STEM dichotomy for answers regarding female participation. *American Educational Research Journal, 55*(3), 453-487. https://doi.org/10.3102/0002831217740221

García, R., Labarca, J., Cornejo, M., Villarroel, M., & Gil, F. (2017). Ranking 850, transición a la educación terciaria de estudiantes con desempeño educativo superior y puntaje PSU insuficiente. *Pensamiento Educativo. Revista de Investigación Educacional Latinoamericana*, *54*(1), 1-11. https://doi.org/10.7764/pel.54.1.2017.2

Godoy, L. & Mladinic, A. (2009). Estereotipos y roles de género en la evaluación laboral y personal de Mens y Womenes en cargos de dirección. *Psykhe (Santiago)*, *18*(29), 51-64. https://doi.org/10.4067/s0718-22282009000200004

González, B. (1999). Los estereotipos como factor de socialización en el género. *Comunicar*, *12*, 79-88. Recuperado de https://www.revistacomunicar.com/index.php?contenido=detalles&numero=12&articulo=12-1999-12

González, C. (2011). Feminización de la escuela básica chilena. Metáforas de la identidad docente. *Educación y Humanismo, 13*(20), 84-94. https://doi.org/10.17081/eduhum.13.20.2283

Good, C., Aronson, J., & Harder, J. (2008). Problems in the pipeline: Stereotype threat and women's achievement in high-level math courses. *Journal of Applied Developmental Psychology*, *29*(1), 17-28. https://doi.org/10.1016/j.appdev.2007.10.004

Good, C., Aronson, J., e Inzlicht, M. (2003). Improving adolescents' standardized test performance: An intervention to reduce the effects of stereotype threat. *Journal of Applied Developmental Psychology*, *24*(6), 645-662. https://doi.org/10.1016/j.appdev.2003.09.002

Guiso, L., Monte, F., Sapienza, P., & Zingales, L. (2008). Culture, gender, and math. *Science, 320*(5880), 1164-1165. https://doi.org/10.1126/science.1154094

Hambleton, R. K., Swaminathan, H., & Rogers, J. (1991). *Fundamentals of item response theory*. Newbury Park, CA: Sage.

Halpern, D., Benbow, C., Geary, D., Gur, R., Hyde, J., & Gernsbacher, M. (2007). The science of sex differences in science and mathematics. *Psychological Science in the Public Interest*, *8*(1), 1-51. https://doi.org/10.1111/j.1529-1006.2007.00032.x

Hedges, L. & Nowell, A. (1995). Sex differences in mental test scores, variability, and numbers of high-scoring individuals. *Science*, *269*(5220), 41-45. https://doi.org/10.1126/science.7604277

Hyde, J. (2014). Gender similarities and differences. *Annual Review of Psychology*, *65*(1), 373-398. https://doi.org/10.1146/annurev-psych-010213-115057

Hyde, J. & Mertz, J. (2009). Gender, culture, and mathematics performance. *Proceedings of National Academy of Sciences*, *106*(22), 8801-8807. https://doi.org/10.1073/pnas.0901265106

Hyde, J., Lindberg, S., Linn, M., Ellis, A., & Williams, C. (2008). Gender similarities characterize math performance. *Science*, *321*(5888), 494-495. https://doi.org/10.1126/science.1160364

International Labour Organization, ILO. (2017). *World employment and social outlook. Trends for women 2017*. Geneva: Autor.

Ingeniería 2030 (2018). *Universidad Federico Santa María crea admisión especial para Womenes*. Recuperado de https://www.ingenieria2030.org/2018/06/11/universidad-federico-santa-maria-crea-admision-especial-para-Womenes/

Jurajda, Š. & Münich, D. (2011). Gender gap in admission performance under competitive pressure. *American Economic Review Papers and Proceedings*, *103*(3), 514-518. https://doi.org/10.1257/aer.101.3.514

Koljatic, M. & Silva, M. (2006). Equity issues associated with the change of college admission tests in Chile. *Equal Opportunities International, 25*(7), 544-561. https://doi.org/10.1108/02610150610714385

Koljatic, M. & Silva, M. (2010). Algunas reflexiones a siete Years de la implementación de la PSU. *Estudios Públicos*, *120*, 1-22. Recuperado de https://www.cepchile.cl/algunas-reflexiones-a-siete-anos-de-la-implementacion-de-la-psu/cep/2016-03-04/095423.html

Lakin, J. (2013). Sex differences in reasoning abilities: Surprising evidence that male-female ratios in the tails of the quantitative reasoning distribution have increased. *Intelligence*, *41*(4), 263-274. https://doi.org/10.1016/j.intell.2013.04.004

Larroucau, T., Ríos, I., & Mizala, A. (2015). Efecto de la incorporación del ranking de notas en el proceso de admisión a las universidades chilenas. *Pensamiento Educativo*, *52*(2), 95-118. https://doi.org/10.7764/pel.52.1.2015.8

Legewiea, J. & DiPrete, T. (2012). School Context and the Gender Gap in Educational Achievement. *American Sociological Review*, *77*(3), 463-485. https://doi.org/10.1177/0003122412440802

Lewis, N. & Sekaquaptewa, D. (2016). Beyond test performance: A broader view of stereotype threat. *Current Opinion in Psychology, 11*, 40-43. https://doi.org/10.1016/j.copsyc.2016.05.002

Ley N° 20.903. (2016). Crea el Sistema de Desarrollo Profesional Docente y modifica otras normas. *Diario Oficial de la República de Chile*, Santiago, Chile, 4 de abril de 2016.

Ley N° 21.091. (2018). Sobre Educación Superior. *Diario Oficial de la República de Chile*, Santiago, Chile, 29 de mayo de 2018.
Lietz, P. (2006). Issues in the change in gender differences in reading achievement in cross-national research studies since 1992: A meta-analytic view. *International Education Journal*, *7*(2), 127-149.
Machin, S. & Pekkarinen, T. (2008). Global sex differences in test score variability. *Science*, *322*(5906), 1331-1332. https://doi.org/10.1126/science.1162573
Mann, A. & DiPrete, T. (2016). The consequences of national math and science performance environment for gender differences in STEM aspirations. *Sociological Science*, *3*, 568-603. https://doi.org/10.15195/v3.a25
Manzi, J., Bosch, A., Bravo, D., del Pino, G., Donoso, G., Martínez, M., & Pizarro, R. (2010). Validez diferencial y sesgo en la predictividad de las pruebas de admisión a las universidades chilenas. *Revista Iberoamericana de Evaluación Educativa*, *3*(2), 29-48. Recuperado de https://revistas.uam.es/index.php/riee/article/view/4489
Martínez, S. & Bivort, B. (2013). Los estereotipos en la comprensión de las desigualdades de género en educación, desde la psicología feminista. *Psicologia & Sociedade*, *25*(3), 549-558. https://doi.org/10.1590/s0102-71822013000300009
Mayol, A., Araya, J., Azócar, C., & Azócar, C. (2011). *7 fenómenos sobre educación y desigualdad en Chile. Informe a prensa de la línea de investigación "Cultura y estructura social" del CIES*. Recuperado de http://educacion2020.cl/sites/default/files/desigualdad-y-educacion-informe-cies-u-de-chile.pdf
Ministerio de Educación de Chile, Mineduc. (2018). *Resultados SIMCE revelan pocos avances en la última década y grandes desafíos en media*. Recuperado http://www.agenciaeducacion.cl/noticias/resultados-simce-revelan-avances-la-ultima-decada-grandes-desafios-media/
Mizala, A. & Romaguera, P. (2000). School performance and choice: The Chilean experience. *The Journal of Human Resources*, *35*(2), 392-417. https://doi.org/10.2307/146331
Niederle, M. & Vesterlund, L. (2010). Explaining the gender gap in math test scores: The role of competition. *The Journal of Economic Perspectives*, *24*(2), 129-144. https://doi.org/10.1257/jep.24.2.129
Organización de las Naciones Unidas para la Educación, la Ciencia y la Cultura, UNESCO. (2015). *Informe de resultados TERCE: logros de aprendizaje.* Santiago de Chile: Autor.
Organisation for Economic Co-operation and Development, OECD. (2009). *Equally prepared for life? How 15-year-old boys and girls perform in school.* Paris: Autor.
Organisation for Economic Co-operation and Development, OECD. (2015). *The ABC of gender equality in education: Aptitude, behavior, confidence.* Recuperado de https://www.oecd.org/pisa/keyfindings/pisa-2012-results-gender-eng.pdf
Organisation for Economic Co-operation and Development, OECD. (2018a). *Education at a Glance 2018: OECD Indicators*. Paris: OECD Publishing.
Organisation for Economic Co-operation and Development, OECD. (2018b). *PISA 2015: Results in focus.* Paris: OECD Publishing.
Ors, E., Palomino, F., & Peyrache, E. (2013). Performance gender gap: Does competition matter? *Journal of Labor Economics*, *31*(3), 443-499. https://doi.org/10.1086/669331
Oswald, D. & Harvey, R. (2000). Hostile environments, stereotype threat, and math performance among undergraduate women. *Current Psychology*, *19*(4), 338-356. https://doi.org/10.1007/s12144-000-1025-5
Paderewski, P., García-Arenas, M., Gil-Iranzo, R., González-González, C., Ortigosa, E. M., & Padilla-Zea, N. (2016). Iniciativas y estrategias para acercar a las Womenes a las ingenierías TICs. *Revista Iberoamericana de Tecnologías del/da Aprendizaje/Aprendizagem*, *12*(2), 141-149. https://doi.org/10.1109/rita.2017.2698719
Programa de Ingreso Prioritario de Equidad de Género, PEG. (2018). *Programa de ingreso prioritario de equidad de género.* Recuperado de http://ingenieria.uchile.cl/admision/admision-especial-pregrado/94355/cupos-equidad-de-genero
Penner, A. (2008). Gender differences in extreme mathematical achievement: An international perspective on biological and social factors. *Sociology*, *114*(S1), 138-170. https://doi.org/10.1086/589252
Penner, A. & Paret, M. (2008). Gender differences in mathematics achievement: Exploring the early grades and the extremes. *Social Science Research*, *37*(1), 239-253. https://doi.org/10.1016/j.ssresearch.2007.06.012
Pontificia Universidad Católica de Chile, PUC. (2017). *Lanzan programa Womenes Ingeniería UC que potencia el rol de las ingenieras en la sociedad.* Recuperado de http://www.uc.cl/la-universidad/noticias/27536-lanzan-programa-Womenes-ingenieria-uc-que-potencia-

Queupil, J. & Durán, F. (2018). El principio de inclusión: similitudes y diferencias en la educación escolar y superior en Chile. *Revista Latinoamericana de Educación Inclusiva, 12*(1), 111-128. https://doi.org/10.4067/s0718-73782018000100111

Riquelme, G. & Guerra, T. (2013). *Universidades investigadas por lucro e irregularidades cierran carreras por falta de postulantes.* Recuperado de https://ciperchile.cl/2013/02/28/universidades-investigadas-por-lucro-e-irregularidades-cierran-carreras-por-falta-de-postulantes/

Rivardo, M., Rhodes, M., Camaione, T., & Legg, J. (2011). Stereotype threat leads to reduction in number of math problems women attempt. *North American Journal of Psychology*, *13*(1), 5-16.

Robinson, J. & Lubienski, S. (2011). The development of gender achievement gaps in mathematics and reading during elementary and middle school: Examining direct cognitive assessments and teacher ratings. *American Educational Research Journal*, *48*(2), 268-302. https://doi.org/10.3102/0002831210372249

Rosado, A. (2012). Género, orientación educativa y profesional. *Revista Mexicana de Orientación Educativa, 9*(22), 36-41. Recuperado de http://pepsic.bvsalud.org/scielo.php?script=sci_arttext&pid=S1665-75272012000100006&lng=pt&tlng=es

Ruiz, J. & Santana, L. (2018). Career choice and gender. *Revista Electrónica de Investigación y Docencia*, *19*, 7-20. https://doi.org/10.17561/reid.v0i19.3470

Sanhueza, J. & Carvallo, F. (2018). Conflictos y transformaciones en la educación superior chilena. En V. Orellana (Ed.), *Entre el mercado público y la educación gratuita* (pp. 209-258). Santiago de Chile: LOM.

Sanhueza, J. & Orellana, V. (2018). Análisis crítico de la reforma educacional de Bachelet (2014-2018). En V. Orellana (Ed.), *Entre el mercado público y la educación gratuita* (pp. 259-322). Santiago de Chile: LOM.

Scott, J. (1996). El género: una categoría útil para el análisis histórico. En M. Lamas (Comp.), *El género: la construcción cultural de la diferencia sexual* (pp. 265-302). México, D.F.: PUEG.

Society for Canadian Woman in Science and Technology, SCWIST. (2019). *Scholarships*. Recuperado de http://www.scwist.ca/programs-and-events/scholarships/

Servicio de Información de Educación Superior, SIES. (2017). *Informe brechas de género en educación superior.* Recuperado de http://www.mifuturo.cl/images/Estudios/Estudios_SIES_DIVESUP/brechas%20de%20genero%20en%20educacion%20superior_sies_2017_editado.pdf

Servicio de Información de Educación Superior, SIES. (2018). *Informe matrícula 2018 en educación superior en Chile*. Recuperado de http://www.mifuturo.cl/wp-content/uploads/2018/SIES/informe%20matricula%202018_sies.pdf?x78460

Spelke, E. (2005). Sex differences in intrinsic aptitude for mathematics and science? A critical review. *American Psychologist*, *60*(9), 950-958. https://doi.org/10.1037/0003-066x.60.9.950

Strand, S., Deary, I., & Smith, P. (2010). Sex differences in cognitive abilities test scores: A UK national picture. *British Journal of Educational Psychology*, *76*(3), 463-480. https://doi.org/10.1348/000709905x50906

The New York Academy of Sciences. (2016). *1000 Girls, 1000 Futures*. Recuperado de https://www.nyas.org/programs/global-stem-alliance/1000-girls-1000-futures/

Universidad Austral de Chile (2018). *Más Womenes en Ingeniería es el programa de ingreso especial para incentivar a Womenes a estudiar carreras de la FCI.* Recuperado de http://www.ingenieria.uach.cl/noticias/9185-mas-Womenes-en-ingenieria-es-el-programa-de-ingreso-especial-para-incentivar-mayor-presencia-femenina-en-udiar-carreras-de-la-fci.html.

Villaseñor, T., Celis, S., Queupil, J., Pinto, L., & Rojas, M. (en prensa). A personal and collective journey: The experience of female students in undergraduate geoscience programs at Universidad de Chile. *Journal of Geoscience Education*.

World Economic Forum. (2017). *Global gender gap report 2017.* Genova: Autor.