Scientific Production in Brazilian Research Institutes: Do Institutional Context, Background Characteristics and Academic Tasks Contribute to Gender Differences?

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Abstract
Despite the recent changes that occurred in the Brazilian science, this field is still strongly anchored on male figures, as it happened at the beginning of its institutionalization. This paper detaches the contribution of Brazilian Research Institutes for the development of Brazilian science and the importance of contextual, background and academic tasks involvement in scientific production in those institutes, giving special attention to gender differences. Data from government graduate programs evaluation forms were obtained for the analyses presented here which take into account all professor-researchers - 890 women and 1,470 men - affiliated to 72 graduate programs under the responsibility of 31 Brazilian Research Institutes (BRI), the majority of which supported by the Federal Government. The main findings include: women are a minority in those institutes, are concentrated in the health and biological sciences, show higher scientific production than their male colleagues, especially in journal articles and among those involved in highly evaluated graduate programs. We believe the set of results presented in this paper may contribute to a better understanding of women's participation not only in BRI, which are dedicated to specific scientific areas, but also in Brazilian science in general and so contribute to gender governmental policy.

Conference Topic
Country level studies

Introduction
The process of science institutionalization in Brazil started about a century ago, when in Europe and in the USA this activity was already structured, both in science academies and in research institutions. One of the first steps contributing to this process in Brazil was the creation, in 1900, of the Federal Serotherapy Institute at Manguinhos, in Rio de Janeiro (which was afterwards named Instituto Oswaldo Cruz), considered the first Brazilian Research Institute to win international recognition (Weltman, 2002). In the following decades, the first public universities were created, as the University of Brazil (later renamed Universidade Federal do Rio de Janeiro), founded in 1920, and the University of São Paulo, in 1934. However, only in the nineteen fifties, with the creation of the first agencies for the promotion of scientific development in the country, this process advanced significantly: CAPES assumed the responsibility of structuring and monitoring graduate programs (Masters and Doctorate), throughout the country, while the other agency, the CNPq assumed the task of promoting scholarships and research projects.

Considering the above mentioned initiatives, it is possible to say that, in the second half of the twentieth century, one witnesses a strong governmental effort towards structuring scientific institutions, and also an induced and spontaneous expansion of graduate programs. In 2010, three decades later, the country already counted with an extensive system of S&T, including: 83,170 doctors-researchers, 64,588 students enrolled in doctorate courses, 2,840 graduate programs, 27,523 research groups, and 452 research institutes and universities throughout the

country (MCTI, 2014). The effort to train and qualify S&T human resources, build up and modernize the infrastructure of research institutions and, more recently, create legal tools to allow the increase and maintenance of science funding, resulted in an outstanding growth of scientific output in the years 2000, especially output in journals indexed by international bibliographic databases (Regalado, 2010; Leta et al., 2013).

It is important to point out that such growth is also result of a combination of factors, besides the previously mentioned ones. Among these factors, the following could be mentioned: (1) the inclusion of Brazilian journals in databases, which resulted in an expressive growth of Brazilian production in international bases in the last few years (Leta, 2012); and (2) the creation of evaluation mechanisms of graduate programs, which stimulate and reward output in journals, mainly in international journals (Mugnaini & Sales, 2011). About this last aspect, it is important to highlight that graduate programs - which cover all areas of knowledge and a great part of the institutions of higher education and research, especially those of the public sector - became the leading stronghold of Brazilian science. Thus, policies and evaluation mechanisms directed to these programs are reflected in Brazilian scientific outputs and outcomes.

The institutionalization, growth and international recognition of Brazilian science have not promoted significant changes in aspects of scientific stratification, more specifically an equalitarian representation of men and women in scientific activities. Although the last decades have witnessed a significant growth in the number of women in the country's academic and scientific fields – in higher education, in graduate programs and as professors and/or researchers at universities and research institutions (INEP, 2007) – they are still a minority in several areas, in higher academic levels and in administrative functions of higher prestige (Olinto, 2011; Gauche, Verdinelli & Silveira, 2013). This scenario, although not exclusive of Brazilian scientific field, calls attention to the fact that, in face of the many recent changes that occurred in the country's science, this field is still strongly anchored on male figures.

Many factors support the maintenance of this scenario in Brazil and in the world, where women are excluded of certain areas, a phenomenon known as horizontal gender segregation, and they do not advance in their careers, a phenomenon known as the vertical gender segregation (Shienbinger, 2001). In a previous study (Leta et al., 2013), considering the symbolic value of different academic tasks that are part of the academic career, the hypothesis posed was that female Brazilian scientists would be involved in tasks of lesser prestige and, consequently, would be less productive and advance less in their careers than their male peers. We inquired into this issue examining productivity and involvement in academic tasks of the population of over 52,000 professor-researchers who participated in Brazilian graduate programs (our unit of analysis was each professor-researcher linked to a Brazilian graduate program, and whose academic characteristics and performance are yearly included in evaluation forms provided by the federal government). This study revealed a higher participation of men in articles published in annals of events, but major differences between male and female professors-researchers were not observed. Even though it may be considered positive the fact that both sexes have an equal share of academic-scientific tasks, the population analyzed in the mentioned study was very heterogeneous. Subtle differences were found, however, when the analysis considered the area of graduate work in which the professor-researcher was linked to. The health area was the closest one to our hypothesis: women tend to get more involved in activities of lesser prestige, like teaching graduate courses, and less involved in activities of higher prestige, like publishing in journals. Academic area and the nature of the institution are some aspects, among others, that may have an impact in the characteristics and the amount of scientific output of both men and women. In order to reduce diversity, in the present study, the focus turned to the participants of

graduate programs who are affiliated to Brazilian Research Institutes. The central question of this study is: how do gender differences in scientific performance are related to the characteristics of the academic and institutional context, as well as the involvement in several academic tasks of professor-researchers in graduate programs of Brazilian Research Institutes?

Research Institutes and Women

The largest part of the Brazilian Research Institutes belongs to the public sector and is linked to the Ministry of Science, Technology and Innovation (MCTI). Among the oldest is the National Observatory, founded in 1827, in the city of Rio de Janeiro. Presently there are thirteen other Research Institutes linked to the MCTI, the majority directed towards research in exact sciences and engineering. Other ministries also maintain Research Institutes, as the Ministry of Agriculture, responsible for Embrapa, created in 1973 with the purpose of developing research in agriculture; the Ministry of Health is responsible for the Brazilian National Cancer Institute (INCA), founded in 1961, and for the Oswaldo Cruz Foundation (at present – Fiocruz), created in 1900.

Until recently, women's presence and contribution at Research Institutes was poorly explored as a research topic in studies about gender and science. Among a few recent studies, the one by Brito Ribeiro (2011) inquired into the distribution of male and female researchers at Research Institutes linked to the MCTI in two career functions: researcher and technologist. This author points out to the small proportion of women in those institutes: about 30% in both types of careers. Nevertheless, that fraction still decreases substantially when the research areas of these institutions are considered. In the Brazilian Center of Research in Physics, for instance, there are only 17% of women in those two careers. The author also presents data about the distribution of men and women in higher prestige posts at these institutions, like presidency and boards of directors: out of 362 senior administrators, only 36 (10%) were occupied by women in 2010, a clear indication of vertical gender segregation. A more thorough analysis was done recently taking into account 571 researchers, with doctor degrees, affiliated to Fiocruz (Rodrigues, 2014), an institution that plays a central role in health research in the country. This author points out that male researchers have a *per capita* output quite superior to that of female ones. A different situation is found in Fiocruz, however, when the analysis focuses on administrative positions. Differently from other Research Institutes, especially those oriented towards exact sciences and engineering, Fiocruz is concerned with gender equity, and thus started a Pro-Equity Gender Program in 2009. This initiative might explain the large number of women in administrative positions in this institution. In 2013, out of 768 administrators with salary bonus, 382 (49.7%) were women, which is close to parity. However, women are still an absolute minority occupying the highest prestige posts, as president and directors.

The scenario previously described is shared by Research Institutes of other countries. One of the most prominent Research Institutes in the world, the Massachusetts Institute of Technology, has recently published a study on gender equity in the institution. Compared with previous studies (1999 and 2002), it showed major advances in two Schools. In the School of Science and School of Engineering, particularly, "the number of women in faculty increased significantly (from 30 to 52 in science and 32 to 60 in engineering) and in both schools women now hold several senior administrative positions" (Gillooly, 2011). However, despite these advances, women are still a minority, especially among those that occupy positions of higher prestige and salary, as tenured faculty members, of which women represent only 15% and 12% in the two schools, respectively. At the Centre National de la Recherche Scientifique (CNRS), the largest Research Institute in France, a country with a solid tradition in science and a pioneer in actions and policies that benefit women, Hermann

& Cyrot-Lackmann (2002) observed that women represent from 22% to 38% of the total CNRS's researchers and, what seems to be more significant, 31% of the research directors are in the highest prestige positions. Yet, as seen in the MCTI Institutes in Brazil, at the CNRS in France, this representation also varies according to the area of study: in Physical & Mathematical Sciences and Engineering Sciences only 12% and 9%, respectively, are women; and in Life Sciences, 28% of the research directors are women.

Different theories and models are considered by the literature to explain the phenomenon of female segregation in science and they include personal, biological, cultural, social and institutional aspects; and empirical studies based on these theories and models usually point out to gender imbalances favoring men (Barrios, 2013; Epstein, 2007; European Commission, 2009; Fox, 2005; Long, 1992; Meulders et al., 2010; Prpic, 2002).

The present focus on gender differences in institutional contexts suggests that male researchers would show better performance in different academic tasks and also present greater scientific production, like publishing in prestigious journals. Rewards for better performance would include the occupation of prestigious posts. Such arguments allow one to bring about the concept of scientific capital, proposed by Bourdieu (2003): a kind of symbolic or tacit capital, which opens opportunities and promotes recognition and which would tend to help perpetuate gender differences in science. Researchers with higher rates in publications and with high involvement in prestigious academic-scientific tasks accumulate scientific capital and, in a "snow ball" feedback effect, would tend to keep to themselves positions of higher academic prominence. In an opposite movement, researchers with less involvement in the more valued activities accumulate less scientific capital and would tend to be less involved in the more valued tasks, as well as to have a greater burden of less valued tasks, as, for instance, teaching assignments. Considering this model, the present study intends to investigate the relation between gender, academic background, institutional context, including the involvement in academic tasks, and scientific output of professor-researchers affiliated to the BRI.

Data collection and method

This study uses the documental analysis technique applied to information retrieved from three pre-established PDF forms with information used in the 2009 national evaluation of graduate programs (CAPES, 2013). Information provided includes aspects of academic and scientific performance as well as personal and academic characteristics of 52,294 professor-researchers affiliated to 2,247 graduate programs. Since a key characteristic, the professor-researcher's gender, was not included in CAPES' forms, a series of strategies was developed to allow for this classification (Leta et al., 2013).

For the present study, we have selected a subset of the 2009 original population and took into account information about all professor-researchers affiliated to 72 graduate programs under the auspices of 31 Brazilian Research Institutes (BRI), which were classified by us in three main groups: (1) supported by funds from the Federal government (Public/Federal), (2) supported by funds from State governments (Public/States) and (3) supported by the private sector (Private).[1]

[1] First group: Brazilian Center of Research in Physics (CBPF), Centre of Nuclear Technology Development (CNEN/CDTN), Institute of Nuclear Engineering (CNEN/IEN), Institute of Radio Protection and Dosimetry (CNEN/IRD), Oswaldo Cruz Foundation (Fiocruz), Research Centre (FIOCRUZ/ CPqGM), René Rachou Research Centre (FIOCRUZ/CPqRR), Institute of Military Engineering (IME), Institute of Pure and Applied Mathematics (IMPA), Brazilian National Cancer Institute (INCA), National Institute of Metrology, Quality and Technology (INMETRO), National Institute of Research in the Amazon (INPA), National Institute for Space Research (INPE), National Institute of Industrial Property (INPI), Technological Institute of Aeronautics (ITA), Botanical Garden Foundation of Rio de Janeiro (JBRJ), National Laboratory for Scientific Computing (LNCC)

It is important to mention that not all BRI are included in this study since a few of them do not have a graduate program under their responsibility. Examples are Embrapa and IBICT, major research institutes in the areas of agricultural sciences/biology and information science, respectively. These Institutes do have graduate programs but they are organized in collaboration with public universities.

Once the BRI were identified and data cleaned, all information was exported to a matrix of SPSS (Statistical Package for the Social Sciences), version 12. The population of the study represented in this matrix, and focus of the analyses presented here, can be so defined: BRI professor-researchers who participated in graduate programs in Brazil in 2009 (N=2,362). Among the variables that characterize each professor-researcher are: (a) personal and academic characteristics of the professor-researcher (gender, S&T area and year of doctoral title), (b) characteristics of institution of affiliation/ graduate programs (economic sector, area and evaluation grade); (c) academic roles performed by each professor-researcher (graduate courses, graduate advising, banking participation, project leadership) and (d) publication output (journal articles, articles in Annals and other types of publications). For the classification of S&T area of the graduate programs, we utilized the categories considered by CNPq (2013).

Results

The analyses are presented in two main sections: (a) characteristics of the institutional context in which professor-researchers participate and aspects of his academic background and (b) academic tasks and the scientific output of the professor-researchers, with emphasis given to gender differences.

Characteristics of the Institutions and of professor-researchers background

Table 1 shows the distribution of the 2,362 professor-researchers according to three macro-characteristics of the graduate programs of the BRI to which these professionals are linked: the economic sector, the area of knowledge and the performance grade.

Considering the economic sector, data show that the greatest part of professor-researchers are linked to the institutions maintained by the Federal Government and very few of these professionals are active in programs belonging to private institutions: only 3%. These results are different from those obtained for Brazilian graduate programs considered as a whole, which showed that 55% of the institutions belonged to the federal government, 30% states government and 15% to the private sector (CAPES, 2014).

The distribution of professor-researchers according to the academic areas of the BRI graduate programs (which represent the areas of expertise of these professionals) is, however, more homogeneous, although it is clear that a massive number of professors are concentrated in two major groups: Engineering and Exact Sciences, in one hand, and in Health and Biological Sciences, in the other hand. These areas together absorb 80.3% of the professor-researchers in the BRI.

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and National Observatory (ON). The second group: Nuclear and Energy Research Institute (CNEN/IPEN), Institute of Medical Assistance to the State Civil Servants (IAMSPE), São Paulo Institute of Biology (IBSP), São Paulo Institute of Botanic (IBT), São Paulo Institute of Fishery (IP), Institute of Ecological Research (IPÊ), São Paulo Institute of Technological Research (IPT), Pernambuco Institute of Technology (ITEP) and Institute of Zoology (IZ / APTA). Third group: Recife Centre of Studies and Advanced Systems (CESAR), Brasilia Institute of Public Law (IDP), Latin American Institute of Research and Education in Odontology (ILAPEO) and Institute of Technology for the Development (LACTEC).

Table 1. Number and % of professor-researchers according to the economic sector, areas and grades of Graduate Programs from Brazilian Research Institutes – 2009.

ECONOMIC SECTOR	*N*	*%*
Public / Federal	1,933	81.8
Public / States	357	15.1
Private	72	3.0
Total	2,362	100
AREAS		
Engineering	489	20.7
Exact Sciences	476	20.2
Health Sciences	601	25.4
Biological Sciences	331	14.0
Human Sciences	71	3.0
Social Applied Sciences	14	0.6
Agrarian	31	1.3
Other/interdisciplinary	349	14.8
Total	2,362	100
CAPES EVALUATION		
Grade 2	38	1.6
Grade 3	356	15.1
Grade 4	623	26.4
Grade 5	693	29.3
Grade 6	489	20.7
Grade 7	163	6.9
Total	2,362	100

Table 2. Distribution (%) of professor-researchers from Brazilian Research Institutes according to academic areas and other characteristics by gender – 2009.

[1]

Contextual aspect	Percentage[1]	
	Women	**Men**
Professor-researchers [2]	37.7 (n= 890)	62.3 (n=1,470)
ACADEMIC AREAS	%	%
Engineering	8.5	28.1
Exact Sciences	10.8	25.9
Health Sciences	38.1	17.8
Biological Sciences	20.9	9.9
Other areas/interdisciplinary	21.7	18.4
TOTAL	100	100[3]
OTHER CHARACTERISTICS	% yes	% yes
Public / Federal	83.7	80.8
PHD before 2000	58.1	66.1
PHD abroad	16.4	30.0
Program with grade 2 to 3	14.5	17.9
Program with grade 5 – 7	59.0	55.8
Program with grade 6 to 7	20.6	31.9

Percentages calculated within each gender category. [2] We were not able to attribute the sex of two professor-researchers. [3] Partial and total percentages provided by SPSS.

The final contextual aspect, presented in table 1, refers to the performance grade of the graduate programs issued by CAPES. These grades are recorded in a scale from 2 to 7, and the meaning of these assessments is: from grade 5 the program is considered to be at a good

level, able to participate in institutional programs etc. Grades 6 and 7 are assigned to programs of high performance, and some aspects that contribute to the assignment of these grades, besides scientific productivity, are institutional agreements as well as institutional exchange of researchers, professors and students. In table 1, it is also possible to observe that the great majority of professor-researchers participate in programs that received grades from 5 to 7.

The following Table 2 aims to identify gender differences in institutional affiliation and aspects of personal background of the professors/researchers in BRI.

It is possible to note that women represent less than 40% of this population (N=890), a fraction similar to the one obtained in a previous study which focused on professor-researchers of all graduate programs in the country (Leta et al., 2013). Data also show that women are predominant in the areas of Biological and Health Sciences, whereas men form a great majority in Engineering and Exact Sciences, which points to the phenomenon of horizontal segregation of gender, a characteristic also observed in Brazilian graduate programs in general (Leta et al., 2013).

Table 2 also presents other relevant information related to gender, calling attention to gender differences favoring men: a higher proportion of men show longer careers than women (which in fact might reflect the recent increase in women's entrance in scientific careers), relatively earn more degrees abroad and participate more in graduate programs of higher prestige.

Gender and scientific production of professor-researchers of Brazilian Research Institutes

Table 3 shows the distribution of men and women according to the number and the kind of published work in 2009 - articles in journals, complete works in annals of events and abstracts in annals of events.

Table 3. Distribution (%) of professor -researchers from Brazilian Research Institutes by sex and number of journal articles, annals full article and annals abstract – 2009.

Publication	Journal Article		Annals full Article		Annals Abstract	
	Women	**Men**	**Women**	**Men**	**Women**	**Men**
0	30.6	38.7	76.7	66.7	68.9	80.3
1-2	33.9	31.7	14.7	15.6	15.7	10.9
3+	35.5	29.6	8.5	17.7	15.4	8.8
Total	**890**	**1,470**	**890**	**1,470**	**890**	**1,470**

These results call attention to the high percentage of both men and women without any work published in 2009, particularly those with zero annals full article and annals abstract. This table also stresses the higher women's performance as far as journal articles are considered: a lower proportion of women are included among those with zero contribution to this kind of publication and a higher proportion of this gender group are among those contributing with one or two journal articles, and especially among those considered more productive: three or more articles. It is important to keep in mind that this is the kind of published work that has more value in the scientific field in general, and is also the kind of publication that contributes the most to the grades attributed to the graduate programs by Brazilian Agencies. In Annals, a type of publication that is highly valued in technological fields, as Engineering, it is possible to see an alternate pattern between men and women: men with better performance in annals full articles and women in annals abstracts.

Scientific production is influenced by a large number of factors, including the academic area, years of academic experience (Bonaccorsi & Daraio, 2003), education abroad (Velema, 2012), etc. Table 4 presents the publication mean of the different types of publications of the BRI professor-researchers by gender, as well as by gender controlled by the above-mentioned factors – area, experience and education abroad –, and also the CAPES grade of the program, a particular aspect in the Brazilian scientific area.

Taking into account the general mean performance and gender, table 4 also shows, as in table 3, that women outperformed men in BRI in 2009 in mean number of journal articles (women published a 2.51 and men 2.12 articles, mean results with similar standard deviation) and the mean number of annals abstract (W=1.14 and M=0.75), while men attained higher means of annals full articles (W=0.74 and M=1.48). With these results, and considering the higher academic value attributed to publication in journal articles, one can say that women of the BRA show higher performance in relation to men.

Focusing on differences between academic fields, in Table 4, as expected, mean number of journal articles is higher in biological, health sciences and in exact sciences than in engineering. This difference could partially account for the women's higher general performance in the BRI, previously mentioned. But even considering journal publication in this specific group, it can also be observed that women in the biological and health areas publish, in average, more journal articles than men. Men, on the other hand, show higher performance in journal articles in exact sciences and engineering. These gender tendencies are not clear in the other two types of publication.

Table 4. Mean of types of publications of professor-researchers from Brazilian Research Institutes by sex considering academic area, Graduate Program evaluation and PHD period and PHD country – 2009.

	Publication Means					
	Journal Article		**Annals Full Article**		**Annals Abstract**	
	Women	**Men**	**Women**	**Men**	**Women**	**Men**
GENERAL MEAN PERFORMANCE	2.51	2.12	0.74	1.48	1.14	0.75
ACADEMIC AREA						
Engineering	0.99	**1.11**	2.66	2.96	0.45	0.32
Exact Sciences	2.24	**2.71**	1.88	1.42	0.86	0.65
Health Sciences	**2.99**	2.90	0.28	0.23	1.26	1.51
Biological Sciences	**3.27**	3.19	0.09	0.07	1.25	1.26
GRADUATE PROGRAMS						
Low evaluated (2 and 3)	**1.12**	0.90	0.99	2.07	0.98	0.30
High evaluated (6 and 7)	**3.66**	2.52	1.23	2.26	0.47	0.45
PHD period						
Before 2000	2.97	**2.40**	0.72	1.60	1.07	0.76
2000 and After	1.88	**1.57**	0.77	1.25	1.23	0.74
PHD country						
Brazil	2.59	2.08	0.72	**1.27**	1.25	0.87
Abroad	2.19	2.25	0.88	**2.07**	0.59	0.49

Table 4 also shows that belonging to programs with higher grades seems to have a positive impact in the output of men and women in journal articles and annals full articles. However, what stands out in the comparison of the two types of program (low and high performance) is

that women's mean number of journal articles is much higher than men's in high performance programs, where men are predominant (Table 2).

Data also suggest that professional experience, estimated through the time elapsed since PHD conclusion, contributes positively, for both women and men, to a greater output in journal publishing. On the other hand, both gender groups with more recent PHD degrees tend to publish more annals full articles. The other factor considered - PHD country- suggests that being educated abroad is more relevant to male output: men educated abroad show a much higher performance than women in this category. Regarding this last result, it could be pointed out that full articles in annals is the type of output that appears more often in the technological areas, like engineering, where 20% of the professor-researchers of the BRI are institutionally related (Table 2). It is also possible to consider that this kind of publication, which is associated to the participation in events, especially international events, may contribute to the development of professional contacts, favored by the period of experience abroad. If this is the case, women are not profiting, as much as their male colleagues, of their experience abroad.

Professor-researchers have several assignments besides publishing results based on their research projects. These assignments comprise, among others, graduate teaching, dissertation advising, banking participation and tasks involved in project leadership. How the involvement with these assignments is related with their publication output, and how gender might interfere in this process is explored in table 5.

Table 5. Mean number of involvement in academic tasks of professor-researchers from Brazilian Research Institutes by publication level and gender – 2009.

Academic Task	Professor-researchers			
	with no journal article		with 3 or more journal articles	
	Mean		Mean	
	Woman	**Man**	**Woman**	**Man**
Graduate Teaching	0.90	1.10	1.17	1.08
MS Advisor	0.59	0.70	0.83	0.98
PHD Advisor	0.37	0.63	**0.80**	**0.98**
Banking participation	0.94	1.42	1.00	1.18
Project Leader	0.87	0.82	**1.64**	**1.37**

Table 5 show that, in average, those BRI professor-researchers who have not published in 2009 – those with zero articles – tend to have less involvement with the different academic tasks considered, notably involvement with doctoral degree advising and project leadership. Besides, the comparison between men and women shows that men, independently of publication quantity, tend to be more involved in academic tasks, except in graduate teaching and project leadership, in which women show higher performance, but only a small positive difference. Women higher involvement in this specific task - project leadership -, especially among the more productive ones, might contribute to explain their higher performance in journal articles as previously shown in tables 3 and 4.

Concluding remarks

This work focused on gender differences in scientific production of professor-researchers attached to in BRI, aiming at identifying how institutional and background aspects may be related do their production, as well as how the diverse academic tasks performance by these men and women might interfere with their scientific production.

Considering institutional and background aspects, the results show that these professor-

researchers are allocated in the public sector, are concentrated in four academic areas, and the majority in programs that received high grades from government evaluation process (Table 1). Results also show that women are a minority in those institutes and are concentrated in the health and biological science, whereas men are concentrated in engineering and exact sciences (Table 2). Women also show higher scientific production, especially in journal articles, the most valued type of academic publication (Tables 3 and 4). Women's performance is especially outstanding when they are involved in highly evaluated graduate programs. Female professor-researchers only show lower production output in relation to their male colleagues in journal articles of traditionally masculine areas: exact sciences and engineering. But male predominance in these areas is not consistently maintained when the other types of scientific productions are considered. The last results highlighted here refer to the involvement in academic tasks by level of production. Data show that the involvement of both men and women in those tasks seems to be positively related to their productive levels, especially PHD advising and project leadership. Men, however, tend to be more involved in most academic tasks, regardless of their productive levels, with the exception of project leadership, in which women are more involved, notably the highly productive ones (Table 5).

The originality of the data presented in this study is the inclusion of different types of scientific production in the analyses of gender differences in science, as well as the examination of associations of these different types of productions with contextual and academic background, as well as with involvement in academic tasks. The originality of this study is also in the selection of a particular study field: the research institutes that have an outstanding place in the development of modern science, as institutions created with the specific purpose of scientific development. Despite their relevance for the scientific field, only few studies about gender and science focus on these institutions. In Brazil, the great majority of BRI are supported by the Federal Government, are dedicated to specific scientific areas and the graduate programs under their responsibility are well recognized by the scientific community and, as data analyses shown here, tend to receive high grade marks from the national graduate programs evaluation. These indicators of excellence make it valuable the analysis of gender differences in those institutions aiming at contributing to better understand women's participation in Brazilian science and also contribute to gender governmental policy.

Intended further analyses with the BRI data will make use of statistical multivariate models trying to evaluate the relative contribution of the different contextual, background and academic tasks involvement, as well as gender in scientific production of professor-researchers. These analyses will help to indicate the importance of institutional and gender cultures, and patterns of academic practices in scientific production.

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