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The Impact of Ex-ante Subsidies to Researchers on Researchers' Productivity: Evidence from a Developing Country[1]

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Abstract

In this paper we perform a short-run (two years after the programme) impact evaluation of a programme that provides ex-ante subsidies to researchers in Paraguay. The analysis of the effects of this type of subsidies, that are prevalent in Latin America, has received little attention in the literature. Thanks to the availability of data coming from electronic CVs of applicants we are able to analyse the impact of the programme in dimensions of researchers' productivity that have been mostly overlooked previously, such as technical production, own education, the training of other researchers and other dimensions of the bibliographic production different to published articles. We also provide estimations of the impact on quantity and quality of publications based on more traditional sources of data. We find some positive impacts of the programme. However, some of the results are not robust to alternative methods of estimation.

Keywords: Economics of Science, Scientific Subsidies, Policy Impact Evaluation.
JEL classification: O30, O38, H43, C21.

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1. Introduction

Since the seminal works by Nelson (1959) and Arrow (1962), knowledge has been regarded as a public good. As such, economic theory predicts that there will be an underinvestment in scientific research if left to the market alone (Nelson, 1971; Arrow, 1971). Therefore – throughout the world – governments devote considerable resources to scientific research.

To do so, different allocation mechanisms have been put in place. Generally speaking, four different ways to fund research exist: (1) long-term funding of research institutions, basically provided either completely or partially independently of research performance or outputs; (2) ex-post funding, in which money is paid in retrospect on the basis of measurable research performance; (3) ex-ante funding, in which money is provided in advance to pre-screened research projects, selected via a competition for grants; (4) ex-ante funding of researchers based on their (recent) past research performance. The chosen mechanism is not neutral on its effects in terms of both research scope and objectives and scientists career paths. Hence, it is understandable that has been a recurrent topic in the science policy literature (see David et al., 2000, Aghion et al., 2010, and Stephan, 2010, to name a few of these contributions).

The fixed funding contract is in most of the cases a combination of ex-post and ex-ante contract in which the contract specifies which proportion is independent of research performance. As such, the decision of choosing research subjects and research responsible falls on the research organizations themselves, with less monitoring by the funder. On the other hand, it is generally stated that long-term funding tend to stimulate riskier projects difficult to support if the system would be entirely based on measurable and verifiable outputs in a given period of time. With ex-post funding, governments provide a strong incentive to produce measurable output. Research institutes -although are autonomous in terms of their budget decisions - are closely monitored in terms of their production. On the opposite, ex-ante mechanisms allow funders to control what (research projects) and/or who (researchers) is to be supported. In relation to the grants for pre-screened projects, governments are capable of selecting (assuming they have the capabilities to do so) the most promising research ideas. Given that ex-ante funding of projects provides weak monetary incentives to actually arrive to verifiable research output, the typical financial instrument in this case is the matching grant. In this case, the research grant never covers all

expected costs of selected projects (Crespi et al, 2011). In most of the cases, competitive funding covers input and research support costs but typically include little to no support for the compensation of the principal researcher. Differently, the last mechanism tends to emphasize the provision of funds to be used as compensation to researchers. Under this setting, performing research is considered a meritorious activity, researchers-driven- that will eventually produce outputs. To limit the opportunistic behaviour, researchers are chosen based on their capabilities to conduct research (proxied by evidence of previous publications, technical products or previously secure funding) and are generally offered support for a limited period of time (a few years), after which they are required to apply again to obtain support. Generally, this last group of incentives tends to be implemented by developing countries aiming at providing an incentive to allow university personnel to devote a larger proportion of their time to research, rather than other activities such as teaching or consultancy.

The objective of this paper is to perform an impact evaluation of the National Programme of Research Support (PRONII) of Paraguay in terms of its impact on research output productivity since its first implementation in 2011. PRONII aims at strengthening and expanding the research community of the country, establishing a process of voluntary participation in periodic calls in which researchers are assessed in terms of their production. Those individual meeting the basic criteria are categorized in one of four different categories. Nowadays, PRONII supports 386 researchers, out of a total of approximately 1550 researchers in the country, of which only half are believed to be active (CONACYT, 2012).

Our study provides to major contributions. First, we expand the evidence by evaluating econometrically the impact of a programme providing ex-ante financial incentives to individuals (rather than to projects or institutions) to pursue their research activities. This type of incentives is pervasive in Latin America. In the recent period a growing literature on the effects of grants on academic careers has developed. However, the majority of this literature has focused on developed countries and on the role that other types of grants have had on the productivity effect in terms of publications and citations. Secondly, we exploit a new type of data source for our analysis, the electronic CVs, and combine it with data on publications. Researchers' output can be classified in three categories: 1. bibliographic production, 2. advanced human capital and 3. technical output. While previous literature has focused mostly on the first one, we are able to

analyse the impact of the ex-ante subsidies to researchers on the three types of outputs.

The remainder of the papers is organized in sections. Section 2 presents the received literature. Section 3 describes PRONII, its objectives and the main eligibility criteria and selection procedures. Section 4 describes the data used in this evaluation. Section 5 focuses on describing the empirical strategy. Section 6 presents the empirical results and, finally, Section 7 offers some conclusions.

2. Literature

Over the last two decades an empirical literature dealing with the impact of support on research productivity and careers has emerged. The majority of these contributions employ quasi-experimental methods to investigate the effect in terms of publications and citations, generally referring to these dimensions as quantity and quality.

The bulk of these contributions focus on unveiling the impact of individual grants on academic careers in developed countries. This literature tends to emphasize that grantees do only marginally better in terms of productivity (e.g., Averch, 1987; Godin, 2002; Holbrook, 2005, Arora and Gambardella, 2010; Jacob and Lefgren, 2011, and Lanser and Van Dalen, 2013). Jacob and Lefgren (2011) for example estimate a causal impact of grant funding on publications. Contributions focusing on the impact of receiving a grant on individual careers are sparser but increasing recently. Specifically, a number of evaluative studies (Langfeldt and Solum, 2007; Böhmer et al., 2008; Böhmer and Hornbostel, 2009; Böhmer and Ins 2009; van Arensbergen and van den Besselaar, 2012; Gerritsen et al. 2013; van Arensbergen 2014; Huber, Wegner and Neufeld, 2015) address the overarching question of the role that highly prestigious funding programmes play in the career development of young researchers and provide empirical evidence about the impact of these programmes. Overall, these evaluative studies show a positive impact on the likelihood of successfully pursuing an academic career – i.e. retaining talented young researchers in academia, increasing the probability of obtaining a professorship or receiving a follow-up research grant.

Nevertheless, this type of robust empirical evidence is rather absent for developing countries. For instance, Fedderke and Goldschmidt (2015) evaluate whether a substantial increase in public

funding to researchers in South Africa is associated with a material difference in their productivity. They compare performance measures of researchers who were granted substantial funding against researchers with similar scholarly standing who did not receive such funding. They find that substantial funding is associated with raised researcher performance – though the increase is moderate, is strongly conditional on the quality of the researcher who receives the funding, and is greater in some disciplines than others. Moreover the cost per additional unit of output is such as to raise questions about the usefulness of the funding model. The implication is that public research funding will be more effective in raising research output where selectivity of recipients of funding is strongly conditional on the established track record of researchers.

In the case of Latin America, only a few contributions -mostly concentrated in Argentina and Chile- are available. For instance, Benavente et al. (2007, 2012) study the effect of the Chilean National Science and Technology Research Fund (FONDECYT), to find significant and positive impact in terms of publications, but no impact in terms of quality of scientific production. Chudnovsky, et al. (2008), Ubfal and Maffioli (2011) and Ghezan and Pereira, (2014), concentrate their efforts in unveiling the impacts of Argentinean FONCYT on scientific productivity. Specifically, Chudnovsky, et al. (2008) found a positive and statistically significant effect of subsidy on academic performance, especially for young researchers while Ubfal and Maffioli (2011) found a positive and significant impact of funding on collaboration measured by the number of co-authors for publications in peer-reviewed journals. In the case of Brazilian BIOTA programme, Colugnati et al. (2014) finds a 10-20% increase in the scientific production of the beneficiaries of BIOTA in comparison to the control group (depending on the indicator considered). The same effect was observed with regard to co-authors. The effect was weaker when all output cited in researchers' CVs was considered, falling to about 30–40% and displaying less statistical significance. The contribution that is closer to ours is that of Bernheim et al (2012) who studied the impact of the national system of researchers (SNI) in Uruguay.[2]

[2] Uruguayan and Mexican SNI programmes have served as an inspiration to the Paraguayan PRONII under analysis here. In the case of Mexico there is no formal impact evaluation of the programme. One of the only contributions on the programme is Gonzalez and Veloso (2007) who analyses what factors affect productivity of a group of 14,328 researchers, in all fields of knowledge, who have been part of the Mexican National System of Researchers (SNI), for at least one year, from 1991 to 2002. The National System of Researchers was created in 1984 to enhance the quality and productivity of researchers in Mexico. It gives pecuniary compensation, as a complement of salary, to the most productive researchers. SNI grants represent on average 30% of the income of researchers in the programme.

SNI, provides ex-ante funding of researchers based on their (recent) past research performance through an assessment of their complete CV by means of an electronic platform. Their results show that being a researcher in SNI produces positive impacts in productivity indicators, with stronger effects on the lower (i.e., younger) category where positives effects are also found with respect to technical production.

3. R&D in Paraguay and the PRONII programme

The investment in research and development (R&D) in Paraguay more than tripled between 2005 and 2012, from US $ 6.5 million to US $ 21.7 million. However, its share to GDP remained almost constant, from 0.080% in 2005 to 0.085% in 2012. Almost all of this R&D investment is public R&D. The number of researchers also grew significantly in the period. The number of researchers increased from 543 in 2005 to 1,521 in 2012 (CONACYT, 2012).

The increase in R&D investment and in the number of researchers was accompanied by an increase in the production of knowledge. The publications indexed in Science Citation Index (SCI) and Scopus grew from 41 and 45 respectively in 2005 to 101 and 135 in 2012. Most Scopus publications correspond to the areas of medical sciences (46.6%), agricultural science (18.37%) and natural sciences (19.29%).

These improvements in R&D investment, number of researchers and knowledge production happened in a context of strengthening of the National Council for Science and Technology (CONACYT for its Spanish acronym), the agency responsible for the design and implementation of STI policies in Paraguay.

In 2011, CONACYT created the National Research Incentive Programme (PRONII) with the objective of strengthening and expanding the scientific community of Paraguay. PRONII seeks to promote the research career in Paraguay, by categorizing researchers according to their scientific and technological production and providing economic incentives (subsidies) according to this categorization. It is worth mentioning that the PRONII has been inspired by the National Research System (SNI) of both Uruguay and Mexico

The assessment and selection of researchers is by means of a standardized CV, entered in an electronic platform called CVPY[3] that is publicly available from the website of CONACYT. Applicants to PRONII are evaluated taking into account the following criteria:

1. Production of basic research, applied research and technological outputs of proven quality.
2. Their level of education.
3. The applicant's participation in the development of other researchers' capabilities (mainly through the direction of undergraduate and graduate theses).
4. The applicant's participation in the creation and strengthening of institutional capacities for research and experimental development.

The quality of research is judged taking into account:

1. Papers published in refereed journals. Indexed international journals are considered of greater value, followed by regional and then national journals.
2. Patents and original technological products.
3. Leadership in the field: international, regional and/or national recognition, in that order of importance.

After being assessed, researchers accepted into the programme are categorized in one of four possible levels: Candidate, Level I, Level II and Level III. In the 2011 edition of the programme only those researchers accepted as either Level I to Level III received monthly subsidies equivalent (approximately) to US$700 for Level I, US$ 1,400 for Level II and US$ 2,100 for Level III. This subsidy last for 2 years in the case of Level I, 3 years for Level II and 5 years for Level III; after this period researchers are evaluated again.

There are four scientific fields in PRONII: 1. Agricultural and Natural Sciences and Botany, 2. Health Sciences, Chemistry and Animal Biology, 3. Social Sciences and Humanities and 4. Engineering and Technology, Mathematics, Computer Science and Physics.

[3]Several Latin American countries have adopted in the last decade a standardized platform to register and maintain the information of their researchers. The majority of these platforms contain similar information since they were developed based on "Plataforma Lattes" of Brazil and its regional adaptation named CvLAC .Hence, the methods presented here have the potential to be used for data from other countries in the region.

In the 2011 call 238 researchers were categorized and 29 were rejected.[4] The number of active researchers by field and level after the 2011 call is shown in the following table. Nowadays, PRONII supports 386 researchers.

Table 1. Number of researchers that entered the programme in 2011 by field and category

Category\Field	1	2	3	4	Total
Candidate	18	62	18	12	110
Level I	25	31	18	15	89
Level II	4	13	5	4	26
Level III	3	5	2	3	13
Total	50	111	43	34	238

Notes: Fields of Science: (1) Agricultural and Natural Sciences and Botany, (2). Health Sciences, Chemistry and Animal Biology, (3). Social Sciences and Humanities and (4) Engineering and Technology, Mathematics, Computer Science and Physics.

4. Data and some descriptive statistics

The data used in this paper comes from the CVs of all the applicants to PRONII that is available in the electronic platform CVPY of CONACYT.

The main focus of this research is on the following four dimensions of researchers' performance: bibliographical production, technical production, level of education and formation of new researchers. In the following tables we present information related to these dimensions for the following two periods: the period corresponding to the two years before to the programme (2010-2011) and the period 2012-2013, the first two years after the call.

The bibliographic production includes working papers, conference papers, both published and accepted papers for publication and, books and books chapters. Under the heading technical production 3 types of works are grouped: (1) technical work (such as advisory activities, consulting, development of regulations and ordinances, etc.)[5]; (2) technological products (such as the production of new varieties of plants, prototypes, software, etc.) and; (3) processes or

[4] In 2012, a total of 597 researchers have uploaded their CV into CVPY.
[5] This type of production represents the bulk of the technical production, and tends to exhibit the larger growth rates.

techniques (such as development of management processes and analytical, instrumental, educational or therapeutic techniques, etc.).

In the following four tables we can see that the bibliographic production, the technical production, the publication of articles, the number of theses under direction and the level of education has increased in the period 2012-2013 with respect to the period 2010-2011 for almost all categories of researchers. The only exceptions were the Candidate researchers that have reduced the number of bibliographic products and the Level III researchers that published a small number of papers in 2012-2013 in comparison with 2010-2011. It should be noted that Candidates although have reduced the average number of bibliographic production (understood in a broad sense), they have increased in the period the number of publications in scientific journals, suggesting an strategy change that emphasizes better quality rather than quantity alone.

Table 2. Mean of bibliographic production and articles in scientific journals by researcher category

Researcher category	**Biblio. Prod.** (mean per year) **2010-2011**	**Biblio. Prod.** (mean per year) **2012-2013**	**Rate of increase**	**Art. in Scientific Journals** (mean per year) **2010-2011**	**Art. in Scientific Journals** (mean per year) **2012-2013**	**Rate of increase**
Candidate	2.41	2.19	-9%	0.78	0.88	12%
Level I	4.61	5.57	21%	1.63	1.70	4%
Level II	5.46	7.44	36%	2.19	2.92	33%
Level III	6.17	7.79	26%	2.13	2.00	-6%

Source: Own elaboration based on CVPY.

Table 3.Technical production by researchers category

Researcher category	**Mean per year 2010-2011**	**Mean per year 2012-2013**	**Rate of increase**
Candidate	0.33	0.45	36%
Level I	0.44	0.80	82%
Level II	0.60	0.65	10%
Level III	1.67	3.13	87%

Source: Own elaboration based on CVPY.

Table 4. Number of theses under direction by research category

	Undergraduate theses (mean per year)		Graduate theses (mean per year)	
Research category	2010-2011	2012-2013	2010-2011	2012-2013

Candidate	0.07	0.21	0.05	0.10
Level I	0.11	0.58	0.09	0.61
Level II	0.02	0.12	0.21	0.60
Level III	0.00	0.21	0.58	0.46

Source: Own elaboration based on CVPY.

Table 5. Highest educational level attained by researcher category (number of individuals)

Researchers category	2011				2013			
	Undergrad	Master	PhD	Total	Undergrad	Master	PhD	Total
Candidate	38	46	20	104	27	53	24	104
Level I	32	29	27	88	27	31	30	88
Level II	3	3	20	26	1	3	22	26
Level III	0	1	11	12	0	1	11	12
Total	73	79	78	230	55	88	87	230

Source: Own elaboration based on CVPY.

5. Empirical strategy

The objective of this paper is to estimate the impact of PRONII on researchers' productivity. With this end we exploit the fact that researchers of higher level in the system have increasing subsidies and compare the productivity of researchers in each level with researchers in the previous level. Candidate researchers are compared with applicants that were rejected. The idea is that researchers in two adjacent levels are relatively similar but receive different subsidies (Candidate is the only category that does not receive subsidies). Therefore, we expect those receiving a higher subsidy to have a greater increase in productivity after the programme than the others. Of course, even though researchers in two adjacent levels are potentially more similar than in non-adjacent groups, they are still potentially very different. To begin with, this is why they have been classified in different categories. Therefore, to ensure that we compare individuals that are relatively similar and that the only difference among them is that they receive different subsidies we will use matching techniques.

We use two alternative methods to evaluate the impact of PRONII on researchers' productivity. The first is propensity score matching (Rosenbaum and Rubin 1983; Abadie and Imbens, 2006)

with difference-in-difference and the second one is difference-in-difference with entropy balancing proposed (Hainmueller, 2012; Hainmueller and Xu, 2013).

Since we cannot observe what would happen if the "treated" researchers did not get the financial support provided by PRONII (the counterfactual), we need to find a proxy for the counterfactual, in other to compare them with the treated individuals. Take the case of Candidates, researchers that did not get public financial support could be considered for a comparison (or control) group; however, it is possible that these researchers did not get support because of some particular characteristic that could also affect the outcome variables. For example, the level of education (e.g. if the individuals have a master or a doctorate degree) is key to enter the PRONII at Candidate level, and at the same time the level of education could be an important predictor of the number of publications. Therefore, if we compare the publication performance of Candidates with that of the individuals that were rejected we are likely to observe that candidates publish more than the control group simply because they have a higher level of education and not necessarily because they have the incentive of the public subsidy.

Propensity score matching methods, under some assumptions, can be used to circumvent this problem.[6] The following briefly explains the rationale behind this strategy.

One of the key parameters of interest in this paper is:

$$\tau_{\mathrm{ATT}} = E[Y(1)|\mathrm{D} = 1] - E[Y(0)|\mathrm{D} = 1]$$

where τ_{ATT} is the average effect of PRONII on researchers that receive the subsidy; $E[Y(1)|\mathrm{D} = 1$ is the mean value of the outcome variable $Y(1)$ (e.g., number of publications) given that the researchers received the public subsidy provided by PRONII; and $E[Y(0)|\mathrm{D} = 1]$ is the counterfactual (i.e., the expected value of outcome variable, $Y(0)$) for researchers in the treatment group in case they did not obtain (or obtain a lower level) of subsidy. D=1 means that the researcher belongs to the treatment group.

Unfortunately, we do not observe the counterfactual. What we do observe is $E[Y(0)|\mathrm{D} = 0]$, which in our case could be number of publications of those researchers that do not belong to

[6] See Caliendo and Kopeining (2008) for very intuitive presentation of these methods.

PRONII ($\mathrm{D}=0$) and do not receive treatment (or subsidy). Of course, $E[Y(0)|\mathrm{D}=0]$ must not need to be equal to $E[Y(0)|\mathrm{D}=1]$ and therefore can introduce a bias to the estimation in case it is used as a proxy for $E[Y(0)|\mathrm{D}=1]$. Note that,

$$\tau_{\mathrm{ATT}} = E[Y(1)|\mathrm{D}=1] - E[Y(0)|\mathrm{D}=1] - E[Y(0)|\mathrm{D}=0] + E[Y(0)|\mathrm{D}=0],$$

and therefore

$$E[Y(1)|\mathrm{D}=1] - E[Y(0)|\mathrm{D}=0] = \tau_{\mathrm{ATT}} + bias,$$

where $bias \equiv E[Y(0)|\mathrm{D}=1] - E[Y(0)|\mathrm{D}=0]$. As previously noted, if researchers with particular characteristics tend to be selected in the treatment group and these characteristics affect outcomes, then there will be bias. On the contrary, if the assignment to both groups is completely random, such bias should not be a concern. Because this condition clearly does not hold in the case of PRONII, we have to do something else.

Assuming the differences between the treated and control groups comes from observable characteristics (e.g., education before the programme, age, previous record of publication) that are not affected by the treatment, we can proceed to find researchers that are similar on these characteristics in both groups and compare them. The identification assumption is that, given a set of observable covariates X that are not affected by treatment, potential outcomes are independent of treatment assignment (this is called the conditional independence assumption). This implies that selection into the treatment group is only based on observable variables X that can be controlled for.

Usually, X is of high dimension. To deal with this dimensionality problem, propensity scores can be balanced. We can use the Xs to estimate the probability of being selected for treatment P(D=1| X)=P(X) —using a probit or logit model in the case of binary treatment— and use this probability to find similar researchers in both groups (treated and control).

The propensity score matching (PSM) estimator for average treatment effect on the treated is

$$\tau_{\mathrm{ATT}}^{\mathrm{PSM}} = E[Y(1)|\mathrm{D}=1, \mathrm{P(X)}] - E[Y(0)|\mathrm{D}=0, \mathrm{P(X)}].$$

Assuming conditional (on the propensity score, $\mathrm{P(X)}$) independence of outcome variables with respect to treatment, this estimator is unbiased.

An additional important condition to use PSM is to have enough treated and control researchers on the common support. More formally, we need $0 < P(\mathrm{D} = 1|\mathrm{X}) < 1$. This condition ensures that researchers with the same values of X have a positive probability of being both participants and non-participants, and we avoid predicting perfectly if a researcher belongs to the control or the treatment group.

The matching algorithm used in this paper is Nearest Neighbour Matching (NNM) with replacement. In particular, for each treated researcher, we found the 5 nearest neighbours (matching partners) and compared them with the treated researcher. We will also report the results with the nearest neighbour as a robustness check.

Note that we are assuming that there are no non-observable variables that could affect the participation in the programme and simultaneously affect the performance of researchers. If this is not the case, and there are variables that could potentially affect the participation in the programme and the outcome that we cannot control for and, they are fixed in time, for example the type of institution where the researchers work (e.g. public vs. private, research vs. consultancy), we can use (in case we have at least two periods of time in our database) difference-in-differences together with matching to circumvent this problem. In this case the estimator of the average impact on the treated will be:

$$\tau_{\mathrm{ATT}}^{\mathrm{DD-PSM}} = E[Y_2(1) - Y_1(1)|\mathrm{D} = 1, \mathrm{P(X)}] - E[Y_2(0) - Y_1(0)|\mathrm{D} = 0, \mathrm{P(X)}].$$

The diff-in-diff PSM estimator $\tau_{\mathrm{ATT}}^{\mathrm{DD-PSM}}$ is the difference of the interest variable (e.g. number of publications) before (period 1) and after the PRONII (period 2), among the treated and the control group compared on the common support (using PSM). This is a more robust estimator of the effect (in the sense that allow for some non-observable heterogeneities) and therefore this is the one that we will be reporting in the results section.

As an alternative methodology we will use the entropy balance proposed by Hainmueller (2012) and Hainmueller and Xu (2013). The basic idea of this method is that it is possible to eliminate

(under some conditions) the bias that comes from the differences between treated and control groups by assigning a weight to each control group individual in order to make them more similar to beneficiaries. The weighting is chosen in the following way (Hainmueller, 2012):

$$\min_{w_i} H \equiv \sum_{i|\mathrm{D}=0} w_i log(w_i/q_i),$$

subject to balance and normalization constraints:

$$\sum_{i|\mathrm{D}=0} w_i X_{ij} = m_j, \ \forall j$$

$$\sum_{i|\mathrm{D}=0} w_i = 1 \ \text{and} \ w_i \geq 0,$$

where w_i is the weight chosen or estimated for each control unit i, q_i is the base weight (usually chosen as 1/n, being n the number of control units). The balance constraints impose that the weighted mean of variable X_j in the control group (i.e. $\sum_{i|\mathrm{D}=0} w_i X_{ij}$) must be equal to the mean of variable X_j in the treated group (i.e. m_j). The other constraints are normalization constraints.

Note that the procedure tries to minimize the difference between a uniform weight and the estimated weight subject to the weighted mean of variables in the control group being equal to the mean in the treated group.

Once these weights are estimated we run the regression of the outcome on the treatment indicator in the reweighted data.

6. Results

a. Probability of participation

In the following 3 tables we show the probability of participating in the programme at the different levels with respect to the excluded category, which is the previous level, except in the

case of Candidates in which case the excluded category is the individuals that were rejected in the 2013 call of the programme.[7]

We started with a very broad specification of the probit models including the following variables for the pre-treatment period: Age, Sex, Master, PhD, Theses directed (concluded), Theses directed (in process), Technical production, Bibliographic production, Papers in Scientific Journals, Papers Scopus, Quality of papers (Mean SJR) [8] and dummies for the different scientific areas (Medical sciences, Social sciences, Humanities, Engineering and Technological sciences, Agriculture sciences, and Natural Sciences).[9] In order to avoid over-specification of the model we kept only those variables that were significant at the 10% confidence level in each of the different categories.

In Table 6 we present the probability of participation for Candidate researchers. The variables Master, PhD, Bibliographic production and papers in scientific journals are positively correlated with being a Candidate researcher in 2011 (instead of being in the "category" rejected by the programme and have applied in 2013). Engineering and Technology, Social Sciences and Humanities areas are negatively correlated.[10] If we take into account that the programme at this entry level establishes the following conditions: Candidate researchers must demonstrate an important participation in research activities supported through publications and other means of communication or documentation of results and preferably, they should be performing advanced level training in master or doctoral programmes; it seems that the screening process has been done properly, except for the bias against some areas.

[7] We have only 29 rejected individuals in the 2011 call, and this is a very small number, this is why we choose to use the rejected individuals in the 2013 call as a potential control group. It is important to notice that 14 of the individuals rejected in the call 2011 are also rejected in the call 2013 and therefore are also in the control group.

[8] The SCImago Journal & Country Rank is a portal that includes the journals and country scientific indicators developed from the information contained in the Scopus database (Elsevier B.V.). These indicators can be used to assess and analyse scientific domains. The SCImago Journal Rank (SJR) indicator, based on the Google algorithm, shows the visibility of the journals contained in the Scopus database from 1996.

[9] Natural sciences is the excluded category.

[10] As mentioned previously we are using as a control group for the Candidates the group of individuals that applied to be part of the programme in 2013 and were rejected. This group in fact includes almost 50% of the individuals that also applied in 2011. We are not using as a control group the 2011 applicants that were rejected because this is very small control group. But in fact the results found using this alternative control group is similar to the results that we will be analysing in the following sections and are available upon request.

Table 6. Probit for Candidates Researchers

	dF/dx	S. E.	z	P>z
Master obtained prior to 2011	0.205	0.088	2.25	0.025
PhD obtained prior to2011	0.273	0.095	2.47	0.014
Bibliographic production (mean 2010-2011)	0.035	0.019	1.78	0.075
Papers in Scientific Journals (mean 2010-2011)	0.627	0.111	5.31	0.000
Engineering and Technology	-0.367	0.107	-3.00	0.003
Social Sciences	-0.395	0.087	-4.15	0.000
Humanities	-0.413	0.145	-2.18	0.030
N=220 / Pseudo R2= 0,3549				

Note: 0 category is rejected applicants in 2013.

The conditions established in the PRONII for researchers Level 1 are: to have a master or doctoral degree, or equivalent scientific production, having demonstrated over the course of the five years prior to the PRONII to be able to carry out original research independently. The probit presented in table 7 shows that the variables that seem relevant to distinguish Level 1 from Candidate researchers are the bibliographic production, the publication record in indexed journals (a measure of quality of research), the theses that they direct, not having a master degree and the age. Belonging to the medical and social areas, other things equal, conspires against belonging to Level 1. The variables bibliographic production, papers indexed in Scopus, theses directed (concluded) seem to be relevant to establish the ability to carry out original research independently as PRONII requires at this level. To have a master degree seemed to be used as a way of discriminating Candidates from Level 1 researchers. The negative sign means that having a master degree reduces the probability of belonging to Level 1 and increases the probability of belonging to Candidate level, probably because evaluators interpreted this as evidence that the researcher did not ended her/his education process or do not have the right education level for Level 1 researchers (even when this is not a condition established by the programme). An interesting finding is that age was also used to differentiate Level 1 researchers from Candidates. Probably, this is another not intended result of the evaluation process.

Table 7. Probit for Level I Researchers

	dF/dx	S. E.	z	P>z
Age in 2011	0.026	0.005	4.98	0.000
Master obtained prior to 2011	-0.166	0.093	-1.76	0.079
Theses directed (concluded) (mean 2010-2011)	0.070	0.027	2.62	0.009

Bibliographic production (mean 2010-2011)	0.061	0.020	3.05	0.002
Papers Scopus (mean 2010-2011)	0.418	0.125	3.34	0.001
Medical Sciences	-0.474	0.093	-4.26	0.000
Social Sciences	-0.218	0.107	-1.91	0.056
N=191 / Pseudo R2= 0,3506				

Note: 0 category is Candidates in 2011.

To be accepted as a Level II researcher, the requisites established by PRONII includes to hold PhD or equivalent scientific output, strong track record of work, particularly in the five years prior to each call of PRONII, having developed its own line of research with sustained production of original knowledge and activities aimed at capacity building for research will also be assessed.

The following probit shows that indeed having a PhD and publications of higher quality (proxied by the mean Scimago journal ranking of the journals where they publish) increases the likelihood of belonging to Level 2 instead of Level 1. To have a master degree is also used as an element to distinguish, other things equal, Level 2 from Level 1 researchers. However the number of theses directed that is a proxy for capacity building for research does not appear in the probit as an element that discriminates Level 2 from Level 1. Having medical and social sciences as the main research area increases the probability of belonging to Level 2 relative to Level 1.

Table 8. Probit for Level II Researchers

	dF/dx	**S. E.**	**z**	**P>z**
Master obtained prior to 2011	0.424	0.219	2.01	0.045
PhD obtained prior to 2011	0.651	0.129	3.97	0.000
Mean SJR (2010-2011)	0.248	0.090	2.71	0.007
Medical Sciences	0.406	0.167	2.57	0.010
Social Sciences	0.278	0.162	1.95	0.051
N=102 / Pseudo R2= 0,331				

Note: 0 category are researchers Level I that were part of PRONII from 2012 to 2014.

b. Impacts

This section presents the results of the impact evaluation. In table 10the results for each of the variables analysed and for each of the 3 alternative methods are presented (1 neighbour PSM

with diff-in-diff, 5 neighbours PSM with diff-in-diff, ebalance with diff-in-diff). The propensity scores were estimated with the probit models presented in the previous section. In the appendix we show mean tests for the variables used in this evaluation in order to show evidence of a good matching on observable characteristics or researchers in the control and treated group. We also report in the appendix the result of the entropy balancing in terms of the mean equalization for some relevant variables.

The results show that the short run effects for the entry level of the programme (i.e. Candidate researchers) seem to be concentrated in the bibliographic production of higher quality, i.e. in the publication of papers in scientific journals and papers indexed in Scopus. In any case, and taking into account the length of time that takes to move a paper from a working paper stage to a published paper in a scientific journal, it is not negligible the increase on average of 0.25 papers per year published in the 2 years after the start of the programme. In the case of Scopus papers the increase is of 0.07 papers per year. It is important to notice, that these results are not very robust to the method used in the estimations; therefore they should be taken with care.

When the performance of researchers Level 1 are compared to Candidate researchers, we find that the increase in the subsidy from one category to the other generates a positive impact on the theses directed that are in process of around 1 additional thesis per year in average, the production of 1 additional bibliographic output per year, the production of 0.5 technical output per year and one additional PhD in every 30 researchers. In turn, the quality of their publications seems to be reduced at least judged by the average Scimago Journal Raking of the journals where they published. The level of robustness of these results across estimation methods is heterogeneous. The result that is more robust to the estimation method is the one related to the direction of theses.

In the case of Level II researchers the significant results when compared with the previous category, is that the impact of the programme seems to be negative on the number of theses directed (both concluded and in process) and positive on the indicator of quality of their research. On average they direct 2 theses less per year than the previous level but they publish on journals that have on average a higher score of between 0.3 and 0.44 points. In the case of researchers

Level 2 they have to reapply to be kept in the programme every 3 years, therefore we have good information in their CVs as to measure the impact of the programme after 3 years of the programme. As can be seen in the table the results after three years in the programme are qualitative similar to those found after two years.

Note that in the case of Level II researchers we are only measuring the additional performance with respect to Level 1, therefore we should expect them to perform better than Candidates along the lines commented in the previous paragraph and in addition along the lines discussed in the case of Level 1 *vis a vis* Candidates.

We are not reporting here the results for Level III researchers since the sample is very small (we have in our sample only 8 individuals in this level).

Table 10. Impact of PRONII on researchers' performance

	Method	Candidate		Level I		Level II - 2 years		Level II - 3 years	
		Coef.	S.E.	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.
Master	1 neighbor	0.06395	0.10400	-0.08772	0.06865	-0.10317	0.06723	-0.10317	0.06723
	5 neighbors	0.04198	0.08033	0.00702	0.06379	-0.04938	0.04819	-0.04938	0.04819
	ebalance	-0.03335	0.04840	0.01108	0.03056	-0.03265	0.03336	-0.03265	0.03336
PhD	1 neighbor	-0.03333	0.06013	0.03509	0.04920	0.10317	0.08952	0.10317	0.08952
	5 neighbors	-0.01341	0.03971	-0.02105	0.04028	0.10494	0.08335	0.10494	0.08335
	ebalance	0.02869	0.01856	**0,03385***	0.01940	0.07078	0.05285	0.07078	0.05285
Theses directed (concluded)	1 neighbor	0.20666	0.50373	0.71930	0.51048	**-2,48264****	1.08854	**-1,60632***	0.89054
	5 neighbors	0.24020	0.37957	0.46667	0.48134	**-2,21458****	0.88663	**-1,56096****	0.72711
	ebalance	0.31527	0.26102	0.68606	0.49199	-0.42614	1.30708	-0.12742	0.92588
Theses directed (in process)	1 neighbor	0.09932	0.29938	**1,32456*****	0.40131	**-1,84276****	0.85399	-0.63608	0.61387
	5 neighbors	0.02558	0.21330	**1,02632*****	0.37410	**-1,86613*****	0.63496	-0.63727	0.47940
	ebalance	-0.10100	0.12717	**0,78868****	0.37530	-0.92176	1.04170	0.23856	0.75072
Technical production	1 neighbor	-0.02693	0.22951	0.66667	0.43558	-0.02728	0.36889	0.02083	0.36354
	5 neighbors	-0.12484	0.20898	0.29825	0.30485	0.08681	0.31476	0.13997	0.31648
	ebalance	0.06685	0.14818	**0,45875*****	0.16348	0.19167	0.27123	0.26419	0.29216
Bibliographic production	1 neighbor	0.11043	0.44525	**0,98246***	0.55055	2.09077	1.41556	1.75331	1.35448
	5 neighbors	0.18376	0.37993	**0,99649***	0.55092	1.63819	1.33368	1.72106	1.27455
	ebalance	-0.39826	0.33818	1.12534	1.06778	-1.77461	1.72218	-1.41112	1.57987
Papers in Scientific Journals	1 neighbor	0.24623	0.15155	0.21930	0.27183	0.52976	0.93772	0.08730	0.81234
	5 neighbors	**0,25659****	0.12882	0.28070	0.24042	0.76443	0.88150	0.47693	0.77525
	ebalance	-0.13419	0.17559	0.34139	0.24612	-1.38005	1.74868	-1.07708	1.31793
Papers Scopus	1 neighbor	0.05561	0.05951	0.12281	0.10657	0.54514	0.43631	0.03687	0.33646
	5 neighbors	0.05143	0.04517	0.04386	0.09080	0.47454	0.44052	0.15180	0.32377
	ebalance	**0,07823****	0.03959	-0.17305	0.13659	0.07819	0.35122	-0.72723	0.64523
Quality of papers	1 neighbor	-0.00728	0.05581	-0.01079	0.10894	**0,44091*****	0.13412	**0,35881*****	0.11455
(Mean SJR)	5 neighbors	-0.00985	0.04409	-0.07242	0.08498	**0,30238****	0.12582	**0,29134*****	0.10948
	ebalance	-0.01610	0.04208	**-0,18413***	0.10105	0.17902	0.16554	0.16155	0.16861

Note: p<0.1 = *, p<0.05 = **, p<0.01 = ***.

7. Conclusions

The objective of this paper is to perform an impact evaluation of a programme that provides ex-ante subsidies to researchers, as a complement to their wages. The analysis of the effects of this type of subsidies that are prevalent in Latin America has received little attention in the literature. Moreover we are able to analyse the impact of the programme in dimensions of researchers' productivity that have been mostly overlooked previously (probably because of lack of data), such as technical production, own education and the training of other researchers.

One important point to stress is that this is a short run impact evaluation of the programme, since we are analysing the impacts after only two year of the beginning of the programme. Another important issue that we must keep in mind when analysing the results and their significance, is that we have a small number of observations, particularly for the case of researchers level II. Both facts go in the direction of not finding significant effects.

We find results that suggest that the short-term effects for the entry level to the programme (researchers Candidates) is mainly on the production of higher quality literature, i.e., in the publication of articles in scientific journals and articles indexed in Scopus. However, the result is not very robust to the estimation method. When Level I researchers are compared to Candidates, we find that the programme generates a positive impact on the number of theses directed by researchers. The impact is of approximately one additional thesis per year and per researcher. This result is robust to alternative methods of estimation. We also find other less robust (to methods of estimations) impacts: one additional bibliographic product and 0.5 additional technical products per year and per researcher and one additional researcher with PhD every 30 researchers at the end of the second year of the programme. Instead, the quality of publications seems reduced. For the case of researchers Level II, when compared with the previous category, we find that the programme appears to have a negative impact on the number of thesis (both completed and in progress) and positive effect on the quality of publications. On average, researchers Level II directed 2 theses less per year compared to the previous level, while published in journals that have on average a higher score. However the statistical significance of these impacts is not robust to alternative methods of estimation.

A final note with respect to how well the evaluators have applied the entry criteria for the different level. In general we found that the probability of entry is affected by the variables that supposed to be relevant to categorize researchers in those categories. However we found a couple of exceptions. The first one refers to the fields that researchers belong. In some cases there is evidence that this area was relevant to explain the categorization in one level opposed to another. The second one is age that seemed to be a relevant variable, other things equal, to explain the categorization in Level 1 instead that in level two. These two variables were not supposed to matter for the classification according to the evaluation criteria.

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Appendix

Table A1. Candidate, mean test 1 neighbour

		Mean			%reduct	t-test	
Variable		Treated	Control	%bias	bias	t	p>t
Master	Unmatched	0.422	0.405	3.4		0.25	0.804
	Matched	0.443	0.471	-5.8	-72	-0.34	0.737
PhD	Unmatched	0.183	0.144	10.6		0.79	0.433
	Matched	0.200	0.286	-23.1	-117.9	-1.18	0.240
Theses directed (concluded)	Unmatched	0.771	0.653	7.4		0.55	0.584
	Matched	0.879	0.724	9.7	-31.6	0.49	0.627
Theses directed (in process)	Unmatched	0.170	0.054	26.7		1.98	0.049
	Matched	0.143	0.152	-2	92.5	-0.09	0.931
Technical production	Unmatched	0.335	0.297	4.4		0.33	0.745
	Matched	0.371	0.138	27.3	-521.9	1.55	0.124
Bibliographic production	Unmatched	2.413	0.914	71.2		5.28	0.000
	Matched	1.500	0.707	-9.8	86.2	-0.56	0.578
Papers in Scientific Journals	Unmatched	0.784	0.095	122.6		9.13	0.000
	Matched	0.314	0.271	7.6	93.8	0.66	0.511
Papers Scopus	Unmatched	0.101	0.041	26.9		2.00	0.047
	Matched	0.093	0.036	25.4	5.4	1.55	0.123
Quality of papers	Unmatched	0.078	0.022	31.1		2.32	0.021
(Mean SJR)	Matched	0.060	0.019	23	26	1.45	0.149

Table A2. Candidate, mean test 5 neighbours

		Mean			%reduct	t-test	
Variable		Treated	Control	%bias	bias	t	p>t
Master	Unmatched	0.422	0.405	3.4		0.25	0.804
	Matched	0.443	0.481	-7.6	-126.9	-0.44	0.657
PhD	Unmatched	0.183	0.144	10.6		0.79	0.433
	Matched	0.200	0.177	6.2	41.6	0.35	0.730
Theses directed (concluded)	Unmatched	0.771	0.653	7.4		0.55	0.584
	Matched	0.879	0.768	6.9	6.2	0.38	0.707
Theses directed (in process)	Unmatched	0.170	0.054	26.7		1.98	0.049
	Matched	0.143	0.060	19	28.8	1.38	0.169
Technical production	Unmatched	0.335	0.297	4.4		0.33	0.745
	Matched	0.371	0.178	22.6	-414.1	1.26	0.208
Bibliographic production	Unmatched	2.413	0.914	71.2		5.28	0.000
	Matched	1.500	1.876	-17.9	74.9	-0.79	0.433
Papers in Scientific Journals	Unmatched	0.784	0.095	122.6		9.13	0.000
	Matched	0.314	0.294	3.5	97.1	0.31	0.759
Papers Scopus	Unmatched	0.101	0.041	26.9		2.00	0.047
	Matched	0.093	0.028	28.8	-7.2	1.77	0.079
Quality of papers	Unmatched	0.078	0.022	31.1		2.32	0.021
(Mean SJR)	Matched	0.060	0.016	24.7	20.6	1.57	0.118

Table A3. Candidate, mean before and after ebalance

	Before		After	
Variables	Treat mean	Control mean	Treat mean	Control mean
Master	0.422	0.4054	0.422	0.4221
PhD	0.1835	0.1441	0.1835	0.1836
Bibliographic production	2.413	0.9144	2.413	2.411
Engineering and Tech. sciences	0.06422	0.1982	0.06422	0.0644
Social sciences	0.1927	0.3964	0.1927	0.1933
Humanities	0.02752	0.07207	0.02752	0.02755

Table A4. Level 1 mean tests 1 neighbour

		Mean		%reduct		t-test	
Variable		Treated	Control	%bias	bias	t	p>t
Master	Unmatched	0.318	0.417	-20.6		-1.42	0.159
	Matched	0.386	0.404	-3.6	82.3	-0.19	0.850
PhD	Unmatched	0.307	0.194	26.1		1.81	0.072
	Matched	0.228	0.333	-24.4	6.6	-1.25	0.215
Theses directed (concluded)	Unmatched	2.244	0.709	55.9		3.97	0.000
	Matched	1.175	1.026	5.4	90.3	0.45	0.651
Theses directed (in process)	Unmatched	0.261	0.175	18.8		1.30	0.195
	Matched	0.184	0.430	-53.3	-183.6	-2.19	0.030
Technical production	Unmatched	0.438	0.330	11.4		0.78	0.435
	Matched	0.289	0.640	-37.4	-226.7	-1.40	0.163
Bibliographic production	Unmatched	4.636	2.510	58.5		4.15	0.000
	Matched	3.079	2.439	17.6	69.9	1.60	0.111
Papers in Scientific Journals	Unmatched	1.653	0.825	44.3		3.16	0.002
	Matched	0.921	0.658	14.1	68.2	1.49	0.138
Papers Scopus	Unmatched	0.443	0.107	51.9		3.70	0.000
	Matched	0.184	0.281	-14.9	71.3	-1.18	0.240
Quality of papers	Unmatched	0.219	0.083	41.2		2.90	0.004
(Mean SJR)	Matched	0.193	0.212	-5.7	86.3	-0.24	0.808

Table A5. Level 1 mean tests 5 neighbours

Variable		Mean Treated	Control	%bias	%reduct bias	t-test t	p>t
Master	Unmatched	0.318	0.417	-20.6		-1.42	0.159
	Matched	0.386	0.453	-13.8	32.9	-0.72	0.475
PhD	Unmatched	0.307	0.194	26.1		1.81	0.072
	Matched	0.228	0.267	-8.9	65.7	-0.47	0.637
Theses directed (concluded)	Unmatched	2.244	0.709	55.9		3.97	0.000
	Matched	1.175	1.314	-5	91	-0.37	0.715
Theses directed (in process)	Unmatched	0.261	0.175	18.8		1.30	0.195
	Matched	0.184	0.284	-21.7	-15.5	-1.03	0.307
Technical production	Unmatched	0.438	0.330	11.4		0.78	0.435
	Matched	0.289	0.400	-11.8	-2.9	-0.57	0.571
Bibliographic production	Unmatched	4.636	2.510	58.5		4.15	0.000
	Matched	3.079	2.549	14.6	75.1	1.30	0.196
Papers in Scientific Journals	Unmatched	1.653	0.825	44.3		3.16	0.002
	Matched	0.921	0.881	2.2	95.1	0.22	0.826
Papers Scopus	Unmatched	0.443	0.107	51.9		3.70	0.000
	Matched	0.184	0.189	-0.8	98.4	-0.07	0.941
Quality of papers	Unmatched	0.219	0.083	41.2		2.90	0.004
(Mean SJR)	Matched	0.193	0.137	16.9	59	0.81	0.420

Table A6. Level 1, mean before and after ebalance

	Before		After	
Variables	Treat mean	Control mean	Treat mean	Control mean
Age	46.51	39.61	46.51	46.51
Master	0.3182	0.4175	0.3182	0.3181
Theses directed (concluded)	2.244	0.7087	2.244	2.242
Bibliographic production	4.636	2.51	4.636	4.636
Medical sciences	0.2614	0.4175	0.2614	0.2616
Social sciences	0.1818	0.1942	0.1818	0.1817

Table A7. Level 2 mean tests 1 neighbour

		Mean			%reduct	t-test	
Variable		Treated	Control	%bias	bias	t	p>t
Master	Unmatched	0.115	0.329	-52.6		-2.13	0.035
	Matched	0.167	0.333	-41	22	-1.14	0.261
PhD	Unmatched	0.769	0.289	108.2		4.69	0.000
	Matched	0.667	0.500	37.6	65.3	1.00	0.324
Theses directed (concluded)	Unmatched	2.385	1.928	16.2		0.70	0.489
	Matched	2.694	1.496	42.5	-162.4	1.42	0.165
Theses directed (in process)	Unmatched	0.365	0.276	14.4		0.70	0.486
	Matched	0.417	0.139	45	-211.3	1.36	0.181
Technical production	Unmatched	0.596	0.414	21.4		0.95	0.342
	Matched	0.722	0.499	26.3	-22.9	0.65	0.520
Bibliographic production	Unmatched	5.462	4.349	23.6		1.14	0.256
	Matched	4.722	3.440	27.2	-15.3	1.03	0.311
Papers in Scientific Journals	Unmatched	2.192	1.625	20.9		0.95	0.342
	Matched	2.028	1.572	16.8	19.7	0.48	0.635
Papers Scopus	Unmatched	0.865	0.382	59.8		2.80	0.006
	Matched	0.889	0.510	46.8	21.8	1.12	0.270
Quality of papers	Unmatched	0.482	0.207	59.1		2.79	0.006
(Mean SJR)	Matched	0.382	0.501	-25.7	56.4	-0.56	0.576

Table A8. Level 2 mean tests 5 neighbours

		Mean			%reduct	t-test	
Variable		Treated	Control	%bias	bias	t	p>t
Master	Unmatched	0.115	0.329	-52.6		-2.13	0.035
	Matched	0.167	0.430	-64.9	-23.3	-1.75	0.089
PhD	Unmatched	0.769	0.289	108.2		4.69	0.000
	Matched	0.667	0.463	46	57.5	1.22	0.229
Theses directed (concluded)	Unmatched	2.385	1.928	16.2		0.70	0.489
	Matched	2.694	1.435	44.6	-175.6	1.46	0.154
Theses directed (in process)	Unmatched	0.365	0.276	14.4		0.70	0.486
	Matched	0.417	0.224	31.2	-116.3	0.88	0.384
Technical production	Unmatched	0.596	0.414	21.4		0.95	0.342
	Matched	0.722	0.680	4.9	77	0.12	0.905
Bibliographic production	Unmatched	5.462	4.349	23.6		1.14	0.256
	Matched	4.722	3.694	21.8	7.6	0.74	0.465
Papers in Scientific Journals	Unmatched	2.192	1.625	20.9		0.95	0.342
	Matched	2.028	1.397	23.2	-11.3	0.77	0.449
Papers Scopus	Unmatched	0.865	0.382	59.8		2.80	0.006
	Matched	0.889	0.404	59.9	-0.2	1.66	0.107
Quality of papers	Unmatched	0.482	0.207	59.1		2.79	0.006
(Mean SJR)	Matched	0.382	0.464	-17.8	69.9	-0.42	0.680

Table A9. Level 2, mean before and after ebalance

	Before		After	
Variables	Treat mean	Control mean	Treat mean	Control mean
Master	0.1154	0.3289	0.1154	0.1156
PhD	0.7692	0.2895	0.7692	0.7687
Quality of papers (Mean SJR)	0.4822	0.2074	0.4822	0.4815
Medical sciences	0.4231	0.2632	0.4231	0.4228
Social sciences	0.1923	0.1316	0.1923	0.1921

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