Glass ceiling in research: evidence from a national program in Uruguay.

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Abstract

We present evidence that female researchers have 7.1 percentage points lower probability of being accepted into the largest national research support program in Uruguay compared to males. They also have lower research productivity than their male counterparts. Differences in observable characteristics explain 4.9 of the 7.1 percentage points gap. We show that the gender gap is wider at the higher ranks of the program consistent with the existence of a glass ceiling. The results are robust to issues of bidirectionality (impact of research productivity on the probability of accessing the program and impact of the program on research productivity), joint determination and correlation of variables (e.g. having a Ph.D., publishing and tutoring) and initial productivity effects (positive results at early stages may have long term effects on career development). We present three hypotheses for the gender gap (an original sin in the organization of the system, biases in the composition of evaluation committees, and differences in field of concentration) and find some evidence for each. Glass ceilings are stronger in the fields where females are overrepresented among the applicants to the system: Medical sciences, Natural sciences and Humanities. Finally, we present a counterfactual distribution of the program in the absence of discriminatory treatment of women and discuss the economic costs of the gender gap.

Keywords: Science and Technology, gender discrimination, glass ceiling, probability, decomposition,

Sistema Nacional de Investigadores (SNI), Uruguay.

JEL codes: J16, J4, J71

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1. Introduction

There is a large literature on gender discrimination that has been applied to almost every single country in the world. The seminal works of Blinder (1973) and Oaxaca (1973) provided a methodology to decompose the wage gap into a part due to differences in observable characteristics (e.g. education, experience) of males and females and a part 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 assimilated to discrimination but this view has been criticized and alternative explanations provided (among them differences in preferences and omitted variables).

The concept of glass ceilings refers to a set of impediments to career advancement for women. Organizational policies and practices that disproportionally and negatively impact females 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 et al (2014) shows that sticky floors and glass ceiling are present in most Latin American countries. The authors show that since female's educational level is above male's education, the observed gender gap is an understatement of the disadvantaged situation of females in the labor market. This is particularly true at the bottom and top of the wage distribution (sticky floors and glass ceilings). Christofides et al (2013), also using quantile regressions, present evidence of glass ceilings in many European countries. There are many other papers that perform detailed analysis of country cases. [1]

In Latin America, although the enrollment rate of females in secondary and tertiary education exceeds that of males' (UNESCO 2015, World Bank 2012), the percentage of females in science and technology (S&T) is lower than that of males. 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 (or Sistema Nacional de Investigadores in Spanish, abbreviated by SNI).

[1] Among others: Albrecht et al. (2003) for Sweden, Albrecht et al. (2009) for Netherlands, Borraz and Robano (2010) for Uruguay and de la Rica et al. (2008) for Spain.

The SNI is a nationwide system of subsidies for researchers provided by the National Agency for Research and Innovation (or Agencia Nacional de Investigación e Innovación in Spanish, abbreviated by 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. quantity of scholarships for tutoring students). Bernheim et al. (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 instance, females 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. Focus on the academia offers the advantage that individual's on-the-job-productivity can for the most part be measured by research output. This is observed by authorities and colleges. Ginther and Hayes (1999) report a wage gender gap of 9% in favor of men in the US. Using data for Scotland, Ward (2001) find that females earn 26% less than males. 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 points 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 the 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 females and that 7.6 of these 12.2 points cannot be explained by differences in productivity. Using a random-effects probit model, McDowell et al. (2001) concluded that on average women are 36% less likely to be promoted to the assistant professor rank and 9% less likely to be promoted to the full professor rank in the US.

In this paper we combine two literatures: gender differences in labor economics and characterization of S&T public programs. Our contribution lies on the analysis of a developing country that nevertheless has 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 focusing on promotions in the S&T arena and none specifically addressing how the professional hierarchy is established neither testing 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 merits 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 females and males 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 females at the highest hierarchy level of the SNI should be about two times the current amount. The actual distribution of males and females within the SNI implies that about 70% of the SNI budget goes to male researchers and 30% to females. 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. In section 2 we introduce the institutional framework and describe 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. In section 7 we test three potential explanations for the gender gaps reported and in section 8 we discuss the implications and limitations of our 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 economics incentives that stimulates scientific production. Since its creation there have been yearly summons to apply to the SNI. By 2015, the eighth call was reached. The SNI is managed by the ANII, which was created by the Government in 2006 as a key player to foster and support research and application of knowledge to production in Uruguay, and fund research and scholarships in S&T as well as entrepreneurs.

The SNI was implemented in a top to bottom way to create an evaluation structure that could assign researchers to the different levels. The Government created the SNI in 2007 and designated an Honorary Commission of five members (CH) in charge of it. The CH is comprised of renowned scientists holding positions in scientific or government institutions. This commission is in charge of the SNI operations. One of it mains tasks is to name the members of the Selection Committee (CS). The CS is composed of two to four members for each field of knowledge. It is in charge of selecting 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 to 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 for the first time 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 (almost all Level III). 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. In order to apply for entry to the SNI the researchers must complete an online standard resume including education, professional experience, scientific production, etc. 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 merits and scientific production, researchers can be rejected from or accepted into the SNI in one of its four levels or categories: Initiation to research, Level I, Level II and Level III. The lower level, Initiation to research, groups junior researchers while the higher level, Level III, comprises the most reputed local scientists. Once accepted into the SNI researchers sign a contract with the ANII for 2, 3 or 4 years depending on the level reached and the overall result of the evaluation. After that time, researchers have to reapply to remain in the system. There is a lot of inertia within the SNI. A non-written rule that was mentioned to us by a former CS member is that there are no demotions within the system unless the researcher deserves to be completely out of the SNI. For instance, 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 note continue in the SNI as a level I (or Initial level) researcher.

Applicants to the SNI are also classified by the place of residence. Only those living in Uruguay are entitled to receive the SNI subsidy. They are called the active members of the SNI. Those not living in Uruguay can also apply and be categorized within the system but do not receive any subsidy. They are called the associated members of the SNI. In this paper we work only with the active members.

The scheme of the SNI gives a differential economic incentive depending of 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 Initiation and Levels I, II and III respectively.[2] How important is the SNI subsidy for researchers depends on their salary at their home institution. Most national researchers are affiliated to the state owned Universidad de la República. The Universidad de la República ranks its faculty in five levels: two teaching or research assistant levels (level 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 1st 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]

Up through December 2015, the SNI 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 resources formation. In 2015, the SNI comprised 1,438 active researchers: 460 (32%) at the Initial Level, 623 (43%) at Level I, 281 (20%) at Level II and 74 (5%) al Level III.

3. Data

In this paper we use data from the online CVs data system called CVuy. This allow us to access the researchers' status regarding their category in the SNI together with their scientific production and academic merits and other relevant information such as date of birth, gender, place of residence, academic affiliation, years of experience, etc. The researchers' academic production can be measured in the following dimensions: papers published in refereed journals (with some indication of journal quality according to indexing in the Journal Citation Report of Thomson Reuters), technical production, books and chapters in books, conference presentations, tutoring of Masters and PhD candidates.

In our database we have information on 3,196 researchers: 1,619 females and 1,577 males (50.7% and 49.3%). As we have longitudinal data for 7 years (corresponding to 2008 to 2014 applications), the final database contains 6,751 observations, which averages 2.1 observations per individual, i.e. on average each researcher was evaluated two times in the period of study.

[2] The monthly transfers of the SNI in Uruguayan pesos were $7,383, $9,844, $12,305 and $14,766 from Initial Level to Level III respectively. The exchange rate used to convert 31 pesos per dollar.

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

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

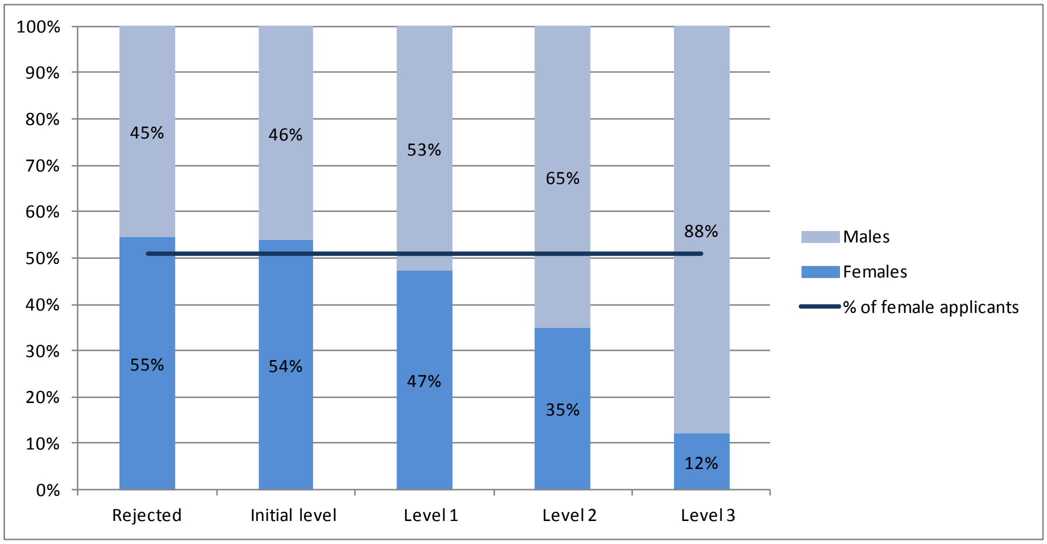
The gender difference at the averages hides the existence of wider differences in the SNI hierarchy. Figure presents the gender structure of the SNI. Females represent 53.8% and 47.4% of researchers at the two lowest levels of the system but only 35.1% and 12.1% of researchers at the highest levels of the system. Overall, females represent 50.8% of researchers at the lower ranks of the system (Initial 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 of any researcher to attain this level is lower. The 7.1 percentage points average gender gap can be decomposed in a gender gap of -3.3 percentage points at the Initiation Level, 2.9 at Level I, 4.5 at Level II and 3.0 at Level III.

Table 1. SNI Categorization by gender

	Males	Females	Total	Males	Females	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%
Initial 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: own elaboration based on Cvuy.

Figure 1. The SNI hierarchy by gender



Source: own elaboration based on Cvuy

3.1. Explanatory variables

For each application we have a series of explanatory variables that could be associated with the categorization within the SNI. We include data referring to the researcher's socio-demographic characteristics, academic formation, scientific and technical production, teaching and human resources activities and academic positions held. The socio-demographic variables used are gender and age. A dummy for holding a PhD 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 amount of published books or chapters of books and the amount 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 impact factor of less than 0.5 are treated as zero articles. Teaching and human resources formation might have an ambiguous effect in the SNI categorization. On the one hand, contributing to the development of other researchers is considered meritorious but the more time that is used in teaching the less time is available for pure research activities. We present information on the sum of total amount of undergraduate and graduate dissertations tutored. We also include dummies for full-time positions and graduate and undergraduate teaching responsibilities during the year of the evaluation. Finally, we present information on institutional affiliation.

Table 2 presents descriptive statistics and t-tests of differences between males and females. The average age of the researchers is 43 and males are 1.5 years older than females. About 43% of researchers hold a PhD and the proportion of males with PhD is higher than that of females. The S&T productivity indicators and the human resources 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 this indicators for the 2012-2014 period). Men published more than females (0.90 chapter books and 0.81 refereed journals vs. 0.79 and 0.62) 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% hold 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 that there are some statistically significant differences in various dimensions in favor of men. This could explain why male researchers are more successful in the probability to access the SNI and to achieve its higher ranks. Table 2 also presents the mean and standard deviation of dummy variables indicating the researchers' field. Most applicants are in Natural sciences (30%) and 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 females are able to scale up the initial levels of the system but they face increasing difficulties to achieve the higher ranks. If this is so we should find that females at high ranks have more academic merit than men and the gender-differences in the higher rank should be larger than at the lower rank.

Females in the higher rank do have some better indicators than males but not consistently so. A higher proportion of them have PhDs, they tutor more dissertations, teach more at the graduate and undergraduate levels and have more full time positions. On the other hand, females at the higher rank publish fewer articles and in worse journals (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 males and females is produced basically by differences among those that are rejected from the SNI. Males and females in the SNI have no statistically significant differences by age. Those at the higher ranks are about 11 years older than those at the lower ranks.

Finally table 3 shows that females are underrepresented in the high ranks of Medical and 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 but publish more and in better journals than their male counterparts.

Table 2 Descriptive statistics by gender

	Overall		**Males**		**Females**		**Difference**
	Mean	Std Dev.	Mean	Std Dev.	Mean	Std Dev.	
Socio demographics							
Female	0.51	0.50					
Age	42.9	10.4	43.7	10.5	42.2	10.3	1.5***
Human capital							
PhD 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 resources formation(average of the last three years)							
Tutored dissertations	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%		

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

Table 3 Descriptive Statistics by SNI rank and gender

	Rejected			Low rank (Initiation, 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									
PhD 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 resources formation(average of the last three years)									
Tutored dissertations	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%	

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 similar to that used by McDowell et al. (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 ε_{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 (υ_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), Initial 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 involve surpassing a higher level, and so on. Thus, if ε_{ij} and υ_i are normally distributed, equation (2) forms the basis for an ordered-probit model of promotion up the academic hierarchy:

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

where the θ'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 lower probability of accessing the higher ranks of SNI than to access the lower ranks of the system.

4.2. Gap decomposition

The previous section implicitly assumed that the formation of the latent productivity indicator for males and females 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 females and the males that are into S&T 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, females will be overrepresented in research activities. This implies that the talent of some female willing-to-be-scientists will be lower than that of males.[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 females are involved in teaching which could explain why they publish less and are less promoted. 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 decomposition the probability gap into a part that can be explained by differences in observable characteristics and a part attributable to differences in the rates of return (coefficients) of these characteristics (the unexplained part).

[4] A model of how discrimination in one market impacts in other is presented in Gandelman (2009) and applied to the soccer labor market.

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

Blinder (1973) and Oaxaca's (1973) starting point is a linear regression fitted separately for the two groups: men 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 that could explain the wage gap and the second term shows the unexplained differences in the wage gap that is related to differences in the rates of return (coefficients).

In non linear 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 non linear models the conditional expectations have to be replace 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 Φ is the cumulative normal density function. For an ordered probit model with *J*

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[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 differences in the weighting of the observable and characteristics part of the decomposition.

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 males and females that could reflect for instance different family and children commitments over life. Age is centered around 40 years old.

The marginal effect reflects that females' probability of being selected to the SNI is on average 2.8 percentage points lower than male's probability. The rest of the variables show expected behaviors and similar but not equal marginal effects for males and females. The average marginal effect of age is positive for males and females (last two columns). After controlling for human capital, productivity and human resource 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 males and females respectively). This linear interpretation is not completely correct as the coefficients of the squared terms in column 1 are negative and statistically significant for males and females. This implies that the age effect of the probability of being accepted is better described by an inverse U. The probability of being accepted at the SNI is maximized at 34 years old for males but much latter, at 52 years old, for females.[7]

More published articles, articles in higher impact journals, teaching positions are correlated with greater probabilities of belonging in 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 referred journals accounts for an increase of almost 40% in the unconditional probability of entering the SNI.

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

[7] The marginal effect of age for males is $\frac{\beta_1}{10} + 2\frac{\beta_2}{100}(Age - 40))$ where β_1 and β_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 males. Using the coefficients interacted with the female dummy we get the results for women.

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 4.5 (0.092*0.49) and 6.8 (0.159*0.43) percentage points in the probability of being accepted.

Table 4. Determinants of the probability of being selected into the SNI

	Coefficients	Marginal effects	Marginal effects	Marginal effects
	All observations	All observations	Males	Females
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

Note: The dependent variable is a dummy equal 1 if accepted into the SNI. Clustered standard errors in parentheses. ***statistically significant at 1%, **statistically significant at 5%, *statistically significant at 10 %.
Source: own elaboration based on Cvuy

We proceed to estimate an ordered probit model where the outcome variable (from 0 to 4) corresponds to being rejected, accepted at the Initial Level, accepted at Level I, accepted at Level II or accepted at Level III. Table 5 shows the marginal effects per outcome for the female coefficients 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 Initial 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 al Level III. In order to properly interpret this marginal effects we should take into account the unconditional probability of being in any of the outcome states. The unconditional probabilities of being accepted to the four SNI Levels 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 of the levels 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 females it is even more difficult than for men. Since at Level III there are less observations we present in Panel B the same analysis but grouping the SNI into its lower rank and its higher rank (Level II and III). We find the same evidence consistent with glass ceilings. Females have lower probability of getting into the SNI at the lower rank but they have it even more difficult to access the higher rank.

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

Table 5. Marginal effects of the probability of reaching different SNI levels for women

	Outcome	Outcome	Outcome	Outcome	Outcome	
Panel A	Rejection	Initial	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			

Note: The dependent variable of Panel A takes the following values: 0 if rejected; 1 if accepted at Initial 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 Initial 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%.

In tables 4 and 5 we report evidence that after controlling for individual characteristics, females have 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. In order 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 include the decomposition using females for the weighting matrix as the reference group (results using males 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 to say, 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 still remains a difference of between 2.2 percentage points that is due to differences in the rates of returns 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 gap is due to differences in males and females' characteristics but also that it remains a sizeable part unexplained. In Panel B we present the decomposition based on probit models for the probability of being rejected into the SNI or accepted into the lower or higher ranks. At the low rank, the raw gap is not statistically significant. Therefore, its decomposition is of no particular 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, initial 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%

Note: Reference group: females. 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. We have shown that the age that maximizes the probability of accessing the SNI is higher for females than males. If due to family reasons (e.g. having children) females have to postpone research efforts in their twenties and thirties 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 the researchers had at 37 years old. This age represents the median age of researchers in the Initial 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 turns out not significant in the estimations for the probability of accessing low and high rank of the SNI.

Second, the goal of incentives schemes as 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 females face more difficulties in being promoted within the SNI this has an indirect impact in their research productivity. Is it that females 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 (full list of marginal effects are reported in tables A3, A4 and A5 in the appendix). 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 Panels A and C (about -3 percentage points). Also 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 8 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 takes high values. Differences in characteristics between men and female explain a part of the differences in the probability of being rejected from the SNI and in the 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 a discriminatory treatment of females. 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	Ordered probit		
	Outcome Rejection	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%

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 (Initial 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%.

Table 8. 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%

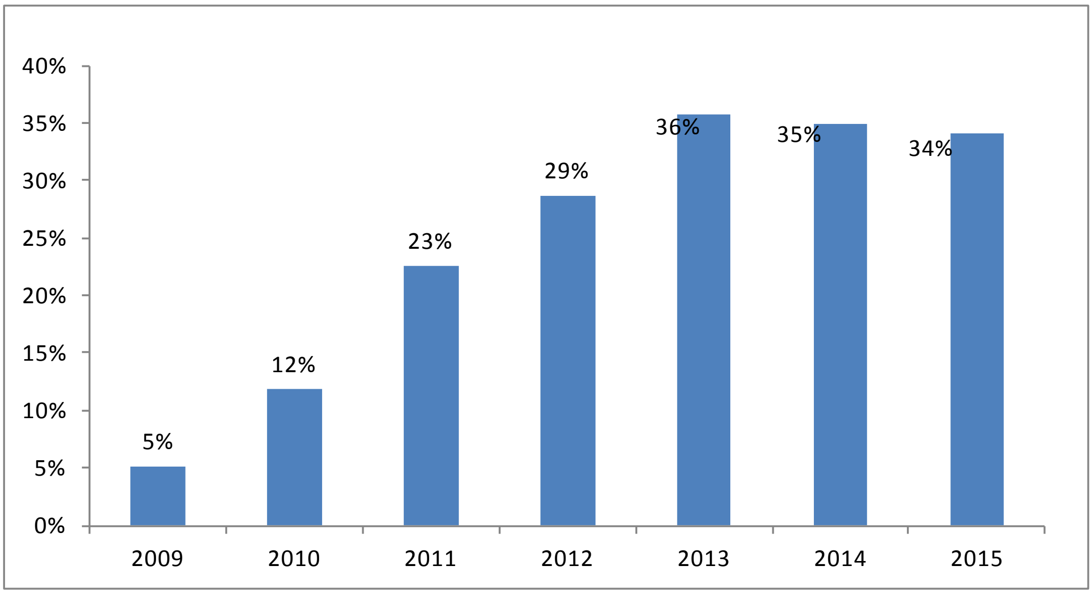
Note: Reference group: females. Estimations based on probit models. Dependent variable in the first column is a dummy for being accepted into the SNI. In the following columns the dependent variables are dummies for being rejected, accepted at low rank (Initial or Level I) or being accepted at high rank (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%.

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 in the CH to be the head the system. They named 39 researchers to organize the technical committees in charge of the evaluations of the bulk of researchers. This 39 researchers were evaluated by international referees and were all assigned to the top rank (Level 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 assignation 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 instance male dominated committees are prone to promote male researchers. Up to 2015 the CH was integrated by 8 researchers. All were men. Figure 2 reports that females are underrepresented in the CTAs especially in the first years of functioning of the program. The share of females 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 females in the SNI it is a reasonable representation of females in the top rank of the system. All CTAs members are Level II or III researchers.

Figure 2. Proportion of females in CTAs by year



Source: own elaboration based on Cvuy.

Finally, it may be that gender discrimination is a problem of some specific fields where the gap is produced or it may even be that the overall gap is due to a composition effect due to segmentation. Females are overrepresented in some fields and are underrepresented in others. The composition effect can be produced by more than one reason. Although the general rules for the SNI are common, since each field CTA works independently it may adopt slightly different criteria (for instance there are some fields where book publications are the norm and journal publications are not as common). If the CTAs of fields where females are overrepresented are tougher (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.

Females are overrepresented in Medical sciences (62% of applicants), Humanities (55% of applicants) and to a lesser extent in Natural sciences and Social sciences (both 52% of applicants). On the other hand, 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. Natural sciences have the lowest rejection rate, 34%, while Agricultural and Social sciences show the highest proportions of non-accepted applicants with 52% and 50% respectively.

Table 9 reports the marginal effect of females 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 females 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 also in all subsequent evaluations since they were also not performed by the local CTAs 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 here, the raw gap for low rank is not statistically significant. Therefore, the glass ceiling effect is not only due to the original assignment of mostly male researchers to the evaluation committees.

Panel B presents the marginal effect of females including as an extra control a variable to capture the gender composition the field evaluation committee. This variable was interacted with the gender dummy. In Table A6 in the appendix we show that the marginal effect is not statistically significant.[9] The marginal effects of female show the same pattern and of similar magnitude than in the main results, i.e. the marginal effect of female represents a 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 10 and 11 present the analysis disaggregated by fields. The point estimates show the expected pattern but in many fields it is not statistically significant. We find no evidence of lower probabilities for females to access the low or high ranks of the SNI in Agricultural sciences and Social sciences. No evidence for lower probability for females 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. Females are underrepresented in Agricultural sciences and Engineering but those that work in these fields seem to receive a fair treatment within the system. Of course, it may be that the female researchers working in there are not a random sample of women. They may have some exceptional characteristics that make them choose these female-not-so-popular fields. In our estimates we control for observable academic merits but we cannot rule the existence of other non observed variables that might sort between females. On the other hand, we find evidence of gender gaps in Medical sciences, Natural sciences and Humanities. These are the three fields that where females are overrepresented among the applicants, thus, magnifying the impact in the overall gap.

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

Table 9. What produced the glass ceiling?

Marginal effects of the probability of reaching different levels in the SNI for women

	Panel A. Excluding "original" SNI members			**Panel B.** 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. Excluding "original" SNI members						**Panel D.** 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%

Note: The dependent variables in Panel A is a dummy that takes the value 0 if rejected, 1 if accepted at the low rank (Initial 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 10. Differentiated field effects

	Agricultural sciences			Medical sciences		
	Rejection	Low	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	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	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

Note: Estimations based on probit models. Dependent variable are dummies for being rejected from the SNI, accepted at low rank (Initial 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%.

Table 11. 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%

Note: Reference group is females. Estimations based on probit models. Dependent variable are dummies for being rejected from the SNI, accepted at low rank (Initial 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

In this paper we present evidence that female researchers have a 7.1 percentage points lower probability of being accepted into the largest national research support program. We find that this gender gap is wider for the upper ranks of the SNI hierarchy where females are largely underrepresented.

We also show that the S&T academic merits (human capital, article and books production, human resources formation) of females are statistically lower than that of males. These differences in observable characteristics explain 4.9 percentage points of the average 7.1 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.

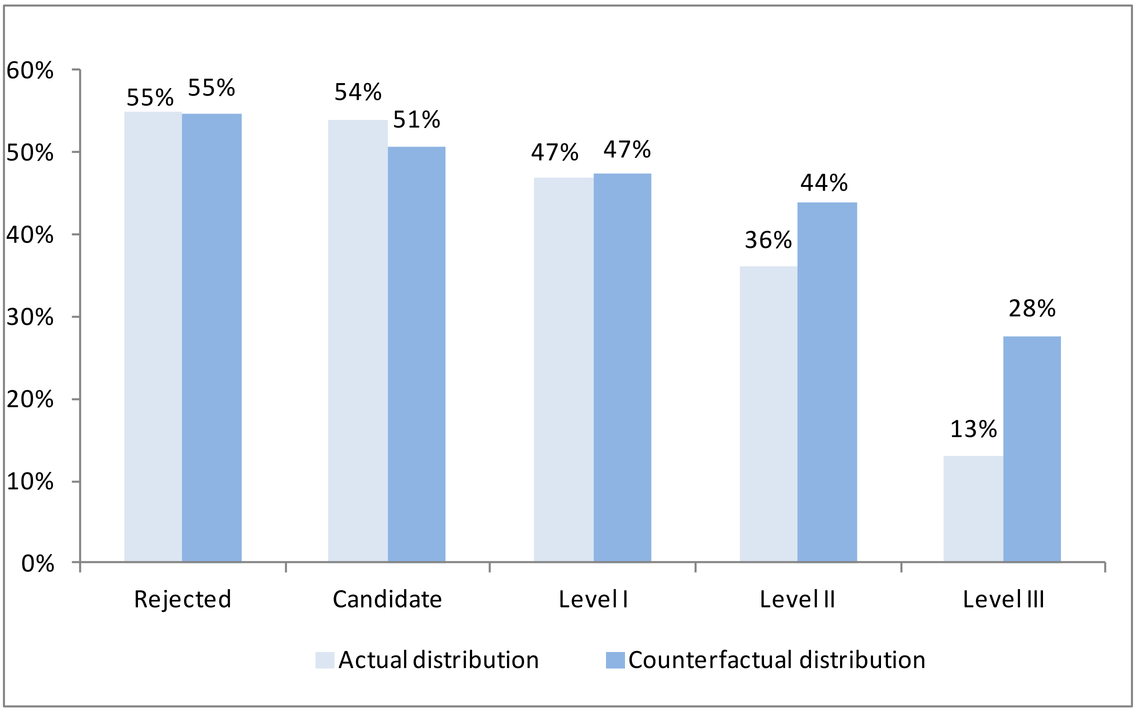
One way of approximating the costs of the glass ceiling is computing the counterfactual SNI distribution in the absence of gender discrimination. That is to say, if there were no differential treatment of men and women, how many females would be in the SNI? How many of them will be in the highest ranks of the system? The procedure is simple. 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 in descending order researchers based on this last predicted value. Fourth, we assign the top researchers to level III, the following to level II, the following to level I, etc. Care should be taken 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 initial level and 2,953 rejected applications. Therefore, the top 112 applications (according to $E(Y_i|X_i)$) are allocated to level III, the following 480 are allocated to level II, the following 1,512 to level I and so on and so forth.

This allows predicting for each individual its position within or out 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 females at each level. The SNI

[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.

has a substantially lower representation of females at Level II and Level III. Instead of the 36% of level II and 13% level III female researchers, it should have 44% and 28% respectively. This has a budgetary implication. A back of the envelope calculation is illustrative. Up to 2015 the SNI gave incentives for $42.6 million dollars. Using the value of the subsidies of 2015, those of high rank represent 23% of the SNI budget (about 10 million dollars). 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 2 million dollars were allocated to male researchers that should have been allocated to female researchers.

Figure 3. Actual and counterfactual proportion of females per SNI level



Source: own elaboration based on Cvuy

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

Moreover, glass ceilings deserve a different set of policies than gender issues at entry or lower level. The overall picture presented in this paper suggests that although females suffer 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 females is null or almost null in Level III. The decomposition exercises suggest that this is not due to less academic merits of females in these areas.

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

The production of knowledge within a country has a direct impact on its growth and development. That is why the development of a strong scientific community could benefit overall well being. Some forms of scientific knowledge can be patented and their inventors can appropriate the returns. This is not the norm. In most cases, scientific knowledge becomes a public good either through its publication in academic journals or other dissemination means. The positive externalities of research are the reason why governments support these activities. ANII was created with the specific goal of promoting innovation and research and the application of 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 research budget are the most important factors in this production function and they are clear complementary. Having the best human capital forming part of the country 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 females to be involved in research activities and as such reduce the quantity and quality of human capital in the research production function.

Moreover, top SNI researchers are in general in charge of research teams. They define new lines of work because they have peer recognition and institutional support. For instance, the research budget of faculty members in some local universities depends on the SNI level where researchers are classified. Female underrepresentation at the top levels implies that the country does not have some of its top minds commanding its research teams. It implies that the research budget they have is lower than what they could have even within the restrictions of a developing country as Uruguay. This manpower restriction affects the output of the research process and through it the country’s productivity and growth and development.

Finally, role models are important in societies. Children and adolescents look at them when making their life decisions. The lack of females at top research position may affect in the medium term the pool of researchers by affecting decisions 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 promote future scientists. It will be advisable to have a gender focus in these programs exposing successful female role models to high school and university women.

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Appendix

Table A1 Descriptive Statistics by field

	Agricultural Sciences			Medical sciences			Natural sciences		
	Male	Female	Diff.	Male	Female	Diff.	Male	Female	Diff.
Socio demographics									
Age	45.4	43.2	2.2***	44.3	42.3	2.0***	42.8	39.9	2.8***
Human capital									
PhD 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 resources formation(average of the last three years)									
Tutored dissertations	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		
Socio demographics									
Age	44.1	43.6	0.5	46.8	44.7	2.1**	40.1	41.4	-1.2
Human capital									
PhD 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 resources formation(average of the last three years)									
Tutored dissertations	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

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

Table A2. Marginal effects for full list of covariates.

	Panel A. Ordered probit model					Panel B. Ordered probit model		
	Outcome= Rejection	Outcome= Initial	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	-0.111***	0.011***	0.044***	0.026***	0.010***	-0.122***	0.075***	0.040***
refereed journals	(0.008)	(0.001)	(0.004)	(0.002)	(0.001)	(0.011)	(0.007)	(0.004)
Books and	-0.036***	0.003***	0.014***	0.008***	0.003***	-0.036***	0.022***	0.011***
chapters in books	(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	-0.055***	0.005***	0.022***	0.013***	0.005***	-0.064***	0.039***	0.021***
teaching	(0.012)	(0.001)	(0.005)	(0.003)	(0.001)	(0.013)	(0.008)	(0.005)
Graduate	-0.165***	0.014***	0.057***	0.033***	0.013***	-0.162***	0.100***	0.046***
teaching	(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

Note. The dependent variable of Panel A takes the following values: 0 if rejected; 1 if accepted at Initial 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 Initial 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 A3. Estimations controlling for initial productivity (marginal effects)

	Probit	Ordered 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 chapters in books	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)
Initial 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%

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 Initial 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 (marginal effects)

	Probit	Ordered Probit		
		Outcome= Rejection	Outcome= Low rank	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 chapters in books	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%

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 Initial 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 only age, gender their interactions and an indicator of academic productivity (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%

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 Initial 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. Marginal effects for women controlling for gender composition of CTA (marginal effects)

	Probit	Ordered 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%

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 Initial 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%.