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RIS-DP # 151

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Who Uses the Patent System in Developing Countries? A Study of Patent Propensities in Argentina, 1992-2001

Andrés López*
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Abstract: This paper aims at studying the determinants of the patent behavior of Argentinean manufacturing firms. In particular, we seek to identify the factors that affect the probability of obtaining a patent and the determinants of the number of patents granted. We include industry fixed effects and our sample is based on data extracted from two innovation surveys. Our main results are: (i) foreign owned firms have a higher probability of obtaining a patent than domestic ones; and (ii) local R&D activities have not had any impact on the probability of obtaining a patent neither on the number of patents obtained by the firms.

1. Introduction

As it is well known, technological innovation is a key determinant of the firms' performance. There is evidence of this relation not only for firms that operate in the developed countries (Kleinknecht y Mohnen, 2002), but also for the ones in the developing countries, including Argentina (Chudnovsky et al, 2006).

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The economic theory suggests that intellectual property rights, in which patents are included, are a relevant resource to guarantee a certain grade of appropriability to the innovators. This means that they are an instrument to limit the diffusion of the new knowledge generated by the innovators to potential competitors who could imitate the original invention (i.e. they help to limit the real externalities that could be reaped by other agents). Although some works show that patents are not the most effective tool to guarantee appropriability – Arundel, 2001; Cohen et al, 2000 - they are widely used and, in fact, there has been a “patent explosion” in the last years, specially in the United States (Hall, 2005).

Since in developing countries the domestic innovative activity is mainly incremental and adaptative (Teitel, 1990; Dahlman et al, 1987), it does not usually generate patentable results. Hence, it is supposed that one of the benefits of having a patent system consists in improving the conditions for the technology transfer from others countries – as it increases the protection of the technology owners. However, the literature suggests that not always a lineal and clear relation exists between the strength of a country’s intellectual property system and the technology transfer inflows it receives (Fink y Maskus, 2005).

At the same time, in some developing countries, especially in those with a higher grade of industrial and technological progress, there could be some degree of innovative activity whose results could meet the requirements of novelty and inventive highness needed for patenting. This implies that the patent system could additionally stimulate the innovative activity of the local residents in those countries (World Bank, 2001). However, it is also suggested that a patent system, per se, does not stimulate the inventive capacity of the firms in the developing countries. There are other requirements for developing innovative capabilities in those countries such as human capital availability, the strength of the linkages among the agents who are part of the innovative process, the nature and strength of the market failures which obstacle innovation activities, etc.(see López et al, 2005).

The aim of this work is studying the determinants of the behavior of

Argentinean manufacturing firms as regards patents. In particular, we seek to identify the factors that affect the probability of obtaining a patent and then the determinants of the number of patents obtained by a firm. Hence, we could know, for example, if the patent system is used mainly by residents or by the affiliates of foreign firms or if there is a link between R&D activities and the obtainment of patents.

Industry fixed effects are included in our estimation. They allow controlling for specific factors of each sector that affect the patent behavior and are constant in time including those that are not observable. We use data from two innovation surveys that describe the technological behavior and performance of Argentine manufacturing firms during two periods: 1992-1996 and 1998-2001 (INDEC-SECYT, 1998; INDEC-SECYT-CEPAL, 2003).

The paper is organized as follows. Section 2 describes briefly the actual legal framework of the patent system in Argentina, the changes occurred in recent years and the main trends in patents applications and patents granted. Section 3 presents the definition of the sample and the descriptive statistics. In section 4, the specification of the model is discussed. Section 5 shows the results of the econometric estimation. Finally, section 6 concludes.

2. The use of the patent system in Argentina

The first Argentina’s patent law was enacted in 1864 (Law 111) and it was in force until 1995, when it was replaced by Law 24,481 – later modified or amended by Laws 24,572 (1996), 24,603 (1996), 24,766 (1996) and 25,859 (2003). The latter group of laws was adopted in order to adapt the local legislation to the requirements of the TRIPS agreement, but also in response to direct pressures from developed countries, notably the US.

Under Law 111, patenting of pharmaceutical products was not allowed (only patents for pharmaceutical processes could be granted). The removal of that prohibition was the major change brought in by the patent laws enacted in mid 1990s.[1]

Other relevant aspects of the new patent legislation are as follows: i) the duration of a patent is 20 years from the date of filing (previously it was 15 years from grant); ii) the National Institute of Industrial Property (INPI) was created; iii) parallel imports are permitted; iv) a regime of utility models was created;[2] v) compulsory licensing is allowed under certain circumstances;[3] vi) the "Bolar" exception" was adopted, allowing for experimentation on and application for approval of a generic product before the expiration of the respective patent.

According to the current legislation, some products or processes are not patentable, including: i) discoveries; ii) raw materials preexisting in nature, iii) plants, animals and their essentially biological reproductive process; iv) preexisting biological and genetic material; v) intellectual creations (e.g. mathematical methods, computer programs,[4] publicity methods, accounting techniques); vi) surgical and therapeutic methods and diagnosis treatment for animals and humans.

Regarding biotechnological inventions, they are patentable if they meet the general conditions for patentability (novelty, inventive height and industrial application). However, alive matter and microorganisms that pre-exist in nature are not patentable (alive matter and substances obtained with human intervention are patentable, including organisms artificially obtained by genetic manipulation of microorganisms). In turn, human's genetic information is patentable if the invention complies with the general patentability conditions.

In late 1990s the United States and other developed countries set complaints in the WTO against what they deemed as remaining deficiencies in Argentina's intellectual property legislation and it threatened with trade sanctions. In 2001 Argentina finally began to issue pharmaceutical products patents and made some changes in the INPI's administration. This paved the way for an agreement with the United States in 2002, by which Argentina agreed to amend its patent law to provide protection for products obtained from a process patent and to ensure that preliminary injunctions are available in intellectual property court proceedings.

Table 1 allows observing the evolution of the use of the patent system that took place in Argentina between 1990 and 2003. The number of patent applications increased more twice during the nineties to later on decrease in the early years of this decade. In addition of being a reflection of the intensification in the use of the patent system in Europe and mainly in the United States, this increase was probably linked to the process of technological modernization that occurred in the nineties and to above-mentioned changes in the patent law.

The increase in patent applications was clearly pushed by foreign firms, who went from 67 per cent to 83 per cent between 1990 and 2003. In fact, the absolute number of the patent applications by residents declined during the period under analysis. This trend is probably the consequence of some phenomena that happened at the local level in such period:

i) The effects of the changes in the patent local legislation, which strengthened the protection for the owners of the rights and allowed patents in the pharmaceutical industry – where the innovative activity at the world level is leaded by a group of large transnational corporations most of which have presence in Argentina.

ii) The strong increase of the TNC's share in the Argentinean economy that took place mainly via the acquisition of local firms.[5]

As regards patents granted, they show a more irregular behavior, with a surprise pick of more than 3000 patents in 1993. This could be explained by a decision of reducing the *backlog* of undecided patents for approval in that year. The comparison between the start and final year shows a clear increase in the number of patent granted. Like in the case of the applications, this increase it was also pushed by foreign firms, whose share went from 67 per cent to 89 per cent between 1990 and 2003 whereas the absolute number of patents granted to residents declined during the period under analysis.[6] This data suggests that the reforms in the local legislation have perhaps mainly benefited TNCs affiliates who ask for patents for inventions developed originally in their headquarters or in other affiliates of the corporation.

Table 1: Patents Applications and Patents Granted in Argentina, 1990-2003 (quantity and %)

	Patents Applications					Patents Granted				
Year	Domestic	%	Foreign	%	Total	Domestic	%	Foreign	%	Total
1990	955	33	1.955	67	2.910	249	33	510	67	759
1991	943	34	1.851	66	2.794	87	22	316	78	403
1992	503	21	1.919	79	2.422	114	17	549	83	663
1993	787	26	2.261	74	3.048	612	18	2835	82	3447
1994	694	20	2.820	80	3.514	451	21	1663	79	2114
1995	676	16	3.588	84	4.264	198	20	805	80	1003
1996	1.097	21	4.012	79	5.109	342	19	1449	81	1791
1997	824	14	5.035	86	5.859	292	24	936	76	1228
1998	861	14	5.459	86	6.320	307	18	1382	82	1689
1999	899	14	5.558	86	6.457	155	12	1086	88	1241
2000	1.062	16	5.574	84	6.636	145	9	1442	91	1587
2001	691	12	5.088	88	5.779	115	9	1118	91	1.233
2002	718	15	4.143	85	4.870	96	11	815	89	951
2003	792	17	3.765	83	4.557	156	11	1211	89	1367

Source: RICyT.

3. DATA

With the purpose of analyzing the magnitude and nature of innovation activities in the Argentine manufacturing industry, many innovation surveys (designed in accordance with the methodology suggested by the Oslo and Bogotá Manuals)[7], have been carried out by INDEC (Argentina's National Statistical Institute) in recent years.

Data for this paper was obtained from the two first of those surveys. While the first survey covered the period 1992-1996 and included 1639 firms (INDEC-SECYT, 1998), the second survey collected information for 1688 firms during 1998-2001 (INDEC-SECYT-CEPAL, 2003). Both samples were randomly drawn from the National Economic Census of 1993 and from the Input-Output Matrix survey of 1997, respectively. In this way, they were intended to be representative samples of the manufacturing industry at the beginning of the periods they covered.

In addition, an important feature of the Argentine innovation surveys is that, as opposed to the European CIS, both innovators and non-innovators were required to answer the whole questionnaire – in particular, to report innovation expenditures. This avoids the selectivity problem in CIS surveys acknowledged in Crepon et al (1998),[8] and has implications on the econometric strategy chosen in this paper, as discussed below.

The data set used in the empirical analysis presented in this study is based on information of 1586 firms interviewed in the 1992-1996 innovation survey and 1536 interviewed for the 1998-2001 innovation survey. Table 2 shows the main characteristics of the sample used for the econometric estimation. Nearly 5 per cent of firms obtained at least one patent in the period under analysis. At the same time, those firms obtained an average of 5 patents per year.

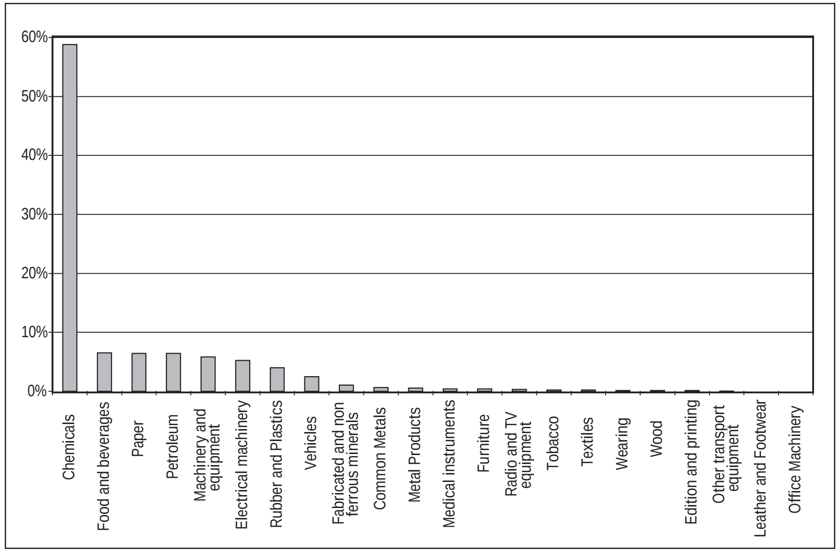
Table 2: Descriptive Statistics

	1992-1996	1998-2001	Total
Number of firms	1586	1536	2268
Firms with patents granted	131	99	186
Means			
Number of patents obtained	5.67	5.13	5.41
R&D expenditures ($)	40.9	465.6	228.2
Labor force (number of people)	219	222	220
Sales ($)	27400	39000	32500
Foreign Firms (%)	16.36	18.63	17.36
Firms with export activity (%)	8.09	11.88	9.76
Skilled people/Total labor force	5.35	6.54	5.88

Source: Own elaboration based on data from the National Innovation Surveys 1992-1996 and 1998-2001.

Figure 1 compares the distribution of patent granted across Argentina's two-digit industries.[9] The figures indicate that eight industries, transportation equipment (1789), electrical machinery and equipment (198), electronics and telecommunications equipment (196), ordinary machinery (178), special equipment (159), chemicals (121), pharmaceuticals (176), together account for about 95 per cent of all patent granted.

Figure 1: Distribution of Patents Granted across Two-digit Industries 1992-2001



Source: Own elaboration based on data from the National Innovation Surveys 1992-1996 and 1998-2001.

4. Model specification

Equation 1 represents the probability that patents are zero or positive. For our estimation, we assume that the probability of obtaining a patent follows a logistic distribution.

$$PATENT_{ij} = \begin{cases} 1 & si\,\alpha_0^1 + \varphi^1 F_{ij} + \kappa^1 Dyear_t + \gamma^1 S_i^1 + \varepsilon_{ij}^1 > 0 \\ 0 & \text{otherwise} \end{cases} \quad (1)$$

The dummy variable (PATENT) is equal to one if firm i in sector j reported a patent granted in period t and zero otherwise.

To estimate the determinants of the firms' patenting process we follow the specification used, among many others works, by Pakes and Griliches (1984), Hausman et al (1984, 1986), Montalvo (1993), Blundell et al (1995), Cincer (1997), Crepon and Duguet (1997) and Hall and Ziedonis (2001). They consider patents as a dependent variable which if a function of the firms' R&D expenditures, along with other firm characteristics. In the absence

of guidance from a theoretical model (see Hu and Jefferson, 2005), we follow the tradition of the literature and include the log of the R&D expenditures in the patent production process. Therefore, we are implicitly assuming a proportional relationship between R&D and patents.

In order to assess the impacts of different explicative variables on the number of patents granted, the discreteness of this variable has to be taken into account. For instance, firms do not always apply for patents and hence a zero value is a natural outcome for this variable. Because of this property, the use of conventional linear regression models may be inappropriate. The reasons are that some basic assumptions such as the normality of residuals or the linear adjustment of data are no longer fulfilled (Cincer, 1997).

The usual way to deal with the discrete non-negative nature of the patent dependent variable is to consider the non-lineal model of count data. The basic formulation is the Poisson regression model. For a discrete random variable, Y, and observed frequencies, y_i i=1, ..., N where y_i³0, and regressors X_i

$$prob(Y = y_i) = e^{-\lambda_i} \lambda_i^{y_i} / y_i!, y = 0,1,...., \quad (2)$$

where $$\ln \lambda_i = \beta' X_i \quad (3)$$

In this model, l_i is both the mean and the variance of y_i. However, count data models often exhibit over-dispersion, with a variance larger than the mean. The negative binomial regression model is an extension of the Poisson regression model which allows the variance of the process to differ from the mean. One way that the model arises is a modification of the Poisson model in which l_i is respecified so that

$$\ln \lambda_i = \beta' X_i + \varepsilon \quad (4)$$

Where exp(e) has a gamma distribution. This model has an additional parameter, a, such that

$$Var(y_i) = E(y_i) + \alpha\, E(y_i)^2 \quad (5)$$

Because the Poisson model is a special case of the negative binomial -

if a=0-, one can use a standard likelihood ratio test to compare them.

Let P_{it} be this variable which represents the number of patents obtained by firm i at time t where i=1,…, N indexes firms and t=1,…,T indexes time periods. The P_{it} is assumed to be independent and, as we follow the binomial negative regression, it has a gamma distribution:

$$P_{it} = \exp(\beta X_{it}) = \exp(\alpha_0^2 + \varphi^2 F_{it} + \kappa^2 Dyear_t + \gamma^2 S_i) + \varepsilon_{it} \quad (6)$$

Where X_{it} represents the set of explicative variables and $\hat{a}$ is the parameter vector to estimate.

Our base specification for both equations therefore includes the following variables:

Firm Variables (F_{it})

***R&D expenditures*:** it captures the expenditures in internal R&D activities measured in thousands of dollars. Although patents are far from being a perfect measure of the outcome of R&D activities (Griliches, 1990) they constitute a relevant measure of the technological effectiveness of R&D activities (Cincer, 1997).

Much of the early work that estimated this kind of models focused on the question of whether one could measure the lag structure for the production of patents from past R&D expenditures (Pakes and Griliches, 1980; Hausman et al, 1984; Hall et al, 1986; see also Montalvo, 1997 and Blundell et al, 2000). This literature concludes largely that the lag structure is very poorly identified because of the high within-firm correlation of R&D spending over time. When many lags are included in the model, the estimate of the sum of the coefficients is roughly the same as the estimated coefficient of contemporaneous R&D when no lags are included; in addition, most of the contribution comes from the oldest and the newest R&D lags included. Experimentation with lag structures using these data confirmed the results in the earlier literature. For this reason and because many of our firms have a very short tradition of R&D activities, we use contemporaneous levels of R&D expenditure in our specifications (Hall and Ziedonis, 2001).

Hausman et al (1984), Hall et al (1986) and Hall and Ziedonis (2001) find a positive elasticity between R&D expenditures and the number of

patent granted. However, other studies fail to find that result (Arundel and Kabla, 1998; Hussinger, 2005). As regards the evidence from developing countries, Deolalikar and Roller (1989), with data for India, find a lack of significance of R&D expenditures in the probability of patenting. According to them, this could probably reflect two factors: (i) the poor quality and inappropriate nature of R&D activities pursued by Indian firms, and (ii) the very broad definition of R&D in the Indian context (where expenditures on quality control and other non-inventive activity are considered typically as R&D for taxation purposes).

***Size*:** to capture the impact of this variable we use three different measures: labor force, total sales and size dummies. In the last case, we have small firms (with less than 50 employees), medium firms (between 50 and 250 employees) and large firms (with more than 250 employees).

As stated by Arundel (2001), at the theoretical level, there are reasons to expect that small firms could find patents more valuable than large firms, but there are also arguments that could lead us to expect the other way round. While small firms could use patents to create a temporary barrier against competitors in order to build the manufacturing and marketing capabilities needed to become a successful innovator, it could also be the case that patent application costs and specially the costs implied in protecting patents from infringement could lead them to value more secrecy than patents. Furthermore, small firms could have less patentable innovations than large firms, since they could be mostly engaged in incremental improvements. Large firms often have intellectual property departments or other similar organizational devices which could also lead them to display a higher patent propensity. At the same time, as shown in Giuri et al (2007), since they bear relatively lower costs in terms of patent applications and litigation, it comes as no surprise to find that large firms have a very high level of unused patents compared with small and medium enterprises (SMEs) and may also patent minor innovations. Hence, as the size of the firm increases, it could be expected that the probability of obtaining a patent and the number of patents obtained also increase. Some econometric works confirm this hypothesis (Lerner, 1995; Lanjouw and Lerner, 1996; Hall and Ziedonis, 2001; Iversen, 2003; Brouwer and Kleinknecht, 1999; Arundel and Kabla, 1998).

In a previous work for Argentina using cross-section data, we aimed at identifying the factors that affect the probability of obtaining a patent by manufacturing firms (López *et al*, 2005). The results showed that, *ceteris paribus*, large firms had a higher probability than SMEs of obtaining a patent in the period under analysis (1992-2001). In that work, size was measured as a dummy variable equal to one if firm i was large and zero otherwise. Hall and Ziedonis (2001) and Hu and Jefferson (2005) find a positive scale effect using a similar technique.

***Foreign*:** This variable is included to differentiate the firms by their country of origin and it is equal to one if foreign ownership is equal or greater than 10 per cent of the firms' equity. As TNCs firms are in better conditions to apply for patents of products or processes developed by their headquarters or other affiliates, it is expected that they have a higher probability of patenting and obtaining more patents than domestic firms. Hu and Jefferson (2005) find a positive effect of this variable on the probability of patenting in China.

***Export Activity*:** this dummy variable is equal to one if firm i in sector j exported in period t and zero otherwise. As regards the expected sign, there are two contrary arguments. On one hand, as the adoption of an export strategy implies a higher possibility of being imitated by other firms – in particular, in the destination markets, a positive coefficient would be expected. On the other hand, as long as we are only considering the patens granted in Argentina which only offers a local protection, the variable could not have any significant impact on the probability of patenting and/or the number of patents.

***Skills*:** it measures the share of professional on total labor during period t in firm i. The available of skilled workers could have an impact not only on the innovative capacity but also on the ability of obtaining patents – as it influences the "writing" skills of the patents, among other factors. Hence, we expect that the coefficient associated to this variable would be positive in both equations. For example, Deolalikar and Roller (1989) find a positive impact of this variable on the probability of patenting in India.

Time Dummies ($Dyear_t$):
We are able to include a time dummy in order to control for unobservable

effects that could have affected all firms over time (for example, different macroeconomic contexts during 1992-1996 and 1998-2001). In general the first years of our sample are associated with a period of strong expansion in the Argentinean economy, while the last years are associated to a recessive stage and higher institutional instability. Additionally, these variables capture the changes in the patent legislation between 1992 and 2001 and the changes in the operation of the patent examination authority.

Industry Fixed Effects (I_i):
Using industry-specific fixed effects estimators is of utmost importance for our purposes, since they allow us to control for time invariant unobserved heterogeneity at the industry level and, in this way, deal with a potential source of endogeneity in our estimations. Industry fixed effects explain inter-industry differences in patenting. In particular, firms in high technological opportunity sectors tend to file significantly more patent applications than firms in low technological opportunity sectors. On the other hand, in the context of the patents-R&D relations, there are many reasons to believe that unobservables are not independent of the regressors. For example, in the industries where the inventive capacity is high, the R&D expenditures are also high.

5. Main Results

In Table 3 we report the results of the estimation of the probit model, while Table 4 shows the results of the estimation of the count data models. In both cases, time dummies are statistically significant. This means that unobservable effects have affected all firms over time. At the same time, many sector fixed effects are statistically significant.[10] This could be reflecting the importance of the characteristics of each sector that remain constant along time and influence the innovative and patent behavior of the firms.

Table 3 presents three columns with three different measures of the firms' size. In all the cases, size has a positive effect on the probability of obtaining a patent. It maintains the positive sign and statistical significance through the three columns. Furthermore, the difference between medium and large firms is also statistically significant.

As it is expected, labor skills and foreign ownership have a positive impact on the probability of obtaining a patent. On the other hand, R&D expenditures[11] and the export activity are not statistically significant.

The marginal effects allow us to estimate the magnitude of the impacts of each variable on the firms' patent behavior. If the size of a firm increases one percent, the probability of obtaining a patent increases, on average, 0.5 per cent. Additionally, if the proportion of skilled workers increases one per cent, the abovementioned probability grows 0.5 per cent. The probability of obtaining a patent is, on average, 5.8 per cent per cent higher for foreign owned firms than for domestic ones, ceteris paribus.

The first three columns of Table 4 present the estimations for the negative binomial model. The sign of the coefficients are similar to those presented above. On one hand, R&D expenditures and export activity are not statistically significant. On the other hand, the coefficients of foreign ownership and labor skills are positive and statistically significant. The variable size has a positive impact on the number of patent granted –- measured by labor force and total sales. When size dummies are included, we observe that medium and large firms have, on average, more patents than small firms. Again, the difference between medium and large firm is also statistically significant. In other words, the factors that affect the probability of obtaining a patent are the same that those that affect the numbers of patents obtained.

The last column of Table 4 reports the results of the estimation of the Poisson model. The high value of the squared-chi of the test is an indicator that the Poisson model would not be a good election. The negative binomial model is generally more appropriate for the cases of over-dispersion. Additionally, the likelihood test is a test of the over dispersion of alpha. When the parameter of over dispersion is equal to 0, the binomial negative distribution coincides with the Poisson. In this case, alpha is significantly different from 0 reinforcing the hypothesis that the Poisson distribution is not adequate. Hence, we prefer the negative binomial specification to a Poisson specification because over dispersion tests indicate that the Poisson assumption that the mean equals the variance is not valid for our data.

Table 3: Econometric Results of the Probit model

	Probit			Marginal Effects		
	i	ii	iii	i	ii	iii
Log R&D	0.003	0.004	0.011	0.00008	0.00009	0.0003
	(0.010)	(0.010)	(0.010)	(0.000)	(0.000)	(0.000)
Log Labor	0.222			0.005		
Force	(0.025)***			(0.001)***		
Ln Sales		0.230		0.005		
		0.022***		0.001***		
Medium Size			0.224			0.006
			0.082***			0.002***
Large Size			0.548			0.020
			0.091***			0.005***
Export	-0.040	-0.063	0.016	-0.001	-0.001	0.000
Activity	(0.069)	(0.069)	(0.067)	(0.002)	(0.001)	(0.002)
Foreign	1.055	0.977	1.096	0.058	0.048	0.066
	(0.058)***	(0.059)***	(0.058)***	(0.007)***	(0.006)***	(0.008)***
Skills	0.206	0.126	0.210	0.005	0.003	0.005
	(0.035)***	(0.034)***	(0.033)***	(0.001)***	(0.001)***	(0.001)***
D1992	-0.011	0.039	0.044	0.000	0.001	0.001
	(0.116)	(0.116)	(0.116)	(0.003)	(0.003)	(0.003)
D1993	0.402	0.453	0.447	0.013	0.015	0.017
	(0.105)***	(0.105)***	(0.104)***	(0.005)***	(0.005)***	(0.006)***
D1994	0.121	0.119	0.146	0.003	0.003	0.004
	(0.107)	(0.109)	(0.106)	(0.003)	(0.003)	(0.003)
D1995	0.018	0.011	0.046	0.000	0.000	0.001
	(0.109)	(0.110)	(0.108)	(0.003)	(0.002)	(0.003)
D1996	0.231	0.229	0.255	0.006	0.006	0.008
	(0.104)**	(0.105)**	(0.104)**	(0.004)**	(0.003)**	(0.004)**
D1998	0.109	0.080	0.136	0.003	0.002	0.004
	(0.108)	(0.110)	(0.107)	(0.003)	(0.003)	(0.003)
D1999	-0.006	-0.041	0.022	0.000	-0.001	0.001
	(0.109)	(0.110)	(0.108)	(0.002)	(0.002)	(0.003)
D2000	-0.018	-0.010	-0.019	0.000	0.000	0.000
	(0.108)	(0.110)	(0.107)	(0.002)	(0.002)	(0.003)
Observations	13424	13424	13424	13424	13424	13424

Note: Industry dummies are not reported for the sake of space (they are available upon request).This sample exclude firms in the sectors of Leather and Footwear and Office Machines because they do not present variablity inside each group. Robust standard errors in brackets: *significant at 10%, ** significant at 5%; *** significant at 1%.

Table 4: Econometric Results of the *Count Data Models*

	Negative Binomial			Poisson
	i	ii	iii	i
Log R&D	0,008	-0,008	0,031	-0,039
	(0,022)	(0,021)	(0,021)	(0,027)
Log Labor Force	0,572			0,532
	(0,064)***			(0,068)***
Ln Sales		0,640		
		0,054***		
Medium Size			0,506	
			0,211**	
Large Size			1,442	
			0,216***	
Export Activity	0,011	-0,028	0,193	0,433
	(0,172)	(0,168)	(0,168)	(0,245)*
Foreign	2,856	2,547	2,998	2,635
	(0,149)***	(0,149)***	(0,147)***	(0,287)***
Skills	0,641	0,381	0,607	0,674
	(0,075)***	(0,077)***	(0,073***	(0,101)***
D 1992	-0,124	-0,040	-0,042	-0,572
	(0,286)	(0,279)	(0,283)	(0,337)*
D 1993	1,705	1,700	1,654	1,263
	(0,239)***	(0,234)***	(0,236)***	(0,310)***
D 1994	0,498	0,413	0,451	0,377
	(0,241)**	(0,240)**	(0,240)**	(0,309)
D 1995	0,067	0,028	0,095	-0,156
	(0,253)	(0,251)	(0,251)	(0,305)
D 1996	0,628	0,592	0,659	0,323
	(0,244)***	(0,241)**	(0,242)**	(0,289)
D 1998	0,333	0,217	0,384	0,163
	(0,247)	(0,244)	(0,245)	(0,406)
D 1999	-0,086	-0,128	-0,041	-0,202
	(0,256)	(0,252)	(0,254)	(0,370)
D 2000	0,011	0,036	-0,020	0,069
	(0,246)	(0,245)	(0,243)	(0,344)
Alpha	8,040	7,250	7,993	
	(0,545)	(6,336)	(0,546)	
Chi-squared	5758	5251	5918	
Likelihood Ratio Test				9407
Observations	13749	13749	13749	13749

Note: Industry dummies are not reported for the sake of space (they are available upon request). Robust standard errors in brackets: *significant at 10%, ** significant at 5%; *** significant at 1%.

6. Conclusions

Using data from innovation surveys and applying econometric techniques, this work aims at being a contribution to the study of the determinants of the use of the system patent in the Argentinean manufacturing industry.

The first relevant finding is that foreign owned firms have a higher probability of obtaining a patent than domestic ones. This finding goes in line with the data observed in descriptive statistics which show that the preeminence of foreign firms in patents granted is clear and has been growing in recent years. This outcome suggests that the changes in patent legislation adopted in the last decade may have had facilitated the obtainment by TNCs affiliates of local patents which correspond to inventions already patented elsewhere, instead of stimulating patenting by local firms.

The finding that internal R&D activities do not have an impact on the probability of obtaining a patent neither on the number of patents obtained goes in the same line. Among other factors, this could be associated with the fact that R&D activities in Argentina are mainly adaptative.

Larger firms and those with a higher use of skilled labor have higher probabilities of obtaining a patent and of obtaining more patents. In addition, the unobservable characteristics of the sectors are relevant to explain the firms' patent behavior.

More research is needed to know more on the determinants and impacts of the patent behavior of Argentinean firms. However, one possible interpretation of our findings is that the patent system does not represent *per se* a stimulus for the innovative activity of local firms. To achieve this objective, in our view, it is needed first to strengthen the local conditions that could stimulate the innovative efforts of local firms. Once this objective is achieved, it is perhaps the case that the patent system could be more relevant for domestic firms.

FOOTNOTES

[1] A five years transition period was established for allowing the patenting of pharmaceutical products, so they began to be issued only in 2001.

[2] Utility Models are similar to "petty patents", and protect those inventions that do not qualify for full patent protection (since they do no meet the requirements of novelty and inventive height).

[3] Compulsory licences can be applied in the following situations: i) refusal to deal; ii) lack of exploitation; iii) unfair competition practices; iv) health emergency or national security; v) under certain circumstances, to allow the grant of a secondary patent.

[4] However, a device, machine or apparatus related to a software program is patentable.

[5] The participation of the TNCs in the gross production value generated by the 500 Argentinean larger firms changed from to 60% to 82% between 1993 and 2003 (based on INDEC's data).

[6] In a previous work, we found that nearly 80% of the residents' patents were given to individuals between 1998 and 2000 (López *et al*, 2005). Although this reflects the existence of a group of people with inventive capabilities, an unknown part of those patents could really be owned by firms which prefer (by legal or tax reasons) that the patents are granted to the owner of the firm. This could be the case, for example, of unipersonal, family or informal firms where the legal entity is subject to a higher degree of uncertainty regarding their continuity.

[7] OECD (1997) and RICYT (2001), respectively.

[8] In CIS surveys, firms are first asked whether they have introduced a new product or process during 1998-2000, or whether they had any ongoing or abandoned activities to do so during this period. Only if they answer positively to one of these questions, they are asked additional information about their innovation outcomes, their R&D expenditures and other characteristics.

[9] Based on the CLANAE (National Classification of Economic Activities) Classification.

[10] Due to the lack of space, industry fixed effects are not reported in the tables.

[11] If we consider R&D intensity, this result is not altered.

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