



Characteristics of university-industry linkages in the Argentinean Industrial Sector.

Valeria Arza¹
Andrés López²

I) Introduction

Universities and public research institutes (hereafter public research organisations, PRO) have a key role in the creation and diffusion of knowledge via traditional activities, such as teaching and research. During the last decades and as a response to specific demands from the industry, to PRO's funding needs and to policy recommendations by international multilateral organisations, new activities that involve linkages with the private sector have emerged in many countries.

It has been said that these activities have a broad potential to create and diffuse knowledge (Dasgupta and David, 1994, Nelson, 2004, Pavitt, 2001, Slaughter and Leslie, 1997). Firstly, PRO create and renew the stock of knowledge available in any country. Any user of technological knowledge (firms included) would need to develop their own capabilities to assimilate and exploit knowledge created elsewhere. Therefore, PRO are key elements within the National Innovation System. Secondly, PRO could widen the industry capacity to solve concrete and complex problems. Thirdly, some problems demand a combination of technology that no single firm could developed on its own, but which could nevertheless be solved using the knowledge stock available in PRO (Patel and Pavitt, 1995). In the same vein, PRO develop new laboratory instrument and analytic methodologies that constitute a fundamental input for industry (Rosenberg, 1992). Finally, PRO also produce knowledge related to the economic and social context where firms sell and produce (Fritsch and Schwirten, 1999), which could determine the final success of any innovation process.

However, the relation between PRO and the private sector (especially Universities and firms) is not free from controversies. The main ones are related to the goals of public research (e.g. must it be oriented to solve concrete problems in the industry?, or rather, it must not be conditioned in any way so as to exploit to the maximum the creative potential

¹ varza@fund-cenit.org.ar, Centro de Estudios para la Transformación (CENIT)

² anlopez@fund-cenit.org.ar, Centro de Estudios para la Transformación (CENIT)

in PRO?) and the wide diffusion of knowledge (e.g. what would be the private sector role in diffusing publicly created knowledge?)

Given the likelihood of conflicting interests, to take the most of the public/private interactions, a common platform must be developed to improve the capabilities to define specific objectives on each side in a way that preserves their respective goals and contributes to improve the process of knowledge creation and diffusion within Argentina's National Innovation System.

This paper is part of a larger project that aims at contributing with developing such common platform. The project is based on three sources of information: firms' innovation surveys, survey of PRO researchers, and two cases-study on firms-PRO interaction in the biotechnology sector.

In particular, this paper presents the preliminary analysis of firms-PRO interactions as informed by the last Argentinean Innovation Survey. We discuss the main knowledge activities of firms that form linkages with PRO and we compare them with firms that do not establish those linkages. The exploratory research questions that guide the paper are:

What type of knowledge activities perform firms that interact with PRO? Are they more or less innovative than those that do not interact? What are the most important PRO's research outputs for firms' innovative activities? Are they different from the ones informed by firms that do not interact with PRO? What are the main objectives and obstacles for interacting with PRO? Do firms usually pay for interacting with PRO? Are interactions generally successful in terms of their objectives?

In Argentina there are very few academic studies available related to the process of PRO's knowledge creation and diffusion, and even less papers that explicitly research about private-public interactions³. In general, most of these studies claim that interactions are scarce and the same conclusion can be reached by looking at recent National Innovation Surveys (see INDEC-SECYT-CEPAL, 2003, INDEC-SECYT, 1998).

The great majority of the very few academic papers available related to the interaction between firms and PRO are based on case-studies, which either study the impact of those linkages on firms' innovative capabilities⁴ or analyze the interaction dynamics from the point of view of the PRO⁵. To the best of our knowledge, there are not studies that compare the knowledge activities of firms that interact against those that do not interact with PRO.

³ An incomplete list of those studies includes: Albornoz, 1993, Bisang, 1995, Estébanez, 1996, García de Fanelli, 1993a, García de Fanelli, 1993b, García de Fanelli, 1994, Llomovatte, *et al.*, 2006, Tenti Fanfani, 1993 Bisang, *et al.*, 1995, Chudnovsky and López, 1996, Decibe and Canela, 2003

⁴ Both Moori-Koenig and Yoguel, 1998 (on a neighborhood near the Federal District, Tres de Febrero) and Yoguel and López, 2001 (on the city of Rafaela, in the province of Santa Fe) conclude that linkages have positive impacts on innovative capabilities. Lugones and Lugones, 2004 find a different outcome when they study the case of Bariloche city, since they find that in that case only one public firm managed to reach international competitiveness levels in spite of the linkages that PRO had with many private firms.

⁵ For example, Dávila, 2006 identifies incentives and obstacles that promote and limit interactions in the School of Agronomy of Buenos Aires University and Juarros, 2006 analyzes the extent to which knowledge

Therefore, the originality of this research is two-fold. Firstly, our research questions refer to the characteristics of firms that interact with PRO as opposed to non-interactive firms. The research design took into account the main characteristics of interactive firms to create the control group of non-interactive firms. Secondly, we work with original and representative survey data which is used for the first time to produce this paper.

The paper is divided in three more sections besides this introduction. Next section presents the strategy of data collection and analysis. The third section presents and discuss the descriptive evidence as it results from our preliminary analysis of the Argentinean Innovation Survey of 2006. Finally, the last section four, presents the conclusions which aim at answering the above research questions.

II) Data collection, sample characteristics and research strategy

This paper is based on information from the National Innovation Survey whose fieldwork was carried out in December 2007 (with information for 2006) and managed by the National Institute of Statistics and Censuses (INDEC). The sample was designed so as to be representative of the Argentinean manufacturing sector (2055 firms were included in the original sample). The response rate was 73% (1496 firms answered the form).

In order to pursue the current research, a especial section on firms- PRO interactions was included in the Survey. That section was sent to 592 firms that had declared to have interactions with PRO in the innovation survey for the previous year (2005). The response rate of this section was 60% (354 firms). Besides, another section with questions about firms-PRO interaction was sent to a control group of firms that did not have interactions with PRO in 2005. This control group was built taken into account the size and sector characteristics of linked firms. This form was sent to 384 firms and the response rate was 62% (238 firms).

The empirical approach to answer our research question was to provide descriptive statistics and inferential analysis⁶ to test for the significance of our statements. The strategy, is to add to the text *** when the statement is based on hypothesis testing at 1% level of significance, **, at 5% level of significance, and * at 10% level of significance. In some cases, the significance was also informed in the Tables.

Moreover, the characteristics of interactions between firms and PRO is usually presented by firms size and innovativeness. To this end, firms in the sample were classified in a) small (less than 40 employees), medium (less than 116 employees) and big (more than 116 employees) using information for 2005, and b) innovative and non-innovative, depending on whether they have introduced new products and processes (or significantly improved them) also in 2005.

interactions between firms and PRO have modified the academic orientation of researchers involved in the case of the School of Pharmacy and Bio-chemistry of Buenos Aires University.

⁶ Particularly, chi2 test of independence, t-test on mean differences and z-test on probability differences

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Table 1 presents the characteristics of the sample used for the empirical analysis of this papers in terms of size and innovativeness.

Table 1: Sample characteristics in terms of size and innovativeness of linked and control firms

	Size			Innovative (% of linked and control firms)
	Small (% of linked and control firms)	medium (% of linked and control firms)	big (% of linked and control firms)	
Linked	16%	27%	56%	67%
Control group firms	21%	36%	43%	60%

III) Discussion

III.1) Characteristics of the cooperation

In 2005 590 firms answered that they had established linkages with either an university, or public research organizations such as INTI, INTA, Agency for promotion of science and technology, and other public institutions for science and technology. This represented a 35% of the total number of firms that answer the Innovation Survey that year.

Most collaborative firms have informal linkages of information exchange, however the proportion of collaborative firms that claimed to have active cooperation in joint innovation activities, is not low. As showed in Table 2, 54% of collaborative firms had declared to have at least one active cooperation with some PRO.

Table 2: Type of collaboration among those that collaborate with PRO, 2005.

	Information exchange	Active cooperation
University	27%	27%
INTI	43%	25%
INTA	11%	12%
Government Agency that promotes science and technology	5%	8%
Other public organisations for science and technology	16%	11%
Any of the above	66%	54%

Reasons for no collaboration with PRO

According to information from the Innovation Survey of 2006, the most important reason why firms do not collaborate with PRO is that firms believe they do not need it because their in-house R&D is enough. This is particularly the case for innovative and large firms (**). The second most important reason is that firms consider that PRO do not have a

proper understanding of their line of business, and the third reason is the difficulty in establishing contractual agreements with PRO.

Table 3: Main reasons for not collaborating with PRO

Reasons	No importance (% of control firms)	Little to Moderate importance (% of control firms)	Very important (% of control firms)
Our firm's R&D is enough to innovate	36%	37%	27%
Universities/Public research institutes have no understanding of our line of business	44%	42%	14%
Contractual agreements are difficult	48%	42%	10%
University concerned only with big science	55%	39%	5%
Intellectual property issues	60%	26%	15%
Quality of research is low	60%	36%	4%
Lack of trust	63%	32%	6%
Difficulties in dialogue	63%	34%	3%
Geographic distance	70%	25%	5%

Goals of cooperation

The majority of firms declared that one of their goals for interacting with PRO was the testing of products or processes (60%). Innovative firms allocate higher level of importance to this goal (*). Other important goals indicated by many firms were to contribute to quality control (54%) and to receive technical advice to solve production problems (48%).

It is interesting to point out, that among firms that have allocated some degree of importance to these activities, only 55%, 48%, and 30% respectively declared to have paid for these services. In general, the pattern is that firms that consider the goal very important, pay for the service (**). However, there are still around 19%, 25%, and 52% respectively of firms that although considering the goals *very* important, do not pay for the service.

Table 4: Goals of the cooperation

Goals	No importance (% of linked firms)	Little to Moderate importance (% of linked firms)	Very important (% of linked firms)	The service was paid (% over those that consider the goal of some importance)
To perform tests necessary for your products/processes	40%	44%	17%	55%
To help in quality control	46%	41%	14%	48%
To get technological/consulting advice from researchers and/or professors in solving production-related problems	52%	39%	9%	30%
To make earlier contact with excellent university students for future recruiting	59%	31%	10%	24%
To contract research helpful to the firm's innovative activities (complementary research by universities and public labs)	62%	32%	7%	29%
To use resources available at universities and public labs	62%	33%	5%	30%
To augment the firm's limited ability to find and absorb technological information	64%	32%	5%	17%
To get information about engineers or scientists and/or trends in R&D in the field	64%	31%	5%	10%
Technology transfer from the university	67%	25%	8%	31%
To contract research that the firm cannot perform (substitutive research by universities and public labs)	69%	25%	6%	28%

One interesting finding is that in average firms consider collaboration with PRO more important to contribute to their innovative activities rather than to substitute the activities they do not do (***). This finding is sensible to the size of the firms, while there are no significant differences between these goals for small firms, medium and large firms interact with PRO more to contribute to than to substitute their innovative activities (**).

Another goal that was mentioned as important by 41% of firms was the possibility of recruiting good students, especially in large firms (*).

Success and duration of the interactions

Table 5 shows that 88% of firms consider that the linkages with PRO were successful or expected to be successful in terms of their goals. Although success seems a little bit more frequent for innovative firms, the difference is not significant. The bigger the firm, however, the larger the probability of success (*)

Table 5: Frequency of success of firms – PRO collaboration, 2006

	Innovativeness		Size			
	Non-innovative	Innovative	Small	Medium	Big	Total
Successful linkage	58%	64%	52%	60%	66%	62%
Failed linkage	13%	9%	21%	8%	9%	10%
Success expected	26%	26%	23%	30%	25%	26%
Failure expected	3%	1%	4%	2%	1%	2%
Total firms	115	238	56	97	200	353

Those that considered that the collaboration failed (or expected to fail) pointed out that a “mismatch between available knowledge in PRO and the one the firm needed” was the most important reason (among nine) that explained the failure. The second most important was “low sensitivity of PRO to the demands of industry”, and the third, “PRO research too oriented to basic science”.

Duration of the collaboration

Table 6: Duration of firms – PRO collaboration, 2006.

	Innovativeness		Size			
	Non-innovative	Innovative	Small	Medium	Big	Total
Less than one year	38%	30%	47%	37%	26%	33%
Less than two years	13%	18%	18%	14%	16%	16%
Less than five years	20%	20%	13%	19%	22%	20%
Less than ten years	12%	7%	2%	11%	9%	9%
More than ten years	18%	26%	20%	19%	26%	23%
Total firms	112	238	55	97	198	350

Most firms- PRO collaborations (69%) last less than five years. Innovative firms seem to have longer-term collaboration than non-innovative firms, however the difference is not significant. On the contrary, there is a significant relation (*) between size and duration: large firms seem to manage to establish longer-term collaborations than small firms.

Fields of research

There are not marked difference in the importance allocated to different fields of research. This should be highly dependent on firms’ sector. The field of research most frequently mentioned as important, was industrial design; followed by chemical engineering and

engineering of materials and metallurgy, in the latter two cases, especially for large firms (*).

Table 7: Importance of research done in PRO, by fields of research, 1996-2006.

	No importance (% of linked firms)	Little to Moderate importance (% of linked firms)	Very important (% of linked firms)
Industrial Design	53%	37%	10%
Chemical Engineering	59%	30%	11%
Engineering of Materials and Metallurgy	61%	28%	11%
Mechanical Engineering	61%	31%	8%
Computer Science	63%	32%	5%
Electrical Engineering	64%	27%	8%
Chemistry	66%	23%	11%
Food Science and Technology	69%	21%	10%
Agronomy	72%	17%	12%
Civil Engineering	77%	21%	2%
Biology	79%	17%	4%
Physics	81%	17%	2%
Veterinary	87%	10%	3%
Medicine	87%	10%	3%
Mathematics	87%	12%	1%
Mining Engineering	88%	11%	1%
Geosciences	91%	9%	1%
Other(specify:)	92%	5%	2%

III.2) Main differences between collaborative and non-collaborative firms

A great part of the literature that study firms' collaboration with PRO has been advocated to identify firms, industries, universities' characteristics that affect the probability of forming linkages (e.g. Anselin, *et al.*, 2000, Arundel and Geuna, 2004, Cohen, *et al.*, 2002, Fontana, *et al.*, 2006, Jaffe, 1989, Lee, 1996, Santoro and Chakrabarti, 1999, Tornquist and Kallsen, 1994).

This section follows the same path in particular in what respect to a) firms' knowledge base (KB) (i.e. one aspect of firms' internal characteristics) and b) types of PRO research outputs that firms consider important

Firms' KB should be an important factor that affects the formation of linkages between PRO and firms (Giuliani and Arza, 2008). On the one hand, firms with more developed KB will be in an advantageous situation to search and exploit external knowledge, such as the one produced by PRO. This is similar to say that firms with more sophisticated KB enjoy better absorptive capacity (Cohen and Levinthal, 1990). On the other hand, PRO will also

tend to prefer the connection with better prepared firms, especially when collaboration implies joint innovative activities. Knowledge resides in skilled workers and it is dependent on the innovative efforts pursued by firms, both to exploit and to explore new ways to solve problems (Nelson and Winter, 1982). We, therefore, compare the proportion of skilled workers and the characteristics of innovative efforts by collaborative and non-collaborative firms.

Moreover, we will also analyse the extent to which the decision to collaborate might be influenced by the type of research output that is necessary for firms (e.g. publication, prototypes, techniques and instruments, and laboratory and metrology). In other words, it could be the case that it is not firms' characteristics themselves that matter, but the fact that some firms nurtures themselves from PRO outputs that could be available at arms-length (e.g. publication, prototypes), while other firms need to establish geographically close relations since what is important for them is to get access to PRO facilities such as technical instruments or laboratories.

Firms knowledge bases

In Table 1 we saw that 67% of collaborative firms in were innovative, while 60% were innovative among firms in the control group. This difference is significant at 10%. However, when one analyses the relation between innovativeness and collaboration per firms' size, one finds that the significant relation is exists only for big firms. 57% of non-collaborative big firms had introduced innovations, while 72% had among those that collaborate with PRO. For small and medium firms, there were not significant differences between collaborative and non collaborative firms in terms of innovativeness: around 64% of medium firms were innovative (regardless of whether they were linked to PRO or not) and around 57-58% of small firms were innovative (idem).

The above discussion suggests that small and medium firms connect with PRO regardless of their innovative performance, while big firms that connect with PRO perform relatively better than those that do not.

In Table 8 we present similar data but for innovative efforts rather than performance. It is interesting to note that although linked firms seem to invest higher proportion of their resources to innovative activities, the differences with the control group are not significant. For example, in the case of in-house R&D, linked firms invest 0.68% of their sales while the control group invest 0.39%, but the difference is not significant. However, looking at it deeper, one sees that the average figures are too much influenced by three outliers (they invest more than 2% of their sales in in-house R&D), which are among small and medium linked firms. This explains the lack of significance in the comparison of means.

In the same vein, there are not significant differences in innovative efforts between linked and non-collaborative *innovative* firms. It seems that innovative firms invest more or less the same in innovative activities, regardless of whether they are (or not) connected to PRO. Similar conclusions can be derived from Table 9. There is no difference in human resources between collaborative and non-collaborative firms, not even for firms of different sizes.

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Table 8: Expenditures in innovation of collaborative and non-collaborative firms, 2005

	Linked (mean)	Control (mean)	Sig	Size									Innovative					
				Small			medium			big			yes			no		
				linked	control	Sig	linked	control	Sig	linked	control	Sig	linked	control	Sig	linked	control	Sig
In-house R&D	0.68%	0.39%		0.99%	0.57%		0.88%	0.39%		0.49%	0.31%		0.88%	0.60%		0.26%	0.09%	*
External R&D	0.04%	0.06%		0.07%	0.07%		0.02%	0.04%		0.03%	0.07%		0.05%	0.08%		0.00%	0.02%	
Machinery and equipment	1.51%	1.37%		2.86%	1.00%	**	0.80%	2.17%	*	1.46%	0.87%		1.79%	1.77%		0.91%	0.77%	
Hardware	0.11%	0.07%		0.25%	0.04%	*	0.13%	0.11%		0.07%	0.05%		0.13%	0.08%		0.08%	0.05%	
Software	0.07%	0.09%		0.08%	0.20%		0.07%	0.08%		0.06%	0.04%		0.07%	0.10%		0.05%	0.07%	
Licensing	0.07%	0.06%		0.14%	0.01%		0.07%	0.05%		0.05%	0.09%		0.10%	0.03%		0.02%	0.10%	*
Training	0.05%	0.05%		0.08%	0.11%		0.05%	0.04%		0.03%	0.04%		0.06%	0.07%		0.02%	0.03%	
Industrial engineering	0.23%	0.12%		0.55%	0.28%		0.21%	0.09%	*	0.15%	0.06%	*	0.32%	0.15%		0.05%	0.08%	
Consultancy	0.06%	0.03%		0.14%	0.05%		0.06%	0.03%		0.04%	0.03%		0.07%	0.04%		0.03%	0.03%	
Total	2.80%	2.24%		5.17%	2.33%	**	2.29%	2.99%		2.38%	1.56%	**	3.47%	2.92%		1.43%	1.23%	

Table 9: Human resources of collaborative and non-collaborative firms, 2005

	Linked (mean)	Control (mean)	Sig	Size									Innovative					
				small			medium			big			yes			no		
				linked	control	Sig	linked	control	Sig	linked	control	Sig	linked	control	Sig	linked	control	Sig
Professionals/Employees	0.116	0.119		0.099	0.099		0.120	0.111		0.119	0.136		0.116	0.135		0.116	0.096	

On the contrary, in Table 8 some significant results appear when one controls by size. In the central area of this table we can see that small firms that are linked invest significantly more in innovative activities than those that are not. In particular, investments in machinery and hardware by small linked firms are significantly larger than these types of investment by small un-connected firms. This might suggest that small firms that connect to PRO are primarily those that use hard technologies, but more research is needed to justify such statement. Big firms that are linked to PRO also invest significantly more than un-connected big firms, particularly in industrial engineering. This is consistent with the discussion of some paragraphs above about the relation of innovativeness and interactions with PRO in big firms, and also with the relatively high importance that industrial design has as a field of research for linked firms (Table 7)

Finally, differences between collaborative and non-collaborative firms neither exist in what respects to reasons for not investing in in-house R&D (Table 10). The most frequently mentioned reason for not investing in in-house R&D, was that external sources of information were enough for the innovative activities of the firms. Surprisingly, this was mentioned by both, linked firms (66%) and the control group (59%) that did not invest, and no significant difference exists in these proportions.

Table 10: Reasons for not investing in in-house R&D

Reasons	No importance		Little to Moderate importance		Very important	
	% of linked firms that do not invest in in-house R&D	% of control firms that do not invest in in-house R&D	% of linked firms that do not invest in in-house R&D	% of control firms that do not invest in in-house R&D	% of linked firms that do not invest in in-house R&D	% of control firms that do not invest in in-house R&D
External sources of information are sufficient for innovation	34%	41%	45%	37%	22%	23%
R&D is too costly for the firm	38%	46%	36%	34%	26%	20%
Small market size does not allow recovering R&D investments	44%	46%	41%	39%	15%	15%
Lack of access to credit	46%	52%	30%	28%	25%	20%
Lack of public support	54%	56%	27%	35%	19%	9%
The firm does not innovate	54%	59%	38%	33%	7%	8%
R&D investment is too risky	55%	59%	34%	32%	10%	9%
Difficulties to appropriate R&D results	55%	54%	37%	38%	8%	7%
Public research institutes substitute firm's R&D	58%	66%	38%	28%	4%	6%
Universities substitute firm's R&D	60%	64%	33%	30%	7%	6%

In sum, different to what we expected from the received literature, this section suggests that firms' KB do not seem to be significant drivers of PRO linkages. It seems that in general, there are not significant differences in terms of innovative performance, human resources, innovative activities (and reasons for not investing in them) between linked and un-connected firms. Although, some differences do turn up when one controls for firms' size.

Research outputs

We could not find significant differences in firms' KB between firms that are connected to PRO and those that are not. This is an interesting finding, since it highlights that other characteristics about firms, industry, university, or knowledge might be driving the probability of linking.

In this section we explore the extent to which research outputs required by collaborative and non-collaborative firms differ. Table 11 presents the relative importance of four types of research products as evaluated by firms. The last three columns present the level of significance of different tests of independence. The first of these columns informs whether importance was independent from linking. The second column presents the same test of independence split by innovative and non-innovative firms. Finally, the last column shows the same test of independence split by firms' size.

Interesting (but not unexpected), firms that value more research outputs that need geographically close interactions to be exploited (e.g. such as instruments or laboratories) tend to be linked to PRO. On the contrary, the importance of other research outputs that could be enjoyed at arm-lengths (e.g. publications, prototypes) do not significantly discriminate between collaborative and non-collaborative firm. The difference in the importance of items c) and d) in Table 11 between linked and un-connected firms does not exist for small firms. This might suggest that firms, especially large firms, link to PRO especially if they could take advantage of their infrastructure and facilities. However further analysis is required to validate such statement.

Table 11: Relative importance of research outputs, by collaborative and non-collaborative firms, 2006

Type of knowledge output	No importance		Little to Moderate importance		Very important		Significance H_0 :linked=control Chi ² test		
	% of linked firms	(% of control firms)	% of linked firms	(% of control firms)	% of linked firms	(% of control firms)		Innov	size
a) Publications, Research findings, etc.	25%	31%	58%	57%	17%	13%			
b) Prototypes	44%	46%	48%	45%	9%	8%			
c) New techniques and instruments	24%	35%	53%	52%	23%	13%	***	*(no innov) **(innov)	***(big)
d) Laboratories/Metrology	28%	39%	50%	50%	23%	10%	***	***(innov)	***(medium) ***(big)

IV) Conclusions

This is an explorative paper that aims at characterizing firms that connect to PRO in Argentinean using very recent information from the last Innovation Survey (2006).

In the introduction we have posed some research questions that have guided the empirical analysis. We arrive to the following conclusions in our attempt to answer to those questions:

- Around 35% of firms collaborate with PRO, 54% of them have collaborate in joint innovation activities
- Firms that do not collaborate argue that in-house R&D was enough to innovate (64% of non-collaborative firms), that PRO have no understanding of their line of business (56%), and that contractual agreements were difficult (52%)
- Firms collaborate for testing products and processes (60% of collaborative firms), for quality control procedures (54%) and for getting advice to solve problems (48%).
- In general firms DO NOT pay for achieving these goals through interactions with PRO, although the higher the goal importance the more likely the firm will pay PRO for their services.
- Most collaborative firms (88%) have succeeded in their goals for collaboration or expect to succeed.
- Most collaborations (69%) last less than five years and time duration increases with firms size.
- In general, there are not significant difference in firms innovative performance, innovative activities, and human resources between firms that collaborate and firms that do not. This relation, nevertheless, seems to be dependent on firm size. Preliminary evidence suggests that large firms that collaborate have better innovative performance than those big firms that do not collaborate.
- Firms that value PRO research outputs that require geographically close collaboration (i.e. mostly PRO infrastructure) tend to form linkages with PRO, no significant difference was found for firms that value research output that could be available at distance (e.g. publications).

Econometric analysis would fine-tune our understanding on firms-PRO interaction in the Argentinean case. However, some aspects of the descriptive evidence presented in this paper contribute to illuminate some policy recommendations to develop a common platform to optimize the impact on the overall performance of the national innovation system. For example, the fact that firms that connect to PRO are not necessarily those that have better developed knowledge bases, suggest that linkages are not being established in a selective basis. This might imply that PRO resources are not being used efficiently. Moreover, the fact that firms do not generally pay for interacting with PRO together with

the fact that firms that interact are those that particularly value PRO infrastructure is also worrisome.

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