Motivations for collaborating with industry: has public policy influenced new academics in Argentina?

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Abstract

Between 2005 and 2015 a series of science, technology and innovation policies were deployed in Argentina among which academic research collaborations with industry was particularly fostered. This paper studies the effect of those policies on newer researchers, defined as those with PhD or postdoctoral scholarships, looking at their motivations to collaborate and, to some extent, at their actual collaborations with Industry. Our hypothesis is that those policies had a positive effect on young academics' perception of collaborations with industry, now conceived as a dimension of their job, and also on actual collaborations. To conduct our study, we used an original database constructed from an online survey answered by more than 600 newer researchers. Empirical results partly confirm our hypothesis: a direct policy encouraging collaborations by providing collaborative grants was not associated with actual collaborations, while orienting research towards strategic areas –defined by the Science and Technology Ministry- is.

Keywords: Public Policy; Academic Research-Industry collaborations; New Academics; Motivations; Argentina.

1. Introduction

The promotion of a commodified or maketised model for higher education, including academic research, has been observed as a growing trend in Europe (Ashwin, Deem, and McAlpine 2015; Bok 2003; Larsen 2011), in the Anglo-Saxon countries (Slaughter and Leslie 1997; Slaughter and Rhoades 2004) and also in Latin America (Arocena, Göransson, and Sutz 2015; Naidorf et al. 2015). In Argentina, among the market-oriented policies deployed since 2005, the promotion of collaborations between academics and private actors stands out (Ministerio de Ciencia, Tecnología e Innovación Productiva 2011; Secretaría de Ciencia, Tecnología e Innovación Productiva 2006). Nevertheless, different authors agree that research communities in Latin America have historically rejected links with industry because it was assumed that those collaborations would diminish research autonomy (Buchbinder 2005; Naidorf 2006; Sutz 2000). Yet, in the late '80s and the '90s, the general rejection towards perceived restrictions to academic autonomy was partly replaced by incipiently fluid collaborations with other actors, both from industry and governments (Albornoz 2002; Arocena and Sutz 2001; Di Meglio and López Bidone 2010).

In Argentina, between 2005 and 2015[1], in line with the policies developed all around Latin America (Sánchez Macchioli and Osorio 2017), the Argentinean State assigned a predominant place to the Science, Technology and Innovation (STI) policies. These policies were in line with Salto's (2018) observation of policies –in his study accreditation policies- as giving a greater role to the state and the market while reducing the direct influence or autonomy of academia. An aim of the STI policy was to promote collaborations between academia and industry.

[1] This period corresponds to the governments of Nestor Kirchner and Cristina Fernandez de Kirchner. The first years of Nestor Kirchner's administration were focused on solving the economic, political and social crisis. It was not until 2005 that STI policies took off.

Drawing on the concept of generations used by Marquina et al (2015) for studying academics in Argentina, in this paper we focus on the new generation of academics. We identified them as those with a PhD or Postdoctoral scholarship. They correspond to the third identified generation in Marquina et al (2015), the 'novel' academics. Novel academics are aware of the university traditions but, at the same time, are the generation that adapts the most to external demands and policies. Still, by the time when the aforementioned STI policies started, PhD and postdoctoral fellows did not consider collaborations with industry as a relevant aspect of their job (Naidorf and Armella 2007). Did public policies have an effect on newer academics' motivations and practices? To our knowledge, research on individual motivations for collaborating with industry has not considered the effects of STI policies on researchers motivations (Bercovitz and Feldman 2008; Lam 2011, 2010; Olmos-Peñuela, Benneworth, and Castro-Martínez 2015; Perkmann et al. 2013). Our paper contributes to this assessment by analysing the effects of those policies on novel academics who, regardless of some exceptions like Ashwin et al (2015) and Naidorf and Armella (2007), have received little attention in the studies that focus on scholars and/or faculty understanding and reactions to STI and education policies.

Indeed, investigations tend to privilege senior scholars. However, even if the latter's hierarchical position gives them greater influence on the whole research community, novel academics occupy a key position for addressing a potential change in the academic mindset. They are the generation that will occupy hierarchical positions in the future, thus having a role as future policy influencers (Ashwin, Deem, and McAlpine 2015). Therefore, looking at them not only sheds light on current transformations, but also contributes to anticipate future trends. Moreover, as aforementioned, a specificity of this generation is that we can expect scholars to be more open-minded towards public policies fostering public-private collaborations, even if we also acknowledge that old generations' reluctance could be inherited, considering that work

environment has an effect on collaborations (Bercovitz and Feldman 2008). Therefore, if STI policies were innocuous for this generation, it would not be an oversimplification to extend this result to the other, less prone to change, generations.

Our hypothesis is that STI policies had an effect on this new academics' motivations and, to some extent, actual collaborations with Industry. This effect may vary in strength according to the context (scientific field, institutional affiliation, etc.). On the ground of our hypothesis, we conducted an online survey that included information on fellows' profile, and focused on their perceptions of STI policies and different variables measuring forms of collaboration with industry. We extend Naidorf and Armella (2007) research by further evaluating the impact of STI policies that were conducted after their investigation and by performing a quantitative analysis that complements their qualitative approach.

A series of statistical techniques were put in place to analyze this survey's results. After balancing the sample for province and scientific field, ensuring geographical and discipline representativeness, we built a variable called "Collaborate with industry" with the results of all the questions related to actual collaborations and motivations on the topic. A linear model was estimated to study how that variable is distributed according to STI policies and control variables (scientific fields, institutional affiliation, age, gender, etc.).

Our main results partly confirm our hypothesis since a direct STI policy that provides grants that favor collaborations and applied research is not associated with actual collaborations. Nonetheless, we found a positive association between "Collaborate with industry" and orienting research towards strategic research areas which are in line with industry needs and were defined by the Ministry of Science, Technology and Productive Innovation (MinCyT). Furthermore, our results also show that working in a National University[2] (instead of working in a CONICET

[2] National Universities in Argentina are public although autonomous institutions.

-Argentina's National Council for Scientific and Technical Research- laboratory or other public agencies) reduces the chances of collaborating with industry. Also as expected, fellows more connected with industry are particularly significant among those working on 'Agricultural Sciences and Engineering' whereas those working on 'Social Sciences and Humanities' and 'Exact and Natural Sciences' are negatively associated with collaborating with industry.

The rest of this paper is organized as follows. Section two summarizes STI policy in Argentina between 2005 and 2015 focusing on Academic Research-Industry collaborations. Section three briefly shows that our research problem remains understudied. Section four describes the survey, and section five presents the methodology and results. Finally, section six concludes.

2. Science, Technology and Innovation policies in Argentina between 2005 and 2015.

Since 2005, public investment in R&D followed a growing course in Argentina. According to MinCyT's figures, in 1997 total investment in R&D represented 0.42% of Argentina's Gross Domestic Product (GDP). The latter was affected by 2001 crisis but, since 2005, its importance progressively grew reaching 0.64% in 2012, during a period of steady GDP increase.[3]

The orientation of research towards applications was explicitly pointed out by the MinCyT's Minister: 'what we are asking is not that everyone dedicates to do transfers but to think about what could be the use of what they are doing, if it has an application or not.' (Barañao 2012, 346 own translation). Moreover, linking scientific research and innovation and tightening intellectual property rights that facilitate commercialization were preconditions established by international organizations (such as World Bank and the Inter-American Development Bank)

[3] In the following years, R&D in terms of GDP dropped to 0.62 in 2013 and 0.59 in 2014, due to tighter public budgets.

for granting loans to the MinCyT (and the ANPCyT) (Etchichury and Pacheco 2014; Juarros and Naidorf 2006).

Two STI plans were developed during this period: the 'Plan Estratégico Nacional de Ciencia, Tecnología e Innovación "Bicentenario" (2006-2010)' and the 'Argentina Innovadora 2020: Plan Nacional de Ciencia, Tecnología e Innovación (2011-2015)'. A shared priority of both plans was to overcome difficulties of Argentina's disjointed STI system (Ministerio de Ciencia, Tecnología e Innovación Productiva 2011; Secretaría de Ciencia, Tecnología e Innovación Productiva 2006).

The main objective of the 'Argentina Innovadora 2020' plan was to foster productive innovation, contributing to increase productivity. To do so, the plan recognized the need to connect the STI system, in particular public and private actors. According to the assessment included in the 'Argentina Innovadora 2020', the first plan did not achieve significant transformations in terms of public-private collaborations (Ministerio de Ciencia, Tecnología e Innovación Productiva 2011). As Etchichury and Pacheco (2014, 109) pointed out, the new plan aimed to explicitly 'put knowledge into the productive cycle'. To do so, three main policies directly or indirectly encouraged Academic Research-Industry collaborations.

1) The definition of strategic research areas. The 'Argentina Innovadora 2020' defined six: i) agro-industry, ii) environment and sustainable development, iii) social development, iv) energy, v) industry and vi) health. They are all oriented towards applied research and experimental development, thus closer to industry needs. These areas received specific grants as well as a special call for PhD, postdoctoral and permanent research positions in the CONICET. In institutional terms, new national universities have been observed as more open to align their research to those strategic areas than traditional national universities (Rovelli 2017, 2015).

2) Changes in evaluation criteria: a turn into quantitative criteria for evaluating research and the inclusion of technology transfers in evaluations (Emiliozzi 2011; Etchichury and Pacheco 2014; Lavarello and Sarabia 2015). Concerning the former, Beigel (2017) observed that scholars in Argentina modified their publishing attitudes due to evaluation criteria, and Aguado-López et al (2018) showed that researchers collaborate with colleagues from other institutions and countries to enlarge their quantity of published articles and thus do better in those evaluations.

3) The creation of different funds granted by the ANPCyT that promoted those links as well as applied research was the most direct policy implemented to promote academic research-industry collaborations. Between 2009 and 2015 the number of projects funded by the ANPCyT grew from 1,710 to 2,724, with a 140% increase in real terms of allocation of funds.[4] In a nutshell, one of the ANPCyT grant that promotes and strengthens public researchers' links with private enterprises is the FONARSEC (for its Spanish name, 'Fondo Argentino Sectorial'). Among its different programs, the most important in quantity of projects and granted amounts is the Regional Technological Innovation Fund (93% of total approved projects in 2015)[5]. This funding line targets public-private partnerships aimed at producing innovations in different regions of the country, taking into account the aforementioned strategic research areas (Secretaría de Planeamiento y Políticas 2015).

The FONCyT (for its name in Spanish, 'Fondo para la Investigación Científica y Tecnológica') is another program that manages a vast range of funds. It is the biggest ANPCyT fund in terms of number of funded projects (1,390 in 2015), but it is the third one in granted amounts. It privileges applied research that might lead to innovations. The FONCyT also encourages public-private partnerships. For instance, the Project for Oriented Scientific and Technological Research (PICT-O) is a fund that includes a special line, the PICT-O Glaxo, which is a joint

[4] Retrieved from http://www.mincyt.gob.ar/ministerio-presentacion last accessed February 3rd, 2017
[5] Retrieved from: http://www.agencia.mincyt.gob.ar/frontend/agencia/post/1539, last accessed April 18th 2017.

competitive call between the ANPCyT and GlaxoSmithKline. The 'R&D Projects' fund within the FONCyT also look to boost public-private research links. In order to compete for this fund, researchers must show that, if their project is selected, it will be co-funded by a private enterprise or other organization.

Summing up, between 2005 and 2015 there was a major change in the relevance given to STI policy in Argentina, which prioritized collaborations between academic research and industry. However, there is a blind spot in the assessment of the impact these policies on researchers' motivations to engage in such partnerships.

3. Understanding researchers' motivations and determinants for collaborating with industry.

Our aim in this paper is to analyze the effect of STI policies on Academic Research-Industry collaborations, focusing on the motivations and experiences of new academics. In global terms, as shown by Hessels and Van Lente (2008), multiple approaches agree that the research agenda is changing and that there is a growing interaction between science and other actors (see for instance Berman 2011; Clark 2004; Gibbons et al. 1994; Slaughter and Leslie 1997). In this context, different authors have studied how individual characteristics contribute to explain academics' engagement with industry showing the effects of factors like age, gender or identities formed during their training (Giuliani et al. 2010; Olmos-Peñuela, Benneworth, and Castro-Martínez 2015; Perkmann et al. 2013). Still, according to Bercovitz and Feldman (2008), individual factors are conditioned by the work environment. Furthermore, some research fields are more permeable to collaborating with industry, such as engineering (Boardman 2008; Ponomariov 2008) while others, like humanities, remain more distant (Taylor, Cantwell, and Slaughter 2013).

D'Este and Perkmann (2011), looking at researchers' individual motivations for engaging with industry, found different answers within United Kingdom scholars according to the type of established bond. Joint R&D projects, contract research and consulting are motivated by research-related reasons, such as having more funds for research and learn from industry. Meanwhile, spin-offs and patenting are highly motivated by the aim to commercialize results to obtain personal rewards. Again for United Kingdom, Lam (2010) studied how scientists act and respond to university-industry ties. She defined four types of scientists: the traditional, the entrepreneur and two hybrids, one closer to each of the polar cases. Lam (2011) continued that research, and stated that traditional scientists' main rationale for commercializing research is to assure career rewards. On the contrary, the entrepreneurial scientists are more motivated by financial rewards and the intrinsic satisfaction obtained from problem solving.

In a recent paper, Garcia et al (2018) considered how benefits, results and barriers perceived by researches from Brazil have an impact on their group's future degrees of collaboration with industry. They found that both perceiving intellectual benefits from collaborating with industry and previous positive commercial results (patents, spin-offs, etc.) from former collaborations increase future engagements. On the contrary, perceived economic benefits from sharing equipment and having greater financial resources actually discourage researchers from augmenting their collaborations with industry. Finally, the authors founds that extended bureaucracy mainly from universities discourages greater engagements.

All in all, authors have explored how individual characteristics and perceptions, the work environment and differences in terms of scientific fields impact on researchers' collaborations with industry. However, as shown in Perkmann et al (2013) comprehensive literature review, the study of the effects of STI policies on researchers motivations and actual public-private engagements in non-core countries remains understudied. In the next section we describe the

survey we used to identify the impact of STI policy fostering these collaborations on a new generation of researchers in Argentina.

4. Data: survey strategy and description

According to the MinCyT, the total population of doctorate and post-doctorate fellows in Argentina was 13 661 in 2014, last available figure. Scholarships are divided in four groups: 1) CONICET post-doctoral scholarships, 2) CONICET doctoral scholarships, 3) national universities doctoral scholarships and 4) ANPCyT doctoral scholarships. CONICET fellows (groups 1 and 2) represent a vast majority (10 890 representing 80% of the total doctorates and post-doctorates fellows in 2014). The complete list of fellows is not available, forbidding a census or a simple random sampling within it.

To overcome this limitation, we've conducted an online survey following a snowball strategy. We first launched the survey on new academics' main online networks (Becarixs CONICET with more than 13 000 members; Becarixs CONICET 2.0, 5 000 members; Becarixs UBA, 400 members), asking to forward the survey after completing it. The survey was opened for a month since September 16, 2016. Answers where considered as valid only when the person declared enjoying a scholarship by September 30, 2016. 603 workable filled sheets were gathered, representing a sampling of 4.4% of the original population.

Considering that the survey could not be balanced at the sampling stage, an ex post marginal calibration was necessary considering scientific fields (5 modalities)[6] and provinces (Argentina is divided in 24 provinces). The repartition of CONICET grants across scientific fields and provinces is publicly available at its web page (Table 1 in appendix), thus was used to balance

[6] Research in Argentina is structured according five fields: 'Agricultural Sciences, Engineering and Materials', 'Life and Health Sciences', 'Exact and Natural Sciences', 'Social Sciences and Humanities' and 'Technology'.

the survey. We used R 'survey' package (created by Thomas Lumley, University of Auckland) to produce a set of weights that recalibrated the data set according to those two variables. The representativeness of the sample is key not only to this particular analysis and for arriving to accurate conclusions for Argentina but also, as Perkmann et al (2013) state, for arriving to internationally comparable results.

The survey exceeded the scope of this paper and was composed of 6 parts including information on academics' profile, and subjective as well as objective elements of the individual and teamwork in the laboratory, STI policies and different variables measuring forms of collaboration with industry. The first part of the survey refers to fellow's profile and personal information. The second one asks details on the interviewed working institution (origins of the institution's funds, degree of interrelation with corporations and subjective evaluation of the impact of these interrelations on the institution's research agenda). The third part is devoted to teamwork, relations with colleagues and research culture. The fourth part concerns relation with their supervisor/s. Subjective perceptions on the global situation of academia in Argentina were included in the fifth part. Finally, the sixth part was devoted to the destiny of achieved results (communications, publications, patents, technology transfer, etc.).

5. Methods and results

Considering the aim of this article –to study the effect of policies deployed since 2005 encouraging Academic Research-Industry collaborations on new academics in Argentina, our survey included the following questions: i) whether his/her research institute enjoys private sponsorship; ii) if he/she perceived that his/her research institute or herself/himself adapts research according to private sponsorship; iii) if he/she considers that in academia there is a permanent search for links with the private sector; and iv) whether delivering results to a

counterpart that asked for an investigation was a regular action after achieving an outcome or not. These variables show, at the same time, objective aspects of actual collaborations and a subjective adaptation or predisposition towards collaborating with industry. As expected, they resulted strongly correlated. From the answers to these questions, we used a dimension reduction method (principal component analysis) to construct a synthetic variable called 'Collaborate with Industry' that captures most of the information of the four variables mentioned above.

An econometric analysis was conducted to study how different variables, particularly those related to STI policies, may contribute to explain 'Collaborate with Industry'. We considered variables on STI policies but also on fellow's institutional situation, the organization and evaluation of research, gender, age and scientific field. Hence, we controlled for individual determinants as well as organization and institutional contexts, which have all being observed as playing a part in explaining collaborations with industry (Perkmann et al. 2013). We conducted an OLS with variance covariance correction for heterogeneity. The linear model allows to estimate the importance of the relation of each variable with 'Collaborate with Industry', with all the other variables held constant (*ceteris paribus*).

We have tested different settings for the dependent variable 'Collaborate with Industry' and every estimation leads to the same signs and significativity levels (see Table 2).

Table 2. Linear Model Specifications for 'Collaborate with Industry'

Variable	Equation 1	Equation 2	Equation 3
Intercept	-0.118	0.405***	0.823***
Adapt to MinCyT strategic lines	0.113***	0.103***	0.109***
Public Agency Funds	0.068	-0.011	-0.024
Adapt to budget scarcity	0.207***	0.124*	0.153**
Adapt to Evaluation Criteria			0.036
TeamWork			0.050**
National University	-0.196***	-0.199***	-0.210***
Field (ref.= Agricultural Sciences and Engineering)			
Exact and Natural Sciences		-0.346***	-0.350***
Social Sciences and Humanities		-0.641***	-0.608***
Life and Health Sciences		-0.284**	-0.281**
Technology		0.279	0.332
Age			-0.011
Female			-0.115*

p-value: *** stands for less than 0.1%, ** for less than 1% and * for less than 5%

In Table 2, significance is corrected for heteroscedasticity (when detected via Breusch-Pagan test) using heteroscedasticity consistent variance-covariance matrix estimation. The effects of our considered variables of interest are robust to the introduction of control variables.

In a nutshell, results partly confirm our hypothesis. A positive degree of 'Collaborate with Industry' is very strongly and positively associated with the choice of the research subject according to MinCyT's strategic research areas and with the adaptation of research according to budget constraints. However, there seems to be no relation with the availability of ANPCyT's grants.[7] Furthermore, 'Collaborate with Industry' is strongly and negatively correlated to working in a National University.

[7] It may be said that young fellows are not aware of all the funds their institution enjoys and thus results could be inaccurate. However, two facts ensures that this information is available for them: 1) the structure of research institutions in Argentina, which generally include a young fellows' representative in the laboratory board (that later informs other young fellows) and 2) young fellows' personal information is needed to apply for grants in Argentina. Anyway, fellows that did not know an answer could simply state that in the survey.

As we have previously explained, the STI policies deployed in Argentina between 2005 and 2015 underlined the role of Argentina's public science and technology agency, the ANPCyT, which became the main provider of competitive funds for research, particularly fostering public-private collaborations. However, our results show that this policy did not have a significant impact on young fellows' motivations to collaborate and actual collaborations with private actors.

Another STI policy that appeared to have no association with 'Collaborate with Industry' is adapting research to the evaluation criteria defined mainly by the CONICET which considers technology –or more generally knowledge- transfers since 2012.[8] One explanation for the observed lack of association could be that those criteria have not been directly applied to evaluate full-time faculty in public universities (Beigel 2017; Unzué 2013). Furthermore, since published papers remain as the most used and relevant criteria for evaluating researchers' entrance to the CONICET and for achieving promotions, publishing in top journals persisted as the most common practice (Beigel 2017), regardless of collaborations with industry. To some extent, this result shows an internal incoherence of STI policies in Argentina during the analysed period since they fostered public-private collaborations but still mainly evaluate researchers for their published papers. The attempt to include knowledge transfers as an evaluation criteria seems to have not hampered the prevalence of paper publishing.

While results may be showing that STI policies aiming to encourage collaboration failed, another policy that indirectly fostered those engagements did have a positive and significant impact. This is the case of strategic research lines defined by the MinCyT: researchers that have further adapted their work towards those areas (which as we said are in line with industry needs and privilege applied research) are, at the same time, those that perceive collaborations with

[8] Retrieved from: http://www.pagina12.com.ar/diario/universidad/index-2012-10-05.html, November 15th, 2017

industry as part of their job (either based on their motivations and/or on actual collaborations, both integrated in 'Collaborate with Industry').

Summing up, the ANPCyT competitive grants had no impact on young fellows' motivations and actual collaborations while adapting to strategic research lines did.

Budget shortfalls are a structural condition of public research in Argentina, especially in national universities (Castro 2013; Doberti 2014, 2014, García de Fanelli 2007, 2012; Sánchez Martínez 2004) that may thus lead to hypothesize that researchers will be more inclined to collaborate with industry in those cases where these shortfalls are bigger and/or greatly determine the chances to effectively do research. In this respect, we found that a positive degree of 'Collaborate with Industry' is very strongly and positively associated with the adaptation of research according to budget scarcity. This result could confirm the aforementioned hypothesis and mean that when adapting research due to budget constraints, researchers at least partly reorient it towards more commercialized or industry-appealing research, possibly to enlarge their chances to find private sponsors. This is in line with Lam's (2011) results for United Kingdom researchers who commercialize research in order to get more resources for their investigations.

Next, we will explain the effects of control variables which were chosen considering the other potential motives explaining collaborations that had been considered by the literature (section 3). In order to avoid omitted variables' bias, we controlled a set of variables on the organization and evaluation of research work, and for scientific field, age and gender. As we said, our results are robust to the introduction of these variables meaning that, in all the estimations, the signs and significance of the effects of the main variables remained unchanged.

The strong and negative correlation between 'Collaborate with Industry' and working in a national university (instead of in a CONICET institute, other public research institutions or even

a private university) could be explained by the prevalence of an academic culture based on academic autonomy. University's autonomy, including academic freedom, has historically been pursued and defended by national universities, specially older or traditional ones in Argentina, as in other Latin American countries (Beigel 2010; Bekerman 2010; Buchbinder 2005; Marquina, Yuni, and Ferreiro 2015; Naidorf 2006; Navarro and Quesada 2010; Rikap 2017; Sutz 2000; Unzué 2013). Furthermore, institutional constraints, including excess bureaucracy in traditional national universities may also contribute to explain this result, in line with Garcia et al (2018) findings for researchers from Brazil.

Teamwork's positive association with 'Collaborate with Industry' is in line with literature results (Boardman and Corley 2008). This association could be explained by the magnitude of the research projects performed with enterprises and/or oriented by strategic research areas. Fulfilling external demands may entail larger projects that require the work of at least part of the researchers of a laboratory. Furthermore, Teamwork describes a situation where young researchers prioritize bigger projects led by more experienced researchers over potential individual research questions. Hence, it contributes to develop collaborations with other researchers, being potentially more open to relate with enterprises if their research centre is already engaged (Boardman and Corley 2008).

Concerning scientific fields, we included their effects with respect to the reference field 'Agricultural Sciences and Engineering'. As expected, collaboration with industry shows contrasting effects among scientific fields. There is a strong negative association with 'Social Sciences and Humanities' and with 'Exact and Natural Sciences'. The latter is a mainly basic research field. Furthermore, 'Life and Health Sciences' is also negatively though not so strongly associated. The reference field 'Agricultural Sciences and Engineering' appears then to be particularly correlated to 'Collaborate with Industry', as well as 'Technology' (that is not

significantly different from the reference). These two fields comprise mainly applied research and experimental developments, thus closer to industry needs.

When including the rest of the control variables, Age shows no significative effect while being Female seems to be negatively correlated, in line with the literature on the subject (Azagra-Caro et al. 2006; Giuliani et al. 2010; Link, Siegel, and Bozeman 2007). Interestingly, this gender effect does not mitigate the fields' effects.

All in all, concerning our research question, we have observed that the most direct STI policy fostering academic research-industry collaborations seems to have no effect on new academics' motivations nor on actual collaborations, as synthesized in 'Collaborate with Industry'. Still, this result needs to be mediated by the success of what we called an indirect policy encouraging those engagements, the definitions of strategic research areas which were defined considering industry needs. We may state that STI policies that motivate researchers to adapt their research lines towards industry needs contributed to shape novel academics motivations and further engage them with private actors. Furthermore, the still predominance of a traditional culture attached to university's autonomy may be the explanation behind the negative association between collaborating with industry and working in national universities.

6. Conclusions

In this article we studied the impact of STI policies fostering academic research-industry collaborations in Argentina on its new or novel generation of academics. Between 2005 and 2015, a series of STI policies were put in place encouraging academics to collaborate with industry and to adapt their research towards more applied investigations. Our initial hypothesis was that these policies affected novel academics' desire to collaborate with industry. Results partly confirmed this hypothesis. An STI policy that indirectly promoted collaboration with

industry has been more successful than competitive grants given by the ANPCyT because enjoying (or having enjoyed) an ANPCyT grant is not associated to 'Collaborate with Industry', a variable that synthesized novel academics' motivations to collaborate and actual collaborations, therefore referring to the inclusion of such collaborations into what they perceive as their job as academics. Nevertheless, while these early career researchers appear to be at the front end of changing academic perspectives, the weak association with the changes in funding system could be a product of their present location in career trajectories.

Results in terms of control variables were in line with the literature (Giuliani et al. 2010; Olmos-Peñuela, Benneworth, and Castro-Martínez 2015; Perkmann et al. 2013). 'Collaborate with Industry' is negatively associated with being female, and positively associated with teamwork, while age does not seem to have an effect. Moreover, controlling by fields also showed expected results with a stronger negative association between collaborating with industry and 'Social Sciences and Humanities', 'Exact and Natural Sciences' and a smaller though significant negative effect with 'Life and Health Science', all with respect to the reference field, 'Agricultural Sciences and Engineering'. We also observed that working in National Universities is negatively associated with collaborating with industry, probably because a culture of autonomy that rejects collaborations is more entrenched in older or traditional universities which also have higher shares of novel academics.

To conclude, we point out limitations of our investigation that lead to open questions that we expect to tackle in our future research. This analysis is based on a survey conducted only to a sample of new academics, thus we have not been able to compare their answers with that of senior scholars, even if we have considered senior researchers from 'Life and Health Sciences' in a previous research (Author, 2017) whose results are in line with those achieved in this paper. Moreover, a comparative study could be conducted considering the experiences of other non-core countries. Finally, Argentina's political shift since 2016 has also introduced

transformations in STI policy. It would be interesting to see if we arrive to the same results in this new context. In the light of recent STI policies that were deployed since 2016, we may point out that countries like Argentina should not leave aside fundamental research nor should they cut research positions in public institutions if pursuing a developmental strategy. Indeed, these are necessary, although not sufficient, conditions for development that should actually constitute building blocks of STI policies.

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8. Appendix

Table 1. Repartition of CONICET grants across scientific fields and provinces. Year: 2015

Provinces	Agricultural Sciences, Engineering and Materials	Life and Health Sciences	Exact and Natural Sciences	Social Sciences and Humanities	Technology	Total

Buenos Aires	738	551	664	617	40	2610
Capital Federal	292	892	459	933	23	2599
Córdoba	280	302	399	325	15	1321
Santa Fe	296	221	161	176	23	877
Tucumán	179	99	52	62	5	397
Mendoza	147	86	57	101	4	395
Río Negro	68	67	103	31	7	276
Salta	75	56	31	43	1	206
San Juan	69	29	57	35	1	191
Chubut	38	84	34	28	3	187
San Luis	23	44	89	15	4	175
Misiones	53	48	6	32	1	140
Corrientes	25	66	36	7	2	136
Jujuy	17	28	16	37	0	98
Santiago del Estero	26	9	16	35	1	87
Entre Ríos	22	18	11	23	0	74
Chaco	15	13	2	41	0	71
Neuquén	30	9	5	23	2	69
La Pampa	17	17	14	9	1	58
Tierra del Fuego	4	18	13	8	0	43

La Rioja	9	11	5	8	0	33
Catamarca	3	4	2	21	2	32
Santa Cruz	2	1	3	3	0	9
Formosa	2	3	0	3	0	8
Total	2430	2676	2235	2616	135	10092

(Retrieved from: CONICET)