Cooperation for Innovation and Technology Licensing: Empirical Evidence from Spain*

Pedro Mendi† Rafael Moner-Colonques‡ José J. Sempere-Monerris§

Abstract

We study whether past cooperation activities make firms more likely to use disembodied technology licensed by other firms. Using empirical evidence from the PITEC database, a panel of Spanish firms yearly surveyed in the 2005-13 period, evidence is found of a positive relationship between past cooperation and licensing, especially cooperation with research institutions. We also find that the likelihood of licensing-in increases with the number of different types of cooperation partners. These results are robust to using different estimation techniques and econometric specifications, and point at the relevance for the diffusion of technology of policy interventions that reduce the costs of creating linkages among diverse cooperation partners, in particular between firms and other research institutions.

Keywords: Licensing, cooperation.

---

*We are grateful to the Associate Editor, Floor Alkemade, as well as to two anonymous referees, for their helpful comments, which have significantly improved the quality of the paper. We thank comments from participants at the Second KIIS Workshop at University of Valencia, especially Juan Máñez. Mendi gratefully acknowledges financial support from Fundación Ramón Areces, from Ministerio de Economía y Competitividad (ECO2014-55236-R), and from Ministerio de Ciencia, Innovación y Universidades (PGC2018-098131-B-I00). Moner-Colonques and Sempere-Monerris acknowledge financial support from Ministerio de Economía y Competitividad (ECO2016-77589-R), as well as Fundación BBVA, Programa de Ayudas a Proyectos de Investigación en Socioeconomía 2014.

†Department of Business, Edificio Amigos, Universidad de Navarra. 31009 Pamplona, Spain. Tel +34-948425600, e-mail: pmendi@unav.es

‡Department of Economic Analysis and ERI-CES, Facultad de Economía. Campus dels Tarongers. Avd. dels Tarongers s/n, E-46022-Valencia, Spain. Tel. +34-963828784, e-mail: Rafael.Moner@uv.es

§Department of Economic Analysis and ERI-CES, University of Valencia and CORE-Université catholique de Louvain. e-mail: Jose.J.Sempere@uv.es

1 Introduction

The organization of firms' innovation activities is essential to bring new products to market and to introduce new production processes. In addition to the competitive advantages enjoyed by successful firms, these activities contribute to productivity and growth (Romer, 1990; Lokshin et al., 2008). In their quest for innovation, firms combine internal with external knowledge sources (Teece, 1986; Rigby and Zook, 2002; Chesbrough, 2003; Laursen and Salter, 2006). Among external sources, licensing-in –understood as the use under a licensing agreement of technology owned by some other economic agent- is a channel to access external knowledge. The relevance of this particular channel has been increasing in recent times: whether domestically or across international borders, licensing is one of the main channels of technology diffusion (Gambardella, 2002; Arora et al., 2004; Ziedonis, 2004; Gambardella et al., 2007; Mendi, 2007b). Innovative firms are actively operating in such markets in search of external knowledge and/or commercial revenues (Lee et al., 2019; Pitkethly, 2001; Santiago et al., 2015). In fact, payments for the use of intellectual property have been growing at a compound annual rate of 10.8% for the period 2000-2018 (World Bank, 2017).

The benefits of using externally-developed technology may be enhanced by the adoption of other innovation-related strategies. In particular, cooperation may be channel to access external knowledge, potentially increasing the benefit from using licensed technology. For instance, licensing deals in the biopharma industry since 2015 have been oscillating between 112 and 150, with upfront payments between 4.94 and 8.6 billion dollars (Brown et al., 2019). Simultaneously, this industry has witnessed a growing number of research partnerships between pharmaceutical companies, academic institutions and biotechnology start-ups. Our paper precisely studies whether cooperation with other firms or research institutions increases a firm's propensity to engage in licensing-in.

In particular, we use firm-level innovation data from the PITEC database, a panel of Spanish firms yearly surveyed in the 2005-13 period, to investigate whether firms' cooperation activities make them more likely to purchase a license to use disembodied technology. Evidence is found of R&D cooperation positively affecting the likelihood of licensing, the results being driven mainly by cooperation with research institutions.

Although, to the best of our knowledge, the literature is devoid of an empirical study of the effect of cooperation on licensing, the determinants and consequences of cooperation in innovation and licensing have been separately studied,[1] Whereas a number of papers have considered the interaction among different innovation activities, including collaboration with other firms or research institutions, (Belderbos et al., 2006; Barge-Gil, 2010; Criscuolo et al., 2018; Haus-Reve et al., 2019; Cassiman and Veugelers, 2002a; Schmiedeberg, 2008; Serrano-Bedia et al., 2018), to the best of our knowledge, this is the first contribution that focuses on the relationship between cooperation and licensing.

Technology licensing is a direct way to access already existing external technology and allows licensees to exploit the potential of recombining different knowledge blocks (Schumpeter, 1934; Kogut and Zander, 1992; Fleming, 2001). While many empirical studies have focused on firms' licensing activities from the perspective of the licensor, only a few contributions have examined the licensee's side (see Costamagna et al. (2019) for a recent article in the context of developing countries). Licensing-in can be seen as an alternative to in-house R&D (Atuahene-Gima and Patterson, 1993), although Lowe and Taylor (1998) and Cassiman and Veugelers (2006) find that the buy and make decisions are complements rather than substitutes.

Licensing-in allows the licensee to introduce new inventions more rapidly (Leone and Reichstein, 2012) and is positively associated with its technological performance (Wang et al., 2013). In order to reap these benefits, licensees need some familiarity with the acquired technology to assimilate and integrate the new knowledge, which oftentimes is provided by the licensor via technical assistance or know-how (Leone et al., 2016). Actually, the impact of licensing-in on the licensee's knowledge capabilities depends on its initial stock of knowledge (Laursen et al., 2010), as well as on its ability to deal with tacit knowledge (Choi, 2002; Mendi et al., 2016; Mendi, 2007a). In this line, collaborations with holders of knowledge external to

[1] See Bhattacharya et al. (2014) for an excellent survey on theoretical research about R&D competition, cooperation and licensing.

the firm are organizational practices aligned with the concept of outward-looking absorptive capacity (Cohen and Levinthal, 1990). We expect previous collaborations and diversity in collaboration sources to increase firms' technological opportunity (Breschi et al., 2000), which is an important antecedent of potential absorptive capacity, thus making firms more likely to engage in licensing-in activities. Actually, Laursen et al. (2010) confirm that the firms' stock of knowledge and how broadly firms have searched in the past have greater effects on licensees compared to non-licensees, which may give tactical benefits to the former. Hence, our paper contributes to this literature by studying whether cooperation activities and the type of cooperation partner have any effects on the probability that a firm acquires a technology license.

The remainder of the paper is structured as follows. Section 2 introduces the conceptual background and hypotheses to be tested using the methodology and data described in Section 3. Section 4 presents and discusses the econometric results, whereas Section 5 offers some conclusions and implications.

2 Conceptual background and hypotheses

Innovation may be viewed as the recombination of existing bodies of knowledge (Schumpeter, 1934; Kogut and Zander, 1992; Fleming, 2001). For this reason, firms need to interact with various agents beyond their organizational boundaries to collaborate and exchange knowledge with them. Licensing is a common and significant means of inter-firm technology transactions.[2] The literature has pointed out the benefits for innovation of accessing technology markets (Chatterji, 1996; Guan et al., 2006; Lin, 2003; Leone and Reichstein, 2012; Tsai and Wang, 2007; Lee et al., 2017).

Indeed, other external sourcing strategies exist –collaborations with other firms, with uni-

[2] Markets for technology are increasing in importance: whether domestically or across international borders, licensing is one of the main channels of technology diffusion (Arora et al., 2004; Gambardella et al., 2007; Mendi, 2007b). Actually, according to World Bank (2017), global payments for the use of intellectual property amounted $333bn in 2017.

versities and research institutions, customers and suppliers,– which play different roles in the creation of new knowledge. Cooperation is one way to access and co-create relevant knowledge to increase a firm's absorptive capacity, ultimately improving innovation performance. Hence the relevance of the study of the determinants and consequences of cooperation for research (Belderbos et al., 2004; Becker and Dietz, 2004; Barge-Gil, 2010; Fiedler and Welpe, 2010), as well as its persistence along time (Hibbert and Huxham, 2010; Belderbos et al., 2015; Badillo and Moreno, 2016), and its organizational implications (Staropoli, 1998). Looking more closely at R&D cooperation, the literature has found that its determinants differ significantly depending on the type of cooperation partner: the type of knowledge that extracted from competitors, universities, suppliers and customers is not equally easy to exploit (Cassiman and Veugelers, 2002b; Belderbos et al., 2004; Nieto and Santamaría, 2007; Banal-Estañol et al., 2017). It is arguable that collaboration types complement one another unless properly combined (Belderbos et al., 2006; Criscuolo et al., 2018; Haus-Reve et al., 2019).

The question remains as to the relationship between cooperation, cooperation partner types and licensing-in. We expect cooperation to increase licensing activities by boosting both the demand for licenses as well as the licensor's willingness to license its technology. From the licensee's standpoint, licensing-in reduces the risks and costs associated with the innovation process, facilitates technological learning and increases the speed of innovation (Atuahene-Gima and Patterson, 1993; Lowe and Taylor, 1998; Leone and Reichstein, 2012; Wang et al., 2013). Furthermore, technological discoveries create knowledge can be employed for other innovations in related technological domains (Scotchmer, 1991; Malerba and Orsenigo, 1993; Breschi et al., 2000; Laursen et al., 2010). Cooperating firms will have access to some of its partners' tacit and codified knowledge, increasing their absorptive capacity (Cohen and Levinthal, 1989, 1990) and thus the willingness to pay for licensed technology. R&D cooperation, external knowledge acquisition and experience with knowledge search are actually key antecedents of a firm's potential absorptive capacity (Fosfuri and Tribó, 2008). In fact, cooperation experience is one of the elements that firms use to acquire and learn capabilities and knowledge from partners (Dyer and Singh, 1998; Gulati, 1999; Eisenhardt and Martin, 2000; Christensen and Lundvall, 2004; Jensen et al., 2007). Therefore, cooperation enhances a firm's benefits from using licensed technology, via an increase in its absorptive capacity. This is summarized in the following hypothesis.

Hypothesis 1. *Previous cooperation increases the likelihood of licensing.*

Different types of collaboration play different, potentially complementary roles in a firm's knowledge system (Malerba and Orsenigo, 1993). For instance, cooperation with customers and suppliers reduces the uncertainties of new product introduction and improves both the product development process and the adaptation to users' needs (Von Hippel, 1986; Bidault et al., 1998; Bogers et al., 2010). Similarly, cooperation with competitors allows firms to share R&D costs and pool resources (Miotti and Sachwald, 2003; Das and Teng, 2000), and to face major technological challenges (Gnyawali and Park, 2011). On the other hand, university-industry collaboration produces substantial spillovers to firms (Monjon and Waelbroeck, 2003) and contributes to basic research awareness (Hall et al., 2003). The fact that different types of cooperation partners enhance different aspects of a firm's absorptive capacity suggests that the more diverse the portfolio of cooperation partners, the greater the gains from participating in the market for technology.

While the joint adoption of different cooperation strategies has been found not to have a positive effect on performance (Belderbos et al., 2006; Lee et al., 2017) and that scientific and supply-chain collaboration may be indeed substitutes (Haus-Reve et al., 2019), the arguments put forth in the previous paragraph suggest that a greater diversity of cooperation partners increases the benefits from licensing-in. Actually, combinations of knowledge sources have been found to be better than solo strategies for subsequent innovation (Criscuolo et al., 2018). The following hypothesis summarizes this discussion.

Hypothesis 2. *Diversity of partners in cooperation for research increases the likelihood of licensing.*

Knowledge coming from heterogeneous sources may be close or distant to that of the receiving firm, affecting innovation performance (Nooteboom et al., 2007). Furthermore, the economic interests and incentives of the firm and its cooperating partners need not be aligned, thus suggesting that vertical and horizontal relationships are not equally successful (Nooteboom, 1999). In fact, university-firm collaboration typically operates under aligned economic interests, which is not the case in cooperation with competitors. For instance, disclosure of knowledge within universities is rewarded differently than in the case of corporations, whose incentive system rests on exploitation of knowledge (D'Este and Patel, 2007; Agarwal and Ohyama, 2013; Criscuolo et al., 2018). All this suggests that firms will be more reluctant than universities to share knowledge that increases a cooperating partner's absorptive capacity.

Cooperation with universities and other research institutions may also grant a firm access to a more general, theoretical knowledge than cooperation with firms (Roessner et al., 2013). This more general knowledge is more likely to be applied to a wider set of situations. While it has been argued that general knowledge may give rise to contractual problems (Dechenaux et al., 2011), it is reasonable to expect that the potential risk of leaking proprietary to a third party may constitute a more important issue when the transaction is between two corporations than in the case of a transaction between a firm and a research institution. For this reason, while we expect cooperation with both other firms and research institutions to increase the likelihood of using licensed technology, we expect the effect to be stronger for cooperation with research institutions. These arguments are reflected in the following two hypotheses.

Hypothesis 3. *Previous cooperation with other firms and with research institutions increases the likelihood of licensing.*

Hypothesis 4. *Previous cooperation with research institutions increases the likelihood of licensing more than previous cooperation with other firms.*

3 Methods

The empirical evidence is drawn from PITEC, a panel of firms yearly surveyed by the Spanish Statistical Office (INE), using a questionnaire similar to that in the Community Innovation

Survey (CIS). The panel structure of PITEC allows for controlling for firm-specific, unobserved factors that could be jointly determining the outcome and the independent variables. PITEC comprises four subsamples, large and small firms, spanning the 2003-15 period.[3]

Table 1 lists the definitions of the variables, distinguishing between dependent and independent variables, and controls. LICENSING is the dependent variable in all the specifications, and takes value one if the firm purchased the right to use externally-developed technology in period t, and zero otherwise. As independent variables we use, first, the indicator with cooperation with at least one firm or research institution (COOPERATION). Second, a measure of the diversity of cooperation partners, specifically number of different types of cooperation partners (N_COOP), as listed in Table 1. Finally, we use indicators of cooperation with firms (COOP_FIRM), which includes suppliers, customers, competitors or other firms in the same industry, and research institutions (COOP_RI), which includes consultants or R&D labs, universities, technological centers or public research institutions. Therefore, both for firms and for research institutions we consider three categories. Since for each category we make the distinction between domestic and foreign, the maximum number of different types of cooperation partners is 12. The cooperation-related variables have been lagged one period to avoid simultaneity with the dependent variable, and refer to three-year time windows. This way, if the dependent variable refers to period t, the independent variables refer to periods $t-3$ to $t-1$.

Our controls have been previously found to affect innovation strategies and outcomes. FORSUB accounts for the fact that subsidiaries of foreign multinational corporations (MNCs) may have a better access to information channels within the multinational increasing the probability of licensing. Size, proxied by the logarithm of the number of employees (LNEMP) in $t-1$, is also a factor that typically affects innovation activities (Schumpeter, 1939; Belderbos et al., 2004; Beneito, 2006; Veugelers and Cassiman, 1999). Exporting is also associated with innovation activities (Laursen and Salter, 2006; Criscuolo et al., 2018; Salomon and Jin, 2008),

[3] Armand and Mendi (2018) describe in detail the composition of the different subsamples, as well as the anonymization method used for some variables. Since a full sample is available only for 2005 on and a change in the methodology was introduced in 2014, we use data from the 2005-13 period only.

and for this reason we include EXPORT as a control. Finally, to control for firms' absorptive capacities, which are expected to have a positive impact on the probability of licensing (Roper et al., 2008; Leone et al., 2016; Badillo and Moreno, 2016), we include R&D expenditures as a fraction of firm sales (RDINTENSITY), and the logarithm of the number of patents (LNPATNUM), lagged one period.

Table 1: Variable definitions

Dependent variables	
LICENSING	Dummy that takes value 1 if the firm acquired a technology license in t, 0 otherwise.
Independent variables	
COOPERATION	Dummy that takes value 1 if the firm cooperated in research from $t-3$ to $t-1$ with any of the following cooperation partners (domestic or foreign): Suppliers; customers; competitors or other firms in the same industry; consultants or R&D labs; universities; technological centers or public research institutions, 0 otherwise.
N_COOP	Number of different types of cooperation partners from $t-3$ to $t-1$.
COOP_FIRM	Dummy that takes value 1 if the firm cooperated in research with other firms from $t-3$ to $t-1$, 0 otherwise.
COOP_RI	Dummy that takes value 1 if the firm cooperated in research with universities and/or research institutions from $t-3$ to $t-1$, 0 otherwise.
Controls	
FORSUB	Dummy that takes value 1 if the firm is a subsidiary of a foreign MNC, 0 otherwise.
LNEMP	Logarithm of the number of employees in $t-1$.
EXPORT	Dummy that takes value 1 if the firm exported from $t-2$ to t, 0 otherwise.
RDINTENSITY	Internal R&D expenditures as a proportion of sales in $t-1$.
LNPATNUM	Logarithm of the number of patents the firm **applied for from $t-3$ to $t-1$.**

Table 2 presents summary statistics of the data. The total number of observations in our sample with complete data is 63,324, which corresponds to firms that have remained active from 2005 to 2013.[4] Licensing takes place among a relatively small fraction of the firms in the sample, approximately 2%, and only 41% of the firms that use licensed technology continue to do so the following year. However, while the proportion of firms that engage in licensing-in is low, the large sample size allows for the use of standard panel probit techniques, as opposed to

[4]As pointed out in Armand and Mendi (2018), the exit rate among firms in PITEC is relatively low, which makes the sample fairly stable in time.

Extreme Value Models usually employed in the study of rare events. Meanwhile, cooperation for innovation is a more common phenomenon, with 26% of the firms having cooperated with any cooperation partner in at least one of the periods from $t-3$ to $t-1$. Regarding the type of cooperation partner, the likelihood of cooperation with firms and research institutions is very similar, both slightly below 20%.

Table 2: Summary statistics

	mean	sd	min	max
LICENSING	0.020	0.141	0	1
COOPERATION	0.256	0.436	0	1
COOP_FIRMS	0.180	0.384	0	1
COOP_RI	0.195	0.397	0	1
N_COOP	0.722	1.683	0	12
FORSUB	0.122	0.327	0	1
LNEMPLOYEES	4.178	1.684	0	11
EXPORTER	0.635	0.481	0	1
RDINTENSITY	0.053	0.174	0	2
LNPATNUM	0.131	0.458	0	7

4 Empirical analysis

The analysis is conducted to test the hypotheses in Section 2, and exploiting the panel nature of our data. In cross-sectional studies, unobserved firm characteristics may be correlated both with licensing and cooperation, thus biasing the results. By using panel data we can control for firm-specific effects that do not vary along time. Additionally, we control for time-specific effects, which are common to all firms in a given year, and we include the control variables listed in Table 1.

Table 3 presents estimated marginal effects of the independent variables on LICENSING to test Hypothesis 1. The marginal effect of interest is that of COOPERATION, which is to be interpreted as the change in the probability of licensing following a change in the cooperation variable from zero to one. In the first column of Table 3 we report results using a correlated random effects (CRE) probit model.[5] The estimated marginal effect of COOPERATION is positive and statistically significant at the one percentage level. Engaging in cooperation is associated with a 0.6% increase in the probability of licensing, which is a sizeable effect, considering that the average of LICENSING is 2%. In the second column we estimate a fixed-effects linear probability model, whose estimated coefficients may be readily interpreted as marginal effects, while controlling for fixed effects.[6] The estimated coefficient on COOPERATION, is similar to that in the previous column.

Next, we consider the existence of dynamic effects driving a firm's decision to license-in. In fact, many licensing agreements last for several years (Mendi, 2005), introducing high persistence in the LICENSING variable. Therefore, we estimate a dynamic model, including the lagged value of LICENSING as an additional regressor. We follow Blundell et al. (1999, 2002), and Máñez et al. (2014), and estimate the firm fixed effect by including the pre-sample means (prior to 2010) of the dependent and independent variables as additional regressors. These pre-sample means are unbiased estimates of the firm fixed effect. The estimated marginal effects of cooperation and lagged licensing are positive and highly statistically significant. While in column (3) we only include the pre-sample mean of the dependent variable, we also include in column (4) the pre-sample means of the regressors, as in Blundell et al. (2002). As an alternative way to control for persistence in licensing, in column (5) we exclude from the sample those observations such that the firm used licensed technology in the previous year. The estimated marginal effect of COOPERATION, as well as of the rest of the independent variables, is similar in size and statistically significance to those in column (4). Overall, all the results give support for Hypothesis 1. Regarding the effect of the controls, the estimated coefficients are as expected, with those on RDINTENSITY and PATNUM being always positive and statistically significant, consistent with the importance of the initial level of absorptive capacity, as pointed out in the introduction.

[5]This is essentially a random effects probit that includes as additional regressors the firm-level averages of the independent variables. This constitutes a feasible alternative to the use of fixed effects, which can not implemented in a probit model.

[6]If using a linear probability model, the proportion of estimated probabilities that fall outside the $[0, 1]$ interval is negligible.

Table 3: Effect of cooperation on licensing

Estimation method:	Probit	OLS,FE	Probit	Probit	Probit
Sample:	Full	Full	Full	Full	Non-lic.
	(1)	(2)	(3)	(4)	(5)
COOPERATION	0.0056***	0.0066***	0.0070***	0.0064***	0.0055***
	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)
LICENSING t-1			0.0463***	0.0465***	
			(0.002)	(0.002)	
FORSUB	0.0024	0.0030	0.0004	0.0013	0.0009
	(0.004)	(0.004)	(0.002)	(0.003)	(0.003)
LNEMPLOYEES	0.0013	-0.0011	0.0024***	0.0045***	0.0043***
	(0.002)	(0.002)	(0.000)	(0.001)	(0.001)
EXPORTER	0.0019	0.0024	0.0016	0.0023	0.0010
	(0.002)	(0.003)	(0.001)	(0.002)	(0.002)
RDINTENSITY	0.0157***	0.0224**	0.0111***	0.0100***	0.0069***
	(0.004)	(0.009)	(0.003)	(0.003)	(0.002)
LNPATNUM	0.0039***	0.0065**	0.0022**	0.0025**	0.0018*
	(0.001)	(0.003)	(0.001)	(0.001)	(0.001)
Observations	63324	63324	31387	31369	30843
Time fixed effects	Yes	Yes	Yes	Yes	Yes
Pre-sample mean of dep. var.	No	No	Yes	Yes	Yes
Pre-sample means of regressors	No	No	No	Yes	Yes

Standard errors in parenthesis below estimated coefficients.

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

We use analogous specifications as those in Table 3 to test Hypothesis 2, replacing COOPERATION with N_COOP. Results are presented in Table 4. In the first column, where the estimation method is CRE, the coefficient on N_COOP is positive and statistically significant at the 1% level. Recall that N_COOP is not a count of the number of cooperation partners, but of the number of different categories of cooperation partners, as listed in Table 1. This way, N_COOP does not measure the extension of the network of collaboration partners, but rather its diversity, which is the object of Hypothesis 2. The positive, statistically significant coefficient on N_COOP gives support to this hypothesis.

As we did in Table 3, we verify whether the estimated effect of the variable of interest is robust to the use of different specifications. Columns (2)-(5) report estimated coefficients using a linear probability model with fixed effects, a dynamic probit controlling for the pre-sample means of the dependent variable, a dynamic probit controlling for the pre-sample means of the dependent variable and the regressors, and a probit excluding firms that did not engage in licensing in the previous period while controlling for the pre-sample means of the dependent variable and the regressors. As it may be observed by comparing the estimated coefficients on N_COOP, the results are very similar in terms of sign and statistical significance. Regarding the effect of the controls, these are very similar to those reported in Table 3.

Finally, to test hypotheses 3 and 4, Table 5 reports estimated marginal effects of cooperation with firms (COOP_FIRM) and with research institutions (COOP_RI), using the same econometric specifications and controls as in the previous tables. Recall that COOP_FIRM includes suppliers, customers, competitors or other firms in the same industry, and COOP_RI includes consultants or R&D labs, universities, technological centers or public research institutions, both domestic and foreign. While the effects of both COOP_FIRM and COOP_RI in column (1) are positive, only that of COOP_RI is statistically significant at the 1% level, thus finding support for Hypothesis 3. In fact, the test of equality of the marginal effects of COOP_FIRMS and COOP_RI shows evidence of a differential effect of COOP_RI, consistent with Hypothesis 4. Very similar results are obtained in the rest of the columns, whose specifications are the same as the analogous columns of Tables 3 and 4. The only different result is that in column (5), where the estimated coefficient on COOP_FIRMS is slightly larger, whereas that on COOP_RI is lower than in the previous columns, not being able to reject the null hypothesis of equal marginal effects. Recall that the specification in the last column excludes firms that did not license-in in the previous period.

Table 4: Effect of number of cooperation partners on licensing

Estimation method:	Probit	OLS,FE	Probit	Probit	Probit
Sample:	Full	Full	Full	Full	Non-lic.
	(1)	(2)	(3)	(4)	(5)
N_COOP	0.0016***	0.0027***	0.0012***	0.0014***	0.0012***
	(0.000)	(0.001)	(0.000)	(0.000)	(0.000)
LICENSING t-1			0.0469***	0.0469***	
			(0.002)	(0.002)	
FORSUB	0.0021	0.0029	0.0002	0.0012	0.0006
	(0.004)	(0.004)	(0.002)	(0.003)	(0.003)
LNEMPLOYEES	0.0011	-0.0012	0.0023***	0.0047***	0.0046***
	(0.001)	(0.002)	(0.000)	(0.001)	(0.001)
EXPORTER	0.0017	0.0023	0.0018	0.0024	0.0013
	(0.002)	(0.003)	(0.001)	(0.002)	(0.002)
RDINTENSITY	0.0152***	0.0219**	0.0101***	0.0096***	0.0070***
	(0.005)	(0.009)	(0.003)	(0.003)	(0.002)
LNPATNUM	0.0038***	0.0062**	0.0017*	0.0021*	0.0015
	(0.001)	(0.003)	(0.001)	(0.001)	(0.001)
Observations	63324	63324	31387	31369	30843
Time fixed effects	Yes	Yes	Yes	Yes	Yes
Pre-sample mean of dep. var.	No	No	Yes	Yes	Yes
Pre-sample means of regressors	No	No	No	Yes	Yes

Standard errors in parenthesis below estimated coefficients.

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

5 Conclusion and implications

Using data from the Spanish panel PITEC, we have studied the question of whether past cooperation with other firms and research institutions is associated with a higher probability of a firm's purchasing the right to use disembodied technology developed by a third party, referred to as licensing-in. We find evidence consistent with past cooperation activities with other firms and research institutions outside of the firm's group increasing the probability of firms using licensed technology. This result is robust to the use of different panel-data econometric

Table 5: Effect of cooperation on licensing by type of cooperation partner

Estimation method:	Probit	OLS,FE	Probit	Probit	Probit
Sample:	Full	Full	Full	Full	Non-lic.
	(1)	(2)	(3)	(4)	(5)
COOP_FIRMS	0.0004	0.0000	0.0011	0.0009	0.0016
	(0.002)	(0.003)	(0.002)	(0.002)	(0.002)
COOP_RI	0.0077***	0.0107***	0.0068***	0.0073***	0.0060***
	(0.002)	(0.003)	(0.002)	(0.002)	(0.002)
LICENSING t-1			0.0464***	0.0462***	
			(0.002)	(0.002)	
FORSUB	0.0022	0.0028	0.0004	0.0011	0.0008
	(0.004)	(0.004)	(0.002)	(0.003)	(0.003)
LNEMPLOYEES	0.0013	-0.0011	0.0024***	0.0045***	0.0043***
	(0.001)	(0.002)	(0.000)	(0.001)	(0.001)
EXPORTER	0.0017	0.0023	0.0015	0.0022	0.0010
	(0.002)	(0.003)	(0.001)	(0.002)	(0.002)
RDINTENSITY	0.0152***	0.0219**	0.0105***	0.0099***	0.0066***
	(0.004)	(0.009)	(0.003)	(0.003)	(0.002)
LNPATNUM	0.0038***	0.0063**	0.0020**	0.0024**	0.0016*
	(0.001)	(0.003)	(0.001)	(0.001)	(0.001)
Observations	63324	63324	31387	31369	30843
Test of equal effects	6.181	5.164	3.181	3.586	2.096
p-value	.013	.023	.074	.058	.148
Time fixed effects	Yes	Yes	Yes	Yes	Yes
Pre-sample mean of dep. var.	No	No	Yes	Yes	Yes
Pre-sample means of regressors	No	No	No	Yes	Yes

Standard errors in parenthesis below estimated coefficients.

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

techniques. Having a more diverse pool of cooperation partners also increases the likelihood of licensing-in. We found the effect of cooperation with firms not to be statistically significant, whereas the effect of cooperation with research institutions, which include universities, was found to be positive and statistically significant. This paper is therefore a contribution to the scarce literature that focuses on the demand side of technology markets. In particular, on how firms organize their innovation activities. Although our results suggest that accessing external knowledge via cooperation is aligned with accessing technology markets, they also point out at the relevance of in-house R&D activities for licensing-in.

Our results provide evidence consistent with cooperation increasing firms' willingness to access the technology market. While no previous contribution to the literature has addressed this specific question, in order to put our results into perspective, we must emphasize that our results are obtained using panel data techniques, which allow us to control for unobserved, time-invariant firm characteristics, in contrast to the vast majority of the previous literature, which relies on cross-sectional methods.[7] In addition to the methodological side, we believe our results are important, since they suggests that adopting policies that reduce the costs of firms of cooperating with other firms or research institutions increases firm's chances of accessing external knowledge materialized in a license. Institutions such as industry associations may allow their members to reduce the cost of accessing information relevant for cooperation. Our results also suggest that increasing diversity in the composition of a firm's pool of cooperation partners and engaging in cooperation with research institutions such as universities or public research centers increase the likelihood of licensing. This way, public programs that foster the collaboration between the corporate and the academic worlds allows firms to make use of externally-developed technologies, increasing the rate of technological diffusion, speeding-up innovation at the firm-level. These implications are particularly interesting for countries like Spain where firms purchasing licenses represent a small percentage of the total, in our case only 2% of our sample.

References

Agarwal, R. and A. Ohyama (2013). Industry or academia, basic or applied? Career choices and earnings trajectories of scientists. *Management Science 59*(4), 950–970.

[7]The results from using different cross-sections of our data point at the existence of a strong positive relationship between cooperation and licensing. The estimated marginal effect of cooperation exceeds one percentage point.

Armand, A. and P. Mendi (2018). Demand drops and innovation investments: Evidence from the Great Recession in Spain. *Research Policy 47*(7), 1321–1333.

Arora, A., A. Fosfuri, and A. Gambardella (2004). *Markets for technology: The economics of innovation and corporate strategy*. MIT press.

Atuahene-Gima, K. and P. Patterson (1993). Managerial perceptions of technology licensing as an alternative to internal R&D in new product development: an empirical investigation. *R&D Management 23*(4), 327–336.

Badillo, E. R. and R. Moreno (2016). Are collaborative agreements in innovation activities persistent at the firm level? Empirical evidence for the Spanish case. *Review of Industrial Organization 49*(1), 71–101.

Banal-Estañol, A., I. Macho-Stadler, and D. Pérez-Castrillo (2017). Endogenous matching in university-industry collaboration: Theory and empirical evidence from the United Kingdom. *Management Science 64*(4), 1591–1608.

Barge-Gil, A. (2010). Cooperation-based innovators and peripheral cooperators: An empirical analysis of their characteristics and behavior. *Technovation 30*(3), 195 – 206.

Becker, W. and J. Dietz (2004). R&D cooperation and innovation activities of firms–evidence for the German manufacturing industry. *Research Policy 33*(2), 209 – 223.

Belderbos, R., M. Carree, B. Diederen, B. Lokshin, and R. Veugelers (2004). Heterogeneity in R&D cooperation strategies. *International Journal of Industrial Organization 22*(8-9), 1237 – 1263.

Belderbos, R., M. Carree, and B. Lokshin (2004). Cooperative R&D and firm performance. *Research Policy 33*(10), 1477–1492.

Belderbos, R., M. Carree, and B. Lokshin (2006). Complementarity in R&D cooperation strategies. *Review of Industrial Organization 28*(4), 401–426.

Belderbos, R., M. Carree, B. Lokshin, and J. Fernández Sastre (2015). Inter-temporal patterns of R&D collaboration and innovative performance. *The Journal of Technology Transfer 40*(1), 123–137.

Beneito, P. (2006). The innovative performance of in-house and contracted R&D in terms of patents and utility models. *Research Policy 35*(4), 502–517.

Bhattacharya, S., C. d'Aspremont, S. Guriev, D. Sen, and Y. Tauman (2014). Cooperation in R&D: Patenting, Licensing, and Contracting. In K. Chatterjee and W. Samuelson (Eds.), *Game Theory and Business Applications*, pp. 265–286. Boston, MA: Springer US.

Bidault, F., C. Despres, and C. Butler (1998). The drivers of cooperation between buyers and suppliers for product innovation. *Research Policy 26*(7-8), 719–732.

Blundell, R., R. Griffith, and J. van Reenen (1999). Market share, market value and innovation in a panel of British manufacturing firms. *The Review of Economic Studies 66*(3), 529–554.

Blundell, R., R. Griffith, and F. Windmeijer (2002). Individual effects and dynamics in count data models. *Journal of Econometrics 108*(1), 113 – 131.

Bogers, M., A. Afuah, and B. Bastian (2010). Users as innovators: A review, critique, and future research directions. *Journal of Management 36*(4), 857–875.

Breschi, S., F. Malerba, and L. Orsenigo (2000). Technological regimes and Schumpeterian patterns of innovation. *The Economic Journal 110*(463), 388–410.

Brown, A., E. Cairns, and E. Elmhirst (2019). Pharma, biotech and medtech 2018 in review.

Cassiman, B. and R. Veugelers (2002a). Complementarity in the innovation strategy: Internal R&D, external technology acquisition and cooperation. *CEPR Discussion Paper*.

Cassiman, B. and R. Veugelers (2002b). R&D cooperation and spillovers: Some empirical evidence from Belgium. *American Economic Review 92*(4), 1169–1184.

Cassiman, B. and R. Veugelers (2006). In search of complementarity in innovation strategy: Internal R&D and external knowledge acquisition. *Management Science 52*(1), 68–82.

Chatterji, D. (1996). Accessing external sources of technology. *Research-Technology Management 39*(2), 48–56.

Chesbrough, H. (2003). The era of open innovation. *MIT Sloan Management Review 44*(3), 35–41.

Choi, J. P. (2002). A dynamic analysis of licensing: The "boomerang"effect and grant-back clauses. *International Economic Review 43*(3), 803–829.

Christensen, J. L. and B.-Å. Lundvall (2004). *Product innovation, interactive learning and economic performance*. Elsevier Jai.

Cohen, W. M. and D. A. Levinthal (1989). Innovation and learning: The two faces of R&D. *Economic Journal 125*(583), 546 – 573.

Cohen, W. M. and D. A. Levinthal (1990). Absorptive-capacity - a new perspective on learning and innovation. *Administrative Science Quarterly 35*(1), 128–152.

Costamagna, R., S. Idrovo, and P. Mendi (2019). Initial informality as an obstacle to intellectual capital acquisitions: Empirical evidence from latin america. *Journal of Intellectual Capital 20*(4), 472–487.

Criscuolo, P., K. Laursen, T. Reichstein, and A. Salter (2018). Winning combinations: Search strategies and innovativeness in the UK. *Industry and Innovation 25*(2), 115–143.

Das, T. K. and B.-S. Teng (2000). A resource-based theory of strategic alliances. *Journal of Management 26*(1), 31–61.

Dechenaux, E., J. Thursby, and M. Thursby (2011). Inventor moral hazard in university licensing: The role of contracts. *Research Policy 40*(1), 94–104.

D'Este, P. and P. Patel (2007). University–industry linkages in the UK: What are the factors underlying the variety of interactions with industry? *Research Policy 36*(9), 1295–1313.

Dyer, J. H. and H. Singh (1998). The relational view: Cooperative strategy and sources of interorganizational competitive advantage. *Academy of management review 23*(4), 660–679.

Eisenhardt, K. M. and J. A. Martin (2000). Dynamic capabilities: What are they? *Strategic Management Journal 21*(10-11), 1105–1121.

Fiedler, M. and I. M. Welpe (2010). Antecedents of cooperative commercialisation strategies of nanotechnology firms. *Research Policy 39*(3), 400–410.

Fleming, L. (2001). Recombinant uncertainty in technological search. *Management Science 47*(1), 117–132.

Fosfuri, A. and J. A. Tribó (2008). Exploring the antecedents of potential absorptive capacity and its impact on innovation performance. *Omega 36*(2), 173–187.

Gambardella, A. (2002, 03). 'Successes' and 'Failures' in the Markets for Technology. *Oxford Review of Economic Policy 18*(1), 52–62.

Gambardella, A., P. Giuri, and A. Luzzi (2007). The market for patents in Europe. *Research Policy 36*(8), 1163–1183.

Gnyawali, D. R. and B.-J. R. Park (2011). Co-opetition between giants: Collaboration with competitors for technological innovation. *Research Policy 40*(5), 650–663.

Guan, J. C., C. K. Mok, R. C. Yam, K. Chin, and K. F. Pun (2006). Technology transfer and innovation performance: Evidence from Chinese firms. *Technological Forecasting and Social Change 73*(6), 666–678.

Gulati, R. (1999). Network location and learning: The influence of network resources and firm capabilities on alliance formation. *Strategic Management Journal 20*(5), 397–420.

Hall, B. H., A. N. Link, and J. T. Scott (2003). Universities as research partners. *Review of Economics and Statistics 85*(2), 485–491.

Haus-Reve, S., R. D. Fitjar, and A. Rodríguez-Pose (2019). Does combining different types of collaboration always benefit firms? Collaboration, complementarity and product innovation in norway. *Research Policy 48*(6), 1476–1486.

Hibbert, P. and C. Huxham (2010). The past in play: Tradition in the structures of collaboration. *Organization Studies 31*(5), 525–554.

Jensen, M. B., B. Johnson, E. Lorenz, and B. Å. Lundvall (2007). Forms of knowledge and modes of innovation. *Research Policy 36*(5), 680–693.

Kogut, B. and U. Zander (1992). Knowledge of the firm, combinative capabilities, and the replication of technology. *Organization Science 3*(3), 383–397.

Laursen, K., M. I. Leone, and S. Torrisi (2010). Technological exploration through licensing: New insights from the licensee's point of view. *Industrial and Corporate Change 19*(3), 871–897.

Laursen, K. and A. Salter (2006). Open for innovation: The role of openness in explaining innovation performance among UK manufacturing firms. *Strategic Management Journal 27*(2), 131–150.

Lee, J.-S., N. Kim, and Z.-T. Bae (2019). The effects of patent litigation involving npes on firms' patent strategies. *Technological Forecasting and Social Change 149*, 119758.

Lee, J.-S., J.-H. Park, and Z.-T. Bae (2017). The effects of licensing-in on innovative performance in different technological regimes. *Research Policy 46*(2), 485–496.

Leone, M. I. and T. Reichstein (2012). Licensing-in fosters rapid invention! The effect of the grant-back clause and technological unfamiliarity. *Strategic Management Journal 33*(8), 965–985.

Leone, M. I., T. Reichstein, P. Boccardelli, and M. Magnusson (2016). License to learn: An investigation into thin and thick licensing contracts. *R & D Management 46*(2), 326–340.

Lin, B.-W. (2003). Technology transfer as technological learning: A source of competitive advantage for firms with limited R&D resources source of competitive advantage for firms with limited r&d resources. *R&D Management 33*(3), 327–341.

Lokshin, B., R. Belderbos, and M. Carree (2008). The productivity effects of internal and external R&D: Evidence from a dynamic panel data model. *Oxford bulletin of Economics and Statistics 70*(3), 399–413.

Lowe, J. and P. Taylor (1998). R&D and technology purchase through licence agreements: Complementary strategies and complementary assets. *R&D Management 28*(4), 263–278.

Malerba, F. and L. Orsenigo (1993). Technological firms and firm behaviour. *Industrial and Corporate Change 1*(2), 47–71.

Máñez, J. A., M. E. Rochina-Barrachina, J. A. Sanchis-Llopis, and O. Vicente (2014). Financial constraints and R&D and exporting strategies for Spanish manufacturing firms. *Industrial and Corporate Change 23*(6), 1563–1594.

Mendi, P. (2005). The structure of payments in technology transfer contracts: Evidence from Spain. *Journal of Economics & Management Strategy 14*(2), 403–429.

Mendi, P. (2007a). Contractual implications of international trade in tacit knowledge. *Applied Economics 39*(7-9), 1173–1183.

Mendi, P. (2007b). Trade in disembodied technology and total factor productivity in OECD countries. *Research Policy 36*(1), 121–133.

Mendi, P., R. Moner-Colonques, and J. J. Sempere-Monerris (2016). Optimal know-how transfers in licensing contracts. *Journal of Economics 118*(2), 121–139.

Miotti, L. and F. Sachwald (2003). Co-operative R&D: Why and with whom? An integrated framework of analysis. *Research Policy 32*(8), 1481–1499.

Monjon, S. and P. Waelbroeck (2003). Assessing spillovers from universities to firms: Evidence from French firm-level data. *International Journal of Industrial Organization 21*(9), 1255–1270.

Nieto, M. J. and L. Santamaría (2007). The importance of diverse collaborative networks for the novelty of product innovation. *Technovation 27*(6-7), 367–377.

Nooteboom, B. (1999). Innovation and inter-firm linkages: New implications for policy. *Research Policy 28*(8), 793–805.

Nooteboom, B., W. Van Haverbeke, G. Duysters, V. Gilsing, and A. Van den Oord (2007). Optimal cognitive distance and absorptive capacity. *Research Policy 36*(7), 1016–1034.

Pitkethly, R. H. (2001). Intellectual property strategy in japanese and uk companies: patent licensing decisions and learning opportunities. *Research Policy 30*(3), 425 – 442.

Rigby, D. and C. Zook (2002). Open-market innovation. *Harvard Business Review 80*(10), 80–93.

Roessner, D., J. Bond, S. Okubo, and M. Planting (2013). The economic impact of licensed commercialized inventions originating in university research. *Research Policy 42*(1), 23–34.

Romer, P. M. (1990). Endogenous technological change. *Journal of Political Economy 98*(5, Part 2), S71–S102.

Roper, S., J. Du, and J. H. Love (2008). Modelling the innovation value chain. *Research Policy 37*(6-7), 961–977.

Salomon, R. and B. Jin (2008). Does knowledge spill to leaders or laggards? Exploring industry heterogeneity in learning by exporting. *Journal of International Business Studies 39*(1), 132–150.

Santiago, L. P., M. Martinelli, D. T. Eloi-Santos, and L. H. Hortac (2015). A framework for assessing a portfolio of technologies for licensing out. *Technological Forecasting and Social Change 99*, 242 – 251.

Schmiedeberg, C. (2008). Complementarities of innovation activities: An empirical analysis of the German manufacturing sector. *Research Policy 37*(9), 1492–1503.

Schumpeter, J. A. (1934). The theory of economic development, (translated by Redvers Opie). *Harvard: Economic Studies 46*.

Schumpeter, J. A. (1939). *Business cycles: A Theoretical, Historical, and Statistical Analysis of the Capitalist Process*, Volume 1. McGraw-Hill New York.

Scotchmer, S. (1991). Standing on the shoulders of giants: Cumulative research and the patent law. *Journal of Economic Perspectives 5*(1), 29–41.

Serrano-Bedia, A. M., M. C. López-Fernández, and G. García-Piqueres (2018). Complementarity between innovation knowledge sources: Does the innovation performance measure matter? *BRQ Business Research Quarterly 21*(1), 53–67.

Staropoli, C. (1998). Cooperation in R&D in the pharmaceutical industry - the network as an organizational innovation governing technological innovation. *Technovation 18*(1), 13–23.

Teece, D. (1986). Profiting from technological innovation - implications for integration, collaboration, licensing and public-policy. *Research Policy 15*(6), 285–305.

Tsai, K.-H. and J.-C. Wang (2007). Inward technology licensing and firm performance: A longitudinal study. *R&D Management 37*(2), 151–160.

Veugelers, R. and B. Cassiman (1999). Make and buy in innovation strategies: Evidence from Belgian manufacturing firms. *Research Policy 28*(1), 63–80.

Von Hippel, E. (1986). Lead users: A source of novel product concepts. *Management Science 32*(7), 791–805.

Wang, Y., Z. Zhou, and J. Li-Ying (2013). The impact of licensed-knowledge attributes on the innovation performance of licensee firms: Evidence from the chinese electronic industry. *Journal of Technology Transfer 38*(5), 699–715.

World Bank (2017). World Development Indicators.

Ziedonis, R. H. (2004). Don't fence me in: Fragmented markets for technology and the patent acquisition strategies of firms. *Management Science 50*(6), 804–820.

Cross-sectional results

In this Appendix we present estimations using the different cross-sections of the data. Whereas in Table 6 we present estimations not including the lagged value of the dependent variable, we include this variable as an additional regressor in the specifications reported in Table 7.

Table 6: Effect of cooperation on licensing, cross-sectional analysis

Estimation method:	Probit	Probit	Probit	Probit	Probit	Probit	Probit	Probit
Year:	2006	2007	2008	2009	2010	2011	2012	2013
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
COOPERATION	0.0249***	0.0270***	0.0262***	0.0166***	0.0150***	0.0153***	0.0138***	0.0161***
	(0.004)	(0.004)	(0.004)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
FORSUB	0.0088	0.0036	0.0017	0.0004	0.0015	0.0020	0.0064**	0.0020
	(0.006)	(0.005)	(0.005)	(0.004)	(0.004)	(0.004)	(0.003)	(0.003)
LNEMPLOYEES	0.0047***	0.0053***	0.0048***	0.0036***	0.0046***	0.0045***	0.0046***	0.0046***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
EXPORTER	0.0096**	0.0104**	0.0037	0.0055	0.0009	0.0006	0.0086**	0.0027
	(0.004)	(0.004)	(0.004)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
RDINTENSITY	0.0162*	0.0176**	0.0077	0.0050	0.0037	0.0109*	0.0143**	0.0096**
	(0.009)	(0.009)	(0.008)	(0.007)	(0.007)	(0.006)	(0.006)	(0.005)
LNPATNUM	0.0148***	0.0087***	0.0083***	0.0059***	0.0059***	0.0052**	0.0050***	0.0047***
	(0.003)	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Observations	7889	7899	7919	7919	7926	7923	7920	7929
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Standard errors in parenthesis below estimated coefficients.

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table 7: Effect of cooperation on licensing, cross-sectional analysis with lagged dependent variable

Estimation method:	Probit	Probit	Probit	Probit	Probit	Probit	Probit	Probit
Year:	2006	2007	2008	2009	2010	2011	2012	2013
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
COOPERATION	0.0133***	0.0163***	0.0133***	0.0062**	0.0072**	0.0091***	0.0079***	0.0090***
	(0.004)	(0.004)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.002)
LICENSING t-1	0.0943***	0.0883***	0.0733***	0.0697***	0.0610***	0.0616***	0.0509***	0.0501***
	(0.006)	(0.006)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
FORSUB	0.0088*	0.0007	0.0010	-0.0018	0.0007	0.0003	0.0056**	-0.0023
	(0.005)	(0.005)	(0.004)	(0.004)	(0.004)	(0.004)	(0.003)	(0.003)
LNEMPLOYEES	0.0018	0.0027***	0.0025**	0.0012	0.0031***	0.0025***	0.0027***	0.0026***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
EXPORTER	0.0044	0.0077**	-0.0007	0.0042	0.0002	0.0007	0.0070**	-0.0004
	(0.004)	(0.004)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
RDINTENSITY	0.0133*	0.0121	0.0063	0.0055	0.0070	0.0126**	0.0133***	0.0035
	(0.008)	(0.008)	(0.007)	(0.007)	(0.006)	(0.006)	(0.005)	(0.004)
LNPATNUM	0.0095***	0.0028	0.0057***	0.0025	0.0024	0.0025	0.0034**	0.0028*
	(0.003)	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Observations	7889	7899	7919	7919	7926	7923	7920	7929
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Standard errors in parenthesis below estimated coefficients.

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.