# Glass Ceiling in Research: Evidence from a National Program in Uruguay


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**Abstract***

Female researchers have lower probability of being accepted into the largest national research support program than male researchers. Observable characteristics explain 4.9 points of the7.1 gender gap. The gap is wider at the higher ranks of the program. Results are robust to issues of bidirectionality (research productivity and probability of being accepted), joint determination and correlation of variables, and productivity effects at early stages of career development. The paper tests three hypotheses for the gender gap (an original sin in the organization of the system, composition biases in the evaluation committees, and field effects) and finds some evidence for each.



JEL codes: J16, J4, J71
Keywords: gender discrimination, glass ceiling, probability decomposition, science and technology, Sistema Nacional de Investigadores (SNI), Uruguay



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## 1. Introduction

There is a large literature on gender discrimination that has been applied to almost every country in the world. The seminal works of Blinder (1973) and Oaxaca (1973) provided a methodology to decompose the wage gap into a part that is due to differences in observable characteristics (e.g. education, experience) of men and women and another part that is due to differences in the returns to these characteristics. The literature calls them the explained and the unexplained parts of the decomposition. Originally, the unexplained part was attributed to discrimination, but this view has been criticized and alternative explanations provided (among them differences in preferences and omitted variables).

The concept of glass ceiling refers to a set of impediments to career advancement for women. Organizational policies and practices that disproportionally and negatively impact women could create a hidden system of discrimination. The glass ceiling is a subtle, transparent barrier that prevents the advancement of women into the upper ranks of the job hierarchy. Extending the Oaxaca-Blinder framework to allow for quantile regressions, glass ceilings are said to exist when the gender wage gap is wider at the top of the distribution than at the median. Sticky floors refer to a case where the wage gap is wider at the bottom of the wage distribution. Carrillo, Gandelman, and Robano (2014) show that sticky floors and glass ceilings are present in most Latin American countries. The authors show that since women's educational level is higher than men's, the observed gender gap is an understatement of the disadvantaged situation of women in the labor market. This is particularly true at the bottom and top of the wage distribution (sticky floors and glass ceilings). Christofides, Polycarpou and Konstantinos (2013), also using quantile regressions, present evidence of glass ceilings in many European countries. There are many other papers that perform detailed analyses of country cases.[1]

In Latin America, although female enrollment in secondary and tertiary education exceeds male enrollment (UNESCO, 2015; World Bank, 2012), the percentage of women in science and technology (S&T) is lower than that of men. In this paper we address the existence of glass ceilings in S&T research activities in Uruguay. We do so by evaluating gender biases in the largest national research incentive program, the National System of Researchers (Sistema Nacional de Investigadores, or SNI).

The SNI is a nationwide system of subsidies for researchers provided by the National Agency for Research and Innovation (Agencia Nacional de Investigación e Innovación, or ANII). The SNI categorizes researchers into four active levels and one emeritus level. The upper levels are associated with larger government transfers, more prestige and recognition, and other advantages (e.g., number of scholarships for tutoring students). Bernheim et al.

[1] Among others: Albrecht, Bjorklund, and Vroman (2003) for Sweden; Albrecht, van Vuuren, and Vroman (2009) for the Netherlands; Borráz and Robano (2010) for Uruguay; and de la Rica et al. (2008) for Spain.

(2012) report that the proportion of men and women in the lower ranks is almost the same but that women are clearly underrepresented in the upper ranks. As we explain in the methodology section, although this is indicative of glass ceilings, it is by no means a closed issue. For example, women may invest more time in academic activities that do not lead to publications (e.g., teaching undergraduate students).

The analysis of discrimination has been applied to specific labor markets. A focus on academia offers the advantage that an individual's on-the-job-productivity can be measured largely by research output. Authorities and colleges observe this. Ginther and Hayes (1999) report a wage gender gap of 9% in favor of men in the United States. Using data for Scotland, Ward (2001) find that women earn 26% less than men. In these studies, estimated wage gaps are mainly caused by gender differences in observable heterogeneity. Applying the Oaxaca-Blinder decomposition, Ward (2001) showed that only 3 of the estimated 26 percentage point difference in wages remains unexplained. Ginther and Hayes (2003) report similar evidence and argue that gender wage gaps are mostly due to gender rank differentials. Thus, it is important to study how the hierarchy is established in academia because this leads to wage gaps. Ginther and Hayes (2003) estimated promotion probabilities and concluded that women in the human sciences are significantly less likely to be promoted to tenured positions. The estimated gap is about 8%. Mixon and Trevino (2005), applying Oaxaca-Blinder type of decomposition to a logit model, found that the promotion probability is 12.2 percentage points lower for women and that 7.6 of these 12.2 points cannot be explained by differences in productivity. Using a random-effects probit model, McDowell, Singell, and Ziliak (2001) concluded that, on average, women in the United States are 36% less likely to be promoted to the rank of assistant professor and 9% less likely to be promoted to rank of full professor.

There is also a sociological literature that has addressed gender biases within S&T. Wenneras and Wold's (1997) seminal paper was the first to analyze genuine peer-review evaluation sheets. They find that, in the Swedish Medical Research Council funding program, female applicants were scored lower than men in the three key evaluation parameters: scientific competence, quality of proposed methodology, and relevance of research proposal. They show that nepotism and sexism are key to understanding differences in referees' scores. Other studies show that men and women tend to rate the quality of men's work higher than women's work when they are aware of the gender of the person evaluated. This does not happen when the evaluation is blind (Goldberg, 1968). There is also a body of work within the qualitative tradition that addresses gender issues, which finds that women's work is considered less worthy (devalued) and that women suffer discrimination in the academic workplace (e.g., Monroe et al., 2008; Roos and Gatta, 2009).

In this paper, we contribute to two strands of literature: the study of gender differences in labor markets and the study of gender biases in public S&T programs. Our contribution is an analysis of a developing country with a well-established research support program. Methodologically, we are part of a tradition of addressing gender issues using econometric decomposition techniques. There are various such studies for Uruguay, but none focuses on promotions in the S&T arena and none specifically addresses how the professional hierarchy is established or tests the existence of glass ceilings.

We report a gender gap in the probability of being accepted to the SNI of 7.1 percentage points. Most of this difference (4.9 percentage points) can be attributed to lower academic achievements of women. We also report that the gender gap in the probability of acceptance is larger in the higher ranks of the system and that the observable characteristics of women and men explain less at the top than at the bottom of the SNI. This is all evidence of a glass ceiling in S&T in Uruguay. In the absence of gender gaps, the number of women at the highest hierarchical level of the SNI should be about twice the current number. The actual distribution of men and women within the SNI implies that about 70% of the SNI budget goes to male researchers and 30% to female researchers. The counterfactual assignment computed assuming absence of gender gaps in the probabilities of accessing the SNI implies that the budget should go 60% to male researchers and 40% to female researchers.

The paper proceeds as follows. Section 2 introduces the institutional framework and describes the functioning of the SNI program. Section 3 presents the data used in the estimations and some descriptive statistics of researchers' characteristics by gender. This provides an overview of gender differences in S&T. Section 4 is the more technical part of the paper dealing with the estimation methodology. The main results are presented in Section 5 and several robustness exercises are computed in Section 6. Section 7 presents tests of three potential explanations for the gender gaps reported, and Section 8 discusses the implications and limitations of the results.

## 2. Institutional Background: ANII and the SNI

The SNI is an incentive scheme for researchers. The goals of the SNI are: to expand and strengthen the scientific community; to identify, evaluate, and categorize researchers; and to establish a system of economic incentives that encourages scientific production. Since its creation, there have been yearly calls for application to the SNI. By 2015, there had been eight calls. The SNI is managed by the ANII, which the government created in 2006 as a key player to foster and support research and application of knowledge to production, and to fund research and scholarships in S&T as well as entrepreneurs.

The SNI was implemented in a top-down way to create an evaluation structure that could assign researchers to the various levels. The government created the SNI in 2007 and designated an Honorary Commission (CH) of five members in charge of it. The CH comprises renowned scientists holding positions in scientific or government institutions. It is in charge of SNI operations. One of it mains tasks is to nominate the members of the Selection Committee (CS). The CS is composed of two to four members from each field of knowledge. It selects the members of field technical committees (CTAs) that later evaluate the researchers applying to the SNI. Each CTA ranks applicants in its own fields and informs the CS. The CS integrates the fields' rankings into a unique evaluation that is handled by the CH for final approval.

According to the SNI bylaws, members of the CH, the CS, and the CTAs must have been previously evaluated and accepted to the SNI and have held their positions for three years. When the SNI was implemented, the bylaws provided a special mechanism to integrate the members of the CS and CTAs. They were evaluated by international referees proposed by the CH and were almost all assigned to the highest ranks of the system. After they were selected, CTAs started to operate and application to the SNI was open to all researchers in the country.

The SNI opens the application window at the end of each year. Applicants of year t are accepted (or not) into the system in year t+1. To apply for entry to the SNI, researchers must complete an online standard resume including education, professional experience, scientific production, and others. The researchers' CVs are then analyzed by peers organized in the CTAs. Annually, there are six committees corresponding to each of the OECD fields of knowledge for S&T: natural sciences, engineering and technology, medical and health sciences, agricultural sciences, social sciences, and humanities. Then, according to their academic achievements and scientific production, researchers can be rejected or accepted into the SNI in one of its four categories: Entry Level (called Initiation to research), Level I, Level II, and Level III. The lower level, entry level researcher, groups junior researchers while the higher level, Level III, comprises the most renowned local scientists. Once accepted into the SNI, researchers sign a contract with the ANII for two, three, or four years depending on the level reached and the overall result of the evaluation. After that time, researchers must reapply to remain in the system.

There is a lot of inertia within the SNI. According to a former CS member, an unwritten rule is that there are no demotions within the system unless the researcher deserves to be completely out of the SNI. For example, a level II researcher that finishes his contract and reapplies to the system, in practice, faces three options: being promoted to level III, remaining at level II, or being denied continuation on the SNI. He will not continue in the SNI as a level I (or entry level) researcher.

Applicants to the SNI are also classified by place of residence. Only those living in Uruguay are entitled to receive the SNI subsidy. They are known as the active members of the SNI. Those not living in Uruguay can also apply and be categorized within the system but do not receive a subsidy. They are known as the associated members of the SNI. This paper analyzes only active members.

The SNI offers differential economic incentives according to the level of the researcher. As of 2016, the annual subsidies (net of taxes) were US$2,857, US$3,810, US$4,763, and US$5,715 for researchers categorized as Entry Level and Levels I, II, and III respectively.[2] The importance of the SNI subsidy for researchers depends on their salary at their home institution. Most national researchers are affiliated with the state-owned Universidad de la República. The Universidad de la República ranks its faculty in five levels: two teaching or research assistant levels (levels 1 and 2), adjunct professor (level 3), associate professor (level 4) and full professor (level 5). Most of its faculty hold part time positions and are not involved in research activities. Many of them also teach in some of the other national private universities. The Universidad de la República pays a salary bonus to those faculty members that have an exclusive dedication to it (they cannot teach in any other national university). As of January 1, 2016, the net annual salaries of full-time non-exclusive adjunct, associate, and full professors were US$17,451, US$19,961, and US$22,507, respectively. The annual net salaries of exclusive faculty were US$25,936, $29,959, and $34,096, respectively.[3]

By December 2015, the SNI had provided transfers for US$42.6 million, and it currently represents 11% of the ANII's total budget. Including all programs, in 2015, ANII allocated US$11 million to research activities and US$6 million to scholarships and human capital formation. In 2015, the SNI had 1,438 active researchers: 460 (32%) at the Entry Level, 623 (43%) at Level I, 281 (20%) at Level II, and 74 (5%) at Level III.

## 3. Data

In this paper, we use data from the online curriculum vitae (CV) data system called CVuy. This allows us to access information on the researchers' categories in the SNI together with their scientific production, academic achievements, and demographic information such as date of birth, gender, place of residence, academic affiliation, years of experience, and other relevant data. The researchers' academic production can be measured by the following: papers published in refereed journals (with some indication of journal quality according to

[2] The monthly transfers of the SNI in Uruguayan pesos were $7,383, $9,844, $12,305, and $14,766 from Entry Level to Level III, respectively. The exchange rate used was 31 pesos = US$1.

[3] Tax deductions and social security contributions were calculated for a typical faculty member that graduated from the Universidad de la República, pays into the University's solidarity fund, and has two children.

indexing in the Journal Citation Report of Thomson Reuters), technical production, books and chapters in books, conference presentations, and tutoring of master and Ph.D. candidates.

The database contains information on 3,196 researchers: 1,619 women and 1,577 men (50.7% and 49.3%, respectively). As we have longitudinal data for 7 seven years (corresponding to 2008 to 2014 applications), the final database contains 6,751 observations, averaging 2.1 observations per individual, that is, each researcher was evaluated an average of twice in the period of study.

As shown in Table 1, about 56.3% of the applications to the SNI were accepted. Applications submitted by women were successful in 53.2% of the cases, while applications submitted by men were successful in 60.3% of the cases. The gender gap in the unconditional probability of being accepted to the SNI is 7.1 percentage points.

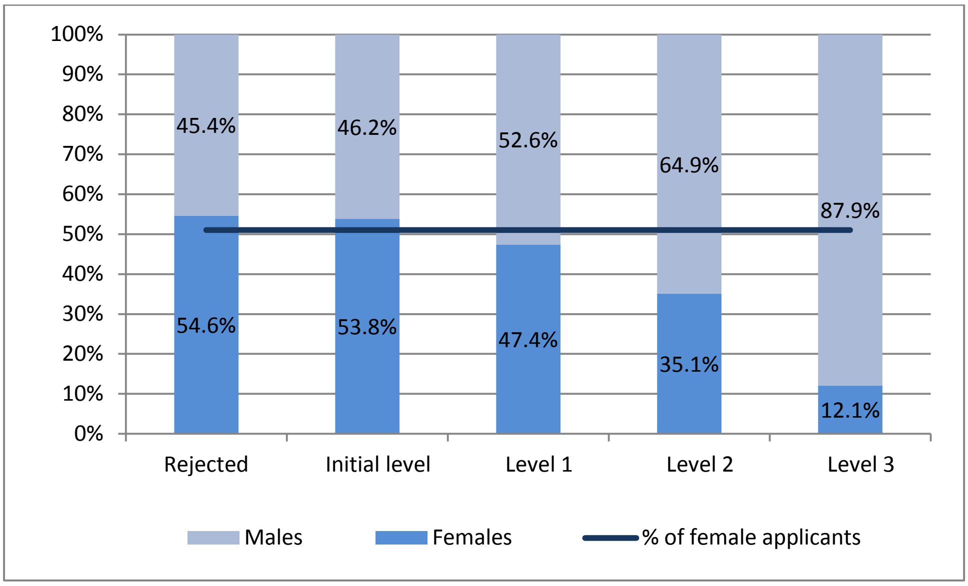
The gender difference at the overall probability of being accepted obscures the existence of wider differences in the SNI hierarchy. Figure 1 presents the gender structure of the SNI. Women represent 53.8% and 47.4% of researchers at the two lowest levels of the system but only 35.1% and 12.1% of researchers at the highest levels of the system. Overall, women represent 50.8% of researchers at the lower ranks of the system (Entry Level and Level I) but only 30.2% of researchers at the higher ranks (Level II and III). Naturally, there are fewer researchers at the higher levels of the SNI and therefore the probability that any researcher will reach this level is lower. The 7.1 percentage point average probability gender gap can be decomposed in a probability gender gap of -3.3 percentage points at the Entry Level, 2.9 at Level I, 4.5 at Level II, and 3.0 at Level III.

**Table 1. SNI Categorization by Gender**

| | Men | Women | Total | Men | Women | Total |
|---|---|---|---|---|---|---|
| Rejected | 1,326 | 1,597 | 2,923 | 39.7% | 46.8% | 43.3% |
| Accepted SNI | 2,012 | 1,816 | 3,828 | 60.3% | 53.2% | 56.3% |
| Entry Level | 782 | 912 | 1,694 | 23.4% | 26.7% | 25.1% |
| Level I | 796 | 716 | 1,512 | 23.8% | 21.0% | 22.4% |
| Level II | 318 | 172 | 490 | 9.5% | 5.0% | 7.3% |
| Level III | 116 | 16 | 132 | 3.5% | 0.5% | 2.0% |
| Total | **3,338** | **3,413** | **6,751** | 100.0% | 100.0% | 100.0% |

Source: Authors' elaboration based on CVuy.

**Figure 1. The SNI Hierarchy by Gender**




Source: Authors' elaboration based on CVuy.

### 3.1. Explanatory Variables

For each application, we have a series of potential explanatory variables that could be associated with the categorization within the SNI. We include data referring to the researchers' sociodemographic characteristics, academic formation, scientific and technical production, teaching and human capital training activities and academic positions held. The socio-demographic variables used are gender and age. A dummy for holding a Ph.D. degree is also used as indicator of academic background. We have variables measuring the quantity and quality of S&T outputs. The quantity of academic production is proxied by the number of published books or chapters of books and the number of articles in refereed journals. Quality is proxied by the average impact factor of journal articles as reported in the Journal Citation Report of Thomson Reuters. In one robustness exercise, we employ a measure encompassing both quantity and quality, used in Mairesse and Pezzoni (2015) in the evaluation of gender effects in scientific productivity among French physicists. This productivity indicator equals the sum of the impact factor of published articles in journals with an impact factor of 0.5 or higher. Publications in journals with an impact factor of less than 0.5 are treated as zero articles. Teaching and human capital formation might have an ambiguous effect in the SNI categorization. Contributing to the development of other researchers is considered meritorious, but the more time spent in teaching, the less time is available for pure research activities. We consider information on the sum of total amount of time spent tutoring undergraduate and graduate dissertations. We also include dummies for full-time positions and graduate and undergraduate teaching responsibilities during the year of the evaluation. Finally, we use information on institutional affiliations.

Table 2 presents descriptive statistics and t-tests of differences between men and women. The average age of the researchers is 43, and men are 1.5 years older than women. About 43% of researchers hold a Ph.D., and the proportion of men with Ph.D. is higher than that of women. The S&T productivity indicators and the human capital indicators are reported for the last three years before researchers were evaluated (i.e., for someone that applied to the SNI in 2014 we report these indicators for the 2012-2014 period). Men published more than women (0.90 book chapters and 0.81 refereed journals vs. 0.79 and 0.62, respectively) but we find no significant differences in the average quality of publications between men and women. The Mairesse and Pezzoni (2015) measure of academic productivity also shows higher male productivity (1.43 vs. 1.24 impact factor weighted number of articles). Male researchers have tutored more dissertations than female researchers (0.98 vs. 0.81 on average). Regarding academic positions, 60% of the researchers were professors of undergraduate courses the year of the evaluation and 32% held full-time positions in their institutions. Finally, we report that most of the researchers (68%) are affiliated with the public Universidad de la República. The summary statistics reported suggest some statistically significant differences in various dimensions in favor of men. This could explain why male researchers are more successful in the probability of accessing the SNI and reaching its higher ranks. Table 2 also presents a disaggregation of researchers by field. Most applicants are in the natural sciences (30%) and the social sciences (23%). Humanities (9%) and engineering (10%) have the fewest applicants. The t-test shows that female applicants are statically overrepresented in medical sciences, natural sciences, and humanities and are underrepresented in agricultural sciences and engineering.

Table 3 shows gender differences within the SNI (rejected, low rank, and high rank). Glass ceilings imply that women can rise up in the lower ranks of the system but they face increasing difficulties in achieving the higher ranks. If this is so, we should find that women at high ranks have more academic merit than men. Moreover, the differences in academic merit in favor of women should be larger in the higher rank than in the lower rank. Women in the higher ranks have some better indicators than men but not consistently so. A higher proportion of them have Ph.D.s, they advise on more dissertations, teach more at the graduate and undergraduate levels, and hold more full-time positions. On the other hand, women in higher rank publish fewer articles and in journals with a lower impact factor. This productivity gap in publications is wider at the high rank than at the lower rank in journal articles but not in books and chapters in books. We find that the age difference between men and women is due mainly to differences among those that are rejected from the SNI. The differences in ages of men and women in the SNI are not statistically significant. Overall, those in the higher ranks are about 11 years older than those in the lower ranks.

Finally, Table 3 shows that women are underrepresented in the high ranks in the medical and the natural sciences and overrepresented in the high ranks of agricultural sciences. No statistically significant differences are found in the high ranks of social sciences, humanities, or engineering. Table A1 in the Appendix reports descriptive statistics by field. The pattern of older and more productive male researchers is present in all fields but engineering. Female engineers in the SNI are about the same age, teach about the same amount, but publish more and in better journals than their male counterparts.

**Table 2. Descriptive Statistics by Gender**

| | **Overall** | | **Men** | | **Women** | | **Difference** |
|---|---|---|---|---|---|---|---|
| | Mean | Std Dev. | Mean | Std Dev. | Mean | Std Dev. | |
| *Sociodemographics* | | | | | | | |
| Female | 0.51 | 0.50 | | | | | |
| Age | 42.9 | 10.4 | 43.7 | 10.5 | 42.2 | 10.3 | 1.5*** |
| *Human capital* | | | | | | | |
| Ph.D. Degree | 0.43 | 0.49 | 0.46 | 0.50 | 0.40 | 0.49 | 0.07*** |
| *S&T productivity (average of the last three years)* | | | | | | | |
| Books and chapters in books | 0.85 | 1.17 | 0.90 | 1.25 | 0.79 | 1.10 | 0.11*** |
| Articles in refereed journals | 0.72 | 1.13 | 0.82 | 1.32 | 0.62 | 0.90 | 0.19*** |
| Impact Factor | 0.50 | 0.98 | 0.51 | 1.04 | 0.49 | 0.93 | 0.02 |
| Articles (impact factor weighted) | 1.33 | 1.78 | 1.43 | 1.88 | 1.24 | 1.66 | 0.19*** |
| *Human capital formation (average of the last three years)* | | | | | | | |
| Dissertations advised | 0.90 | 1.57 | 0.99 | 1.63 | 0.81 | 1.50 | 0.16*** |
| Undergraduate teaching | 0.60 | 0.49 | 0.61 | 0.49 | 0.60 | 0.49 | 0.01 |
| Graduate teaching | 0.24 | 0.43 | 0.24 | 0.43 | 0.24 | 0.43 | -0.00 |
| *Institutional affiliation* | | | | | | | |
| Full-time position | 0.32 | 0.47 | 0.33 | 0.47 | 0.32 | 0.47 | 0.01 |
| Universidad de la República | 0.68 | 0.47 | 0.67 | 0.47 | 0.69 | 0.46 | -0.02*** |
| Private universities | 0.07 | 0.25 | 0.09 | 0.28 | 0.05 | 0.22 | 0.04*** |
| *Fields of knowledge (% structure)* | | | | | | | |
| Agricultural sciences | 16% | | 17% | | 14% | | 3%*** |
| Medical sciences | 13% | | 10% | | 15% | | -6%*** |
| Natural sciences | 30% | | 29% | | 31% | | -2%* |
| Social sciences | 23% | | 23% | | 24% | | -1% |
| Humanities | 9% | | 8% | | 10% | | -1%* |
| Engineering | 10% | | 13% | | 7% | | 7%*** |
| Total | 100% | | 100% | | 100% | | |

Source: Authors' elaboration based on CVuy.
Note ***statistically significant at 1%, **statistically significant at 5%, *statistically significant at 10%.

**Table 3. Descriptive Statistics by SNI Rank and Gender**

| | Rejected | | | Low rank (Entry, Level I) | | | High rank (Level II, Level III) | | |
|---|---|---|---|---|---|---|---|---|---|
| Variables | Male | Female | Diff. | Male | Female | Diff. | Male | Female | Diff. |
| *Socio demographics* | | | | | | | | | |
| Age | 42.3 | 40.2 | 2.1*** | 42.4 | 42.8 | -0.4 | 53.4 | 54.1 | -0.7 |
| *Human capital* | | | | | | | | | |
| Ph.D. degree | 0.22 | 0.17 | 0.05*** | 0.56 | 0.56 | 0.00 | 0.87 | 0.93 | -0.07** |
| *S&T productivity (average of the last three years)* | | | | | | | | | |
| Articles in refereed journals | 0.34 | 0.34 | 0.00 | 0.97 | 0.82 | 0.15*** | 1.73 | 1.38 | 0.35** |
| Books and chapters in books | 0.74 | 0.66 | 0.08* | 0.98 | 0.87 | 0.11** | 1.12 | 1.22 | -0.10 |
| Impact Factor | 0.24 | 0.30 | -0.06** | 0.61 | 0.66 | -0.05 | 0.97 | 0.60 | 0.38*** |
| Articles (impact factor weighted) | 0.57 | 0.55 | 0.02 | 1.75 | 1.73 | 0.02 | 2.96 | 2.81 | 0.15 |
| *Human capital formation (average of the last three years)* | | | | | | | | | |
| Dissertations advised | 0.56 | 0.46 | 0.10** | 1.05 | 0.97 | 0.09 | 2.10 | 2.46 | -0.37** |
| Undergraduate teaching | 0.52 | 0.50 | 0.02 | 0.69 | 0.67 | 0.01 | 0.60 | 0.79 | -0.20*** |
| Graduate teaching | 0.14 | 0.13 | 0.00 | 0.28 | 0.31 | -0.03* | 0.43 | 0.61 | -0.18*** |
| *Institutional affiliation* | | | | | | | | | |
| Full-time position | 0.13 | 0.14 | -0.01 | 0.40 | 0.44 | -0.04** | 0.72 | 0.80 | -0.08** |
| Universidad de la República | 0.556 | 0.619 | -0.063*** | 0.725 | 0.740 | -0.015 | 0.804 | 0.851 | -0.047 |
| Private universities | 0.103 | 0.054 | 0.048*** | 0.085 | 0.046 | 0.039*** | 0.048 | 0.027 | 0.022 |
| *Fields of knowledge (% structure)* | | | | | | | | | |
| Agricultural sciences | 23% | 15% | 7%*** | 15% | 12% | 3%*** | 7% | 16% | -9%*** |
| Medical sciences | 8% | 15% | -7%*** | 11% | 17% | -6%*** | 12% | 7% | 5%* |
| Natural sciences | 20% | 27% | -7%*** | 30% | 33% | -4%** | 52% | 43% | 9%** |
| Social sciences | 27% | 26% | 10% | 22% | 22% | 0% | 11% | 15% | -4% |
| Humanities | 8% | 10% | -2%* | 8% | 10% | -2% | 9% | 9% | 0% |
| Engineering | 14% | 6% | 7%*** | 14% | 7% | 8%*** | 8% | 10% | -2% |
| Total | 100% | 100% | | 100% | 100% | | 100% | 100% | |

Source: Authors' calculations based on CVuy.

Note ***statistically significant at 1%, **statistically significant at 5%, *statistically significant at 10%. Source: own elaboration based on Cvuy.

# 4. Methodology

## 4.1. Discrete Choice Modeling

The basic setup is a discrete-choice model like that used by McDowell, Singell, and Ziliak (2001) to address gender biases in promotion within the economics profession. Assume an aggregate measure of productivity ($P_{ij}$) for individual i working on the j-field depends linearly on a vector of attributes ($X_{ij}$):

$$P_{ij} = X_{ij}\beta + \varepsilon_{ij} \qquad (1)$$

where $\varepsilon_{ij}$ measures unobserved individual productivity assumed to be normally distributed. Each area (*j*) evaluation committee has a threshold productivity level in mind, and potentially it could apply different thresholds for different individuals ($P^*_{ij}$), which represents the minimum necessary productivity to achieve promotion. This threshold is a function of the characteristics of the field and individuals ($Z_{ij}$) and measurement error in assessing productivity ($\upsilon_i$), $P^*_j = Z_{ij}\gamma + \upsilon_i$ . An individual is included in the SNI if his productivity level exceeds the required threshold. Formally,

$$X_{ij}\beta + \varepsilon_{ij} \ > Z_{ij}\gamma + \upsilon_i \qquad (2)$$

Gender differences can be modeled by including a gender dummy variable in *Z* to examine whether women have different requirements than men.

Based on equation (2), we can have two manifestations of gender differences that can be analyzed jointly or separately: entry into the SNI and advancement within the SNI. For professional attainment, we consider the progress of an individual through the SNI ranks from rejected (R=0), Entry Level (R=1), to researcher Level I (R=2), to researcher Level II (R=3) and researcher Level III (R=4). Getting into the system involves surpassing a certain threshold; achieving Level I involves surpassing a higher level, and so on. Thus, if $\varepsilon_{ij}$ and $\upsilon_i$ are normally distributed, equation (2) forms the basis for an ordered-probit model of promotion up the academic hierarchy:

$$
\begin{aligned}
&R = 0 \text{ if } \left(Z_j\gamma - X_{ij}\beta\right) + \left(\upsilon - \varepsilon_{ij}\right) \ < \theta_1 \\
&R = 1 \text{ if } \theta_1 \le \left(Z_j\gamma - X_{ij}\beta\right) + \left(\upsilon - \varepsilon_{ij}\right) \ < \theta_2 \\
&R = 2 \text{ if } \theta_2 \le \left(Z_j\gamma - X_{ij}\beta\right) + \left(\upsilon - \varepsilon_{ij}\right) \ < \theta_3 \quad (3) \\
&R = 3 \text{ if } \theta_3 \le \left(Z_j\gamma - X_{ij}\beta\right) + \left(\upsilon - \varepsilon_{ij}\right) < \theta_4 \\
&R = 3 \text{ if } \theta_r \le \left(Z_j\gamma - X_{ij}\beta\right) + \left(\upsilon - \varepsilon_{ij}\right)
\end{aligned}
$$

where the $\theta' \text{s}\, 0$ are parameters to be estimated.

This model can be used to estimate the determinants of entry and promotion within the SNI. Marginal effects can be computed at the different hierarchy levels. These determinants include education, different forms of academic production and demographic characteristics. An indication of glass ceiling is that, after controlling for all other relevant covariates, women have a lower probability of accessing the higher ranks of SNI than of accessing the lower ranks of the system.

### 4.2. Gap Decomposition

The previous section implicitly assumed that the formation of the latent productivity indicator for men and women is the same $(\beta \text{ and } \gamma)$. If we consider gender differences, we would like to open the possibility that this is not so.

Furthermore, it might be that the women and the men that in the S&T fields represent a different sample of the total workforce and have systemically different characteristics. For instance, assume that intellectual talent is equally distributed among men and women. Further assume that there are only two labor markets: unskilled work and research. In equilibrium, the most talented people are more likely to get into research. If there is discrimination against women in the unskilled market, women will be overrepresented in research activities. This implies that the talent of some women willing to be scientists will be lower than that of men.[4] A gender-blind evaluation committee of the SNI will find the need to reject more women than men at the lower ranks but not at the upper ranks.

On the other hand, the lower female participation in the upper ranks of the SNI can also be due to observed differences in activities that lead to different promotion patterns. Schneider (1998) points that a larger proportion of women are involved in teaching, which could explain why they publish less and are promoted less frequently. Our summary statistics confirm that female researchers produce fewer publications and that women in the upper ranks teach more than men.

In this section, we address these issues by decomposing the probability gap into one part that can be explained by differences in observable characteristics and another part attributable to differences in the rates of return (coefficients) of these characteristics (the unexplained part).

Blinder (1973) and Oaxaca's (1973) seminal studies allow the decomposition of a continuous variable (wages). In our case, the outcome variable is nonlinear. We follow Bauer and Sinning (2008), who develop an extension of the Blinder-Oaxaca decomposition to nonlinear regression models.

Blinder (1973) and Oaxaca's (1973) starting point is a linear regression fitted separately for the two groups: male and female, g=(M,F).

$$Y_{ig} = X_{ig}\beta_g + \varepsilon_{ig} \qquad (4)$$

The simplest decomposition is the result of adding and subtracting $X_F\beta_M$. The decomposition is:

$$\overline{Y_M} - \overline{Y_F} = \left(\overline{X_M} - \overline{X_F}\right)\hat{\beta}_M + \overline{X_F}\left(\hat{\beta}_M - \hat{\beta}_F\right) \qquad (5)$$

where the upper bar is the sample average and the hat indicates estimated coefficients.[5] The first term in the right-hand side of (5) indicates differences in observable characteristics

[4] Gandelman (2009) presents a model of how discrimination in one market impacts the other and applies it to the soccer labor market.

[5] Changing the reference group and adding and subtracting $X_M\beta_F$ to the right-hand side of (4) the decomposition is: $\overline{Y_M} - \overline{Y_F} = \left(\overline{X_M} - \overline{X_F}\right)\hat{\beta}_F + \overline{X_M}\left(\hat{\beta}_M - \hat{\beta}_F\right)$. The literature discusses the estimation effects of the different weighting posibilities.

that could explain the wage gap, and the second term shows the unexplained differences in the wage gap that are related to differences in the rates of return (coefficients).

In nonlinear models, a decomposition of the outcome variables as in (5) is not appropriate, since the $E\left(Y_{ig} \middle| X_{ig}\right)$ may not be equal to $\overline{X_g}\hat{\beta}_g$. Bauer and Sinning (2008) rewrite (4) in terms of conditional expectations and propose the following general decomposition:

$$\Delta_M^{Nl} = \left\{E_{\hat{\beta}_M}\left(Y_{iM}\middle|X_{iM}\right) - E_{\hat{\beta}_M}\left(Y_{iF}\middle|X_{iF}\right)\right\} + \left\{E_{\hat{\beta}_M}\left(Y_{iF}\middle|X_{iF}\right) - E_{\hat{\beta}_F}\left(Y_{iF}\middle|X_{iF}\right)\right\} \qquad (6)$$

or changing the reference group it becomes:

$$\Delta_F^{Nl} = \left\{E_{\hat{\beta}_F}\left(Y_{iM}\middle|X_{iM}\right) - E_{\hat{\beta}_F}\left(Y_{iF}\middle|X_{iF}\right)\right\} + \left\{E_{\hat{\beta}_M}\left(Y_{iM}\middle|X_{iM}\right) - E_{\hat{\beta}_F}\left(Y_{iM}\middle|X_{iM}\right)\right\} \qquad (7).$$

To apply (6) or (7) to nonlinear models, the conditional expectations must be replaced by their sample counterparts. For the probit model, they are computed as $\frac{1}{N_g}\sum_{i=1}^{N}\Phi\left(X_{ig}\hat{\beta}_g\right)$ where $\Phi$ is the cumulative normal density function. For an ordered probit model with *J* possible outcomes, the sample counterpart is:

$$\frac{1}{N_g}\sum_{i=1}^{N}\left\{\left[\Phi\left(\hat{\theta}_1 - X_{ig}\hat{\beta}_g\right) - \Phi\left(-X_{ig}\hat{\beta}_g\right)\right] + 2\left[\Phi\left(\hat{\theta}_2 - X_{ig}\hat{\beta}_g\right) - \Phi\left(\hat{\theta}_1 - X_{ig}\hat{\beta}_g\right)\right] + \ldots + J\left[1 - \Phi\left(\hat{\theta}_{J-1} - X_{ig}\hat{\beta}_g\right)\right]\right\}$$

where the $\hat{\theta}$'s are the estimated threshold values of equation (3).[6]

## 5. Results

Table 4 shows the estimates of a probit model where the outcome variable takes the value 1 if the researcher was accepted into the SNI and 0 otherwise. Gender and age are interacted to allow for different age effects for men and women that could reflect, for example, different family and childcare commitments over the life cycle. Age is centered around 40 years old.

The marginal effect reflects that women's probability of being selected to the SNI is on average 2.8 percentage points lower than men's probability of selection. The remaining variables show expected behaviors and similar but not equal marginal effects for men and women. The average marginal effect of age is positive for men and women (last two columns). After controlling for human capital, productivity, and human capital formation indicators, older individuals have a larger probability of being accepted into the system (4.6 and 8.4 percentage points larger per year for men and women, respectively). This linear interpretation is not completely correct, as the coefficients of the squared terms in column 1 are negative and statistically significant for men and women. This implies that the age effect of the probability of being accepted is better described by an inverse U. The probability of

[6] See Sinning, Hahn, and Bauer (2008) for the application to a Stata code.

being accepted at the SNI is maximized at 34 years old for men but much later, at 52 years old, for women.[7]

More published articles, articles in higher-impact journals, and teaching positions are correlated with greater probabilities of belonging to the SNI. Quantitatively, articles in refereed journals are the most important. An increase in one standard deviation in the number of articles is associated with an increase of 22.0 percentage points (=0.195*1.13) in the probability of accessing the SNI. Recalling that 56.3% of all applications are accepted into the SNI, a movement of one standard deviation in articles in refereed journals accounts for an increase of almost 40% in the unconditional probability of entering the SNI.

Increases in the other variables have effects of lower magnitude. A one standard deviation increase in the number of published book chapters is associated with an increase of 3.2 percentage points (0.027*1.17) in the probability of being accepted into the SNI. A one standard deviation increase in the quality of publications, proxied by the impact factor, is associated with an increase of 5.0 percentage points (0.051*0.98) in the probability of accessing the SNI. Form an SNI point of view, graduate teaching is much more important than undergraduate teaching. A one standard deviation increase in them is respectively associated with an increase of 6.8 (0.159*0.43) and 4.5 (0.092*0.49) percentage points in the probability of being accepted.

[7] The marginal effect of age for men is $\frac{\beta_1}{10}+2\frac{\beta_2}{100}(Age-40))$, where $\beta_1$ and $\beta_2$ are the coefficients of age centered and the square of age centered, respectively. Equalizing to 0 and clearing age, we get the age that maximizes the probability of being selected for men. Using the coefficients interacted with the female dummy, we get the results for women.

**Table 4. Determinants of the Probability of Being Selected into the SNI**

| | Coefficients | Marginal effects | Marginal effects | Marginal effects |
|---|---|---|---|---|
| | All observations | All observations | Men | Women |
| Female | -0.009 | -0.028** | | |
| | (0.050) | (0.012) | | |
| (Age-40)/10 | 0.194*** | 0.065*** | 0.046*** | 0.084*** |
| | (0.036) | (0.006) | (0.009) | (0.009) |
| Female*(Age-40)/10 | 0.167*** | | | |
| | (0.050) | | | |
| $((Age-40)/10)^2$ | -0.067*** | | | |
| | (0.021) | | | |
| $Female*((Age-40)/10)^2$ | -0.112*** | | | |
| | (0.032) | | | |
| Articles in refereed journals | 0.642*** | 0.195*** | 0.187*** | 0.201*** |
| | (0.048) | (0.014) | (0.018) | (0.020) |
| Books and chapters in books | 0.088** | 0.027** | 0.031* | 0.023 |
| | (0.037) | (0.011) | (0.017) | (0.015) |
| Impact factor | 0.166*** | 0.051*** | 0.047*** | 0.055*** |
| | (0.025) | (0.008) | (0.011) | (0.009) |
| Undergraduate teaching | 0.303*** | 0.092*** | 0.085*** | 0.101*** |
| | (0.043) | (0.013) | (0.018) | (0.018) |
| Graduate teaching | 0.524*** | 0.159*** | 0.158*** | 0.159*** |
| | (0.050) | (0.015) | (0.021) | (0.021) |
| Observations | 6,751 | 6,751 | 3,338 | 3,413 |
| Institutional dummies | YES | YES | YES | YES |
| Year dummies | YES | YES | YES | YES |
| Field dummies | YES | YES | YES | YES |

Source: Authors' elaboration based on CVuy.
Note: The dependent variable is a dummy equal 1 if accepted into the SNI. The first two columns refer to the whole database. Column three is estimated only using male researchers and column four only using female researchers Clustered standard errors in parentheses. ***statistically significant at 1%, **statistically significant at 5%, *statistically significant at 10%.

We proceed to estimate an ordered probit model where the outcome variable (from 0 to 4) corresponds to being rejected, accepted at the Entry Level, accepted at Level I, accepted at Level II, or accepted at Level III. Table 5 shows the marginal effects of being female per outcome in the ordered probit.[8] Female applicants are 6.0 percentage points more likely to be rejected, 0.2 percentage points less likely to be accepted at the Entry Level, 2.5 percentage points less likely to be accepted at Level I, 1.8 percentage points less likely to be accepted at Level II, and 0.8 percentage points less likely to be accepted at Level III. To properly interpret these marginal effects, we should consider the unconditional

[8] Marginal effects for the full list of covariates can be found in Table A2 in the Appendix.

probabilities of being accepted to the four SNI Levels. They are 25%, 22%, 7%, and 2% in ascending hierarchical order. Thus, the female marginal effect represents -1%, -11%, -26%, and -40% of these unconditional probabilities for each level of the SNI. This is evidence of a glass ceiling. For every researcher, accessing the higher ranks of the system is more difficult than accessing the lower ranks. For women, it is even more difficult than for men. Since at Level III there are fewer observations, we present in Panel B the same analysis but grouping the SNI into its lower rank and its higher rank (Levels II and III). We find the same evidence consistent with glass ceilings. Women have a lower probability of getting into the SNI at the low rank, but it is even more difficult for them to access the high rank.

**Table 5. Marginal Effects of Being Female on the Probability of Reaching Different SNI Levels**

| | Outcome | Outcome | Outcome | Outcome | Outcome | |
|---|---|---|---|---|---|---|
| **Panel A** | Rejection | Entry | Level I | Level II | Level III | |
| Marginal effect female (A) | 0.060*** | -0.002 | -0.025*** | -0.018*** | -0.008*** | |
| | (0.010) | (0.003) | (0.005) | (0.003) | (0.002) | |
| Unconditional probability (B) | 44% | 25% | 22% | 7% | 2% | |
| (A)/(B) | 14% | -1% | -11% | -26% | -40% | |
| Observations | 6,751 | 6,751 | 6,751 | 6,751 | 6,751 | 6,751 |
| | Outcome | Outcome | Outcome | | | |
| **Panel B** | Rejection | Low rank | High rank | | | |
| Marginal effect female (A) | 0.053*** | -0.031*** | -0.021*** | | | |
| | (0.011) | (0.007) | (0.005) | | | |
| Unconditional probability (B) | 44% | 47% | 9% | | | |
| (A)/(B) | 12% | -6% | -23% | | | |
| Observations | 6,751 | 6,751 | 6,751 | | | |

Source: Authors' calculations based on CVuy.
Note: The dependent variable of Panel A takes the following values: 0 if rejected; 1 if accepted at Entry Level, 2 if accepted at Level I, 3 if accepted at Level II and 4 if accepted at Level III. The dependent variable of Panel B takes the following values: 0 if rejected; 1 if accepted at Entry or Level I and 2 if accepted at Level II or III. The regressions have the same control variables as in Table 4. Clustered standard errors in parentheses. ***statistically significant at 1%, **statistically significant at 5%, *statistically significant at 10%.

Tables 4 and 5 report evidence that after controlling for individual characteristics, women have a lower probability of being accepted into the SNI and especially into its higher ranks. In these estimations, we implicitly assumed that the returns to these individual characteristics are the same. We have shown in the last two columns of Table 4 that, although the marginal effects of the determinants to access the SNI are similar for the male and female subsample, they are not identical. To correctly assess the role of characteristics and returns in the probability of reaching each level of the SNI, we present in Panel A of

Table 6 the nonlinear version of the Oaxaca-Blinder decomposition based on a probit estimation for accessing the SNI and an ordered probit estimation for the different SNI levels. We report the decomposition using women for the weighting matrix as the reference group (results using men are similar). Bootstrap standard errors show that the differences found are statistically significant. Decomposition outputs suggest that differences in characteristics of men and women weigh 68% when explaining the differences in the probability of belonging in the SNI. That is, most (4.9 percentage points) of the raw gender gap of 7.1 percentage points can be explained by differences in human capital and productivity. There remains a difference of between 2.2 percentage points that is due to differences in the rates of return and cannot be explained by observable differences between male and female researchers.

The decomposition based on the ordered probit model also shows that most of the difference in the probability gap is due to differences in male and female characteristics but that a sizeable part of the difference remains unexplained. In Panel B, we present the decomposition based on probit models for the probability of not being accepted into the SNI or accepted into lower or higher ranks. At the low rank, the raw gap is not statistically significant. Therefore, its decomposition is of no interest. We find that the observable characteristics explain a larger share of the gap for the probability of being rejected than for the probability of attaining the higher rank. This evidence is also consistent with a glass ceiling.

**Table 6. Probability Decompositions**

**Panel A**

| | Probit for accessing SNI | | Ordered probit (rejected, Entry Level, Level I, Level II, and Level III) | |
|---|---|---|---|---|
| Char | -0.049*** | 68% | -0. 174*** | 57% |
| Coef | -0. 022*** | 32% | -0. 131*** | 43% |
| Raw | -0.071*** | 100% | -0. 305*** | 100% |

**Panel B**

| | Probit (dummy =1 if rejected) | | Probit (dummy =1 if low rank) | | Probit (dummy =1 if high rank) | |
|---|---|---|---|---|---|---|
| Char | 0.049*** | 68% | -0.015*** | -818% | -0.035*** | 47% |
| Coef | 0.022*** | 32% | 0.017*** | 918% | -0.039*** | 52% |
| Raw | 0.071*** | 100% | 0.002 | 100% | -0.075*** | 100% |

Source: Authors' calculations based on CVuy.
Note: Reference group: women. The regressions for the decompositions of Panels A and B have the same independent variables as in Table 4. Clustered standard errors in parentheses. ***statistically significant at 1%, **statistically significant at 5%, *statistically significant at 10%.

## 6. Robustness

In this section, we present three robustness exercises. First, the first years in any job may have a disproportional effect on the future career path. Discoveries and publications at early research stages might open grounds for collaboration with senior colleagues in the country and internationally and may facilitate access to grants to support research programs. In the sociology literature, this is referred to as cumulative advantage theory, which Cole and Cole (1973) have generalized into a dynamic theory of stratification in scientific careers. We have shown that the age that maximizes the probability of accessing the SNI is higher for women than for men. If women must postpone research efforts in their twenties and thirties for family reasons (e.g., having children), this might also affect their research outcomes later in life. We construct a variable to capture the initial productivity of researchers, taking the number of articles in refereed journals that the researchers had published by age 37. This age represents the median age of researchers at the Entry Level (excluding the first generation of SNI applicants that was even older). Table A3 in the Appendix shows that this variable is positively correlated with the probability of accessing the SNI but is not significant in the estimations for the probability of accessing low and high ranks in the SNI.

Second, the goal of incentive schemes at the SNI is to improve research and foster human capital formation in the country. We have the paradoxal situation that the productivity determinants of accessing the SNI are what the system wants to improve. Thus, accessing the SNI is likely to produce an impact in the determinants that we use in the right hand side of our probability estimations. Moreover, if women face more difficulties in being promoted within the SNI this has an indirect impact in their research productivity. Is it that women are less productive and therefore they have lower probabilities of accessing the SNI? Or is it that their lower probability of being promoted impacts negatively on their productivity? To test whether our results are affected by this bidirectionality we restrict the analysis to the first year in our database. In 2008 researchers applied to the SNI for the first time. Since the SNI was not currently in place it could not affect researcher's productivity. At least for this year, the causality clearly goes from academic merits to the probability of accessing the SNI and any of its levels.

Third, many of the determinants of the probability of being accepted into the SNI or of accessing its higher ranks are jointly determined and highly correlated. Those that have a Ph.D. have written a dissertation that they could send to journals and obtain publications. Those that have full-time positions at universities have more time to do research and to teach. At the same time, full-time positions are likely awarded to those that are academically more successful in terms of publications and teaching. Therefore, we redo our estimates in a stripped variant of the model where we only include the impact factor weighted sum of articles as indicator of a researcher quality. We also include as controls gender, age, its squared and interactions and field, year and institutions dummies.

Panels A, B, and C of Table 7 show the results of these robustness exercises (Tables A3, A4, and A5 in the Appendix report the full list of marginal effects). The results are the same as before. In the estimation of a probit model for accessing the SNI, we find a negative and statistically significant marginal effect for female applicants. Using only the first-year observations, the marginal effect is even larger (-4.6 percentage points) that the reported in the main estimations and in the other robustness tests (about -3 percentage points). Moreover, the marginal effects on the probability of being rejected and the evidence of glass ceiling (marginal effect larger for higher ranks than for lower ranks in absolute and relative terms) are stronger in Panel B. A possible reason for this will be addressed in the next section. In Table A6 in the Appendix, we report the probability decomposition for the three robustness exercises. As before, since the raw gap for the low rank is very small and not statistically different from 0, the decomposition of the part due to characteristics and coefficients has high values. Differences in characteristics between men and women explain part of the differences in the probability of being rejected from the SNI and differences in the probability of accessing its higher ranks. Nevertheless, it remains a sizeable part (between a half and two-thirds of the gap) that cannot be explained by characteristics and reflects discriminatory treatment of women. This unexplained part is larger for the probability of attaining high rank than the probability of being rejected, as before.

**Table 7. Robustness Exercises: Marginal Effects**

| | Probit outcome rejection | Ordered probit outcome rejected | Outcome low rank | Outcome high rank |
|---|---|---|---|---|
| **Panel A.** Estimations controlling for initial productivity | | | | |
| Marginal effect female (A) | -0.032*** | 0.056*** | -0.033*** | -0.024*** |
| | (0.012) | (0.011) | (0.007) | (0.005) |
| Unconditional probability (B) | | 44% | 47% | 9% |
| (A)/(B) | | 13% | -7% | -27% |
| **Panel B.** Estimations including only first year observations | | | | |
| Marginal effect female (A) | -0.046** | 0.063*** | -0.018* | -0.045*** |
| | (0.019) | (0.016) | (0.010) | (0.010) |
| Unconditional probability (B) | | 43% | 42% | 15% |
| (A)/(B) | | 15% | -4% | -30% |
| **Panel C.** Estimations using only the weighted sum of publication as productivity indicator | | | | |
| Marginal effect female (A) | -0.031** | 0.058*** | -0.036*** | -0.022*** |
| | (0.013) | (0.010) | (0.007) | (0.004) |
| Unconditional probability (B) | | 44% | 47% | 9% |
| (A)/(B) | | 13% | -8% | -24% |

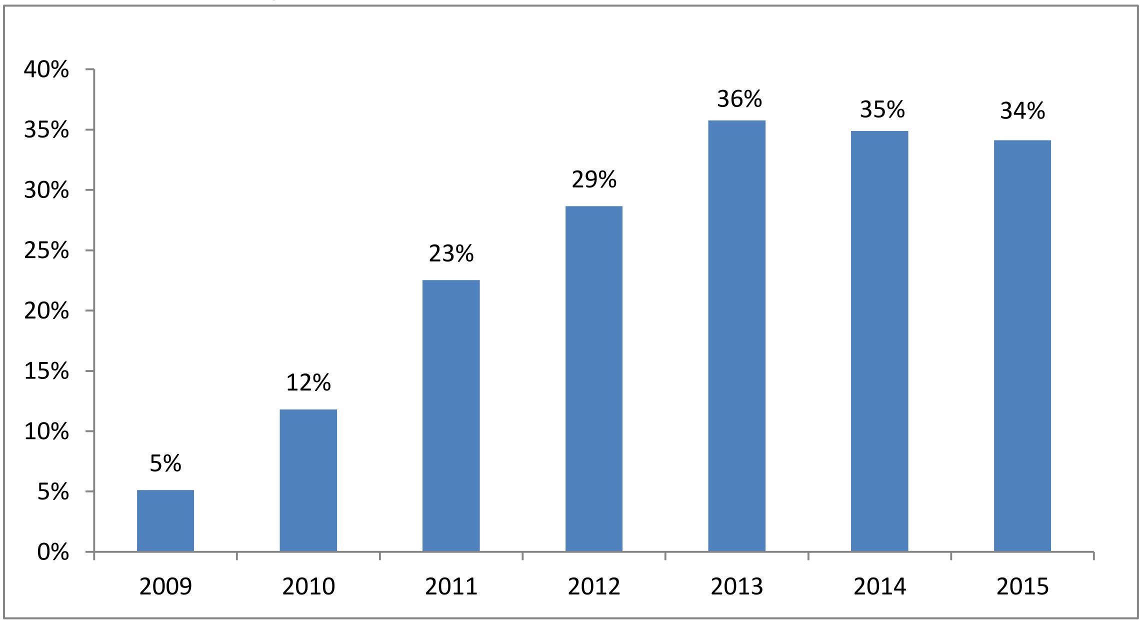
Source: Authors' calculations based on CVuy.
Note: Dependent variables in the probit is a dummy for having been accepted into the SNI. In the ordered probit model it takes the value 0 if rejected, 1 if is accepted at the lower ranks (Entry and Level I) and 2 if it is accepted at the higher ranks (Levels II and III). The regressions for Panels A and B have the same control variables as in Table 4. Clustered standard errors in parentheses. ***statistically significant at 1%, **statistically significant at 5%, *statistically significant at 10%.

## 7. Causes of the Glass Ceiling

What produces the gender gap in accessing and ascending through the SNI? We propose three complementary hypotheses and provide partial evidence of them. We refer to the first hypothesis as the "original sin." When the SNI was implemented for the first time, ANII named five male researchers to the CH to head the system. They named 39 researchers to organize the technical committees in charge of the evaluations of the bulk of researchers. International referees evaluated these 39 researchers and assigned all of them to the top ranks (Levels II and III) of the system. Out of these 39 researchers, 35 were men. The original sin hypothesis affirms that the glass ceiling is the result of an original placement of predominantly male researchers at the top of the SNI hierarchy.

The second hypothesis refers to a possible ongoing phenomenon. One of the pillars of the SNI is that researchers are evaluated by their peers. The gender composition of these committees may have an impact on the overall evaluation if, for example, male-dominated committees are prone to promote male researchers, as reported in the case of Spanish and Italian academia (Bagues and Esteve-Volart, 2010; Bagues, Sylos-Labini and Zinovyeva 2017; De Paola and Scoppa, 2015). Until 2015, eight researchers comprised the CH. All were men. Figure 2 reports that women are underrepresented in the CTAs, especially in the early years of the program's functioning. The share of women in the CTAs grew from 2009 to 2013, when it stagnated in about a third of its members. Although this is an underrepresentation of the share of women in the SNI, it is a reasonable representation of women in the top rank of the system. All CTA members are Level II or III researchers.

**Figure 2. Proportion of Women in CTAs by Year**




Source: Authors' elaboration based on CVuy.

Finally, it is possible that gender discrimination is a problem in certain fields where the gap is evident, or it may even be that the overall gap is attributable to a composition effect due to segmentation. Women are overrepresented in some fields and underrepresented in others. There may be more than one explanation for the composition effect. Although the general rules for the SNI are common, since each field CTA works independently, it may adopt slightly different criteria (e.g., in some fields, book publication is the norm and publication in journals is less common). If the CTAs of fields where women are overrepresented haver higher standards to be accepted and promoted (for both men and women) they may produce a composition effect in which overall there is a gender gap but there is none at the field level.

Women are overrepresented in the medical sciences (62% of applicants), humanities (55% of applicants) and, to a lesser extent, in the natural sciences and the social sciences (52% of applicants in each case). However, they are underrepresented in agricultural sciences (45% of applicants) and engineering (34% of applicants). Rejection rates in medical sciences, humanities and engineering are very similar: 41%, 43%, and 42%, respectively. The natural sciences have the lowest rejection rate, 34%, while the agricultural and scial sciences show the highest proportions of non-accepted applicants, with 52% and 50%, respectively.

Table 8 reports the marginal effect of being female on the probability of being rejected and achieving the low and high ranks of the system and the corresponding probability decompositions. In Panel A, we present the marginal effect of being female in a subsample excluding the 39 researchers that were originally evaluated by international referees and were not part of the same process as the rest. We exclude them in the first year of the system and in all subsequent evaluations, since the local CTAs did not perform these evaluations until 2015. The probability decomposition in Panel C shows that differences in characteristics explain less of the probability of achieving high rank than the probability of being rejected. Also, the raw gap for low rank is not statistically significant. Therefore, the glass ceiling effect is not solely due to the original assigning of predominantly male researchers to the evaluation committees.

Panel B presents the marginal effect of being female, including as an extra control a variable to capture the gender composition of the field evaluation committee. This variable was interacted with the gender dummy. In Table A7 in the Appendix, we show that the marginal effect is not statistically significant.[9] The marginal effect of being female shows the same pattern and of similar magnitude than in the main results. That is, it represents a

[9] Neither the coefficient nor the interaction with women was significant (not reported).

higher proportion of the unconditional probability at the higher rank than at the lower. Thus, this hypothesis of the reason for the glass ceiling effect is also not quantitatively important.

Table 9 presents the marginal effects of being female by field (Table A8 in the Appendix reports the probability decompositions by field). The point estimates show the expected pattern but in many fields, it is not statistically significant. We find no evidence of lower probabilities for women to access the low or high ranks of the SNI in the agricultural sciences and the social sciences. No evidence for lower probability for women at the high rank is found in engineering. In these fields, the probability decomposition shows that most differences in probabilities can be explained by differences in observable characteristics. Women are underrepresented in agricultural sciences and engineering, but those who work in these fields appear to receive fair treatment within the system. Of course, it may be that the female researchers working there are not a random sample of women. They may have some exceptional characteristics that make them choose these traditionally male-dominated fields. In our estimates, we control for observable academic merits, but we cannot rule out the existence of other non-observed variables that might sort between women. On the other hand, we find evidence of gender gaps in the medical sciences, the natural sciences, and the humanities. These are the three fields where women are overrepresented among the applicants, thus magnifying the impact in the overall gap.

## Table 8. Factors that have Contributed to the Glass Ceiling

**Marginal Effects of the Probability of Reaching Different Levels in the SNI for Women**

| | **Panel A.** | | | **Panel B.** | | |
|---|---|---|---|---|---|---|
| | Excluding "original" SNI members | | | Controlling for gender CTA composition | | |
| | Rejection | Low rank | High rank | Rejection | Low rank | High rank |
| Marginal effect female (A) | 0.051*** | -0.032*** | -0.018*** | 0.055*** | -0.030*** | -0.025*** |
| | (0.011) | (0.007) | (0.005) | (0.011) | (0.007) | (0.005) |
| Unconditional prob.(B) | 44% | 48% | 8% | 44% | 47% | 9% |
| (A)/(B) | 11% | -7% | -22% | 13% | -6% | -29% |
| Observations | 6,679 | 6,679 | 6,679 | 6,751 | 6,751 | 6,751 |

**Decomposition of the Probability of Reaching Different SNI Ranks**

| | **Panel C.** | | | | | | **Panel D.** | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Excluding "original" SNI members | | | | | | Controlling for gender CTA composition | | | | | |
| | Rejected | | Low rank | | High rank | | Rejected | | Low Rank | | High rank | |
| | Coef. | % | Coef. | % | Coef. | % | Coef. | % | Coef. | % | Coef. | % |
| Char | 0.038*** | 60% | -0.013** | 197% | -0.026 | 44% | 0.044*** | 61% | -0.015*** | -813% | -0.031*** | 41% |
| Coef | 0.026** | 40% | 0.006 | -97% | -0.034 | 56% | 0.028*** | 38% | 0.017 | 913% | -0.044*** | 58% |
| Raw | 0.064*** | 100% | -0.007 | 100% | -0.059 | 100% | 0.068*** | 100% | -0.002 | 100% | -0.075*** | 100% |

Source: Authors' calculations based on CVuy.
Note: The dependent variable in Panel A is a dummy that takes the value 0 if rejected, 1 if accepted at the low rank (Entry or Level I), and 2 if accepted at high rank (Level II or III). The dependent variables for Panels C and D are dummies for being rejected, accepted at low rank, or being accepted at high rank, respectively The regressions have the same control variables as in Table 4. Clustered standard errors in parentheses. ***statistically significant at 1%, **statistically significant at 5%, *statistically significant at 10%.

**Table 9. Differentiated Field Effects**

| | Agricultural sciences | | | Medical sciences | | |
|---|---|---|---|---|---|---|
| | Rejection | Low rank | High rank | Rejection | Low rank | High rank |
| Marginal effect female (A) | 0.003 | -0.009 | 0.005 | 0.104*** | -0.048** | -0.055*** |
| | (0.030) | (0.021) | (0.009) | (0.032) | (0.024) | (0.014) |
| Unconditional prob.(B) | 53% | 42% | 5% | 41% | 51% | 8% |
| (A)/(B) | 1% | -2% | 10% | 25% | -9% | -69% |
| Observations | 1,047 | 1,047 | 1,047 | 858 | 858 | 858 |
| | Natural sciences | | | Social sciences | | |
| | Rejection | Low rank | High rank | Rejection | Low rank | High rank |
| Marginal effect female (A) | 0.065*** | -0.016 | -0.049*** | 0.027 | -0.021 | -0.006 |
| | (0.016) | (0.012) | (0.014) | (0.024) | (0.019) | (0.006) |
| Unconditional prob.(B) | 35% | 50% | 15% | 50% | 45% | 5% |
| (A)/(B) | 19% | -3% | -33% | 5% | -5% | -12% |
| Observations | 2,008 | 2,008 | 2,008 | 1,558 | 1,558 | 1,558 |
| | Humanities | | | Engineering | | |
| | Rejection | Low rank | High rank | Rejection | Low rank | High rank |
| Marginal effect female (A) | 0.077** | -0.032 | -0.045** | 0.082** | -0.062*** | -0.020 |
| | (0.034) | (0.023) | (0.018) | (0.033) | (0.023) | (0.014) |
| Unconditional prob.(B) | 43% | 48% | 9% | 42% | 50% | 8% |
| (A)/(B) | 18% | -7% | -50% | 20% | -12% | -25% |
| Observations | 602 | 602 | 602 | 678 | 678 | 678 |

Source: Authors' calculations based on CVuy.
Note: Estimations based on probit models. Dependent variable are dummies for being rejected from the SNI, accepted at low rank (Entry or Level I) or accepted at high rank (Level II or III). The control variables are the same as in Table 5. Clustered standard errors in parentheses.
***statistically significant at 1%, **statistically significant at 5%, *statistically significant at 10%.

## 8. Discussion

This paper presents evidence that female researchers have a 7.1 percentage point lower probability of being accepted into SNI, Uruguay's largest national research support program. We find that this gender gap is wider for the upper ranks of the SNI hierarchy, where women are largely underrepresented.

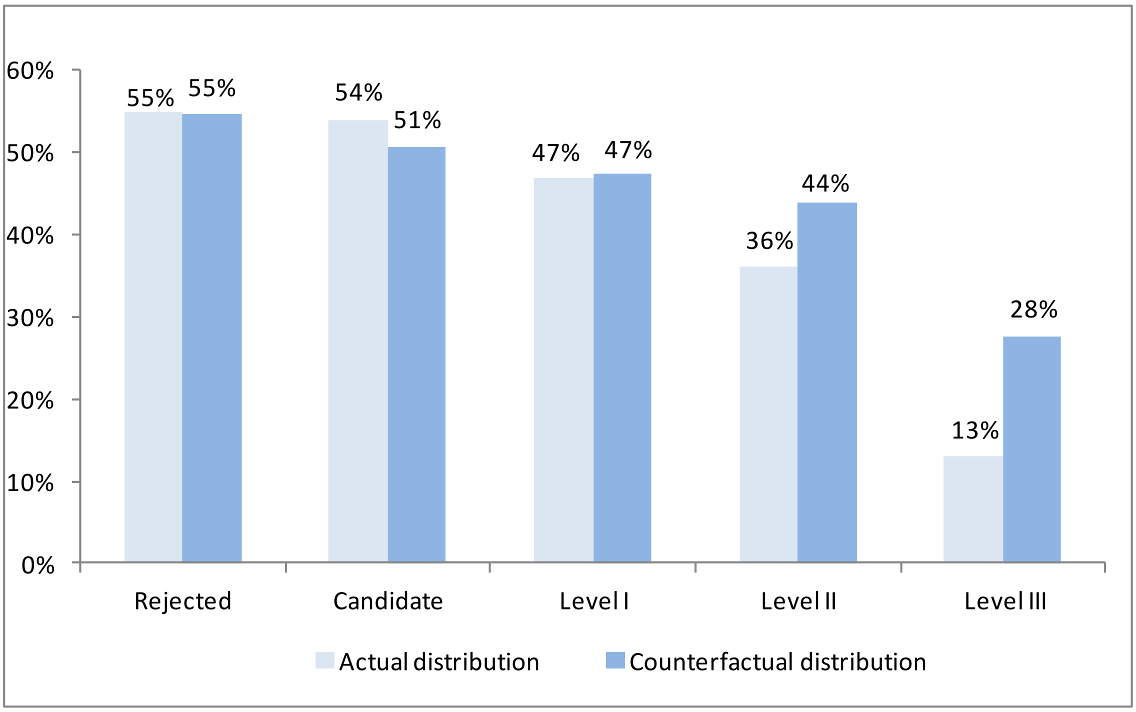
We also show that the academic achievements (article and book production, human capital formation) of women in S&T are statistically fewer than those of men. These differences in observable characteristics explain 4.9 percentage points of the average 7.1 percentage point probability gap. Considering the decomposition for the different SNI levels, we find that observable characteristics explain a higher proportion of the probability of being rejected but a lower proportion of attaining a high rank. This evidence supports the existence of a glass ceiling effect within the SNI system.

One way of estimating the costs of the glass ceiling is to compute the counterfactual SNI distribution in the absence of gender discrimination. That is, if there were no differential treatment of men and women, how many women would be in the SNI? How many of them would be in the highest ranks of the system? To answer this question, we implemented an automatic gender-blind allocation device that evaluates whether applicants should be accepted to the SNI and at what level. First, we estimate an ordered probit model as presented before but without including a control dummy variable for female researchers.[10] Second, we obtain for each researcher the expected value of the dependent variable given its observables, $E(Y_i|X_i)$. Third, we rank the researchers in descending order based on this latter predicted value. Fourth, we assign the top researchers to Level III, the next one to Level II, the next one to Level I, and so on. Care should be taken to ensure that the overall actual and counterfactual distributions have the same number of researchers in each level. In the actual data, we have 112 applications evaluated at Level III, 480 applications evaluated at Level II, 1,512 at Level III, 1,694 at Entry Level, and 2,953 rejected applications. Therefore, the top 112 applications (according to $E(Y_i|X_i)$) are allocated to Level III, the next 480 are allocated to Level II, the next 1,512 to Level I, and so forth.

This method enables predictions of the position of each individual inside or outside of the system. The exercise is similar in spirit to the Oaxaca-Blinder decomposition. It answers the question of how the system would look if the returns to their personal characteristics were equal for all. Figure 3 presents the actual and counterfactual proportion of women at each level. The SNI has a substantially lower representation of women at Levels II and III. Instead of the 36% of female researchers in Level II and 13% in Level III, the SNI should have had 44% and 28%, respectively. This has budgetary implications. A back-of-the-envelope calculation is illustrative. Until 2015, the SNI gave incentives amounting to US$42.6 million. Using the value of the subsidies in 2015, those of high rank represent 23% of the SNI budget (about USS$10 million). Currently, the gender division of this budget is 70-30 in favor of men. According to the counterfactual SNI distributions, it should be 60-40. Thus, about US$1 million were allocated to male researchers that should have been allocated to female researchers.

[10] The same can be done using an ordered probit model based only on male or female researchers and making an out of sample prediction for all applicants. The counterfactual estimates are very similar in all cases.

**Figure 3. Actual and Counterfactual Proportion of Women per SNI Level**




Source: Authors' elaboration based on CVuy.

What are the implications of our results? In terms of policy, the first step is to acknowledge the gender gap presented here. Authorities with a clear gender orientation could help to reduce subtle impediments to career advancement for female scientists. This is especially important in fields where women are overrepresented among the applicants but where the glass ceiling effects are stronger: the medical sciences, the natural sciences, and the humanities.

Moreover, glass ceilings deserve a different set of policies than gender issues at the entry or lower levels. The overall picture presented in this paper suggests that although women have a lower probability of attaining the lower and higher ranks of the SNI, the problem is much worse at the top of the system. In some fields, the presence of women is null or almost null in Level III. The decomposition exercises suggest that this is not due to fewer academic achievements of women in these areas.

The "original sin" will eventually disappear over time, but at the present time, females remain to this day underrepresented in the SNI evaluation committees. This is also a reflection of the glass ceiling. Since there are fewer women at the top of the system, there are fewer eligible women to serve on evaluation committees. Given our results, it would be worth attempting to increase the number of women in the CTAs in the hope that this could, in the medium term, help eliminate the glass ceiling.

The production of knowledge within a country has a direct impact on its growth and development. This is why the development of a strong scientific community could benefit overall well-being. Some types of scientific knowledge can be patented, and their inventors can profit from the returns. However, this is not the norm. In most cases, scientific knowledge becomes a public good through its publication in academic journals or other means of dissemination. The positive externalities of research are the reason that governments support these activities. ANII was created with the specific goal of promoting innovation and research and applying new knowledge to production and society in Uruguay.

The country's national scientific output can be considered the result of a production function. Human capital and the research budget are the most important factors in this production function, and they are clearly complementary. Having the best human capital among the country's scientific community is the best way to improve the quantity and quality of scientific knowledge and its application to production and development. Gender gaps in accessing national research programs do not provide the right incentives for women to be involved in research activities. It also reduces the quantity and quality of human capital in the research production function.

Moreover, top SNI researchers are generally in charge of research teams. They define new lines of work because they have peer recognition and institutional support. For example, the research budget of faculty members in some local universities depends on the SNI level of their researchers. Female underrepresentation at the highest levels implies that the country does not have some of its top minds commanding its research teams. It implies that research budgets are lower than what they could be even given the constraints of a developing country like Uruguay. This manpower constraint affects research output and ultimately the country's productivity, growth, and development.

Finally, role models are important in societies. Children and adolescents look to role models when making life decisions. The lack of women in top research positions may affect the pool of researchers in the medium term by affecting decisions that young girls are making today about their studies and career path. S&T popularization programs have the specific goal of making S&T available to the population to attract future scientists. It is advisable to have a gender focus in these programs that exposes high school and university women to successful female role models.

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**Appendix (probably Online)**

**Table A1. Descriptive Statistics by Field**

| | Agricultural sciences | | | Medical sciences | | | Natural sciences | | |
|---|---|---|---|---|---|---|---|---|---|
| | Male | Female | Diff. | Male | Female | Diff. | Male | Female | Diff. |
| *Sociodemographics* | | | | | | | | | |
| Age | 45.4 | 43.2 | 2.2*** | 44.3 | 42.3 | 2.0*** | 42.8 | 39.9 | 2.8*** |
| *Human capital* | | | | | | | | | |
| Ph.D. degree | 0.38 | 0.36 | 0.02 | 0.465 | 0.43 | 0.03 | 0.59 | 0.49 | 0.10*** |
| *S&T productivity (average of the last three years)* | | | | | | | | | |
| Articles in refereed journals | 0.68 | 0.62 | 0.06 | 1.52 | 1.02 | 0.49*** | 1.41 | 0.90 | 0.51*** |
| Books and chapters in books | 0.87 | 0.59 | 0.27*** | 0.80 | 0.60 | 0.20*** | 0.57 | 0.45 | 0.11*** |
| Impact factor | 0.27 | 0.31 | -0.04 | 1.20 | 1.04 | 0.16* | 1.01 | 0.81 | 0.20*** |
| Articles (impact factor weighted) | 1.30 | 1.25 | 0.04 | 2.88 | 2.15 | 0.72*** | 2.53 | 1.97 | 0.56*** |
| *Human capital formation (average of the last three years)* | | | | | | | | | |
| Dissertations advised | 1.15 | 0.98 | 0.17* | 0.87 | 0.62 | 0.25*** | 0.95 | 0.70 | 0.24*** |
| Undergraduate teaching | 0.48 | 0.56 | -0.08*** | 0.42 | 0.47 | -0.00 | 0.59 | 0.62 | -0.026 |
| Graduate teaching | 0.22 | 0.30 | -0.08*** | 0.10 | 0.18 | -0.07*** | 0.25 | 0.25 | 0.00 |
| *Institutional affiliation* | | | | | | | | | |
| Full-time position | 0.24 | 0.28 | -0.03 | 0.35 | 0.31 | 0.03 | 0.45 | 0.39 | 0.06*** |
| Universidad de la República | 0.49 | 0.60 | -0.10*** | 0.75 | 0.67 | 0.07** | 0.74 | 0.74 | -0.00 |
| Private universities | 0.00 | 0.00 | 0.00 | 0.02 | 0.04 | -0.02 | 0.00 | 0.00 | 0.00** |
| *SNI evaluation* | | | | | | | | | |
| Rejected | 0.52 | 0.52 | 0.00 | 0.33 | 0.46 | -0.12*** | 0.28 | 0.40 | -0.12*** |
| Low rank | 0.42 | 0.41 | 0.01 | 0.52 | 0.51 | 0.00 | 0.48 | 0.51 | -0.02 |
| High rank | 0.04 | 0.06 | -0.01 | 0.14 | 0.02 | 0.12*** | 0.23 | 0.07 | 0.15*** |
| | **Social sciences** | | | **Humanities** | | | **Engineering** | | |
| *Sociodemographics* | | | | | | | | | |
| Age | 44.1 | 43.6 | 0.5 | 46.8 | 44.7 | 2.1** | 40.1 | 41.4 | -1.2 |
| *Human capital* | | | | | | | | | |
| Ph.D. degree | 0.38 | 0.29 | 0.08*** | 0.40 | 0.31 | 0.08** | 0.43 | 0.39 | 0.04 |
| *S&T productivity (average of the last three years)* | | | | | | | | | |
| Articles in refereed journals | 0.24 | 0.17 | 0.07*** | 0.23 | 0.18 | 0.04 | 0.47 | 0.64 | -0.16** |
| Books and chapters in books | 1.47 | 1.35 | 0.11* | 1.609 | 1.43 | 0.18* | 0.27 | 0.29 | -0.02 |
| Impact Factor | 0.04 | 0.04 | 0.00 | 0.02 | 0.013 | 0.01 | 0.27 | 0.32 | -0.05 |
| Articles (impact factor weighted) | 0.167 | 0.118 | 0.04* | 0.07 | 0.061 | 0.01 | 1.07 | 1.30 | -0.23* |
| *Human capital formation (average of the last three years)* | | | | | | | | | |
| Dissertations advised | 0.97 | 1.07 | -0.09 | 0.43 | 0.62 | -0.19* | 1.21 | 0.73 | 0.47*** |
| Undergraduate teaching | 0.67 | 0.64 | 0.03 | 0.66 | 0.57 | 0.09** | 0.75 | 0.71 | 0.04 |
| Graduate teaching | 0.28 | 0.26 | 0.02 | 0.14 | 0.14 | 0.00 | 0.29 | 0.22 | 0.06* |
| *Institutional affiliation* | | | | | | | | | |
| Full-time position | 0.23 | 0.21 | 0.01 | 0.25 | 0.25 | -0.001 | 0.35 | 0.46 | -0.11*** |
| Universidad de la República | 0.59 | 0.63 | -0.04* | 0.78 | 0.74 | 0.043 | 0.70 | 0.74 | -0.04 |
| Private universities | 0.21 | 0.133 | 0.08*** | 0.10 | 0.04 | 0.054** | 0.17 | 0.07 | 0.10*** |
| *SNI level* | | | | | | | | | |
| Rejected | 0.48 | 0.52 | -0.04 | 0.38 | 0.47 | -0.09** | 0.41 | 0.44 | -0.03 |
| Low rank | 0.45 | 0.44 | 0.01 | 0.48 | 0.47 | 0.01 | 0.51 | 0.48 | 0.03 |
| High rank | 0.05 | 0.03 | 0.02** | 0.12 | 0.04 | 0.08*** | 0.07 | 0.07 | -0.00 |

Source: Authors' elaboration based on Cvuy.
Note ***statistically significant at 1%, **statistically significant at 5%, *statistically significant at 10%.

## Table A2. Marginal Effects for Full List of Covariates

| | Panel A. Ordered probit model | | | | | Panel B. Ordered probit model | | |
|---|---|---|---|---|---|---|---|---|
| | Outcome= Rejection | Outcome= Entry | Outcome= Level I | Outcome= Level II | Outcome= Level III | Outcome= Rejection | Outcome= Low rank | Outcome= High rank |
| Female | 0.060*** | -0.002 | -0.025*** | -0.018*** | -0.008*** | 0.053*** | -0.031*** | -0.021*** |
| | (0.010) | (0.003) | (0.005) | (0.003) | (0.002) | (0.011) | (0.007) | (0.005) |
| (Age-40)/10 | -0.136*** | 0.006* | 0.038*** | 0.025*** | 0.011*** | -0.106*** | 0.071*** | 0.024*** |
| | (0.005) | (0.003) | (0.003) | (0.002) | (0.001) | (0.006) | (0.005) | (0.003) |
| Articles in refereed journals | -0.111*** | 0.011*** | 0.044*** | 0.026*** | 0.010*** | -0.122*** | 0.075*** | 0.040*** |
| | (0.008) | (0.001) | (0.004) | (0.002) | (0.001) | (0.011) | (0.007) | (0.004) |
| Books and chapters in books | -0.036*** | 0.003*** | 0.014*** | 0.008*** | 0.003*** | -0.036*** | 0.022*** | 0.011*** |
| | (0.007) | (0.001) | (0.003) | (0.002) | (0.001) | (0.008) | (0.005) | (0.003) |
| Impact factor | -0.044*** | 0.004*** | 0.018*** | 0.010*** | 0.004*** | -0.045*** | 0.028*** | 0.015*** |
| | (0.006) | (0.001) | (0.002) | (0.001) | (0.001) | (0.006) | (0.004) | (0.002) |
| Undergraduate teaching | -0.055*** | 0.005*** | 0.022*** | 0.013*** | 0.005*** | -0.064*** | 0.039*** | 0.021*** |
| | (0.012) | (0.001) | (0.005) | (0.003) | (0.001) | (0.013) | (0.008) | (0.005) |
| Graduate teaching | -0.165*** | 0.014*** | 0.057*** | 0.033*** | 0.013*** | -0.162*** | 0.100*** | 0.046*** |
| | (0.013) | (0.002) | (0.006) | (0.004) | (0.002) | (0.014) | (0.009) | (0.005) |
| Observations | 6,751 | 6,751 | 6,751 | 6,751 | 6,751 | 6,751 | 6,751 | 6,751 |
| Year dummies | YES | YES | YES | YES | YES | YES | YES | YES |
| Field dummies | YES | YES | YES | YES | YES | YES | YES | YES |

Source: Authors' calculations based on CVuy.

Note. The dependent variable of Panel A takes the following values: 0 if rejected; 1 if accepted at Entry Level, 2 if accepted at Level I, 3 if accepted at Level II and 4 if accepted at Level III. The dependent variable of Panel B takes the following values: 0 if rejected; 1 if accepted at Entry Level or Level I and II if accepted at Level II or III. Clustered standard errors in parentheses. ***statistically significant at 1%, **statistically significant at 5%, *statistically significant at 10%.

**Table A3. Estimations Controlling for Initial Productivity (marginal effects)**

| | | Ordered Probit | | |
|---|---|---|---|---|
| | Probit | Outcome= Rejection | Outcome= Low rank | Outcome= High rank |
| Female (A) | -0.0293** | 0.057*** | -0.033*** | -0.024*** |
| | (0.0119) | (0.011) | (0.007) | (0.005) |
| Age | 0.0718*** | -0.0828*** | 0.0553*** | 0.0275*** |
| | (0.00727) | (0.00669) | (0.00515) | (0.00289) |
| Articles in refereed journals | 0.156*** | -0.111*** | 0.071*** | 0.041*** |
| | (0.012) | (0.011) | (0.007) | (0.004) |
| Impact factor | 0.0237** | -0.0324*** | 0.0206*** | 0.0118*** |
| | (0.010) | (0.008) | (0.005) | (0.003) |
| Books and book chapters | 0.045*** | -0.042*** | 0.027*** | 0.015*** |
| | (0.007) | (0.006) | (0.004) | (0.002) |
| Undergraduate teaching | 0.064*** | -0.034*** | 0.025*** | 0.014*** |
| | (0.013) | (0.013) | (0.008) | (0.005) |
| Graduate teaching | 0.120*** | -0.128*** | 0.081*** | 0.045*** |
| | (0.014) | (0.014) | (0.0089) | (0.005) |
| Entry productivity | 0.009*** | -0.000 | 0.000 | 0.000 |
| | (0.0015) | (0.001) | (0.000) | (0.000) |
| Observations | 6,751 | 6,751 | 6,751 | 6,751 |
| Year dummies | YES | YES | YES | YES |
| Field dummies | YES | YES | YES | YES |
| Unconditional probability (B) | | 44% | 47% | 9% |
| (A)/(B) | | 13% | -7% | -27% |

Source: Authors' calculations based on CVuy.

Note: The dependent variable in column 1 is a dummy for being accepted into the SNI. The last three columns are an ordered variable that takes the value 0 if rejected, 1 if accepted at Entry or Level I and 2 if accepted at Level II or III. Clustered standard errors in parentheses. ***statistically significant at 1%, **statistically significant at 5%, *statistically significant at 10%.

**Table A4. Estimations including only first year observations (first application to SNI in 2008)**
**(marginal effects)**

| | Probit | Ordered Probit Outcome= Rejection | Ordered Probit Outcome= Low rank | Ordered Probit Outcome= High rank |
|---|---|---|---|---|
| Female (A) | -0.046** | 0.063*** | -0.018* | -0.045*** |
| | (0.019) | (0.016) | (0.010) | (0.010) |
| Age | 0.074*** | -0.115*** | 0.056*** | 0.059*** |
| | (0.009) | (0.009) | (0.007) | (0.005) |
| Articles in refereed journals | 0.122*** | -0.101*** | 0.046*** | 0.055*** |
| | (0.014) | (0.008) | (0.005) | (0.005) |
| Impact factor | 0.054*** | -0.032*** | 0.014*** | 0.017*** |
| | (0.014) | (0.008) | (0.004) | (0.004) |
| Books and book chapters | 0.061*** | -0.052*** | 0.023*** | 0.028*** |
| | (0.009) | (0.008) | (0.004) | (0.004) |
| Undergraduate teaching | 0.124*** | -0.069*** | 0.031*** | 0.038*** |
| | (0.020) | (0.018) | (0.008) | (0.010) |
| Graduate teaching | 0.166*** | -0.132*** | 0.060*** | 0.072*** |
| | (0.021) | (0.018) | (0.008) | (0.010) |
| Full-time position | 0.211*** | -0.204*** | 0.092*** | 0.112*** |
| | (0.021) | (0.017) | (0.009) | (0.010) |
| Observations | 1,802 | 1,802 | 1,802 | 1,802 |
| Year dummies | YES | YES | YES | YES |
| Field dummies | YES | YES | YES | YES |
| Unconditional probability (B) | | 43% | 42% | 15% |
| (A)/(B) | | 15% | -4% | -30% |

Source: Authors' calculations based on CVuy.
Note. The dependent variable in column 1 is a dummy for being accepted into the SNI. The last three columns is an ordered variable that takes the value 0 if rejected, 1 if accepted at Entry or Level I and 2 if accepted at Level II or III. Clustered standard errors in parentheses. ***statistically significant at 1%, **statistically significant at 5%, *statistically significant at 10%.

**Table A5. Estimations using a Reduced Version (marginal effects)**

| | Probit | Ordered probit | | |
|---|---|---|---|---|
| | | Outcome=Rejection | Outcome= Low Rank | Outcome= High rank |
| Female (A) | -0.031** | 0.058*** | -0.036*** | -0.022*** |
| | (0.013) | (0.010) | (0.007) | (0.004) |
| Age | 0.075*** | -0.114*** | 0.078*** | 0.036*** |
| | (0.006) | (0.005) | (0.004) | (0.002) |
| Articles (impact factor weighted) | 0.151*** | -0.123*** | 0.078*** | 0.046*** |
| | (0.006) | (0.003) | (0.003) | (0.002) |
| Observations | 6,751 | 6,751 | 6,751 | 6,751 |
| Year dummies | YES | YES | YES | YES |
| Field dummies | YES | YES | YES | YES |
| Unconditional probability (B) | | 44% | 47% | 9% |
| (A)/(B) | | 13% | -8% | -24% |

Source: Authors' calculations based on CVuy.

Note. The dependent variable in column 1 is a dummy for being accepted into the SNI. The last three columns is an ordered variable that takes the value 0 if rejected, 1 if accepted at Entry or Level I and 2 if accepted at Level II or III. Clustered standard errors in parentheses. ***statistically significant at 1%, **statistically significant at 5%, *statistically significant at 10%.

## Table A6. Robustness Exercises: Probability Decompositions

| | Prob. accessing SNI | | Prob of being rejected | | Prob of being accepted at low rank | | Prob of being accepted at high rank | |
|---|---|---|---|---|---|---|---|---|
| **Panel A.** Estimations controlling for initial productivity | | | | | | | | |
| Char | -0.042*** | 59% | 0.042*** | 59% | -0.018*** | -743% | -0.031*** | 42% |
| Coef | -0.029*** | 41% | 0.029*** | 41% | 0.020 | 843% | -0.044*** | 58% |
| Raw | -0.072*** | 100% | -0.072*** | 100% | 0.002 | 100% | -0.075*** | 100% |
| **Panel B.** Estimations including only first-year observations | | | | | | | | |
| Char | -0.077*** | 62% | 0.077*** | 62% | -0.0281*** | 1876% | -0.067*** | 54% |
| Coef | -0.047*** | 38% | 0.047*** | 38% | 0.027 | -1776% | -0.058*** | 46% |
| Raw | -0.124*** | 100% | 0.124*** | 100% | -0.001 | 100% | -0.125*** | 100% |
| **Panel C.** Estimations using only the weighted sum of publication as productivity indicator | | | | | | | | |
| Char | -0.041*** | 57% | 0.040*** | 57% | -0.017** | -680% | -0.025*** | 34% |
| Coef | -0.030** | 43% | 0.030** | 43% | 0. 014 | 780% | -0.050*** | 66% |
| Raw | -0.072*** | 100% | 0.072*** | 100% | 0.002 | 100% | -0.075*** | 100% |

Source: Authors' calculations based on CVuy.

Note: Reference group: women. Estimations based on probit models. Dependent variable in the first column is a dummy for being accepted into the SNI. In the following columns, the dependent variables are dummies for being rejected, accepted at low rank (Entry or Level I), or being accepted at high rank (Level II or III), respectively. The regressions for the decompositions of Panels A and B have the same control variables as in Table 4. Clustered standard errors in parentheses. ***statistically significant at 1%, **statistically significant at 5%, *statistically significant at 10%.

## Table A7. Marginal Effects for Women Controlling for Gender Composition of CTA (marginal effects)

| | | Ordered Probit | | |
|---|---|---|---|---|
| | Probit | Outcome= Rejection | Outcome= Low rank | Outcome= High rank |
| Female (A) | -0.032*** | 0.055*** | -0.030*** | -0.025*** |
| | (0.012) | (0.011) | (0.007) | (0.005) |
| Age | 0.044*** | -0.081*** | 0.053*** | 0.028*** |
| | (0.006) | (0.006) | (0.005) | (0.003) |
| Articles in refereed journals | 0.182*** | -0.113*** | 0.071*** | 0.042*** |
| | (0.013) | (0.011) | (0.007) | (0.004) |
| Impact Factor | 0.023** | -0.032*** | 0.020*** | 0.012*** |
| | (0.011) | (0.008) | (0.005) | (0.003) |
| Books and chapters in books | 0.048*** | -0.043*** | 0.027*** | 0.016*** |
| | (0.007) | (0.006) | (0.004) | (0.002) |
| Undergraduate teaching | 0.067*** | -0.038*** | 0.024*** | 0.014*** |
| | (0.013) | (0.013) | (0.008) | (0.005) |
| Graduate teaching | 0.131*** | -0.131*** | 0.082*** | 0.049*** |
| | (0.014) | (0.013) | (0.009) | (0.005) |
| % of females in CTA | 0.010 | 0.017 | -0.007 | -0.011 |
| | (0.030) | (0.026) | (0.017) | (0.010) |
| Observations | 6,751 | 6,751 | 6,751 | 6,751 |
| Year dummies | | YES | YES | YES |
| Field dummies | | YES | YES | YES |
| Unconditional probability (B) | | 44% | 47% | 9% |
| (A)/(B) | | 13% | -6% | -29% |

Source: Authors' calculations based on CVuy.
Note. The dependent variable in column 1 is a dummy for being accepted into the SNI. The last three columns are an ordered variable that takes the value 0 if rejected, 1 if accepted at Entry or Level I and 2 if accepted at Level II or III. Clustered standard errors in parentheses. ***statistically significant at 1%, **statistically significant at 5%, *statistically significant at 10%.

## Table A8. Decomposition of the Probability of Reaching Different SNI Ranks by Field

| | Agricultural sciences | | | | | | | Medical sciences | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Rejected | | Low Rank | | High rank | | | Rejected | | Low rank | | High rank | |
| | Coef. | % | Coef. | % | Coef. | % | | Coef. | % | Coef. | % | Coef. | % |
| Char | 0.004 | 427% | 0.002 | -25% | -0.006 | -109% | Char | 0.049* | 36% | -0.023 | 6604% | -0.016 | 12% |
| Coef | -0.003 | -327% | -0.011 | 125% | 0.010 | 209% | Coef | 0.085* | 64% | -0.023 | 6504% | -0.119*** | 88% |
| Raw | 0.001 | 100% | -0.008 | 100% | 0.005 | 100% | Raw | 0.134*** | 100% | -0.000 | 100% | -0.136*** | 100% |
| | Natural sciences | | | | | | | Social sciences | | | | | |
| | Rejected | | Low rank | | High rank | | | Rejected | | Low rank | | High rank | |
| Char | 0.100*** | 77% | -0.040 | -144% | -0.091*** | 57% | Char | 0.043*** | 92% | -0.023 | 155% | -0.007 | 23% |
| Coef | 0.029* | 23% | 0.068 | 244% | -0.067*** | 43% | Coef | 0.003 | 8% | 0.008 | -55% | -0.023* | 77% |
| Raw | 0.127*** | 100% | 0.028 | 100% | -0.159*** | 100% | Raw | 0.047* | 100% | -0.015 | 100% | -0.030** | 100% |
| | Humanities | | | | | | | Engineering | | | | | |
| | Rejected | | Low Rank | | High rank | | | Rejected | | Low rank | | High rank | |
| Char | 0.040 | 41% | -0.017 | 188% | -0.009 | 10% | Char | -0.046 | -167% | 0.003 | -11% | 0.048*** | 3698% |
| Coef | 0.056 | 59% | 0.008 | -88% | -0.075*** | 90% | Coef | 0.073* | 267% | -0.036 | 111% | -0.047*** | -3598% |
| Raw | 0.096** | 100% | -0.009 | 100% | -0.092*** | 100% | Raw | 0.027 | 100% | -0.033 | 100% | 0.004 | 100% |

Source: Authors' calculations based on CVuy.
Note: Reference group is females. Estimations based on probit models. Dependent variable are dummies for being rejected from the SNI, accepted at low rank (Entry or Level I) or accepted at high rank (Level II or III). The control variables are the same as in Table 5. Clustered standard errors in parentheses. ***statistically significant at 1%, **statistically significant at 5%, *statistically significant at 10%.