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Collaborative agreements and R&D intensity

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CEB Working Paper N° 05/007
January 2005

ULB

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Abstract

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JEL : O31, L63, M21

Keywords : collaborative agreement, R&D intensity, IT industry

1. Introduction

Robertson and Gatignon (1998) suggest that the growth of R&D externalization can be attributed, at least in part, to the US Congress' passage of the National Cooperative Research Act in 1984, which eased antitrust laws to permit collaborative research. Similar collaborative agreements are allowed by the European Commission (i.e., the so-called pre-competitive research collaboration).

Such collaborative agreements were very intense during the 90's within the information technology (IT) industry. This industry was confronted to a major transition phase, where partnerships became a strategic component of the new "divided technical leadership" which emerged from the industry vertical disintegration.

The objective of this paper is to evaluate the impact of 1676 partnerships on the innovative efforts (R&D intensity) of 14 large firms active in the IT industry. The results suggest that collaborative agreements have a negative and significant impact on R&D intensity. However, their impact seems to depend on their type and on their content.

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2. Data and empirical implementation

Few authors have investigated the potential relationship between partnerships and innovation efforts. Duysters and Hagedoorn (1998) state that the combination of rising R&D costs and shorter lifecycles cause firms to search for alternatives to internal development. Cooperation is often considered as a viable means to monitor several technological developments at relatively low cost.

The focus in this paper is put on the 14 largest firms of the IT industry. Data on financial performances and the number of collaborative agreements over the period 1991-2000 has been gathered for the 14 firms. Two main equations are estimated. The first one (see equation 1) attempts to explain R&D intensity with the number of collaborative agreements (NCA). Since collaborative agreements can take place with firms of different size, we use a second equation that intends to approximate the "size" of the agreement, using the total sales of the partners as weight (see equation 2).

$$Y_{i,t} = \varphi_t + \lambda_i + \alpha\, NCA_{i,t-\theta} + u_{it} \tag{1}$$

$$Y_{i,t} = \varphi_t + \lambda_i + \alpha\, WCA_{i,t-\theta} + u_{it} \tag{2}$$

where : $\quad NCA_i = \sum_{j=1}^{N} NCA_{ij}$ and $\quad WCA_i = \sum_{j=1}^{N} S_j \cdot NCA_{ij}$

Where $Y_{i,\,t}$ is the R&D intensity of firm i during the year t. NCA_{ij} is the total number of collaborative agreements that firm i has with firm j. NCA_i is the total number of agreements that firm i has concluded with all other firms. WCA_i is the weighted sum of the agreements performed by firm i. The weights are the total sales value (S_j) of the partner firms. The two equations include time dummies φ_t in order to correct for the cyclicality of the industry, firm dummies λ_i (or within estimates) that allow to correct for firm-specific effects (like size), and an error term u_{it}.

The database includes 1676 collaborative agreements formed by the largest firms of the Information Technology (I.T.) industry between 1986 and 2000. The following firms have been screened for their announcements of collaborative agreements: IBM, HP, Sun, Digital, Compaq, Apple, Unisys, NEC, Xerox, Dell, Fujitsu, Siemens, Gateway, and NCR. The database structure is described in detail in Mortehan (2004). Once the agreements identified by using a query on press sources, their contents have been codified and added into the database.

Consolidated statements of income of the 14 largest I.T. firms and 355 out of more than 700 partners have been entered in the database for the purpose of this study. They have been obtained mainly from the US "Securities and Exchange Commission" (http://www.sec.gov/) or from "Investors relations" web sites of firms or, when not available, from Hoover's online (http://www.hoovers.com). Table 1 provides a summary of the database contents used in this paper. Collaborative agreements are differentiated by their type and their content. Informal alliances are the lion's share of all collaborative agreements. A clear majority of these agreements concern sales performances. However, technology-based agreements are more frequent within consortia and joint ventures.

Table 1. Collaborative agreements by type, content and weights (1986-1999)

# of partnerships/ per content :	Sales	Technology	Mixed	Total
Agreements per type				
Acquisitions	27	5	45	77
Alliances	827	390	191	1408
Alliances with participation	23	19	7	49
Consortia	2	77	0	79
Joint ventures	17	24	22	63
Total	896	515	265	1676

Sources: own computation, from 1676 collaborative agreements performed between 1986 and 2000.

3. Empirical results

The econometric estimates of equations (1) and (2) are presented in table 2. The first estimates are constrained for all types of agreements. The second estimates investigate whether the various types of agreements have differentiated impact on the R&D intensity of large firms. The third estimates test whether the contents of these agreements have a differentiated impact on R&D intensity.

Table 2: Partnerships and internal R&D intensity of large I.T. firms[1]

	count	Weighted sum
(1) All partnerships	-2.80*	-0.30*
	(-1.91)	(-1.93)
R^2	0.11	0.13
(2) *Agreements by type*		
Acquisitions	-87.16***	-7.03***
	(-4.64)	(-3.49)
Alliances	-1.70	-0.28
	(-0.92)	(-1.37)
Alliances with participation	3.84	-0.22
	(0.20)	(-0.13)
Consortia	6.42	0.20
	(0.55)	(0.21)
Joint ventures	8.90	-0.84
	(0.64)	(-1.02)
R^2	0.09	0.12
(3) *Agreements by content*		
Sales/marketing agreements	0.40	-0.23
	(0.12)	(-0.77)
Technological agreements	-1.59	-0.07
	(-0.36)	(-0.21)
Mixed agreements	-15.73**	-1.20**
	(-2.17)	(-2.58)
R^2	0.09	0.12
nobs	195	195

1. All equations include time and firm dummies (within estimates). The dependent variable is R&D intensity; the first column corresponds to the simple count of collaborative agreements (see equation 1) and the second column to the sales-weighted sum of collaborative agreements (see equation 2). * indicates the parameters that are significant at a 10 probability threshold; *** at a 1% probability threshold.

Table 2 shows strong evidence that collaborative agreements contribute to reduce the internal R&D efforts of large I.T. manufacturers. Both the simple count of collaborative agreements and their sales-weighted sum turn out to have a negative and significant impact on R&D intensity. The second estimates show that the negative impact is particularly true for acquisitions. The four other types of collaborative agreements (alliances, alliances with participation, consortia and joint venture) do not seem to have a significant effect on R&D intensity. The third regressions suggest that the content of the agreements does matter. It seems that only the mixed agreements (mix of sales, marketing and technological agreements) turn out to have a significant and negative impact on R&D intensity. Two complementary explanatory factors can be put forward to explain these results.

First, the standardization and emergence of a dominant technology in the I.T. industry stimulated the formation of technology agreements (cooperation and exchange of information being easier and less risky). Therefore the aggregate –hence individual- innovative efforts can be reduced through the exploitation of other firms' knowledge. Within the context of an acquisition, the drop of aggregate R&D outlays is straightforward and clearly appears in our results.

Second, firms confronted to declining profit margins need to cut costs by all means and see partnerships as a way to reduce their internal R&D spending (R&D collaborative agreements allow to share costs and provide more flexibility to adjust R&D efforts in such an unstable technology environment).

4. Concluding remarks

The objective of this paper was to assess whether the intense collaborative agreements that took place in the I.T. industry during the 1990's had an impact on large firms' R&D intensity. The econometric results suggest that these collaborative agreements had a significant and negative impact on relative R&D efforts. However, it seems that the type and content of these agreements have a differentiated impact. The most significant and negative impacts on large firms' R&D intensity are observed for acquisition and for the collaborative agreements with a mixed content (sales, marketing and technology).

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