UNIVERSIDAD DE CHILE
FACULTAD DE CIENCIAS FÍSICAS Y MATEMÁTICAS
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SELF-CONFIDENCE AND THE GENDER GAP IN HIGHER EDUCATION DECISIONS

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MARIANNE ANDREA MOREIRA GODOY

PROFESORA GUÍA:
ALEJANDRA MIZALA SALCES

PROFESOR CO-GUÍA:
DANIEL SCHWARTZ PERLROTH

COMISIÓN:
PAMELA JERVIS ORTIZ

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Resumen

AUTO-CONFIANZA Y LA BRECHA DE GÉNERO EN DECISIONES DE EDUCACIÓN SUPERIOR

Se contribuye al debate sobre cómo la auto-confianza, entendida como creencia en la propia capacidad, desempeña un papel en la decisión optar por trayectorias que involucran competencia. Los resultados muestran que las mujeres tienden a rehuir la competencia en el ámbito educacional. El análisis considera tres enfoques: (i) un modelo teórico que explica cómo influye la auto-confianza en el acceso a las trayectorias competitivas, (ii) un análisis de preferencias reveladas sobre la elección de carreras universitarias competitivas, y (iii) un experimento por encuesta con escenarios hipotéticos realistas sobre postulaciones a programas de magíster.

El modelo teórico ofrece un marco para reflexionar sobre la auto-confianza en relación a las elecciones de formación de capital humano. El resultado principal es que los sesgos en la auto-confianza son relevantes en el caso de aquellos cuya capacidad real se aproxima a la media y aquellos que tienen dudas sobre su capacidad.

En el análisis empírico de elección de carreras universitarias, la auto-confianza se correlaciona positivamente sólo con las carreras más competitivas según el análisis de preferencias reveladas. Sin embargo, la magnitud de esta correlación es inferior a la de otros factores, como sexo, nivel socioeconómico y rendimiento en matemáticas.

En el experimento por encuesta, se estudian los efectos causales de dos acciones afirmativas (AA) sobre la disposición a postular a un programa de magíster. Una AA es proporcionar una fuerte retroalimentación de ser una persona de alta habilidad mediante un referente que entrega una carta de recomendación. Esta AA no afecta la probabilidad de postular, excepto para aquellos/as cuya auto-confianza está cerca de la media, coherente con el modelo teórico.

La otra AA proporciona información sobre dos becas de excelencia académica dirigidas a mujeres que cubren el costo total del magíster. Esta AA es una ayuda financiera a través de una beca y un mensaje de la institución para motivar la postulación de mujeres. Las becas aumentan en 4 pp. la postulación de mujeres y en 6 pp., la de mujeres cuyas notas se encuentran en el 25-10% superior del ranking de notas. También incentiva a mujeres con baja o alta auto-confianza (7 pp.), mientras que desanima (2 pp.) a las de auto-confianza promedio. Curiosamente, mujeres de menor rendimiento académico (50% inferior), reaccionan negativamente a la retroalimentación (7 pp.), contrarrestando el efecto de las becas.

Abstract

This study contributes to the discussion on how self-confidence, understood as a belief in one's own ability, plays a role in a person's decision to enter a competitive track. Results show that women tend to shy away from competition in educational settings.

Three approaches are followed. First, a theoretical model that explains how self-confidence influences entry to competitive tracks. Second, a revealed preference analysis of the college major choice. Lastly, (iii) a survey experiment with realistic hypothetical scenarios regarding master's program applications.

The theoretical model offers a framework for thinking about self-confidence in human capital formation choices. The key result is that biases in self-confidence are highly relevant for two types of individuals. Those whose real ability is close to the average and those who are highly uncertain about their ability.

In the empirical analysis of the college major choices, self-confidence only correlates positively with the most competitive majors according to the revealed preferences analysis. However, the magnitude of this correlation is inferior to other determinants such as gender, socioeconomic background, and mathematics performance.

The survey experiment allows studying the causal effects of two affirmative actions (AA) on the self-reported disposition to apply to a master's program. One AA provides strong feedback (signal) of being a high-ability type by a referee's letter of recommendation. The feedback does not affect the master's application, except for those whose self-confidence is close to average, which is consistent with the theoretical model.

The other AA provides information regarding two women-targeted academic excellence scholarships that cover the total cost of the master's. This is both a potential financial aid and an external reinforcement from the institution for women to apply. Those scholarships increase by 4 pp. women's applications. These effects rise to 6 pp. for women in the top 25% and 10% in their cohort's GPA ranking. Also, it incentives women with low or high self-confidence (7 pp.) while discouraging application (2 pp.) for women with average self-confidence.

Interestingly, women in the lowest part of the academic performance distribution (bottom 50%) react negatively to the strong signal (7 pp.), counteracting the positive effect of the women-targeted scholarships.

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Introduction

In human capital accumulation models, individuals should choose their educational and career decisions in order to maximize their lifetime utility, given their own characteristics (e.g., preferences, performance, ability) and constraints (e.g., financing, etc.). Career path is important for lifetime utility, as it is a determinant of many labor outcomes, such as employability and income prospects, which will translate into possibilities for consumption and savings over one's lifetime.

In this framework, ability is a fundamental attribute for individuals in their career path decision as, in principle, it will be less costly for a high-ability individual compared to a low-ability individual to choose the most competitive career tracks, which are often the most profitable ones. These include, for example, degrees in Civil Engineering, Medicine/Odontology, Business, and Law, as well as specialization through masters and doctorates that increase future economic prospects. A possible reason for this is that ability helps these individuals to successfully navigate environments where the outcome depends on their performance.

Despite this, there are sociodemographic groups that are minorities in these competitive tracks even when ability is not scarce or inferior in such populations. Two notable cases are individuals from low socioeconomic backgrounds and women. Under the aforementioned theoretical premise, the low prevalence of these groups in competitive tracks would be an efficient result if the hegemonic group and the minority were statistically identical, except that minorities endow a lower level of ability.

Many studies explore the distribution of ability in society despite its numerous challenges. Measurement is the main challenge , since ability is a latent variable. It is a characteristic that cannot be perfectly known by those who possess it nor by those who try to observe it, because what is observed is not the ability itself, but rather a signal of this latent variable. It can be more or less accurate or noisy. Additionally, a good quality measure must allow for comparison between individuals and be reliable, stable over time, and as accurate as possible.

There is a consensus on the use of standardized tests, as they meet the first three criteria to some extent. However, the fourth is called into question, since this measure often correlates with other variables, making it less accurate. For example, standardized tests have been found to correlate with school characteristics (Kane and Staiger, 2002). Additionally, it has been found that the stake level of a test is correlated with the performance of men and women, since high-stake tests tend to lower women's performance due to stereotype threat

(Ors, Palomino and Peyrache, 2013; Jurajda and Münich, 2011), and therefore low-stake tests tend to be more accurate for this group. Another area of discussion is that ability can be measured in general or subdomains, for example, specific to mathematics and language fields (Koffman, Ugalde, and Zafar, 2021). Naturally, these subdomains are relevant for major choices such as STEM careers.

While we should be cautious about using standardized test scores as a measure of ability, some results should be taken into consideration. First, standardized scores are on average lower for the low SES groups mainly because they face more restrictions and challenges that prevent them from exploiting their maximum potential throughout their educational journey. Therefore, the gap in competitive tracks is observable even before the college major choice. On the other hand, contrary to the tendency of lower socioeconomic groups, there is no difference in the distribution of ability between men and women when performance is measured in low-stake tests (Arias and Mizala, 2016). Under that framework, we might expect equal proportions of men and women to choose competitive tracks. This makes the women's case puzzling; what causes high-ability women to not choose the most competitive tracks compared to their male peers?

Some public policy formulators argue that the main barrier to choosing competitive tracks for high-ability individuals from these minority groups is financial constraints. For this reason, various affirmative action scholarships target minority groups. The economic framework idea behind these policies is related to two concerns, whether these students face 1) budget constraints that are greater than those of the average student, or 2) higher cost when studying in these particular tracks. In this way, the scholarship functions as a subsidy. The former applies to students from lower socioeconomic strata, for example, first-generation professional or monoparental households. The latter ad students who belong to a minority in the field and who internalize as costs the challenges of being in that group, which can range from stereotype threat to discrimination.

On the other hand, the economic literature has explored multiple psychological traits as underlying mechanisms that shape the decision-making process and could potentially explain the difference between mens' and womens' paths. These include, for instance, risk aversion, patience, taste for studying, willingness to compete, non-pecuniary preferences, and self-confidence. As they are not observable in the data, most have been tested in laboratory experiments (Kagel and Roth, 2015) that expand the understanding of how e psychological traits influence decisions. However, these experiments do not reveal the concrete implications of such traits in real-life settings, such as decisions regarding human capital.

Self-confidence, as an estimate of one's own ability, is relevant in human capital formation because ability level—which is a determinant of decisions related to human capital—is not a known variable, even for those who possess it. Suppose that there is a gender gap in this variable. In that case, self-confidence could potentially be one of the mechanisms by which a gender gap appears in the competitive tracks of human capital accumulation. In other words, if skilled women misperceive their ability, they might be less willing to navigate the challenges of a competitive track and, therefore, reluctant to enter these tracks.

Self-confidence research conducted in the laboratory successfully constructs a clean measure by comparing an objective measurement of ability and belief in that ability. Positive differences indicate a high level of self-confidence, while negative differences indicate a low level of self-confidence. Furthermore, several studies show that the process of updating beliefs after learning new information about one's ability is not straightforward and does not operate as smoothly as predicted by Bayesian theory (Kagel and Roth, 2015).

There is a knowledge gap between models of competitive entry and models of human capital accumulation decisions. Filling this gap could help to explain why women shy away from competitive tracks. To the best of my knowledge, this will be the first study to test the effects of a strong signal of being a high-ability type on a human capital decision. It will also be the first to compare the magnitude of the causal effects of an attempt to boost self-confidence with a scholarship-type affirmative action on the decision to enter a competitive career path.

In this paper, I connect the theoretical literature of human capital accumulation models with the empirical experimental literature of tournament or competition entry in order to advance the understanding of self-confidence as a psychological trait that can distort the optimization process of the individual, thus contributing to a gender gap in the most competitive paths of higher education. I define self-confidence as the belief about one's own intelligence, encompassing the entire set of hard and soft competencies behind the concept of intelligence.

I focus on two decisions that fundamentally shape men's and women's trajectories prior to entering the labor market. These are the choice of college major and the choice to continue one's education by pursuing a master's degree right after completing undergraduate studies. Both decisions reveal gender gaps and are highly relevant to studying how the gender gap develops throughout career trajectories.

Regarding the former, women are less likely to choose Science, Technology, Engineering and Mathematics (STEM) careers that correlate with higher earnings (Arcidiacono, 2004; Hastings et al., 2014). In contrast, they prefer Health, Education, Arts, and Humanities, which correlate with gender stereotypes (OECD, 2022; 2019). Furthermore, according to results from standardized tests, it has been found that talented women do not apply to or participate in the most competitive and profitable majors—such as Medicine/Odontology, Civil Engineering, Business, and Law—to the same extent that men at any level of ability do (Bordon et al., 2020).

This pattern can also be observed in enrollment statistics. While women in OECD countries represent, on average, 53% of bachelor's programs, 56% of master's programs, and 48% of Ph.D. programs, the proportion is lower in STEM fields, with 32% in bachelor's programs, 37% in master's programs, and 35% in Ph.D. programs (OECD, 2022).

I formulate a theoretical model that provides an explanation of how self-confidence is introduced into higher education decisions. I provide a framework for evaluating when self-confidence is relevant in these decisions as well as the trade-off between entering a competitive track with the possibility of being at the bottom of the outcome possibilities versus entering a less competitive one and being at the top - "Is it better to be a big fish in a little pond?". To do this, I specify a model of heterogeneous individuals with different ability levels and personal features, who must choose a competitive or noncompetitive track to maximize their lifetime utility.

In view of the scarcity of data, two approaches are taken to evaluate whether the puzzle can be explained by a financial constraint argument, a biased ability estimation, or perhaps both. I begin by exploring whether self-confidence correlates positively with applying to the most competitive and profitable college major tracks, using a large linked administrative dataset. I confirm this idea and additionally, find that the correlation parameter runs in the opposite direction in relation to the parameter of being a woman. In general, it can be interpreted that low self-confidence may be a relevant barrier to choosing the most competitive career track.

My next step was to use a survey experiment with hypothetical scenarios to study and compare the financial and self-confidence arguments. I estimate the combined effects of offering academic excellence scholarships targeted to women and feedback that provides a strong signal of being high-ability on the likelihood of a student choosing to begin a competitive master's application process right after completing their undergraduate studies instead of entering the workforce.

The hypothetical scenario determines if the respondent receives a neutral or a strong signal (SS) of being a high-ability type from someone of whom the student requests a letter of recommendation for a master's program application. One might assume that this positive feedback will feed into the belief updating process about the respondent's ability. Nevertheless, as the theoretical model illustrates, the belief updating process on this matter does not work linearly. Therefore, the feedback does not translate into a shift in self-confidence levels for all types of populations but only for the ones with more uncertainty about their ability level. This result is consistent with the theoretical model and suggests.

Furthermore, I use this experiment to compare this attempt to boost self-confidence with the causal effects of the availability of two full academic excellence scholarships targeted to women only. I study how both policies, separately and together, can influence the gender gap in terms of students' willingness to pursue a competitive track. Specifically, I study their effects on the willingness to pursue a master's degree right after graduating with a bachelor's degree in a population that is about to face that decision.

For studying self-confidence in the application to college majors, I take advantage of the highly integrated Chilean secondary and higher education systems as a setting to study the role of self-confidence. The empirical study begins with an explanatory analysis, relying on the fact that all Chilean students in regular education take the low-stake SIMCE exam in the 10th grade. From 2012 onward, this test asks students how much they agree with the sentence 'I am intelligent.' Students make two decisions about specialization tracks, one in 11th grade for their high school course electives, and another after graduation regarding their college major. The latter is carried out through a centralized education system, which allows me to explore this decision using a revealed preferences approach.

I estimate a model with administrative microdata on students, parents, schools, and standardized tests. In this model, self-confidence turns out to have a small but statistically significant positive effect on the probability of applying to a competitive program as a first choice. While this does not ensure that there is a causal effect, due to the endogeneity of the self-reported variable of self-confidence, it does allow us to initially describe the study population as one in which self-confidence could potentially play a role that favors applying to competitive tracks.

On the other hand, for studying the entry to a master's application process, I took advantage of the infrastructure of the University of Chile, the largest and most renowned public university in the country with a vast range of disciplines, to collect data from two cohorts of students from eight different disciplines in the last two years of their undergraduate studies. At this university, the pursuit of a master's degree is presented as a feasible option that most students are familiar with. It is often facilitated by combining undergraduate and master's programs, allowing for a smooth transition as elective credits may be transferred. This is convenient for the study because the question of whether to enter the workforce or continue their studies is a decision that all students at the University of Chile must face. Therefore, implementing an RCT with hypothetical scenarios of that situation is realistic.

Literature review

This paper aims to contribute to the understanding of the role of self-confidence in estimating one's ability to pursue a particular educational or career path. I define self-confidence as the belief in one's own level of intelligence, closely related to notions developed in the foundational structural models for estimating labor outcomes (e.g., years of schooling choice models, occupational choice models, etc.). These models assume that individuals have an innate, latent level of ability (Becker, 1964, 1967; Roy et al., 1951) that is not perfectly known for each individual, but may be estimated. In other words, individuals cannot observe the true parameter of their level of ability but can observe signals that come from a distribution function of ability.

With these signals, they develop a belief in their level of ability and, each time they receive signals, they have the opportunity to update their beliefs upward, downward, or maintain them. These beliefs about one's own ability are what I refer to as self-confidence. Given their estimates, individuals self-select into different occupations (Roy et al., 1951), but also into different educational paths. These trajectories are the result of individuals making sequential human capital investment choices that maximize their lifetime earnings (Ben-Porath, 1967), such as how many years to dedicate to higher education, which degrees to obtain, and which occupation to pursue.

When a person systematically overestimates or underestimates their ability, i.e., there is a statistically significant difference between their true ability and their estimate, it means that the person is being overconfident or underconfident, respectively. This estimation error implies a cognitive bias that has been extensively explored by behavioral economics. In some contexts, it refers to people overplacing themselves relative to others in a group (Larrick *et al.*, 2007), with evidence showing that most people will assess themselves as better than the average, which is statistically impossible (Benoit *et al.*, 2013). A stylized fact is that women tend to be less overconfident. That result has been found across several in-lab and in-field settings (e.g., Coffman and Klinowski, 2022; Deaux and Farris, 1977; Falk *et al.*, 2006; Falk and Huffman, 2006; Lundeberg *et al.*, 1994; Möbius *et al.*, 2014; Niederle and Yestrumskas, 2008) and I argue it could potentially imply pass-through to educational decisions.

Another area where this paper aims to contribute is the exploration of the role of self-confidence in the decision to enter a competition or tournament in an educational problem setting. In their seminal paper on this matter, Niederle and Vesterlund (2007) found a gender gap in self-selection in a tournament entry with two factors underlying this result—higher overconfidence and higher preferences for competition in male participants. The implication was that low-ability men competed *too much* and high-ability women competed *too little*.

Not surprisingly, that result is similar to what Bordón et al. (2020) found regarding college major choice. Low-ability men apply *too much* to the most competitive careers (Medicine/Odontology, Civil Engineering, and Law), while high-ability women apply *too little*. That suggests that the phenomena of women shying away from competitive settings may also apply to education career, as competence is a characteristic present both in the major choice decision and in the master's application decision, which both imply a process of candidates competing for slots.

The idea behind this study is that a gender gap in self-confidence could potentially translate into educational choices that shape the pathways that men and women pursue before entering the labor market. If so, policy efforts aimed at increasing women's self-confidence could potentially help to reduce gender gaps in self-confidence and, consequently, in educational trajectories. However, the design of an intervention to increase self-confidence is not trivial.

To address the gender gap in applications to more competitive majors and master's programs, institutions have made an effort to promote the entry of women through the implementation of affirmative action policies, such as quotas and scholarships, among others. Interestingly, the study of Niederle et al. (2013) found that when women are guaranteed equal representation among winners, more women and fewer men enter competitions, and the response exceeds that predicted by changes in the probability of winning. They analyzed three possible mechanisms. First, affirmative action programs may induce women to compete more by making competition more gender specific. Second, they suggest that affirmative action could cause exogenous variation in overconfidence. Third and finally, it could be that the mere mention of this action discourages men and encourages women.

The finding of a self-confidence gap between men and women is nonetheless intriguing for several reasons. First, the results regarding the existence of a gender gap in self-confidence are mixed. Moreover, when a gender gap is identified, there is debate as to whether it stems from a combination of men overestimating and women underestimating their abilities or both men and women overestimating them, with men overestimating more than women. A meta-analysis of research found the latter, with men's estimates slightly higher than women's, although they could not dismiss the difference as statistically null (Bandiera et al., 2022).

Second, despite the fact that the literature has not yet come to a definitive conclusion on this, a large body of work found gender discrepancies in the estimation process behind self-confidence, which would argue in favor of a possible effect of self-confidence on men and women's educational trajectories.

On one hand, women's initial values or first guesses of ability have been shown to be systematically inferior when compared to men in laboratory research (Coffman and Klinowski, 2022; Falk et al., 2006; Falk and Huffman, 2006).

On the other hand, the way in which men and women incorporate feedback into the belief updating process might be different, although the directions and magnitudes of the process are not entirely predictable. Feedback is information provided about aspects of one's performance or understanding (Hattie and Timperley, 2007) that can be interpreted as an informative signal of one's ability. Although a rational individual should want to make the best estimation given the information available according to a Bayesian perspective, the process of belief formation is not exclusively guided by a desire for accuracy, but can be manipulated by a self-serving bias that makes people confirm their previous beliefs and even update them conveniently in favor of an ideal. Individuals are influenced by positive thinking or selective memory of feedback to avoid ego-threatening information (Bénabou and Tirole, 2002, 2006). Furthermore, it has been found that there is an asymmetry in the recall of positive and negative feedback that makes only positive beliefs persistent over time (Zimmermann, 2020).

Köszegi (2006) explained this phenomenon with an ego utility model in which people who are satisfied with their beliefs avoid receiving further signals because of a self-image protection motive, and, if unsatisfied, seek feedback prompted by a self-image enhancement motive. Recent evidence has found that preferences for additional feedback differ between men and women in that women avoid exposure to additional feedback while men seek it (Kogelnik et al., 2022).

In addition to this, once feedback is received, men and women tend to react differently on average. Positive feedback is more encouraging for men than for women. Kolgelnik (2022) found that men were more confident about their future performance than women with the same performance who received the same feedback. There is also evidence that women are more conservative in updating their beliefs about their own ability (Coutts, 2019; Möbius et al., 2014), and are even more pessimistic in response to feedback (Berlin and Dargnies, 2016).

Both the initial values and the incorporation of feedback into the belief updating process show that differences between genders are not trivial, and that self-confidence could be a potential mechanism behind the gender gap in human capital decisions where this variable is relevant.

A theoretical model on self-confidence and human capital decisions

This section presents a theoretical model that formulates the role of self-confidence in a human capital approach for rational individuals. Say that there are heterogeneous individuals indexed by $i \in I$ facing lifetime earnings y that depend on their chosen educational tracks. I distinguish between two types of educational tracks, competitive and non-competitive.

The prototypical individual in the model lives three periods, which I denote by age being zero, one, or two.

At birth or at age zero, all individuals become heterogeneous and are characterized by a set of variables that I denote (θ, x, z). They are the level of ability, $\theta \in [-1, 1]$, where -1 is the lowest level of ability, 0 is an average level and 1 is the highest level, their personal background, z, and the market in which the student is in, x. Importantly, θ represents the level of intrinsic ability that is not perfectly observable for the individual and therefore must be estimated or, in other words, create a belief in that ability $\hat{\theta}$ which can be called *self-confidence*. In practice, the individual will perceive that is characterized by $(\hat{\theta}, x, z)$. All these variables are assumed to remain constant throughout the individual's life.

The vector z consists of observable variables for the individual and measures the conditions that affect the cost of education. This can be family background, school quality, and personal characteristics such as gender and race.

Finally, x is another observable variable for the individual. It measures market conditions and is interpreted as a taste for certain areas of knowledge, for example, health, humanities, or engineering.

At age one, the individual has to choose whether make the competitive or the non-competitive choice. At two years of age, the individual works and perceives the returns of the educational choice.

The problem for individuals is to optimally decide on educational track competitiveness when there is uncertainty about their own ability level and the future returns of their educational investments.

In addition, a college test score is exogenously realized at the beginning of age one and depends on the real ability level such that $s_i = \eta_0 + \eta_1\theta + q_i$. Depending on its value, it can allow the individual to apply for a competitive college track. Eligibility is defined using a threshold rule; the score should be superior to the last score accepted in the past year plus an error term that varies each year. Say $\underline{s} = \underline{s}_t = \underline{s}_{t-1} + \varepsilon_t$.

The individual perceives the utility of the investment choice in higher education indicated by U. It depends on the individual's characteristics as well as the probability of being accepted on a certain college major track, which, in turn, depends on the college test score and the current threshold, $p_i = 1(s_i \geq \underline{s})$. Thus, utility is defined as

$$U_i = \gamma_0 + \gamma_1 z_i + \gamma_2 p_i + v_i \tag{3.1}$$

The decision to choose or not choose a competitive track occurs at the age of one. The test score s and the unpredictable part of the utility v are revealed at the beginning of this period and are used to inform the decision process. Therefore, the precise utility of a competitive track is known at the time of the investment decision. On the other hand, what is not known with certainty at this stage is the return to the track, as it depends on an unpredictable component and the real ability parameter. Only at age of two, these uncertainties are resolved when the individual observes lifetime earnings.

The earnings y are specified as

$$\ln y_i(x_i, \theta, d_i) = \beta_0 + \beta_1 x_i + \beta_2\theta_i + (\alpha_0 + \alpha_1\theta_i)d_i + u_i \tag{3.2}$$

d_i is a dummy variable that indicates whether the competitive track was chosen. Then (β_0, β_1) are parameters that determine low-skilled earnings when not on a competitive track, while the (α_0, α_1) parameters determine high-skilled earnings on the competitive track. Note that the outcome in both tracks depends on the ability parameter as illustrated in Table 3.1.

Nevertheless, notice that returns to track are not known in advance at age zero because u and θ are unknown, and y is nonlinear in its arguments. Then, individuals estimate their lifetime earnings using their estimated ability $\hat{\theta}_i$.

$$\ln y_i(x_i, \hat{\theta}, d_i) = \beta_0 + \beta_1 x_i + \beta_2\hat{\theta}_i + (\alpha_0 + \alpha_1\hat{\theta}_i)d_i + u_i \tag{3.3}$$

Table 3.1: Illustrative cases I

$\hat{\theta}$	d_i	Predicted income value
$\hat{\theta}$	0	$\hat{\beta}_0 + \hat{\beta}_1 x_i + \hat{\beta}_2\hat{\theta}$
$\hat{\theta}$	1	$\hat{\beta}_0 + \hat{\beta}_1 x_i + \hat{\alpha}_0 + (\hat{\beta}_2 + \hat{\alpha}_1)\hat{\theta}$

With that estimation, the selection rule is defined in terms of the income conditional on choosing a particular track. The optimal decision rule is a function of the information set at age one $d = d^*(\hat{\theta}, z, x, s, v)$. Formally,

$$d_i = \begin{cases} 1 & \text{if } E(\ln y_i | d_i = 1) \geq E(\ln y_i | d_i = 0) \\ 0 & \text{if otherwise} \end{cases}$$

In this decision, the individual needs to estimate and compare the income in the two scenarios; in ($d_i = 1$) or out ($d_i = 0$) of the competitive track. Each estimation has two sources of uncertainty, u_i, and θ. Since the ability is a continuous value between -1 and 1, it is illustrative to compare the predicted values when $\hat{\theta}$ is on the extreme values and when it is zero. See it in Table 3.2.

Table 3.2: Illustrative cases II

$\hat{\theta}$	d_i	Predicted income value
-1	0	$\hat{\beta}_0 + \hat{\beta}_1 x_i - \hat{\beta}_2$
-1	1	$\hat{\beta}_0 + \hat{\beta}_1 x_i - \hat{\beta}_2 + \hat{\alpha}_0 - \hat{\alpha}_1$
0	0	$\hat{\beta}_0 + \hat{\beta}_1 x_i$
0	1	$\hat{\beta}_0 + \hat{\beta}_1 x_i + \hat{\alpha}_0$
1	0	$\hat{\beta}_0 + \hat{\beta}_1 x_i + \hat{\beta}_2$
1	1	$\hat{\beta}_0 + \hat{\beta}_1 x_i + \hat{\beta}_2 + \hat{\alpha}_0 + \hat{\alpha}_1$

Assume that $(\beta_0, \beta_1, \beta_2)$ and (α_0, α_1) are nonnegative coefficients and that estimates are not biased. An individual with the lowest level of ability in the distribution, $\hat{\theta} = -1$, will prefer to choose the competitive track only when $\hat{\alpha}_0 \geq \hat{\beta}_2$, which is when the premium to enter a competitive track (which does not depend on the level of ability) at least compensates the loss of not having the level of ability needed to perform well.

On the other hand, an individual with an average ability level will always have incentives to enter a competitive track when $\hat{\alpha}_0 > 0$, which means that there is a positive reward for entering a competitive track that does not depend on the ability. If the premium is null, that person will be indifferent to choosing either track.

Lastly, if the individual has the highest level of ability, $\hat{\theta} = 1$, will always choose to enter competitive tracks where there is a lump sum premium for entering that track (α_0) and even more when the earnings are ability dependent (α_1).

An important result of this model is that biased self-confidence will become highly relevant for two types of individuals. The ones whose real ability is close to the average and are not biased, and individuals very uncertain about their ability since their estimated value is likely to be in the vicinity of zero.

For these cases, the optimal choice is ambiguous and depends on whether $\hat{\alpha}_0 + \hat{\alpha}_1 \hat{\theta} > 0$. In other words, the competitive path will be chosen when self-confidence or ability estimation is above a certain threshold defined by $\frac{-\hat{\alpha}_0}{\hat{\alpha}_1}$, i.e., the negative ratio between the nonability-dependent premium and the ability-dependent premium from choosing a competitive path. The indifference point is

$$\hat{\theta} = \frac{-\hat{\alpha}_0}{\hat{\alpha}_1} \tag{3.4}$$

In this situation, self-confidence will determine whether the person chooses to enter a competitive track if $\hat{\theta} > \frac{-\hat{\alpha}_0}{\hat{\alpha}_1}$, or not to enter if otherwise.

Therefore, in this model, an individual who believes to have the lowest level of ability ($\hat{\theta} = -1$) can still choose to enter a competitive path if and only if $-1 > \frac{-\hat{\alpha}_0}{\hat{\alpha}_1}$, say $\hat{\alpha}_1 < \hat{\alpha}_0$ which means that the nonability dependent premium is greater than the ability dependent premium. Equivalently, an individual who believes possesses the highest level of ability ($\hat{\theta} = -1$) can still choose not to enter the competitive track when $\hat{\alpha}_1 > -\hat{\alpha}_0$.

Also note that when the non-ability-dependent premium is null but the ability-dependent premium is not, then the actual ability must be positive; in other words, the individual must be in the high-ability part of the distribution. With this example, it is clear that the bigger the lump sum premium, the more difficult it is for a competitive track to discriminate between low- and high-ability types, and so that decision would not help individuals to signal ability.

Interestingly, given that the parameters are positive, the model allows self-confidence to determine the optimal decision for the individual. Moreover, the big-fish-in-a-little-pond (English speaker version) or the lion's-tail-or-mouse's-head (Spanish speaker version) is a story that can be understood in this framework.

Up to now, I have taken self-confidence as given, but the literature says that its estimation is the product of a complex updating process that occurs over time. If I extend this model to have more than three ages, then I should add that the ability also varies in time following certain structures. Say $\theta_t = F(\theta_{t-1}, m_t, h_t, z)$ with $F(\cdot)$ is a nonlinear function of belief persistence θ_{t-1}, history of signals h_t, current signals m_t, and family and personal background variables z.

Self-confidence and the college major choice

In this section, I explore the college choice decision for students in Chile in order to understand whether self-confidence correlates with the most competitive majors.

I use a large linked administrative data set from the Chilean cohort of students who took the SIMCE test in 10th grade in 2012. I pooled detailed secondary course grade data from the Ministry of Education, along with scores and student and parent questionnaires from the SIMCE national test (provided by the Quality Education Council) and the PSU test (provided by the DEMRE). A detailed description of the data sources can be found in Annex A. These institutions and tests are explained below.

4.1 Setting

The secondary education system in Chile has two types of schools: scientific-humanist (regular) and technical-professional (vocational). Families choose the school type according to their aspirations. The focus of the first is to prepare students for higher education and, subsequently, the national College Admission Test (PSU for its acronym in Spanish and PDT since 2020), while the second is intended to prepare students for entering the labor market after graduation.

During secondary school, students take the SIMCE test. The SIMCE is a standardized test that the Education Quality Assurance Agency designs and implements yearly to measure the quality of education in private, private subsidized, and public schools. It is a low-stakes test, as it does not have direct consequences on grades; moreover, students and families never receive individual feedback regarding the results. Students, parents, and teachers also respond to specific questionnaires that collect data on the student's environment.

Regarding specialization, the first decision for students occurs at the beginning of the 11th grade. Students in the scientific-humanist type of school choose an academic track in Humanities, Sciences, Mathematics, or Arts according to their interests. Students in the technical-professional school type choose a specialization among the occupations available in their schools. The chosen path sets the course for the last two years of school.

The second and more significant decision is the college major choice. Highly relevant to this study is the fact that Chile has a single centralized admission system for most universities, administered by the Department of Educational Evaluation, Measurement and Registration (DEMRE) at the University of Chile, which is under the authority of the Council of Chancellors of Chilean Universities (CRUCH). Students participate in the admission system with a score computed from three inputs: PSU scores, high school GPA Scores, and a Ranking Score based on high school GPA.

The PSU is the College Admission Test in Chile, similar to the SAT in the U.S. It is a standardized set of tests that the Ministry of Education finances for all students in public education and private subsidized schools. Private school families pay for the test. Once the student is registered for the exam, they must take one mathematics and one language test, while they can choose to take the social science and the science test. PSU scores range from 150 to 850, while both the mean and median were 500 points. The high school GPA score is the average of all grades during the four years of high school and is converted from a 1.0 to 7.0 scale to a score between 150-850 points. The Ranking score is calculated using the overall GPA ranking within the school cohort and transformed into a score between 150-850 points.

Students must submit their application with a list of up to 10 pairs of university-major preferences. The application score for each choice is calculated with those three scores and using specific weights defined by each university-major combination. Once the deadline has passed, the candidates for each university program are placed in strictly decreasing order according to their final weighted score. The university program fills vacancies by starting with the applicant ranked first on the list, following a rigorous order of precedence until all vacant slots are filled. Then, the applicants who were not selected for their first choice are placed on a waiting list and move on to compete for a spot in their second choice university program, etc.

It is important to note that this admission system is designed so that students are incentivized to list their choices sincerely. The only possible strategy for students is to consider the overall probability of admission when deciding which choices to include and which to leave off the list. From one year to the next, one cannot be certain about admission results, since cutoff scores can vary with the volume of applicants.

4.2 Data

The data from this study corresponds to the cohort of Chilean students who took the SIMCE test in the 10th grade in 2012. I use a longitudinal panel at the individual level with a large number of variables that identify the path these students followed from high school to their enrollment in the university. The sample size is 64,423 students, with no missing values in the relevant variables of the model. Tables 4.1 and 4.2 show the descriptive statistics for these variables. This sample is representative of the complete cohort. The mean differences between the sample and the universe are not statistically significant in all variables.

Table 4.1: Descriptive Statistics I

	Mean	Std. Dv.	Min	Max	N
Student' variables					
Woman	0.55	0.50	0.0	1.0	64,423
Self-confidence Prior *I am intelligent*					
Strongly disagree	0.01	0.08	0.0	1.0	64,423
Disagree	0.04	0.20	0.0	1.0	64,423
Agree	0.46	0.50	0.0	1.0	64,423
Strongly agree	0.49	0.50	0.0	1.0	64,423
Academic performance					
Bottom 50%	0.32	0.46	0.0	1.0	64,423
Top 50-25%	0.26	0.43	0.0	1.0	64,423
Top 25-10%	0.20	0.40	0.0	1.0	64,423
Top 10%	0.23	0.42	0.0	1.0	64,423
High-school' variables					
Type of high school financing					
Public	0.25	0.43	0.0	1.0	64,423
Private subsidized	0.58	0.49	0.0	1.0	64,423
Private paid	0.18	0.38	0.0	1.0	64,423
Type of high school class					
Male class	0.14	0.35	0.0	1.0	64,423
Female class	0.34	0.47	0.0	1.0	64,423
Mixed class	0.52	0.50	0.0	1.0	64,423

Note: Academic performance position is computed for the specific high school and the cohort of the student. High school variables are specific to the 12th grade. High school class is defined as exposure to female students.It is a mixed class when between 40% and 60% are women, and a female class when more than 60% are women.

Table 4.2: Descriptive Statistics II

	Mean	Std. Dv.	Min	Max	N
College application' variables					
PSU Scores					
Ranking PSU Score	621	120	297	850	64,423
Language PSU Score	567	88	182	850	64,423
Math PSU Score	573	93	176	850	64,423
Science PSU Score	557	96	158	850	64,423
Social Science PSU Score	562	96	163	850	64,423
Biology-Chemistry GPA	5.58	0.62	3.5	7.0	64,423
Math-Physics GPA	5.55	0.68	2.8	7.0	64,423
Arts-Music GPA	6.53	0.45	2.9	7.0	64,423
Humanities GPA	5.73	0.53	3.6	7.0	64,423
Family background' variables					
Parent's area same sex	0.06	0.23	0.0	1.0	64,423
Parent's area different sex	0.07	0.26	0.0	1.0	64,423
Per capita income (average)	619,2	374,4	72	1,584,001+	64,423
Per capita income quartile					
1st quartile	110,932	60,568	0	144	17,88
2nd quartile	344,208	70,249	144,001	576	19,55
3rd quartile	697,484	119,57	576,001	1,008,000	13,015
4th quartile	1,433,598	214,097	1,008,001	1,584,001+	15,699
Rural	0.01	0.11	0.0	1.0	64,423
Geographical location					
North	0.24	0.20	0.0	1.0	64,423
Capital	0.38	0.49	0.0	1.0	64,423
South	0.38	0.22	0.0	1.0	64,423

Note: PSU scores are specific to a student's first attempt. GPA shows the average from 10th to 12th grades. Per capita income is computed using a categorical variable available in the SIMCE parent's questionnaires and is in CLP. North comprises the 1st to 5th and 15th regions, South of the 6th to 12th and 14th regions, and Capital is the 13th region in Chile.

Table 4.3 shows descriptive statistics regarding applications, enrollment, and gender gap for each study area. The enrollment gaps correlate with application gaps, which justifies looking at applications if one wants to understand the enrollment situation.

Table 4.3: Descriptive Statistics III

College Major Area	% Applications			% Enrollment		
	Women	Men	Gap	Women	Men	Gap
Medicine & Odontology	57%	43%	-14%	57%	43%	-14%
Health	75%	25%	-50%	75%	25%	-50%
Sciences	40%	60%	21%	43%	57%	14%
Civil Engineering	21%	79%	57%	22%	78%	56%
Non-civil Engineering	28%	72%	44%	27%	73%	45%
Business	44%	56%	12%	47%	53%	5%
Arts & Music	59%	41%	-18%	60%	40%	-21%
Social Sciences & Humanities	60%	40%	-20%	61%	39%	-23%
Law	50%	50%	1%	50%	50%	-1%
Education	63%	37%	-27%	66%	34%	-33%

Note: Application refers to the first attempt of the student after graduating from high school. Enrollment refers to the first undergraduate program where they formally enrolled.

4.3 Model and estimation

This college-major application model is inspired by a study conducted by Bordon, Canals, and Mizala (2020). There is a continuum of students indexed with $i \in I$. There are A areas of study or majors indexed with $j \in A$. Students are endowed with a set of high school history (h_{ij}), socioeconomic and demographic characteristics (g_{ij}), the final score (a_{ij}), and academic interests. For simplicity, I assume that students choose among A major independent options[1]. Note that I use the major and area of study indistinctly.

There is a vector of test scores $(s_i) = (s_{i1}, s_{i2}, \ldots, s_{iN})$ that summarizes the specific level of knowledge a student i has in three or four fields: mathematics, language, social science, and/or science. The final application score for a certain program is calculated as $a_{ij} = \sum_{l=1}^{S} \omega_{jl} s_{il}$, where $\omega_j = [\omega_{j1}, \ldots, \omega_{js}]$ is a vector of weights specific to the major j and $\sum_{l=1}^{s} \omega_{il} = 1$. As mentioned above, each program arbitrarily defines the weights, and they are publicly informed in advance.

Students maximize their expected utility and choose their first preference, which is at the top of their application lists.

$$\underbrace{U_{ij}}_{\substack{\text{expected}\\ \text{utility}}} = \beta_j \underbrace{\mathbf{x}_{ij}}_{\substack{\text{student's}\\ \text{charact}}} + \alpha_j \underbrace{\hat{p}_{ij}}_{\substack{\text{pr of } i \text{ being}\\ \text{accepted in } j}} + \gamma_j \underbrace{(\hat{sc_i})}_{\substack{\text{estimated}\\ \text{self-confidence}}} + \underbrace{\varepsilon_{ij}}_{\text{error term}} \tag{4.1}$$

Where x_{ij} is the vector of characteristics of students relevant to their choice of major university, this study is based on the findings of the literature.

The $\widehat{p_{lj}}$ is a relevant variable for students when choosing a major. It is the estimated probability that the specific option will accept the individual. In the Chilean system, this depends on the final score, which depends on the PSU scores $s_i =$ (language, math, science, social science), the Ranking and GPA scores, the weights defined by the program, and the application score of the last student enrolled in the program the year before. The probability of being accepted into the major can be modeled as

$$\underbrace{p_{ij}}_{\substack{\text{pr of } i \text{ being}\\ \text{accepted in } j}} = \theta_j(\underbrace{a_{ij}}_{\text{final score}} - \underbrace{\bar{a}_{ij})}_{\text{cut-off past year}} + \underbrace{\eta_{ij}}_{\text{error term}} \tag{4.2}$$

where a_{ij} is the final score, $\bar{a}_{ij}$ is the cut-off point for the previous year, and η_{ij} is the error term as the cut-off point could change yearly.

[1]This assumption could be strong for some cases, for example, if a student replaces among STEM areas (Science, Technology, Engineering, and Mathematics), it means that then the major Civil Engineering and the major Non-civil Engineering could be correlated in some extent. In Chile, this is not the general case because the outputs of the labor market in salary, employment, and type of jobs are quite different between these careers

The variable $\widehat{sc_l}$ is the estimated self-confidence variable at the individual level. In the model, I conceptualize self-confidence as a belief in the own intelligence. Therefore, it is the result of an estimation model in which independent variables are informative signals of this intelligence. Intelligence is the endowment individuals do not know their level. The individual only sees realizations of the intelligence, which are never accurate, and so, the estimation is a day-to-day activity that relies on the estimation from the past and the new signals,

$$\underbrace{sc_{it}}_{\text{self-confidence } t} = \delta \underbrace{h_{it}}_{\text{history of signals}} + \underbrace{sc_{it-1}}_{\text{self-confidence } t-1} + \underbrace{\xi_{ij}}_{\text{error term}} \tag{4.3}$$

with h_i being a vector of signals that can be positive or negative. They usually update their beliefs using information such as grades, awards, and other feedback. The intelligence signals are sorted from a distribution $h_i = \lambda m_i + \varepsilon_i$ with ε_i being an error term that makes a signal more or less noisy.

Finally, ε_{ij} is the error term of the main model.

$$\underbrace{U_{ij}}_{\substack{\text{expected}\\\text{utility}}} = \beta_j \underbrace{\mathbf{x}_{ij}}_{\substack{\text{student } i\text{'}\\\text{charact.}}} + \alpha_j \underbrace{\left(\theta_j \left(a_{ij} - \bar{a}_{ij}\right) + \eta_{ij}\right)}_{\substack{\text{pr of } i \text{ being}\\\text{accepted in } j}} + \gamma_j \underbrace{\delta(sc_0 + \lambda m_i + \varepsilon_i) + \widehat{sc_{lt-1}} + \xi_{it}}_{\substack{\text{estimated}\\\text{self-confidence}}} + \underbrace{\varepsilon_{ij}}_{\text{error}} \tag{4.4}$$

In the available data, neither $U_{ij}, \widehat{p_{lj}}$ nor $\widehat{sc_{lj}}$ are observable, but there are ways to incorporate them into an empirical model. First, the students' decisions and ranking of preferred choices are observable. In particular, the top of their lists corresponds to the choice j that maximizes the utility $U_{ij^*} = MaxU_{ij}$, so I can use the principle of revealed preference. Let $C_{ij} \in \{0, 1\}$ be the index of whether student i chooses as first preference the major j. Regarding p_{ij}, I can include their determinants as control variables. For self-confidence estimation, I can incorporate a self-reported variable that is a Likert scale variable with the statement 'I am intelligent.' Students must declare if they strongly disagree, disagree, agree, or strongly agree with this statement. This question is confidential and is included in the student questionnaire for the 10^{th} grade SIMCE test. Conveniently for the model's specification, that report is registered before they choose the field track in secondary school, so it can be interpreted as a prior of self-confidence whose estimation takes place before they start getting involved with the subjects related to the majors chosen.

I assume the independence of irrelevant alternatives (IIA), as usual in choice theory. This assumption allows me to use a multinomial logit model such that the estimate of the probability of choosing a specific major j is as follows. Let X_{ij} be the vector that summarizes the relevant characteristics of the students x_{ij}, the PSU scores be s_i = (language, math, science, social science), and the high school class rank be r_i.

$$P\left[C_{ij} = 1\right] = \frac{\exp\left(\beta_j X_{ij} + \gamma_j sc_{ji}\right)}{\sum_{n \in A} \exp\left(\beta_n X_{in} + \gamma_n sc_{ni}\right)} \tag{4.5}$$

Something key for analyzing the entry to competitive tracks was to follow the approach of Bordon, Canals, and Mizala (2020) and classified the programs into ten areas that reflect both a particular area of knowledge and level of competence. They are (1) Medicine and odontology, (2) Health, (3) Sciences, (4) Civil Engineering, (5) Non-Civil Engineering (similar to Technology), (6) Business, (7) Arts and music, (8) Social Sciences and Humanities, (9) Law, and (10) Education. Note that Medicine and Odontology, Civil Engineering, Business, and Law are competitive fields.

I also defined the vector x_{ij} with the same variables. These are gender, father's area of occupation, mother's area of occupation, gender composition of the high school class (a mixed class is between 40% and 60% female, and a female class contains more than 60% females), high school GPA by field (biology-chemistry, math, physics, music-arts, humanities), geographic location (region of the country where the student currently resides), type of high school (public, private subsidized, or private), and per capita income.

The main difference between the estimation approach and the benchmark model is that the former is a multinomial logit model rather than a nested logit model[2]. Since Bordon, Canals, and Mizala's (2020) results show that gender effects are consistent across different levels of selectiveness in universities, I decided to minimize the structure assumption in the decision model, as I am more interested in comparing the decision among the areas themselves than among university types. In this way, I am able to predict categorical placement in the ten major categories defined using the multinomial logit model.

Using a similar framework allows me to roughly validate the model before examining the role of the self-confidence variable by checking whether the results are consistent with the benchmark and what has been observed earlier in the main choice literature. Furthermore, studying self-confidence in the same background facilitates bringing a new element into the discussion, which Bordon et al. (2020) briefly mention as a limitation of their model.

4.4 Results

First, I run the model without the self-confidence variable to check whether the estimates are consistent with the benchmark paper and the literature. Second, I incorporate the self-confidence variable. The pseudo R^2 in both models is 0.18. This is the same value that is achieved in the reference paper, which means that 18% of the variance within the college major decision is explained by the variance of the variables included in the model.

Table 4.4 shows the marginal effects of the first model without the self-confidence variable. Estimates are similar in terms of signs and magnitudes to what is found in the reference paper. The statistical significance is not as high but is still present in several variables, including *Woman*. Note that the Ranking score and the PSU scores are consistent with what was discussed in the theoretical model. GPAs are also relevant because they are proxies of the preferences for a specific field.

[2] In addition, please note that I am using a different sample than that of the benchmark paper. This is explained in the previous section.

Table 4.4: Average marginal effects by area of study – Not including self-confidence variable

Variable	Medicine/Odon.	Health	Sciences	Civil Eng.	Technology	Business	Arts/Music	Social Sc./Hum.	Law
Woman	1.80%***	15.90%***	-0.70%***	-12.00%***	-7.40%***	-1.90%***	0.20%	2.60%***	0.00%
Parent's area same sex	0.25%	-0.40%	-0.60%	-0.00%	-0.30%	2.38%***	-0.10%	-0.70%	0.36%
Parent's area different sex	-0.10%	-0.10%	0%	0.71%	-1.00%	0.36%	0.06%	0.39%	-0.10%
Female high school class	-0.60%	3.07%***	-0.20%	-1.50%***	-2.60%***	1.07%	0.51%	-0.60%	-0.30%
Mixed high school class	0.16%	3.15%***	-0.20%	-0.70%	-2.20%***	0.66%*	0.29%	-0.70%*	-0.60%
High school ranking	2.91%***	-1.00%**	-0.90%***	-0.50%*	-1.20%***	0.67%	-0.10%	0.17%	0.77%***
Language PSU Score	0.86%***	-1.80%***	-0.20%	-1.80%***	-1.40%***	-1.70%***	0.86%***	3.33%***	0.80%***
Math PSU Score	-1.40%***	-0.90%***	0.32%	11.40%***	0.14%	3.63%***	-0.80%***	-6.40%***	-2.80%***
Science PSU Score	6.58%***	-0.10%	1.30%***	-1.50%***	-1.00%***	-5.00%***	-0.10%	0.33%	-0.10%
Social Sciences PSU Score	-1.90%***	-1.30%***	0.14%	-4.20%***	-1.50%***	-0.60%***	0.17%	5.03%***	6.28%***
Biology-Chemistry GPA	3.89%***	13.10%***	1.61%***	-3.30%***	1.23%***	-4.40%***	-1.00%***	-5.40%***	-1.40%***
Math-Physics GPA	-2.50%***	-6.30%***	0.07%	11.40%***	1.77%***	4.24%***	-1.00%***	-4.60%***	-1.60%***
Arts-Music GPA	-0.20%	0.80%***	-0.10%	-0.60%***	0.27%	-0.60%***	1.17%***	-0.30%	-0.50%***
Humanities GPA	-0.00%	-5.80%***	-0.50%***	-3.20%***	-2.90%***	0.10%	0.52%***	6.80%***	2.50%***
Per capita income	0.46%***	-0.50%	-0.00%	0.06%	-0.80%***	0.75%***	0.48%***	0.21%	0.21%*
Private subsized high school	0.19%	-0.90%	-0.10%	0.30%	0.58%	-0.10%	0.10%	-0.30%	0.47%
Private paid high school	0.98%	-7.40%***	-0.00%	-1.60%**	-1.90%***	7.53%***	1.50%***	1.90%***	2.65%***

Note: *** p−value < 0.01, ** p−value < 0.05, * p−value < 0.1. Female high school class and mixed high school class coefficients should be interpreted in comparison to a male high school class in 12th grade. Private subsidized high school and private paid high school coefficients should be interpreted in comparison to the public high school. Estimations have fixed effects by region. The effects are relative to the Education area. All PSU Scores and GPA are included as standard deviations.

Table 4.5 shows the results after incorporating the self-confidence variable as a standard deviation within the school[3]. In general, the coefficients are robust to the addition of the variable, and self-confidence is positively correlated with the four competitive tracks (see Figure 4.1). Moreover, there are significant correlations for three of the four competitive tracks. These are Civil Engineering, Business, and Law. The correlation for the choice of Medicine/Odontology was not statistically significant, although there is a significant negative correlation with choosing the Health area. This might be relevant if students face a trade-off between different levels of selectiveness within certain areas, particularly Medicine/Odontology and Health, or Civil and Non-civil Engineering, as the directions of self-confidence effects are the opposite. However, this is not captured in the structure of this model because I assume the choices are independent of each other.

Table 4.5: Average marginal effects by area of study, including self-confidence variable

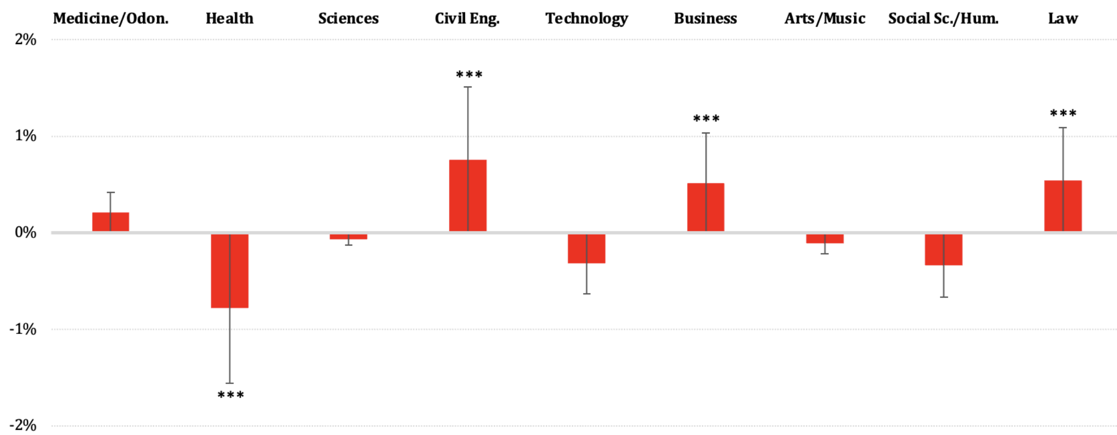
Variable	Medicine/Odon.	Health	Sciences	Civil Eng.	Technology	Business	Arts/Music	Social Sc./Hum.	Law
Self-confidence	0.20%	-0.80%***	-0.10%	0.80%***	-0.30%	0.50%***	-0.10%	-0.30%	0.50%***
Woman	1.90%***	15.6%***	-0.70%***	-13.00%***	-7.30%***	-1.60%***	0.20%	2.40%***	0.10%
Parent's area same sex	0.25%	-0.50%	-0.60%	0.03%	-0.30%	2.28%***	-0.10%	-0.60%	0.42%
Parent's area different sex	-0.10%	-0.10%	0.04%	0.74%	-1.00%	0.29%	0.04%	0.41%	-0.20%
Female high school class	-0.70%	2.97%***	-0.20%	-1.60%***	-2.50%***	0.96%	0.50%	-0.30%	-0.40%
Mixed high school class	0.14%	2.96%***	-0.30%	-0.80%	-2.10%***	0.61%*	0.27%	-0.50%	-0.60%
Ranking psu	2.94%***	-1.00%**	-0.90%***	-0.60%	-1.20%***	0.72%	-0.10%	0.19%	0.72%***
Language PSU Score	0.90%***	-1.80%***	-0.20%	-1.80%***	-1.40%***	-1.8%***	0.86%***	3.30%***	0.79%***
Math PSU Score	-1.50%***	-1.10%***	0.30%	11.60%***	0.07%	3.86%***	-0.80%***	-6.40%***	-2.80%***
Science PSU Score	6.71%***	0.08%	1.30%***	-1.50%***	-0.90%***	-5.20%***	-0.2%*	0.24%	-0.10%
Social Sciences PSU Score	-2.00%***	-1.60%***	0.14%	-40.3%***	-1.60%***	-0.50%	0.20%*	5.22%***	6.32%***
Biology-Chemistry GPA	3.91%***	13.40%***	1.63%***	-3.40%***	1.14%***	-4.50%***	-1.00%***	-5.40%***	-1.40%***
Math-Physics GPA	-2.50%***	-6.50%***	0.09%	11.60%***	1.81%***	4.13%***	-1.00%***	-4.60%***	-1.50%***
Arts-Music GPA	-0.20%	0.80%***	-0.10%	-0.60%***	0.30%	-0.50%***	1.16%***	-0.30%	-0.50%***
Humanities GPA	0.00%	-5.90%***	-0.60%***	-3.20%***	-2.80%***	0.12%	0.53%***	6.84%***	2.43%***
Per capita income	0.44%***	-0.50%	-0.00%	0.07%	-0.80%***	0.72%***	0.48%***	0.23%	0.21%*
Private subsized high school	0.18%	-1.00%	-0.20%	0.30%	0.56%	-0.10%	0.15%	-0.20%	0.49%
Private paid high school	1.05%**	-7.70%***	-0.10%	-1.50%**	-1.90%***	7.45%***	1.55%***	1.93%***	2.71%***

Note: *** p−value < 0.01, ** p−value < 0.05, * p−value < 0.1. Female high school class and mixed high school class should be interpreted in comparison to a male high school class in 12th grade. Private subsidized-high school and private paid-high school coefficients should be interpreted in comparison to the public high school. Estimations have fixed effects by region. The effects are relative to the Education area.

Figure 4.2 shows the correlations of nine determinants in the four competitive tracks. The self-confidence coefficients are not as large as others, yet they are significant and have more narrow confidence intervals relative to others. Note that PSU scores specific to the

[3]The self-confidence variable is included as a standard deviation within the school because this is the relevant environment of the student.

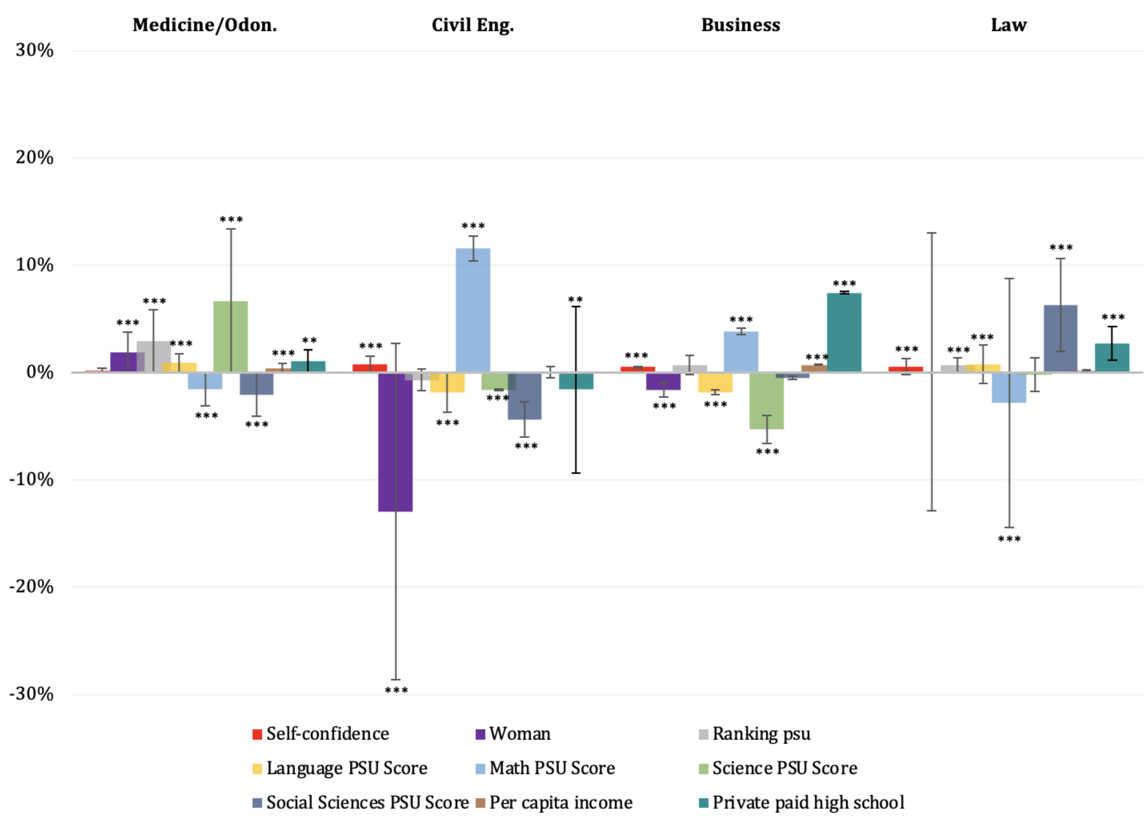
Figure 4.1: Self-confidence average marginal effects by college major



Note: *** p−value < 0.01, ** p−value < 0.05, * p−value < 0.1.

skills needed for each particular track are relevant. The socio-economic component is also relevant, as demonstrated by per capita income and having attended a private school.

Figure 4.2: Most relevant determinants in the competitive tracks



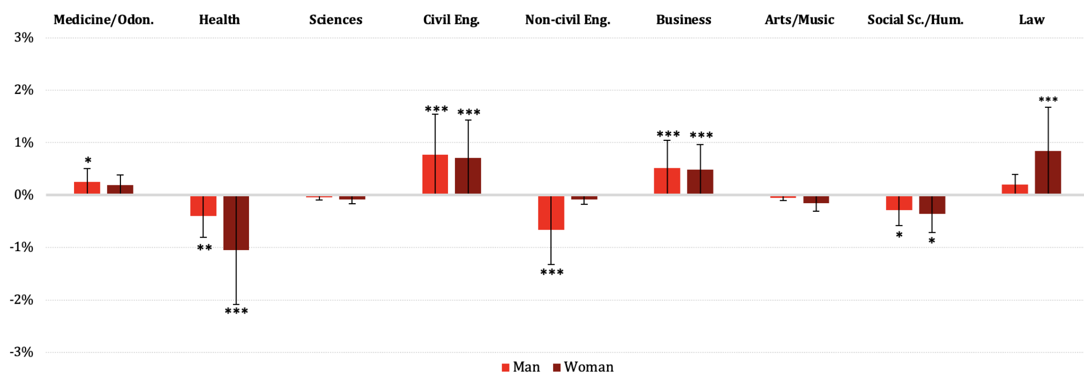
Note: *** p−value < 0.01, ** p−value < 0.05, * p−value < 0.1. Confidence intervals are shown.

The *Women* coefficients were less robust than the others, suggesting that gender effects were underestimated in the model, which does not include this dimension, as its coefficients are higher than before in all cases except Health.

The effect of self-confidence for women is opposite to the female coefficient for all majors, suggesting that high self-confidence mitigates the gender stereotypes captured in the female coefficient. Therefore, there is a window of opportunity related to an exogenous increase in self-confidence.

In terms of heterogeneities, Figure 4.3 shows the average marginal effects of self-confidence on choosing a particular area by gender. On average, these effects move in the same direction for both men and women, but the magnitudes differ. Correlations are higher for men regarding choosing Medicine/Odontology and Non-civil Engineering, and for the decision of women to choose Health and Law. They are similar for Civil Engineering, Business, Social Sciences, and Humanities.

Figure 4.3: Self-confidence average marginal effects by gender



Note: *** p−value < 0.01, ** p−value < 0.05, * p−value < 0.1. Confidence intervals are shown.

As a further analysis, heterogeneities are explored in two other dimensions in addition to gender: income quartiles and performance ranking within high school[4].

Figures 4.4 and 4.5 show the correlation between self-confidence and the choice of different majors according to four different performance high school ranking categories for male and female students, respectively.

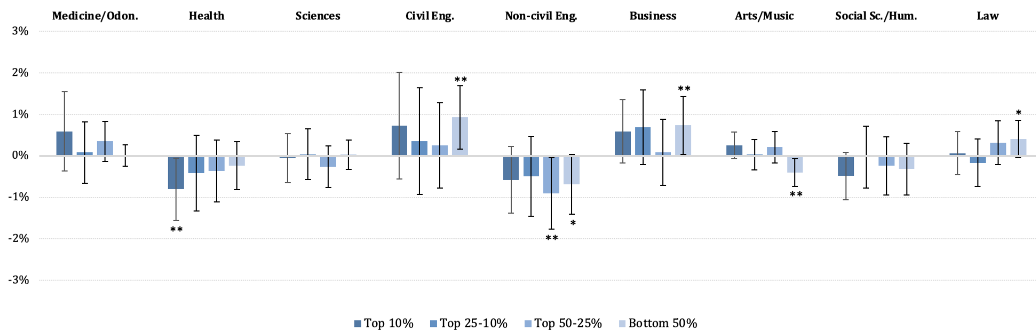
It should be noted that the marginal effects of self-confidence are only statistically significant for men sometimes (Figure 4.4), and most of the men in these cases (where they choose Civil Engineering, Non-civil Engineering, Arts/Music, and Law) are in the bottom 50% which is the category of low-performing students. In contrast, for women (Figure 4.5), the effects of self-confidence are significant for different groups. First, for high-performance students who choose Health or Civil Engineering. Self-confidence also plays a role for women in the top 50-25% in choosing Medicine/Odontology, Business, and Arts/Music. In particular, self-confidence is positive and significant at any level of performance for Law, which means this is a must in order for women to choose this area.

Regarding the quartile of income and gender (Figures 4.6 and 4.7), the tendencies are less categorical. It can be argued that self-confidence is relevant across different income quartiles

[4]Performance ranking categories are defined on the basis of the overall GPA of the student's last three years of high school. The first year of high school (9th grade) is excluded, since it is confounded with the self-confidence variable reported in the 10th grade. The overall GPA is only known at the end of the academic year, so it is not known when the students take the SIMCE exam.

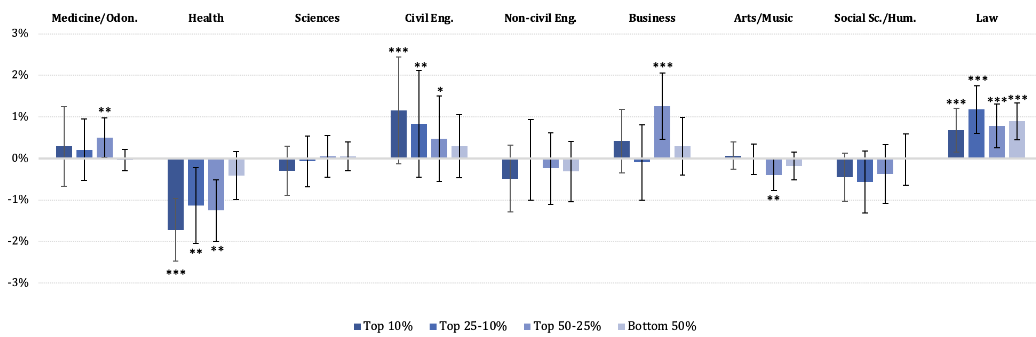
and thus does not only affect the poorest or richest students.

Figure 4.4: Self-confidence average marginal effects by performance level for men



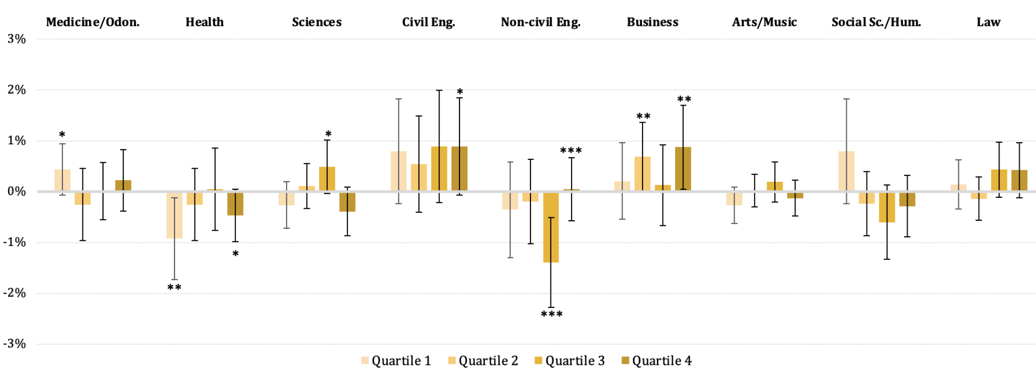
Note: *** p−value < 0.01, ** p−value < 0.05, * p−value < 0.1. Confidence intervals are shown.

Figure 4.5: Self-confidence average marginal effects by performance level for women



Note: *** p−value < 0.01, ** p−value < 0.05, * p−value < 0.1. Confidence intervals are shown.

Figure 4.6: Self-confidence average marginal effects by income quartile for men

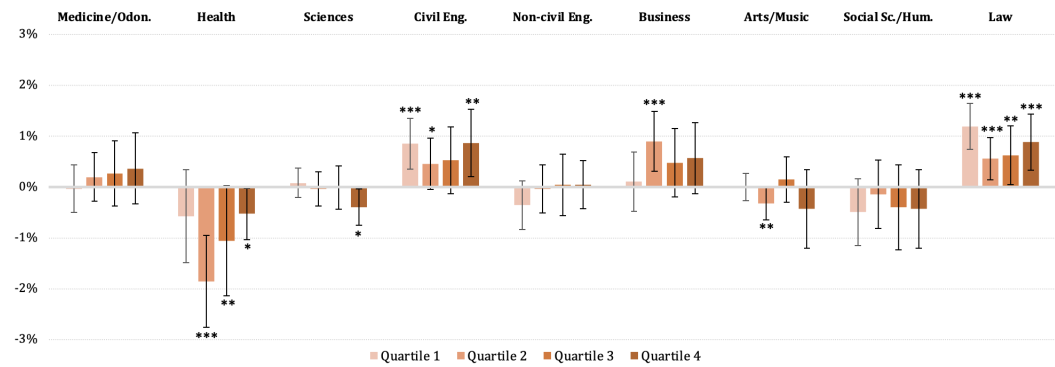


Note: *** p−value < 0.01, ** p−value < 0.05, * p−value < 0.1. Confidence intervals are shown.

In view of this analysis, I argue that self-confidence is a variable that can help explain the choice to pursue competitive tracks in the college major choice for both men and women. This correlation, although small in comparison to the relevance of PSU scores and socioeconomic variables, is consistent with the literature on self-confidence and competition entry.

In addition, self-confidence is most relevant for high-performing women, in other words, women that may have a high level of ability. This last point reinforces the idea that boosting

Figure 4.7: Self-confidence average marginal effects by income quartile for women



Note: *** p−value < 0.01, ** p−value < 0.05, * p−value < 0.1. Confidence intervals are shown.

students' self-confidence in their intelligence or ability has the potential to improve efficiency in the distribution of ability levels. With the right policies, greater gender equality in the labor market and a highly skilled workforce in the most competitive tracks could be achieved.

Self-confidence, affirmative actions, and the application to a master program

In this section, I further explore competitive track decisions along the education pathway by focusing on the application to a master's program. The study sample consists of students from the University of Chile, the largest and most renowned public university in the country with a wide range of disciplines.

I implement an experimental survey with a realistic hypothetical scenario to explore and measure the possible causal effects of two interventions to attract female applicants. One relates to the financial argument, and the other tackles the self-confidence argument by providing positive feedback about the student's ability.

5.1 Setting

The sample consists of 2,325 students from two cohorts that began undergraduate programs at the University of Chile in 2017 and 2018, respectively, comprising eight different areas of knowledge. In the year that this study was conducted, most of these students were in the fifth and sixth years of their studies, which corresponds to the last two years of their undergrad programs. They accessed an 8-minute online survey platform where they provided informed consent to participate, allowing researchers to use the data.

The survey consisted of two parts. In the first part, students are asked to imagine that they are in a scenario described in a vignette and to answer a question as they would in the real world. The second part is a survey that collects data that characterize these students with questions about their sociodemographic background, academic performance, undergrad background, and attitudes toward master programs, as well as personality indexes.

At the University of Chile, continuing to a master's degree is presented as a feasible option by information from various departments and is often facilitated by splicing programs to allow a for smooth transition through the transfer of course credits. This is convenient for the study because deciding whether to enter the workforce or continue their studies in a master is a choice all students eventually face. Therefore, the hypothetical scenarios are realistic for the research participants.

Table 5.1: Descriptive Statistics

	Mean	SD	Min	Max
Individual characteristics				
Woman	0.60	0.49	0.00	1.00
Age	23.42	2.10	21.00	53.00
Mother's education				
Up to high school	0.34	0.47	0.00	1.00
Up to technical degree	0.32	0.47	0.00	1.00
Up to professional degree	0.27	0.45	0.00	1.00
Up to graduate degree	0.06	0.24	0.00	1.00
Social Priority Index				
Low	0.14	0.35	0.00	1.00
Medium-low	0.36	0.48	0.00	1.00
Medium-high	0.27	0.44	0.00	1.00
High	0.24	0.42	0.00	1.00
Attitudes to masters				
Willingness to pay				
Nothing	0.06	0.23	0.00	1.00
$1-2 million	0.38	0.49	0.00	1.00
$2-3 million	0.31	0.46	0.00	1.00
$3-4 million	0.11	0.31	0.00	1.00
$4-5 million	0.07	0.25	0.00	1.00
$5-6 million	0.03	0.18	0.00	1.00
$6 or more million	0.02	0.15	0.00	1.00
Indifferent	0.02	0.14	0.00	1.00
Social Network Density Index	2.09	1.89	0.00	10.00
Pressure Index	6.59	2.72	0.00	10.00
Consumption Value Index	7.23	1.68	0.00	10.00
Master's electives	0.27	0.44	0.00	1.00
Personality indexes				
Self-Confidence Index	6.64	1.72	0.00	10.00
Patience Index	6.71	1.82	0.00	10.00
Risk Averssion Index	6.15	2.00	0.00	10.00
Big Five Indexes				
Agreeableness	6.50	1.43	2.00	10.00
Conscientiousness	7.21	1.60	2.00	10.00
Extraversion	5.46	2.01	2.00	10.00
Neuroticism	6.37	1.88	2.00	10.00
Openness	7.68	1.70	2.00	10.00

Note: Sample size is 2,325 students. Willingness to pay in CLP.

5.2 Experimental design

The experiment follows a 2×2 design that allows the study of the impact of each intervention, alone or in combination with others. The control group (*Base scenario*) is the student receiving neutral feedback from a potential referee for applying to the master's program. The feedback is neutral in the sense that it does not refer to the student's ability. In addition, the student is informed that the program offers two standard full academic excellence scholarships, for which both men and women are eligible.

There are three alternative scenarios to the base one. One alternative scenario is that the feedback, rather than being neutral, is positive and functions as a strong signal (*SS*) of ability for the student. The second alternative scenario is that the scholarships are targeted at women only (*WScholarships*), so men are not eligible. In the third alternative scenario, both of the previous alternative scenarios occur simultaneously.

In particular, the vignette shows a scenario where the student is at a point in their studies where they need to decide between graduating and entering the labor market to find a full-time job or continuing to study in a demanding but promising master's degree program or a medical specialty if they are a medical student.

Choosing specialization is a choice that implies going through a competitive application process. Therefore, the student needs to visit the office of someone that the student thinks would advocate for their admission into a master's program and request a letter of recommendation. The student talks about the program with the potential referee and I randomize what the referee replies. In some cases, the referee says, "Sure, I'll write a letter saying that I know you." In others, they say, "Sure, I'll write a letter saying that I know you and giving examples of your great intellectual capacity." The second type of answer is designed for the student to interpret it as a SS of being a high-ability type. It is then incorporated into the ability estimation process.

After that situation, the vignette presents the following. The student receives the information that the program offers two academic excellence scholarships covering 100% of the master's cost, which will be awarded to applicants based on the quality of the applications. I randomize whether the scholarship would be for men and women or only for women. The second alternative was designed to be a reinforcement for women from the institution, signaling that they want to promote women's enrollment in the program.

The effects of receiving the *SS* are not trivial because, as explained above, the literature on feedback has found mixed results regarding the belief updating process for men and women. Furthermore, sponsorship, which has the same intent as a letter of recommendation, shows mixed effects on competition entry. Baldiga and Coffman (2016) found that sponsorship, which seeks to promote advancement in competitive career fields, does not increase willingness to compete among women but does, on average, among men. It leads to a greater effort in participants due to more optimistic beliefs about potential gains from this effort. It has particularly positive effects for women in the top 25% of ability. In addition, sponsorship was more effective among overconfident participants, particularly overconfident men. Therefore, I analyze heterogeneity according to academic performance and self-confidence.

On the other hand, academic excellence scholarships targeted at women can be perceived as an external reinforcement for women to compete. Alternatively, it could be perceived as a signal of the institutional disposition towards women that, while positive, will decrease the competitive environment that women perceive. In both cases, this treatment may positively affect the probability of applying for a master's degree.

An element that is typically used as a signal in the belief updating process is performance measurements such as GPA. In fact, women have been found to be less likely than men to choose STEM and economics majors in response to low GPA (Astorne-Figari and Speer, 2019; Goldin et al., 2006; Rask and Tiefenthaler, 2004). Given that, results by GPA ranking are analyzed to explore whether treatments could have interesting effects on the tails of the performance distribution.

Prior to the data collection, a pilot was implemented with a sample of 12% of the universe, 956 students. I used that pilot to refine the vignette and experimental conditions. For the main data collection, I invited the remaining universe of 7,047 students to participate in a Qualtrics online survey. I accessed a contact information dataset after signing a confidentiality agreement with the university and obtaining ethical approval from the institutional ethics committee.

The invitations were emailed to their personal and institutional addresses and each non-successful invitation was followed up with up to three reminders. The participation was incentivized with a lottery of 6 gift cards, one of $100,000 CLP ($103 USD) and five of $50,000 ($52 USD).

The response rate was 44%, resulting in 3,111 students (39% of the universe). I conducted a validation process to exclude some low-quality responses using rules clearly explained in the pre-registration of the study (see Annex I). First, when a respondent answered the survey more than once and only one of the responses was completed, I dropped the unfinished one. However, if more than one was finished or all were unfinished, I selected the one that was most complete. Additionally, when a respondent answered the survey in fewer than 2 minutes, took less than 15 seconds to read the vignette, or did not give an answer to the dependent variable, it was considered invalid, and I dropped the response. The validation process reduced the sample size to 2,325, equivalent to a response rate of 33% and 29% of the total universe of students.

The experiment has four study conditions, as shown in Figure 5.1. The treatment status was randomly assigned and stratified by gender and eight college major areas. The college major areas distinguish between areas of knowledge and competitiveness level and are as follows: (i) Arts and Architecture, (ii) Science and Non-civil Engineering, (iii) Business, (iv) Social science, Humanities and Education, (v) Law, (vi) Civil Engineering, (vii) Medicine and Odontology, and (viii) Health. I define attrition as an observation in which the respondent did not answer the question with the dependent variable. The prevalence was 11.6% throughout all the study conditions. See Annex E for a detailed picture.

To test balance, I regress the full set of relevant covariates over each of the experimental conditions, which I call *Base* for the control group or the base hypothetical scenario, *SS* for the variation when a strong signal is received, *WScholarships* for the variation when the

Figure 5.1: Experimental conditions in the 2 × 2 factorial design

	Receiving no signal of being High Ability (N=1,164)	**Receiving strong signal (SS) of being High Ability** (N=1,161)
The program has two 100% scholarships for academic excellence (N=1,287)	**Control & Control** (N=582)	**Treatment & Control** (N=587)
The program has two 100% scholarships for academic excellence exclusively for women (N=1,282)	**Control & Treatment** (N=582)	**Treatment & Treatment** (N=574)

scholarships are for women only, and *SS* & *WScholarships* for the scenario that combines the latter two. As the scenarios were randomly assigned, one may expect to find that the covariates do not significatively correlate with the treatment status. Figure 5.2 below and Tables A2, A3, and A4 in Annex C show that the sample is balanced in all relevant variables (see a detailed description of covariates in Annex D) across the experimental conditions.

5.3 Results

I test whether a strong positive signal about a student's cognitive ability increases their probability of applying to a master's program. This could reduce the gender gap in applications to master's studies since women—who have a lower level of self-confidence, according to the evidence—may perceive greater returns Second, I test whether the availability of academic excellence scholarships for women motivates women to apply. I hypothesized that this would occur, since the scholarships are an external reinforcement for women to enter competitive tracks. Ultimately, I test whether the effects of both affirmative actions reinforce one another.

To test these hypotheses, I estimate a linear regression model controlled by covariates at the individual level. The dependent variable y_i is the probability that the student i apply to a master's program (or medical school if they are a medical student). This is a self-reported variable on a scale of 0 to 10 where 0 is not probable at all and 10 represents complete certainty. For the sake of clarity, the dependent variable was amplified by 10 so that the coefficients could be interpreted as percentages. SS_i referee's feedback treatment as a dichotomic variable with a value of 1 when the feedback is a strong signal and 0 when it is not. $WScholarships_i$ is a dichotomic variable with value 1 when the two 100% academic excellence scholarships are for women only and 0 when women and men are eligible. $Woman_i$ is a dichotomic variable that indicates whether the student is a woman[1]. Finally, X_i is a

[1]In the model, I use the gender variable within the administrative university dataset, which is the sex recorded in their legal ID document. For exploratory purposes, I collected self-reported gender data. I found that 2.3% of the sample was non-binary, of which 57% was classified as women and 43% as men in the

Figure 5.2: Balance among experimental conditions - Regression coefficients

control vector with covariates that are relevant according to the literature, and μ_i is the error term.

$$\begin{aligned} y_i = \alpha_0 + \alpha_1 SS_i + \alpha_2 WScholarships_i + \alpha_3 SS_i \times WScholarships_i + \alpha_4 Woman_i \\ + \alpha_5 SS_i \times Woman_i + \alpha_6 WScholarships_i \times Woman_i \\ + \alpha_7 WScholarships_i \times SS_i \times Woman_i + \beta X_i + \mu_i \end{aligned} \tag{5.1}$$

Because the treatments were exogenous and randomly assigned, leading to a balance in X_i,

administrative data. Additionally, 0.3% was transgender.

treatment effects are unconfounded and can be estimated with linear regression. I included the single effects per treatment and interaction to test the third hypothesis about conditional marginal effects. To test hypotheses regarding whether treatments and interaction have different effects among men and women, I include an interaction variable with $Woman_i$ that allows me to study conditional effects.

Table 5.2 below shows six columns where column five is the preferred model. Column one shows the results from the linear model without controls or fixed effects (FE). The next columns include controls cumulatively. First, individual characteristics such as gender, age, SES, and mother's education are considered. Second, undergrad background characteristics, i.e., GPA ranking, the trajectory of GPA (positive, stable and unstable/negative), enrollment in a STEM major, and enrollment in a competitive track major. Third, the student's attitude towards a master's degree, including their willingness to pay, the density of the social networks involved in postgraduate studies, the consumption value of pursuing a master's degree, etc.

Finally, the personality covariates refer to multiple indexes such as risk aversion, patience, self-confidence, and the Big Five Inventory. The effects of the treatment are robust to the different specifications. All models reach an F value greater than 10, and the preferred model shows an adjusted R^2 of 0.27. The sixth model was not selected as the preferrred one because the information from the fixed effects at area level are already contained in the variables *STEM college major* and *Competitive college major* among the undergraduate background set of variables.

The average treatment effects of the woman-targeted scholarships scenario are negative for men and positive for women. Note that the comparison to the base scenario means different things for men and women. For men, this implies shifting from a situation where they receive information about potential scholarships available to them to a situation where they have no access to scholarships. Moreover, there may be an effect of noticing that the program provides special help to women and not to them. On the other hand, for women, the treatment means shifting from a situation where they have to compete with men and women for scholarships to a situation where the competition is only among women. This can mean that competition changes, but also, as before, it may be some effect from noticing that the program wants to promote the entry of women, which can be interpreted as external reinforcement.

Results in Table 5.2, column six, show women increase their probability of applying in 4 percentual points (pp) in reaction to the scholarships for women only. This means that for every 100 women, there will be four more female applicants. On the other hand, naturally, eliminating scholarships where men are eligible reduces their probability of application. These effects are around 14 pp. which can be considered substantial.

Regarding the strong signal of ability, this turns out to have null effects on the probability of application both for men and women. It does not contribute either when combined with the women-targeted scholarships. This is consistent with the fact that ability estimation is a process where recent signals have low effects on the updating process. Presumably, the feedback from the referee is a strong enough treatment for shifting self-confidence, at least in this type of decision.

Table 5.2: Treatment effects on the probability of applying to a masters program

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
WScholarships	-13.402***	-14.754***	-16.017***	-14.809***	-14.021***	-14.188***
	(2.555)	(2.661)	(2.595)	(2.370)	(2.366)	(2.370)
SS	3.116	2.654	1.789	1.346	1.559	1.475
	(2.353)	(2.463)	(2.404)	(2.205)	(2.186)	(2.183)
WScholarships × SS	-0.309	0.463	1.550	0.664	-0.568	-0.601
	(3.561)	(3.699)	(3.628)	(3.341)	(3.332)	(3.329)
Woman	2.044	2.012	0.703	0.711	-2.668	-2.382
	(2.223)	(2.336)	(2.269)	(2.016)	(4.452)	(4.460)
WScholarships × Woman	17.011***	18.495***	19.288***	18.896***	17.644***	17.823***
	(3.126)	(3.246)	(3.184)	(2.922)	(2.919)	(2.922)
SS× Woman	-2.113	-1.735	-1.044	-0.272	-0.946	-0.891
	(3.043)	(3.181)	(3.131)	(2.865)	(2.845)	(2.833)
WScholarships × SS × Woman	1.131	-0.079	-1.064	-1.032	0.574	0.558
	(4.393)	(4.559)	(4.486)	(4.127)	(4.118)	(4.107)
Base control	68.833***	66.153***	67.759***	40.802***	34.420***	32.885***
	(1.763)	(11.349)	(11.696)	(11.238)	(12.163)	(12.156)
Individual characteristics	No	Yes	Yes	Yes	Yes	Yes
Undergrad background	No	No	Yes	Yes	Yes	Yes
Attitudes to masters	No	No	No	Yes	Yes	Yes
Personality indexes	No	No	No	No	Yes	Yes
FE college major	No	No	No	No	No	Yes
Observations	2,325	2,162	2,142	2,103	2,099	2,099
Adjusted R^2	0.062	0.069	0.105	0.253	0.266	0.271
F-test	20.52	12.86	13.36	34.96	27.28	24.45

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

It is interesting to explore whether the treatments had different effects in certain particular populations. I analyze heterogeneity on the effects by academic performance and self-confidence level.

Table 5.3 shows the average treatment effects for four groups in the academic performance distribution. The academic performance is measured using the GPA ranking position[2] and can be interpreted as a measure of observed ability. The table shows that the best-performing male students are more susceptible to scholarship elimination. While the gains in application probability for women are strongest in the top 25-10% performance bracket, reaching an increase of 6 pp. (21.1 - 14.9), whilst the effects for women from the other brackets are between 1 and 2 pp.

One could think of two potential reasons for this result. One is that this group, which is high-performant but not the top one, is the one that would have faced the strongest competition in a pool of men and women. Then, for a woman in this group, competing only with women will increase the possibility of granting a scholarship. A second reason could be that these women are the ones around the threshold that divide high and low ability types. If that is the case, they are in a more uncertain situation and the signal results as informative.

Regarding the strong signal of ability, it has effects when presenting alone for the low-performant group, the bottom 50% in the GPA ranking position. Men in this group increase their probability of applying by 11 pp. on average. However, for women, the effect is opposite

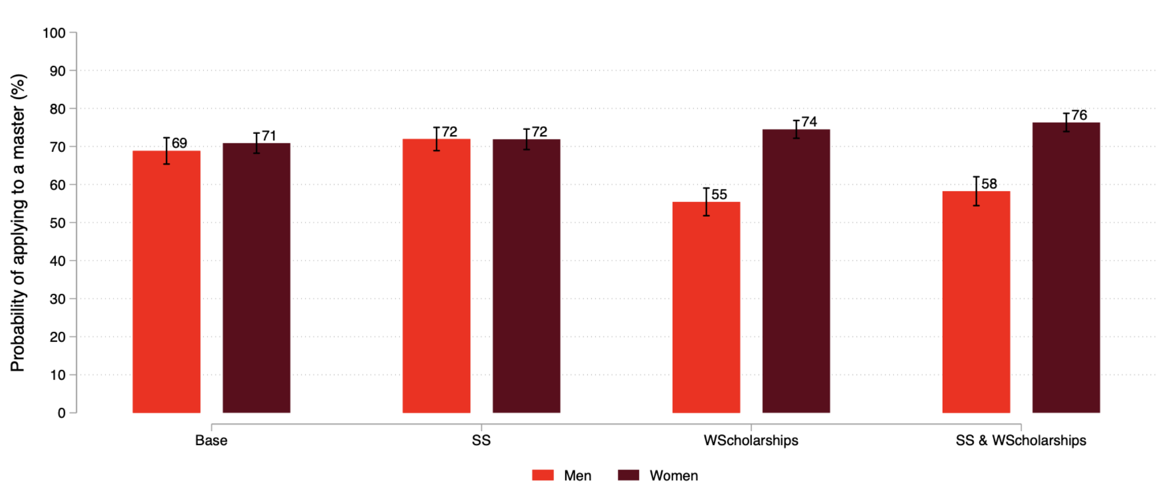
[2]GPA ranking is a self-reported variable collected in the survey. As a validity exercise, it was checked to be consistent with the reported GPA.

to the intended effect; the signal decreases their probability of applying by 7 pp. (10.6 - 16.9). When the signal is presented with the scholarship, there are no additional effects as the coefficient of the interaction of the treatments are statistically non-significant. However, the magnitudes suggest that the signal attenuates the effect of the scholarship both for males and females.

The result in women from the bottom 50% is a curious finding as the feedback was not intended to discourage them. The self-servant bias can be a possible explanation behind this result and can be evidence of women being more susceptible to this bias. In essence, when women in this group receive the message "Sure, I'll write a letter saying that I know you and giving examples of your great intellectual capacity" they will feel pressure and think that the referee will not have enough examples. Instead of passing through that uncomfortable situation, they will shy away from applying. The message, if this is the logic, is creating cognitive dissonance with their own beliefs, therefore, they opt to mislead the feedback.

Table 5.4 shows the effects for students with different levels of self-confidence. Interestingly, the results for students in an average self-confidence group are different from the rest as suggested in the theoretical model. First, regarding the woman-targeted scholarship, in contrast to the high and low confidence group, where women increase their pr of applying by 7 pp (3 pp more than the overall effect found in Table 5.4), the average group decreases their probability by 2 pp. Second, regarding the signal, as before, men and women in the high and low-ability groups do not react to the signal. However, men and women in the middle group have a positive effect (7 pp).

Figure 5.3: Dependent variable levels per treatment



The covariates were consistent with the literature and can be seen in detail in Annex G. Significant coefficients were found for GPA Ranking top 10%, GPA trajectory unstable or negative, having a competitive college major background, and all the variables that measure attitudes to masters, i.e., Willingness to Pay, Social Network Density index, Master's electives, Pressure index, and Consumption Value index. The personality indexes with significative coefficients are the Self-confidence Index, the Patience Index, and the Risk Aversion Index. An exhaustive description of the covariates can be found in Annex D.

Table 5.3: Treatment effects on the probability of applying to a masters program by academic performance

VARIABLES	(1) Bottom 50%	(2) Top 50-25%	(3) Top 25-10%	(4) Top 10%
WScholarships	-13.397*	-12.533***	-14.978***	-19.143***
	(7.211)	(3.672)	(4.645)	(5.032)
SS	10.601*	-2.027	3.327	-2.756
	(5.946)	(3.602)	(4.226)	(4.595)
WScholarships × SS	-5.592	-2.449	1.815	8.248
	(9.942)	(5.619)	(6.204)	(7.042)
Woman	1.359	-6.474	-3.079	-10.169
	(11.559)	(6.764)	(9.899)	(11.489)
WScholarships × Woman	15.314*	13.928***	21.164***	22.771***
	(8.328)	(4.578)	(5.684)	(6.699)
SS × Woman	-16.928**	0.847	2.155	5.615
	(7.769)	(4.584)	(5.435)	(6.627)
WScholarships × SS × Woman	13.102	5.889	-8.501	-8.944
	(11.877)	(6.859)	(7.579)	(9.753)
Base control	80.460**	26.498	40.665*	4.355
	(35.310)	(18.833)	(23.728)	(28.807)
Individual characteristics	Yes	Yes	Yes	Yes
Undergrad background	Yes	Yes	Yes	Yes
Attitudes to masters	Yes	Yes	Yes	Yes
Personality indexes	Yes	Yes	Yes	Yes
FE college major	No	No	No	No
Observations	306	811	693	289
Adjusted R^2	0.248	0.264	0.187	0.274
F-test	6.65	12.63	6.60	5.12

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 5.4: Treatment effects on the probability of applying to a masters program by self-confidence

VARIABLES	(1) Low self-confidence	(2) Average self-confidence	(3) High self-confidence
WScholarships	-13.894***	-13.807***	-14.280***
	(4.092)	(3.889)	(4.513)
SS	0.573	6.793**	-1.709
	(3.814)	(3.412)	(4.072)
WScholarships × SS	-0.728	-5.802	3.509
	(5.511)	(5.498)	(6.424)
Woman	-1.019	-35.918	12.218
	(7.416)	(29.469)	(29.379)
WScholarships × Woman	20.822***	11.514**	20.460***
	(4.838)	(4.932)	(5.830)
SS × Woman	-0.341	-7.366	5.680
	(4.710)	(4.630)	(5.691)
WScholarships × SS × Woman	-3.151	10.854	-5.556
	(6.736)	(6.781)	(8.243)
Base control	10.541	56.093*	43.011
	(19.872)	(28.889)	(34.824)
Individual characteristics	Yes	Yes	Yes
Undergrad background	Yes	Yes	Yes
Attitudes to masters	Yes	Yes	Yes
Personality indexes	Yes	Yes	Yes
FE college major	No	No	No
Observations	775	779	545
Adjusted R-squared	0.299	0.239	0.241
F-test	13.67	9.47	6.670

Robust standard errors in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Figure 5.4: Base level per area

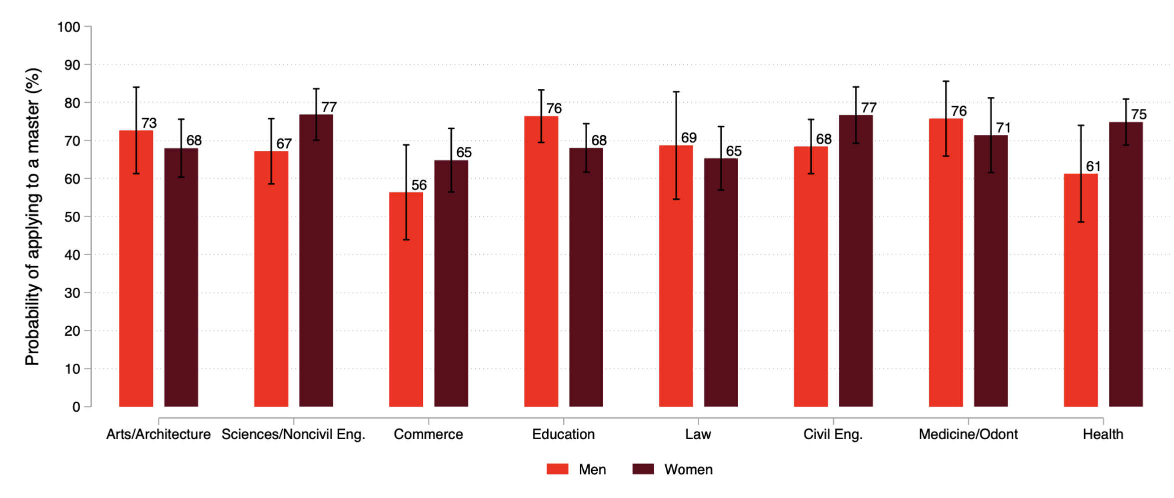


Figure 5.3 illustrates the results by plotting the average probability of applying to a master's program (or medical school if medical student) over the entire sample and by gender, per each experimental condition. The average probabilities for women and men change only when the woman-targeted scholarship is implemented.

It is noteworthy that in the base scenario, the average level is around 70%. That probability is high and consistent with the fact that the sample comes from a universe of students from Chile's most selective public university. Thus, extrapolating these results to a broader population will not be as accurate. Instead, they should be interpreted as effects that can be found in a high-performance type of student and, possibly, a lower bound of the effects. Additionally, despite the average of women and men being similar in the base scenario, there is heterogeneity at the baseline level among the participants' different college majors (see Figure 5.4).

Discussion and conclusion

Psychological traits are relevant in the decision-making process of individuals. The economic approach to studying psychological traits began with controlled trial exercises, mostly in laboratory settings where researchers expose research participants to experiments designed to isolate effects and disentangle mechanisms. Important progress has been made in understanding information processing (Benabou and Tirole, 2016) and utility specification (time-discounting, risk preferences, etc.).

A natural next step in the understanding of psychological traits is to measure how they influence real-setting decisions, such as choices regarding education, marriage, and the labor market. The main challenge involved is measurement. First, there is a lack of data available, since measurements of psychological features are not usually included in administrative data collections. Second, how to measure is not trivial because psychological traits are underlying features that cannot be perfectly observed.

On that framework, this study contributes to the discussion on how self-confidence, as a belief in one's ability, has a role in the choice of entering or not a competitive career track before entering the workforce. Results regarding women shying away from the competition can also be observed in education settings. In particular, this paper argues that it can be rationalized through a self-confidence mechanism.

I used three methodologies to study self-confidence in entry to competitive educational/-career tracks: a theoretical model, a revealed preferences exploration analysis, and a survey experiment.

The exploration analysis's key result is that in a college major choice, self-confidence correlates positively only with the most competitive majors under the analysis of the revealed preferences. However, the magnitude is inferior to other determinants, such as gender, socioeconomic background, and performance in mathematics. The coefficient for self-confidence was statistically significant for both men and women, but greater for women, which suggests that this mechanism could be playing a particular role for women.

On the other hand, the theoretical model suggests a manner to think of self-confidence in a human capital formation choice. The key result is that biased self-confidence becomes highly relevant for two types of individuals. The ones whose real ability is close to the average and individuals who are very uncertain about their ability since their estimated value is likely to be in the vicinity of the threshold that divide the low-ability and the high-ability individuals.

For these cases, the optimal choice is ambiguous and depends on the nonability-dependent and ability-dependent premiums of both the competitive and the non-competitive tracks. The ratio of those two premiums will determine whether low-ability individuals will rationally choose a competitive track over a non-competitive track. Likewise, whether a high-ability individual chooses a noncompetitive track over a competitive one. This paradigm provides an explanation to the phenomena of a "a big fish in a small pond" or the Hispanic version of that say; "a mouse's head versus a lion's tail".

Finally, I use a survey experiment with a hypothetical realistic scenario to understand two interventions intended to promote the entry of women to master's programs that imply going through a competitive application process. This is a relevant public policy issue because of the large gender gap in graduate studies, especially in STEM programs. Affirmative actions have been designed mostly regarding quotas, scholarships, and provision of information.

In the experiment, I study the causal effects of two affirmative actions on the self-reported disposition to apply to a master (measured as the probability to apply). One affirmative action is providing a strong signal of being high ability by a referee writing a letter of recommendation. This type of intervention directly tackles the self-confidence argument since is intended to boost self-confidence and enhance an upward belief update.

The other affirmative action is providing information about the availability of two academic excellence scholarships that cover the total cost of the master, targeted only for women. This is, at the same time, a potential financial alleviation and an external reinforcement from the institution to women to apply. This type of intervention is primarily based on the idea of reducing the cost to minorities, who may be internalizing the futility of facing, for example, the threat of stereotypes and discrimination.

The results of my experiment are a lower bound of the effects that can arise in a broader population as the study is performed in a very competitive university.

The strong signal of skill has no effect on master's application in the case of men or women, except for a specific group, that is, men and women who are close to the average self-confidence, who presumably face greater uncertainty. The magnitudes of the coefficient suggest that the effects may be smaller for women. Overall, this result is consistent with the theoretical model.

Interestingly, women in the lowest part of the academic performance distribution, the bottom 50% category, reacts negatively to the strong signal in 7 pp., totally counteracting the positive effect of the women-targeted scholarships. This unintended result may be explained by the motivated beliefs theory (Benaboú and Tirole, 2016) and the preferences for belief consonance (Golman et al., 2016). Women with this profile may feel cognitive dissonance from the strong signal of ability and, therefore, choose to shy away from the exposure to additional feedback. The study finds a limitation in explaining the mechanism, and further research must be done on these lines.

Scholarships aimed at women, for their part, generated an increase of 4 pp, on average, in the application of women to master's degrees. These effects rise to 6 pp. on women that self-reported to be between the top 25% and 10% in the GPA ranking of their cohorts. Women in these groups share the peculiarity that they know they are not the best performers and may have better opportunities in a gender-based competition. Nevertheless, women in the Top 10% and Top 50-25% also react positively (between 1 and 2 pp).

The scholarships strongly enhance the master's application of women with low and high self-confidence (7 pp.) while it discourages application in 2 pp. of women with average self-confidence.

The last result from the experiment is that the combination of the strong signal and the women-targeted scholarship does not create any special reaction in either men or women.

This study aimed to analyze the role of self-confidence in a human capital framework. Regardless of the limitations, we can conclude that self-confidence is relevant in this context, and it is a mechanism that accentuates the gender gap observed when entering competitive tracks.

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Annexes

Annex A

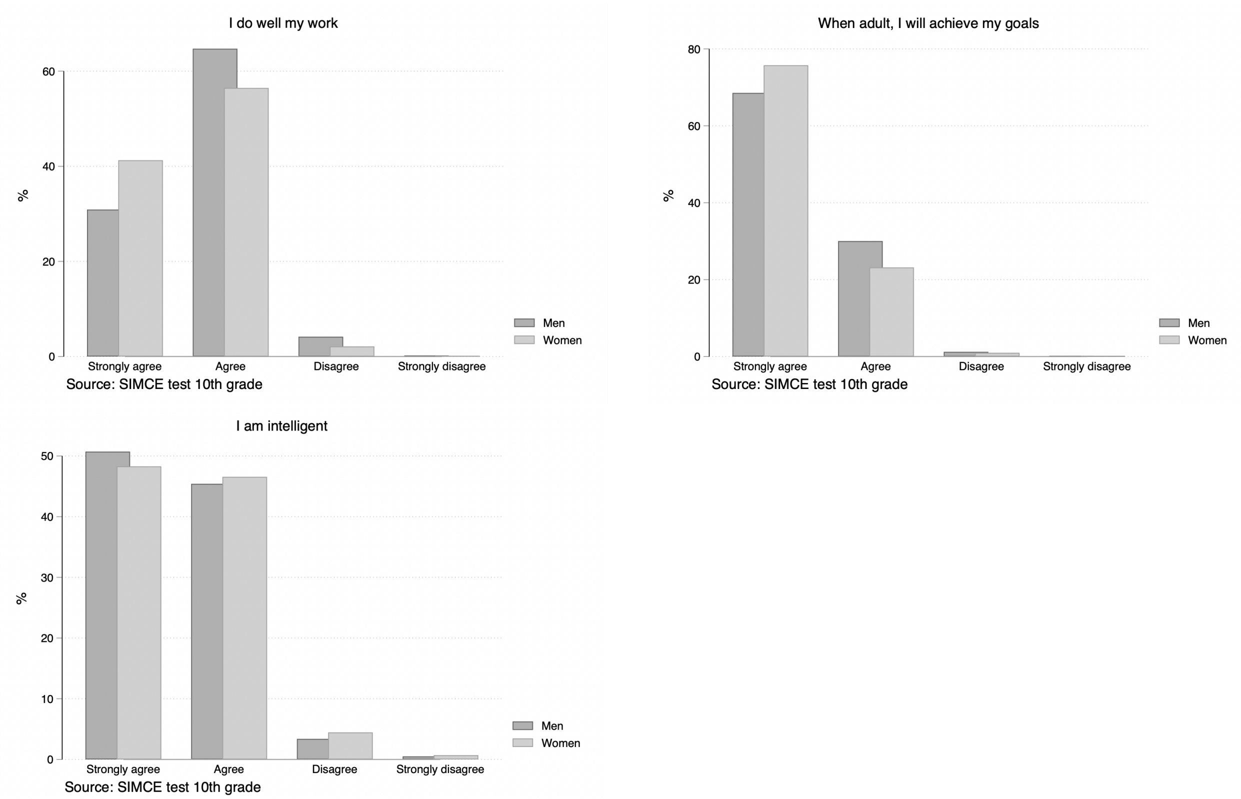
Table A.1: Sources of data

Data	**Description**	**Source**
Longitudinal panel cohort SIMCE 2006	Longitudinal panel of students that took SIMCE in 4th grade in 2006 and in primary school and in 10th grade in 2012, graduation in 2014 and PSU application process for 2015. Contained parents and student questionnaires.	Dateset from (Bordon, Canals, and Mizala, 2020) under the confidential agreement.
Enrollment in Primary and Secondary School	Matrícula sistema de educación escolar en todas las instituciones registradas por MINEDUC. Años 2004-2018. Individual and pseudonymized data.	Open data MINEDUC.
GPA	GPA (1-7 scale with one decimal) per course. Years 2007, 2011-2018. Individual and pseudonymized data.	Administrative data SIGE required to MINEDUC by transparency law.
Enrollment in higher education	Enrollment in educational institutions registered in the Ministry of Education (MINEDUC). Years 2007-2019. Individual and pseudonymized data.	Open data MINEDUC.
PSU and application to higher education	Application and enrollment years 2016-2018. Individual and pseudonymized data.	Data from DEMRE required by transparency law.
SIMCE 4th year in primary school and 10th grade in secondary school	Performance and questionnaires 2007-2015. Individual and pseudonymized data.	Data from Agencia de Calidad de la Educación required by transparency law.

Annex B

The student questionnaire associated with the PSU test (DEMRE) contained three variables that potentially measure self-confidence. The interviewer asked the student how much he or she agrees with the following sentences. They replied on a Likert scale of four categories without a neutral one. It was found that only 'I am intelligent' displays a distribution that is consistent with the self-confidence gender gap measure in laboratory studies. For the exploratory part of the study, self-confidence was included in the model as the standard deviation of that variable within the reference group which was the school cohort.

Figure A.1: Candidates variables for measuring self-confidence



Annex C

Table A.2: Descriptive Statistics and Balance I

Variable	(1) CC Mean/SE	(2) CT Mean/SE	(3) TC Mean/SE	(4) TT Mean/SE
N	522	515	529	532
Family background' variables				
Mother's education				
High school diploma	0.341	0.355	0.336	0.355
	[0.021]	[0.021]	[0.021]	[0.021]
Technical degree	0.312	0.320	0.295	0.329
	[0.020]	[0.021]	[0.020]	[0.020]
Professional degree	0.262	0.262	0.318	0.259
	[0.019]	[0.019]	[0.020]	[0.019]
Graduated degree	0.084	0.064	0.051	0.056
	[0.012]	[0.011]	[0.010]	[0.010]
Father's education				
High school diploma	0.295	0.329	0.330	0.326
	[0.020]	[0.021]	[0.021]	[0.021]
Technical degree	0.295	0.264	0.266	0.275
	[0.020]	[0.020]	[0.020]	[0.020]
Professional degree	0.295	0.309	0.314	0.298
	[0.020]	[0.021]	[0.021]	[0.020]
Graduated degree	0.114	0.098	0.091	0.101
	[0.014]	[0.013]	[0.013]	[0.013]
Neighborhood's Social Priority Index				
High and middle high	0.123	0.157	0.132	0.152
	[0.014]	[0.016]	[0.015]	[0.016]
Middle low	0.391	0.335	0.355	0.367
	[0.021]	[0.021]	[0.021]	[0.021]
Low	0.268	0.283	0.278	0.229
	[0.019]	[0.020]	[0.019]	[0.018]
No priority	0.218	0.225	0.234	0.252

Table A.3: Descriptive Statistics and Balance II

Variable	(1) CC Mean/SE	(2) CT Mean/SE	(3) TC Mean/SE	(4) TT Mean/SE
Student' background variables				
Woman	0.596	0.605	0.601	0.611
	[0.021]	[0.022]	[0.021]	[0.021]
Age	23.372	23.406	23.340	23.415
	[0.084]	[0.094]	[0.078]	[0.089]
GPA Ranking				
Top 10%	0.142	0.138	0.168	0.135
	[0.015]	[0.015]	[0.016]	[0.015]
Between top 25% and 10%	0.420	0.384	0.378	0.365
	[0.022]	[0.021]	[0.021]	[0.021]
Between top 50% and 25%	0.312	0.341	0.327	0.340
	[0.020]	[0.021]	[0.020]	[0.021]
Bottom 50%	0.126	0.138	0.127	0.160
	[0.015]	[0.015]	[0.014]	[0.016]
Undergrad GPA trajectory				
Worsened/Were unstable	0.410	0.368	0.391	0.378
	[0.022]	[0.021]	[0.021]	[0.021]
Remained constant	0.193	0.202	0.206	0.231
	[0.017]	[0.018]	[0.018]	[0.018]
Improved	0.397	0.430	0.403	0.391
	[0.021]	[0.022]	[0.021]	[0.021]
STEM undergrad background	0.404	0.405	0.416	0.419
	[0.021]	[0.022]	[0.021]	[0.021]
Competitive undergrad background	0.404	0.403	0.401	0.393
	[0.021]	[0.022]	[0.021]	[0.021]
Willingness to pay for master studies				
Between 2 and 3 million CLP	0.079	0.052	0.070	0.047
	[0.012]	[0.010]	[0.011]	[0.009]
Between 3 and 4 million CLP	0.385	0.384	0.422	0.398
	[0.021]	[0.021]	[0.021]	[0.021]
Between 4 and 5 million CLP	0.301	0.281	0.289	0.308
	[0.020]	[0.020]	[0.020]	[0.020]
Between 5 and 6 million CLP	0.113	0.116	0.076	0.113
	[0.014]	[0.014]	[0.012]	[0.014]
More than 6 million CLP	0.042	0.083	0.074	0.064
	[0.009]	[0.012]	[0.011]	[0.011]
Indifferent	0.033	0.043	0.028	0.026

Table A.4: Descriptive Statistics and Balance III

Variable	(1) CC Mean/SE	(2) CT Mean/SE	(3) TC Mean/SE	(4) TT Mean/SE
Student' indexes				
Social Network Density Index	3.772	3.718	3.640	3.729
	[0.169]	[0.158]	[0.153]	[0.158]
Continuation Program Index	6.728	6.733	6.951	6.769
	[0.130]	[0.126]	[0.121]	[0.118]
Pressure Index	6.655	6.548	6.584	6.581
	[0.116]	[0.124]	[0.120]	[0.116]
Patience Index	6.646	6.651	6.792	6.782
	[0.083]	[0.079]	[0.078]	[0.079]
Risk Aversion Index	6.100	6.072	6.284	6.169
Big Five Inventory				
Extraversion	5.462	5.510	5.524	5.340
	[0.089]	[0.089]	[0.089]	[0.085]
Agreeableness	6.420	6.519	6.554	6.451
	[0.063]	[0.061]	[0.062]	[0.064]
Conscientiousness	7.199	7.231	7.140	7.237
	[0.069]	[0.070]	[0.072]	[0.068]
Neuroticism	6.421	6.267	6.422	6.461
	[0.082]	[0.083]	[0.082]	[0.080]
Openness to Experience	7.686	7.665	7.643	7.694
	[0.075]	[0.075]	[0.075]	[0.073]
Self-confidence Index	5.128	4.961	5.030	5.064
	[0.161]	[0.156]	[0.141]	[0.147]
Consumption Value Index	5.284	5.058	5.233	5.186
	[0.225]	[0.229]	[0.202]	[0.216]

Annex D

Family background (SES)

- Mother's education and father's education. A self-reported variable by the students, with category values (i) up to high school, (ii) up to a technical degree, (iii) up to a professional degree, and (iv) up to a graduate degree.
- Neighborhood Social Priority Index. The Social Protection Index 2020 (Indice de Proteccion Social - Seremi, 2022) at the comune level designed by the Chilean Ministry of Social Development. Values are high, middle-high, middle-low, low, and no priority.
- Social network density. An index built through Exploratory Factor Analysis (EFA) and Impulse Response Theory (IRT) with the following self-reported variables measured on a scale from 0 to 10: (i) Do you have relatives that work in your same career major? Which ones? (ii) How many relatives or friends aspire to start graduate studies? and (iii) How many relatives or friends are currently studying in a graduate program? The index is the weighted sum of the variables to represent the density of the network that the student has regarding the topic of graduate programs and career building. The index was normalized to range between 0 and 10.

Student' background variables

- Woman. A variable registered in administrative data from the University of Chile with two values, man and woman.
- Age. A self-reported variable with values ranging from 22 to 26^+.
- GPA Ranking. A self-reported variable that asked about GPA Ranking in the last semester. The categories are top 10%, between top 25-10%, between 50% and top 25%, and bottom 50%. Right after, the students replied how sure they were about the answer in a scale of 0 to 10. A 37% said very sure and sure, 45% said somewhat sure, and only 18% said little sure or unsure.
- GPA trajectory. A self-reported variable about the academic performance trajectory that the student has had during their years in undergrad studies. The values are categorical: increased year to year, decreased year to year, stable, or unstable. For the analysis, decreased and unstable were joined together, given their low salience.
- STEM undergrad background. A dichotomic variable that indicates whether the major is Science, Technological, Commercial Engineering, Non-civil Engineering, or Civil Engineering. The variable was constructed based on the administrative data about program enrollment.
- Competitive undergrad background. A dichotomic variable that indicates whether the major is Medicine, Law, Commercial Engineering or Civil Engineering. The variable was constructed based on the administrative data about program enrollment.

Attitudes towards masters

- Willignes to pay for master's studies. A self-reported variable that measures disposition to pay for a program if the student does not receive any financial aid. The values are the following categories: Nothing, Less than 2 million CLP, Between 2 and 3 million CLP, Between 3 and 4 million CLP, Between 4 and 5 million CLP, Between 5 and 6 million CLP, More than 6 million CLP, and Indifference. The values were chosen according to the market in Chile in 2020.
- Pressure Index. A self-reported variable measures on a scale from 0 to 10 whether the student feels pressure to enter the working face due to personal or family-related motives. This was salient in the pilot study as a reason why students do not apply to master's. Possible personal or family-related motives are the need for financial independence or taking financial responsibility for a household member.
- Master's electives. A dichotomic variable that indicates whether the students enrolled in electives from a master's program during their undergrad studies.
- Consumption value of studying a master. An index built through Exploratory Factor Analysis (EFA) and Impulse Response Theory (IRT) with the following self-reported variables measured on a scale from 0 to 10: (i) How much would you enjoy studying a master's program? (ii) How much do you like the activity of studying? and (iii) How much did you like your undergrad program? The index is built as an average of those three variables and ranges between 0 and 10.

Personality indexes

- Patience index. A self-reported variable on a scale from 0 to 10 that measures time-discounting. The question is How willing are you to give up something that is beneficial for you today in order to benefit more from that in the future? This instrument was validated by Falk et al. (2022).
- Risk aversion index. A self-reported variable on a scale from 0 to 10 with the answer to the question How you see yourself: Please tell me, in general, how willing or unwilling you are to take risks? This instrument was validated by Falk et al. (2022).
- Big Five Inventory indexes. These indexes measure different dimensions of the personality. The indexes are built using the short version tool, developed and validated by Rammstedt and John (2007). The psychological literature has found a relationship between tertiary academic performance and some of those indexes (Vedel, 2014).
- Self-confidence Index. An index built through Exploratory Factor Analysis (EFA) and Impulse Response Theory (IRT) with the following self-reported variables measured on a scale from 0 to 10: (i) How much do you agree with the sentence 'I am intelligent'? (ii) Beyond the grades, how intelligent are you compared to an average student from the University of Chile? The index is the average of the variables to represent the student's self-confidence among their reference group. The index ranges between 0 and 10.

Annex E

Table A.5: Attrition

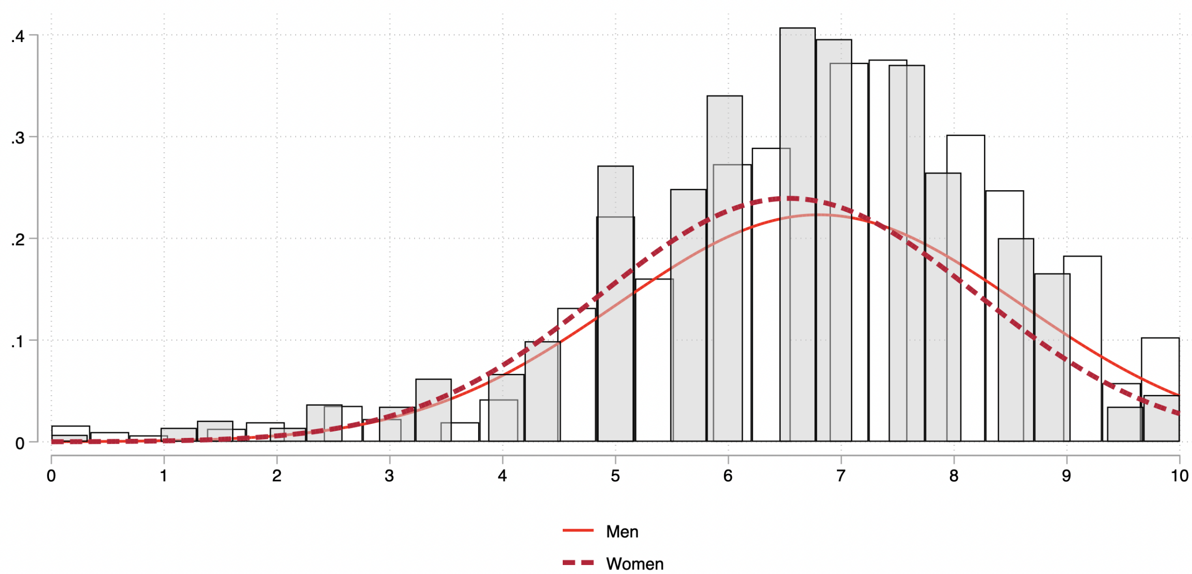
Type of attrition	(1) Base Mean/SE	(2) SS Mean/SE	(3) WScholarships Mean/SE	(4) SS & WScholarships Mean/SE
Dropped by no answer to dependent variable	0.087 (0.011)	0.099 (0.011)	0.101 (0.011)	0.108 (0.012)
Dropped by vignette time <15 seconds	0.088 (0.011)	0.084 (0.011)	0.084 (0.010)	0.101 (0.011)
N	703	700	706	713

Annex F

Self-confidence Index varies within the different self-reported GPA rankings and has a slightly different distribution between men and women.

Figure A.2: Self-confidence Index across different self-reported GPA ranking

Figure A.3: Self-confidence Index across gender



Annex G

Table A.6: Main regression - Long version

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
WScholarships	-13.402***	-14.754***	-16.017***	-14.809***	-14.021***	-14.188***
	(2.555)	(2.661)	(2.595)	(2.370)	(2.366)	(2.370)
SS	3.116	2.654	1.789	1.346	1.559	1.475
	(2.353)	(2.463)	(2.404)	(2.205)	(2.186)	(2.183)
WScholarships $\times$ SS	-0.309	0.463	1.550	0.664	-0.568	-0.601
	(3.561)	(3.699)	(3.628)	(3.341)	(3.332)	(3.329)
Woman	2.044	2.012	0.703	0.711	-2.668	-2.382
	(2.223)	(2.336)	(2.269)	(2.016)	(4.452)	(4.460)
WScholarships $\times$ Woman	17.011***	18.495***	19.288***	18.896***	17.644***	17.823***
	(3.126)	(3.246)	(3.184)	(2.922)	(2.919)	(2.922)
SS$\times$ Woman	-2.113	-1.735	-1.044	-0.272	-0.946	-0.891
	(3.043)	(3.181)	(3.131)	(2.865)	(2.845)	(2.833)
WScholarships $\times$ SS $\times$ Woman	1.131	-0.079	-1.064	-1.032	0.574	0.558
	(4.393)	(4.559)	(4.486)	(4.127)	(4.118)	(4.107)
Student's characteristics						
Age		0.136	-0.048	0.058	0.054	0.065
		(0.477)	(0.477)	(0.450)	(0.444)	(0.443)
Mother education		0.602	0.479	-0.327	-0.183	-0.375
		(0.617)	(0.607)	(0.575)	(0.581)	(0.584)
High Social Priority Index		-1.446	-0.747	1.313	0.594	0.630
		(1.898)	(1.862)	(1.725)	(1.718)	(1.714)
Middle Social Priority Index		-1.810	-1.603	0.173	-0.329	-0.594
		(1.498)	(1.493)	(1.370)	(1.371)	(1.374)
Low Social Priority Index		-1.859	-1.135	0.351	0.252	0.122
Undergrad's background						
		(1.566)	(1.559)	(1.449)	(1.449)	(1.437)
GPA Ranking: Top 50-25%			4.812***	1.020	1.199	1.231
			(1.789)	(1.651)	(1.640)	(1.645)
GPA Ranking: Top 25-10%			9.048***	2.238	2.881	2.848
			(1.849)	(1.763)	(1.768)	(1.772)
GPA Ranking: Top 10%			13.991***	4.575**	5.446***	5.401***
			(2.105)	(2.007)	(2.020)	(2.025)
GPA trajectory: unstable or negative			-4.278***	-2.205*	-2.419**	-2.508**
			(1.282)	(1.183)	(1.185)	(1.189)
GPA trajectory: positive			-3.174**	-1.730	-1.315	-1.080
			(1.427)	(1.336)	(1.326)	(1.325)
STEM college major			-0.553	-1.425	-1.388	-3.249
			(1.193)	(1.113)	(1.115)	(2.323)
Competitive college major			-0.940	-3.038***	-2.628**	1.386
			(1.219)	(1.139)	(1.156)	(2.307)

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
Attitudes to masters						
Willingness to pay				1.243***	1.088***	1.199***
				(0.373)	(0.373)	(0.379)
Social Network Density Index				0.914***	0.919***	0.933***
				(0.279)	(0.284)	(0.289)
Master's electives				3.159***	2.783**	3.288***
				(1.081)	(1.080)	(1.095)
Pressure Index				-1.690***	-1.752***	-1.699***
				(0.210)	(0.210)	(0.210)
Consumption Value Index				4.925***	4.748***	4.683***
				(0.328)	(0.376)	(0.378)
Personality indexes						
Self-confidence Index					-0.938**	-0.846*
					(0.477)	(0.476)
Woman × Self-confidence Index					-0.457	-0.391
					(0.409)	(0.410)
Patience Index					1.382***	1.357***
					(0.334)	(0.334)
Risk Averssion Index					0.498*	0.432
					(0.301)	(0.301)
Agreeableness Big Five Index					-0.006	0.025
					(0.401)	(0.401)
Conscientiousness Big Five Index					-0.161	-0.191
					(0.373)	(0.376)
Extraversion Big Five Index					-0.440	-0.412
					(0.291)	(0.291)
Neuroticism Big Five Index					0.594*	0.531
					(0.324)	(0.326)
Openness Big Five Index					0.255	0.267
					(0.324)	(0.326)
Base control	68.833***	66.153***	67.759***	40.802***	34.420***	32.885***
	(1.763)	(11.349)	(11.696)	(11.238)	(12.163)	(12.156)
FE college major	No	No	No	No	No	Yes
Observations	2,325	2,162	2,142	2,103	2,099	2,099
Adjusted R^2	0.062	0.069	0.105	0.253	0.266	0.271
F-test	20.52	12.86	13.36	34.96	27.28	24.45

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Annex H

Spanish (original language)

Lee el siguiente escenario:

Te encuentras terminando la carrera y estás pensando si continuar tus estudios con un magíster en alguna universidad o si salir a trabajar.

Sabes que salir a trabajar te permitirá ganar experiencia y un sueldo estable. Por otra parte, vienes hace un tiempo considerando un magíster que te interesa. Seguir estudiando será una inversión para tu futuro, pero también implica pasar por un proceso de postulación exigente.

El primer paso para postular es conseguir una carta de recomendación de alguien que te haya hecho clases o con quien hayas trabajado. Vas a la oficina de una persona que crees que te apoyará en la postulación.

Lo conversan y esta persona amablemente te responde "Sí, claro. Escribiré una carta [**X**]".

Control [X]: Contando que te conozco
Tratamiento [X]: Contando que te conozco y dando ejemplos de tu gran capacidad intelectual

Respecto al financiamiento del magíster, te enteras de que se ofrecen dos becas de excelencia académica [**Y**] con cobertura del 100% del arancel y que se asignan según la calidad de las postulaciones.

Control [Y]: ,

Tratamiento [Y]: Sólo para mujeres,

Variable dependiente: Considerando que esto te pasa en el momento de decidir cómo continuar tu desarrollo profesional, de 0 a 10, ¿qué tan probable es que decidas continuar estudiando y postules al magíster? Donde 0 es "Nada probable", 5 es "Medianamente".

English (translated version)

Read the following scenario:

You are finishing your degree and are thinking about whether to continue your studies with a master's degree at a university or find a full-time job.

You know that getting a job will allow you to gain experience and a stable salary. On the other hand, you have been considering a master's degree that interests you for some time. Continuing your studies will be an investment in your future, but it also means going through a demanding application process.

The first step in applying is to get a letter of recommendation from someone who has taught you or with whom you have worked. You go to the office of someone you think will encourage you to apply.

You talk it over and this person kindly replies "Yes, of course. I'll write a letter [**X**]."

Control [X]: Saying that I know you

Treatment [X]: Saying that I know you and providing examples of your great intellectual capacity.

Regarding the financing of the master's degree, you learn that two academic excellence scholarships are being offered [**Y**], which cover 100% of the tuition and are awarded based on the quality of the applications.

Control [Y]: ,

Treatment [Y]: for women only,

Dependent variable: Considering that this happens to you when you are deciding how to proceed with your professional development, on a scale of 0 to 10, how likely is it that you will decide to continue studying and apply for a master's degree? Where 0 is "Not at all likely", and 5 is "Somewhat likely".

Annex I

ASPREDICTED (http://credlab.wharton.upenn.edu) Wharton CREDIBILITY LAB UNIVERSITY of PENNSYLVANIA

You are logged in as: **mmoreirag@fen.uchile.cl**

HOME (https://aspredicted.org) ACCOUNT (https://aspredicted.org/account.php)

SEE ALL (https://aspredicted.org/see_list.php) LOG OUT (https://aspredicted.org/logout.php)

CREATE (https://aspredicted.org/create.php)

PREVIEW: *Gender, Ability Signals, and Reinforcement: A Study During Tertiary Education*

Author(s)

Marianne Moreira (Universidad de Chile) - mmoreirag@fen.uchile.cl
Alejandra Mizala (Universidad de Chile) - amizala@uchile.cl
Daniel Schwartz (University of Chile) - daschwar@dii.uchile.cl

Make sure all email addresses are correct, otherwise authors will not have access to this submission.

Note: The information you entered for at least one of the authors did not perfectly match what they have in their AsPredicted account (e.g., their name spelling or affiliation). We updated what you submitted to match what's in their account. If they wish to change that info, they need to visit their AsPredicted account page.

Submission

1) Have any data been collected for this study already?

It's complicated. We have already collected some data but explain in Question 8 why readers may consider this a valid pre-registration nevertheless.

2) What's the main question being asked or hypothesis being tested in this study?

- A strong positive signal about a student's ability will increase the probability of applying to a master's program in female students more than in male students, which could reduce the gender gap in applications to master's studies.
- The availability of academic excellence scholarships for women will increase the probability of female students applying to a master's program. This effect will increase when combined with a strong signal of the student's intellectual capacity.

3) Describe the key dependent variable(s) specifying how they will be measured.

The key dependent variable is the reported probability of continuing to study a master's program. This will be measured by asking a question using a Likert scale from 0 to 10.

4) How many and which conditions will participants be assigned to?

Four experimental conditions in a 2 x 2 factorial design.
- Signal (weak or strong) for cognitive capacity after a recommendation letter request: "Yes, of course. I will write a letter indicating that I know you" or "Yes, of course. I will write a letter indicating that I know you and giving examples

of your great intellectual capacity"
- Availability of academic excellence scholarships (for women only or for both men and women): "they only offer two academic excellence scholarships that are for female students, cover 100% of the tuition fee, and are awarded based on the quality of the applications" or "they only offer two academic excellence scholarships that cover 100% of the tuition fee, and are awarded based on the quality of the applications"

5) Specify exactly which analyses you will conduct to examine the main question/hypothesis.
We will report the dependent variable mentioned above for each experimental condition, examining the main effect of the different treatments and their combination. We will then estimate regressions for the main dependent variable, controlling for students' characteristics, beliefs about their ability/intelligence, and overconfidence. We will measure the gender gap in the dependent variable.

6) Describe exactly how outliers will be defined and handled, and your precise rule(s) for excluding observations.
(1) If a respondent answers the survey more than once, and only one of the responses is finished, we will drop the unfinished one. However, if more than one is finished or all are unfinished, we will use the one completed the most. (2) If a respondent answers the survey in less than 2 minutes, it will be considered invalid and dropped. (3) If a respondent takes less than 15 seconds when read the vignette, it will be considered invalid and dropped. (4) If a respondent does not give an answer to the dependent variable, it will be considered invalid and dropped.
We will conduct the analysis with those exclusions but will also report the results including all observations.

7) How many observations will be collected or what will determine sample size?
No need to justify decision, but be precise about exactly how the number will be determined.
The survey will be sent to about 8,000 students. They are undergraduate students in their 5th or 6th year of their undergraduate degree. Based on a previous test, we expect a response rate of 15-20%.

8) Anything else you would like to pre-register?
(e.g., secondary analyses, variables collected for exploratory purposes, unusual analyses planned?)
We conducted a pilot with almost 10% of the sample to explore whether the vignette was well understood by the participants, so we added open-ended questions about the understanding of the received experimental conditions, the reason behind their response to the dependent variable, and a general comment of the survey. Also a question about what Spanish noun is most used in the participant's environment to refer to a master's program.
For explanatory purposes, we will collect a question about the reliability of the answer they give to the questions where we ask them to estimate their position in a ranking of scores within the student's cohort.

To make any changes click BACK, otherwise:

SUBMIT

Annex J

Dirección Académica y de Investigación
FACULTAD DE CIENCIAS FÍSICAS Y MATEMÁTICAS UNIVERSIDAD DE CHILE

CERTIFICACIÓN N° 041
COMITÉ DE ÉTICA Y BIOSEGURIDAD PARA LA INVESTIGACIÓN
FACULTAD DE CIENCIAS FÍSICAS Y MATEMÁTICAS

El Comité de Ética y Bioseguridad para la Investigación de la Facultad de Ciencias Físicas y Matemáticas (FCFM) de la Universidad de Chile certifica, haber analizado el Proyecto "**Género, señales de habilidad y creencias: un estudio durante la trayectoria educativa**", de ANID/Proyecto Basal FB0003, cuya investigadora principal es **Alejandra Mizala Salces**, profesora titular de la Facultad de Ciencias Físicas y Matemáticas y directora del Instituto de Estudios Avanzados en Educación de la Universidad de Chile.

El objetivo del proyecto es analizar el fenómeno de la brecha de género en la educación superior, poniendo el foco en las creencias de habilidad y la autoconfianza. La metodología incluye datos administrativos longitudinales de estudiantes que dieron el SIMCE, y encuestas (piloto y definitiva) y estudios focales. Los datos son recolectados mediante el software Qualtrics. Se utilizará Consentimiento Informado al inicio de la encuesta online.

El análisis del proyecto, permite certificar que:

i) El proyecto cumple con los estándares nacionales e internacionales de ética de la investigación, de acuerdo a la Declaración Universal de los Derechos Humanos, el Pacto de Derechos Civiles y Políticos, el Pacto de Derecho Económicos Sociales y Culturales, las leyes chilenas y el Documento oficial de ética para la investigación de la Facultad de Ciencias Físicas y Matemáticas de la Universidad de Chile.

ii) El Comité de Ética considera que la investigación no vulnera la dignidad de los sujetos, no constituye una amenaza bajo ninguna circunstancia ni causa daño.

iii) Asimismo, el Comité que suscribe auditará, al menos una vez durante la ejecución del proyecto, el cumplimiento de los estándares arriba enunciados propios de la disciplina involucrada y la correcta aplicación de los consentimientos informados, para asegurarse de su cumplimiento. Esta auditoría, además, tiene el propósito de asegurar la garantía del derecho a la privacidad, confidencialidad y el anonimato de los sujetos involucrados en la investigación.

Dirección Académica y de Investigación

FACULTAD DE CIENCIAS FÍSICAS Y MATEMÁTICAS UNIVERSIDAD DE CHILE

iv) Dejamos constancia que la investigadora Mizala será responsable por eventuales daños causado a las personas por errores que puedan cometerse durante la investigación.

Dr. Carlos Conca R.
Profesor Titular
Departamento de Ingeniería Matemática

Firmado electrónicamente por
Dra. Marcela Munizaga M.
Profesora Titular
Directora Académica y de Investigación

UNIVERSIDAD DE CHILE · Comité de Ética y de Bioseguridad para la Investigación · Facultad de Ciencias Físicas y Matemáticas

Dr. Patricio Jorquera E.
Secretario

Santiago, 06 de mayo de 2022

MMM/CCR/PJE/rox.