Foreign subsidiaries in the Spanish food and beverage industry.
Local networking for innovation

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Abstract

We performed econometric analysis to identify some of the main features of food and beverages foreign subsidiaries engaged in local R&D cooperation. In Spain, their contribution to local networks of innovators seems to be financial and, probably, commercial rather than technological. Foreign subsidiaries which display high R&D intensity, a large number of R&D employees or a large share of new products in turnover are not necessarily engaged in local R&D networks. Foreign subsidiaries facing fewer obstacles to innovate than the average F&B firm seem more able to build those networks, probably because they are more attractive to local partners. Economic strength and dominant market position seem especially valued. This finding seems to support the view of the managerial theory on networks, rather than that of the Resource Based View of the firm, which predicts that companies attempt to solve their difficulties by establishing cooperative relationships. Foreign subsidiaries seem to combine internal and external information in order to innovate. Their size or their export activities are not significantly associated to their involvement in local cooperation for innovation.

Key words: food and beverage industry, networks of innovators, MNEs.

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Introduction

Worldwide, innovation has become a must for the food and beverage processing industry in view of a saturated food demand in terms of volume in industrialised countries; the need to produce more food for a growing world population; the changing food consumer tastes and the current awareness about health and sustainability problems related to food production (Jongen & Meulenberg, 2005). Science and technology are providing new solutions to change the nutritional characteristics of foodstuffs as well as their taste; to boost production at lower prices and to develop new methods to deal with waste (Acosta et al., 2011). All over the world, multinational enterprises (MNEs) contribute a substantial part of the patented inventions available to this industry and, in general, to the food chain (e.g. agriculture) (Alfranca et al., 2002;Patel & Pavitt, 1991). The share of foreign affiliates in R&D into food, beverages and tobacco is over 40% of the national total in the industries of OECD countries such as Germany, Portugal, Sweden, the United Kingdom and, especially, several Eastern European countries which have recently joined the European Union (EU)[2]. Though these circumstances suggest a potential for transferring technology to host-countries, foreign subsidiaries (FS) may remain isolated, generating a "branch plant syndrome" which limits their possible positive effects (Phelps, 1993). This explains that many Foreign Direct Investment (FDI) schemes are unlikely to fulfil all, or even most, of policy-makers' expectations with regard to the development of national industrial capabilities (McCann & Mudambi, 2004). The general literature on MNEs points now to foreign companies that establish local networks with institutions and other companies since they seem more likely than isolated MNEs to transfer technology to the host country (UNCTAD, 2001); hence the importance of better understanding the local R&D networks of foreign investors.

Most studies on R&D cooperation are cross-sectional studies or studies on high-tech sectors. A possible reason for lack of interest in low tech sectors is that most researchers opine that firms in high tech sectors are more prone to cooperate for innovation because they face more risky and costly innovation

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[2] OECD statistics on globalisation: Inward activity of multinationals - share in national total, from http://stats.oecd.org/index.aspx, as of February 2010 (data for 2007).

processes; therefore, the argument goes, cooperation may allow them to share costs and enter new technological fields.(Miotti & Sachwald, 2003). This point of view is somewhat confirm by the available information. For instance, Carboni (2013) finds that high tech and middle-high tech Italian firms are more prone to engage in R&D partnerships than companies in less advanced sectors. A review of the literature depicts R&D collaboration as a kind of *"elite sport"* mainly practiced by the world's largest firms from the high-tech industries (Bojanowski et al., 2012).   With few exceptions (Bayona-Sáez et al., 2013;Ebersberger et al., 2011), there are virtually no empirical analyses based on large samples on R&D cooperation in traditional sectors, such as the food and beverages processing industry (hereafter, F&B industry).   In turn, most cross-sectional analyses on cooperation for innovation provide little information, if any, on the F&B industry.

In principle, FS which are more innovative than the average company operating in the same national industry display a greater potential for technology transfers since they seem likely to contribute new ideas and practices to the host country. This may be especially true concerning national F&B industries with little capacity or resources to undertake innovation. This occurs in many countries since all over the world this industry is mostly integrated by small and medium sized enterprises (SMEs). In fact, host countries are competing to attract high quality FDI, i.e. innovative companies and R&D FDI (Guimón, 2011). Therefore, sectoral analyses based on systematic evidence are needed to identify the cooperative [3] behaviour of FS in the host-country. The task is particularly pressing in countries such as Spain, which are at the low end of R&D in the European F&B industry (Wijnands et al., 2008), since these countries may potentially benefit from the presence of highly innovative FS. However, as noted by Acosta et al (2011), very little is known about innovation and external sourcing of technology in agro-food firms in Spain. At the same time, Spain is one of the most important European receivers of FDI and its food and beverages industry seems to be an attractive target for foreign MNEs (Rama & Calatrava, 2002;Rastoin et al., 1998;UNCTAD, 2011). Moreover, it is a competitive food producer (Wijnands et

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[3] The term "cooperative" refers, in this article, to engagement of the firm in R&D cooperation.

al., 2008). The situation may be similar in other "intermediate" countries and emerging economies which are also competitive food producers and substantial receivers of agro-food FDI (for instance, Brazil); hence, the interest of analysing the Spanish case.

This paper pursues the following inquiries. Which are the main features of food and beverages FS involved in local R&D cooperation? More specifically, are R&D intensive FS interested in R&D cooperation with local partners?

Section 2 presents the literature review and our hypotheses; section 3 the methodology, and section 4 the results of the econometric analysis and the discussion. Section 5 concludes.

Literature review and hypotheses

This section discusses and integrates findings and interpretations of the International Business (IB) literature, the literature on R&D cooperation and networks, and the literature on innovation in the food and beverages industry. These different strands of theory inform the formulation of our hypotheses.

Importance of R&D cooperation and the role of MNEs

According to the literature on innovation, F&B companies source technology and new ideas from an increasing variety of agents (Omta & Folstar, 2005;Rama & von Tunzelmann, 2008). Both retailers and suppliers are often involved in joint innovation with F&B processors (Grunert et al., 1997;Senker, 1989;Traill & Meulenberg, 2002; Christensen et al., 1996; García Martínez & Burns, 1999; Gonard et al., 1991; Grunert et al., 1997;Rama, 1996). Though the F&B industry is often depicted as a traditional industry, it utilises nowadays a broad spectrum of sciences and techniques (e.g. biotechnology, informatics, instruments) and, therefore, often launches new products into the market or implements new industrial processes in close interaction with many different types of auxiliary industries, and scientific or technical institutions (Christensen et al., 1996). It was found that food firms benefit more from spillovers coming from outside this industry than from intra-industry spillovers (Ramani, 2008). The world's largest food and beverages MNEs patent, in addition to food and agricultural inventions, a number of chemical and biotechnology inventions,

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probably for understanding better food-related technology and for interacting more efficiently with their suppliers (Alfranca et al., 2004). Other F&B companies cooperate with pharmaceutical firms to produce "functional food" (Omta & Folstar, 2005). Not surprisingly, the available evidence suggests that R&D cooperation is becoming increasingly important in this industry. For instance, Spanish agro-food firms tend to be more cooperative than the average Spanish firm (Bayona-Sáez et al., 2013). Also, R&D collaboration between firms and institutions contributes to promote the intensive use of scientific advances in Spanish agro-food firms (Acosta et al., 2011). Worldwide, large F&B firms are displaying increasing interest in partnerships, including partnerships for innovation (Senauer & Venturini, 2005).

MNEs seem to play a substantial role in this new scenario. An important reason is that the world's 100 largest food and beverages MNEs patent around 50% of the inventions available worldwide for food and drink processing, agriculture and auxiliary industries (Alfranca et al., 2002). As summarised by Tozanli (2005, p. 26), within this group, *"the most dynamic and innovative MNEs won over those that placed their competitive advantages merely on raw material procurement"*. Large F&B companies are characterised by high rates of internationalisation of assets, sales and employment (Senauer & Venturini, 2005). FDI in food and beverages goes primarily to developed countries, whose importance appears to have increased in recent years, despite the flows received by developing countries also having grown (Rama & Martínez, 2013).

It should be noted that cultural factors may be especially important with regard to food and drink consumption (Selvanathan & Selvanathan, 2006). Despite trends toward the homogenisation of consumption in Western countries (Connor, 1994), differences in local tastes are significant and persistent. Consequently, F&B multinationals are more prone than other multinationals to internationalise their R&D activities since they need to adapt their foodstuffs to different national tastes (Cantwell & Janne, 2000). MNEs perform R&D abroad for other reasons as well: learning from foreign lead markets or lead customers; adapting their products to local regulations or ingredient availability; accessing to the National System of Innovation (NSI); taking advantage of the technological development of foreign companies or using publicly-funded R&D available in the host-country (Edler, 2008). MNEs may produce their inventions

both in their R&D specialised affiliates and in laboratories attached to production centres (Filippaios et al., 2009). Inventions may also be the result of research performed outside the MNE, through R&D collaboration or subcontracting agreements with local agents (Omta & Folstar, 2005). As stated, this article focuses on local R&D cooperation (also referred to in the literature and in this article as cooperation for innovation and as R&D collaboration).

The social capital of a firm, as generally understood by the economic and management literature, is equivalent to its "networking capital". The transaction cost literature has made particularly important contributions to explaining the value of social capital for networked firms (Williamson, 1985). In a host-country, FS may be lacking such social capital (Rugman & Verbeke, 2001) and this circumstance may restrain their ability for networking locally. Trust facilitates the exchange of new ideas and information between partners, an important consideration in networks of innovators (Häusler et al., 1994). Less tangible concepts like trust or power are as important as purely economic considerations in network innovation processes (Trienekeus et al., 2003). According to the IB theory, to minimise the risks of involuntary spillovers of knowledge MNEs may prefer, instead, to internalise knowledge production. Such risks may be quite real when new products are relatively easy to imitate, as is the case with new foodstuffs (Gallo, 1995). However, the other side of the coin is that internalisation strategies may encourage the technological isolation of the FS in the host country.

From the available evidence, it is difficult to tell whether food and beverage MNEs are likely to engage in local R&D cooperation. The analysis of spillovers and citations has provided some indirect information on R&D cooperation in this sector. Analysing 1970 data for Mexico, Kokko (1994) found that FS may operate as enclaves in industries of monopolistic nature where the competitive assets of these companies were likely to consist in superior market abilities as well as brand names and labels; for instance, the presence of FS was not likely to produce spillovers in Mexican industries such as beverages, instant coffee and prepared foods. Studying non-patent citations, other authors established that cooperation with universities promoted the use of complex technology in Spanish agro-food firms (Acosta et al., 2011).

With the publication of the Community Innovation Surveys (CIS) of the European Union (EU), several cross-sectional studies have focused more specifically on FS' patterns of cooperation for innovation.   Most of them find a negative effect of foreign ownership on R&D cooperation (see, for instance, Faems et al., 2005).   A pan European study reveals that foreign ownership is positively associated to international collaboration and negatively associated to domestic collaboration (Ebersberger et al., 2011). Firms in low tech industries, such as F&B, are no exception. In these authors' view, international linkages of FS may occur at the expense of domestic linkages. The authors conclude that the risk of a branch plant syndrome is empirically supported, especially in those European countries which are not technology leaders (as is the case of Spain). This result supports the conclusions of another cross-sectional study which finds that, within Europe, poor embeddedness of FS is more common in countries that are not at the forefront in science and technology (Srholec, 2009). By contrast, other cross-sectional analyses find a positive association between foreign status and R&D cooperation (see, for instance, Molero & Heijs, 2002; Segarra-Blasco & Arauzo-Carod, 2008;Srholec, 2011). Another study (Holl & Rama, 2014) finds that FS located in Spain have greater propensity than domestic firms to cooperate for innovation in the domestic market, with the only exception being those subsidiaries with no internal R&D. The authors argue that, in Spain, close relationships between FS and their local suppliers may have generated trust and stimulated the launching of local networks for innovation. So far, the discussion shows a lack of consensus concerning the influence of foreign status on domestic collaboration. A reason may be the insufficient sectoral evidence since R&D cooperation patterns may vary across sectors. We turn to this question below.

Innovative firms and R&D cooperation

The literature on sectoral systems of innovation claims that sectors differ about several specific dimensions (Malerba, 2005).   Regarding actors and networks, a sectoral system of innovation includes *"systematic interactions among a wide variety of actors for the generation and exchange of knowledge relevant to innovation and its commercialization"* (p. 385).   Interactions at the sectoral level have been rarely analysed with large databases and, thus, case

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studies need to be complemented with systematic evidence. An important question is whether highly innovative firms and, more specifically, highly innovative FS are prone to cooperate for innovation in the domestic market since these are the most interesting subsidiaries from the point of view of the host-country. One of the few empirical studies dealing specifically with open innovation in the agro-food sector finds that, in Spain, radical innovators are more likely to cooperate with a variety of R&D partners than incremental innovators (Bayona-Sáez et al., 2013). However, the focus was different to that of the present article since these authors' model did not control for foreign ownership. The above mentioned pan European study finds that innovation intensity is associated to high levels of cooperation only in high tech sectors (Ebersberger et al., 2011). Another cross-sectional analysis finds that the association of innovativeness and cooperation vary by sector, though no explanation is provided for variations; the F&B industry is not included in the results (Faems et al., 2005). Claiming that Revealed Tecnological Advantages (RTA) of the host-country need to be taken into consideration, another cross-sectional study finds that R&D intensive FS tend to be more cooperative than R&D intensive domestic firms in sectors where Spain displays technological advantage (García-Sánchez et al., 2013). These sectors mostly comprise traditional industries.

However, FS seem to be a heterogeneous group concerning local R&D cooperation (Holl & Rama, 2014). According to these authors, differences in local cooperative activities were related to the dimension and nature of the company's R&D effort; for instance, the FS which did not performed R&D were the least likely to engage in local R&D cooperation. Alvarez and Cantwell (2011) also find R&D related differences in the cooperative behaviour of FS operating in Spain.

Since the literature is not concluding in this respect, we formulate the following alternate hypotheses:

H1a: R&D intensive FS are more likely to engage in local R&D cooperation than less R&D intensive FS.

H1b: R&D intensive FS are not necessarily more likely to engage in local R&D cooperation than less R&D intensive FS.

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R&D intensive FS are here those which display higher R&D expenditures than those of the average F&B company, including both domestic and foreign firms (definition below and in Annex 1).

Drivers of R&D cooperation

Several reasons may put brakes to the innovative efforts of a company: difficulties in accessing knowledge, insufficient technology information, a market dominated by other firms, demand uncertainties, etc. What is the influence of these factors on R&D cooperation patterns? There are two rival explanations. According to the resource based view (RBV) of the firm, such factors may stimulate R&D cooperation, which is seen as a solution to problems the company cannot solve by itself (Miotti & Sachwald, 2003). Therefore, for this strand of theory insufficient resources are drivers of cooperation. In contrast, the management literature on networks maintains that insufficient resources, such as finance or knowledge, may be a deterrent for potential networking partners (Ahuja, 2000); therefore, they are likley to discourage R&D cooeepration. Srholec (2011) econometric study gives some credence to both strands of theory. He observes that in less advanced European countries firms without R&D capabilities tend to cooperate more than firms with R&D capabilities because they use cooperation to make for their limited internal capabilities. A company, he notes, may engage in a joint project with a partner because it has not enough R&D resources of its own. However, he observes that after a certain threshold, the capabilities of firms matter for their attractiveness as partners for domestic cooperation (industries are controlled for in his model).

Given the presence of two rival interpretations, we formulate the following alternate hypotheses:

H2a: Factors hampering innovation are likely to encourage local cooperation for innovation.

H2b: Factors hampering innovation are likely to be a deterrent for local cooperation for innovation.

Concerning factors hampering innovation, we also take into consideration the relative position of the FS *vis à vis* the average F&B company (definitions in Annex 1).

Methodology.

Data

We use the PITEC (Spanish Innovation Survey) database which provides anonymised microdata for companies foreign or domestic located in Spain. We analyse 121 observations pertaining to a sample of FS operating in the Spanish F&B industry over 2004-2008. This industry is division 15 in CNAE93 rev.1, corresponding with divisions 10 and 11 in NACE rev.2. It is sector 02 in the PITEC classification. FS are here companies where foreign capital accounts for ≥ 50% of total capital. It should be noted that non innovators are not included in our sample since PITEC poses the question about R&D cooperation only to firms defined by the questionnaire as "innovative", i.e. companies which have launched new products into the market or have introduce new industrial processes or have ongoing innovative activities or have abandoned them during the two years prior to the survey. 92.2% of the F&B firms surveyed by PITEC (and 93.8% of the food and beverages FS) are innovative in this sense.

We perform a logistic regression in which our dependent variable (*domRDcoop*) indicates whether the focal FS has been engaged in cooperation for innovation with local partners (in Spain) in the last two years. Our independent variables are presented in the text below and fully defined in Annex 1. See equation below:

$$P(domRDcoop = 1 \,|X_i^T, \beta^T, \alpha_i) = \Lambda(\alpha_i + \beta^T X_i^T)$$

Dependent variable

domRDcoop (cooperation with local partners external to the multinational group in the last two years). Our dependent variable is a dummy indicating whether the focal FS cooperates for innovation with external partners located in Spain. "External" refers here to partners which are no part of the multinational

group, such as other FS, Spanish groups, independent companies and institutions located in Spain.

Independent variables

i_RDexpend (intensity in R&D expenditures as compared with F&B industry average). This is our independent variable of interest since we aim at understanding whether quality food and beverages FDI is likely to be involved in local R&D cooperation networks.

Many previous analyses concerning R&D and cooperation employ a single R&D variable, usually internal R&D. However, certain empirical results suggest the need to approximate innovation from a variety of angles (Annique Un & Romero-Martínez, 2009;Vega-Jurado et al., 2009). Moreover, in industrialising countries and even in the periphery of Europe, FS may concentrate their technological effort on aspects other than developing internal R&D capabilities (Franco & Quadros, 2003). The above study actually finds that foreign F&B firms operating in Brazil use the acquisition of equipment as their most important technological strategy in the host-country, followed by the acquisition of disembodied technology and, only last, by internal R&D activities. Therefore, we calculate an aggregated variable including different types of R&D expenditures in order to capture all the possible contributions of FS to the technological upgrading of the F&B industry.

To calculate the R&D intensity of the focal FS, we start by constructing an aggregated index which includes the following types of R&D expenditures: internal R&D expenditures, external R&D expenditures, external knowledge acquisitions for innovation (e.g. licences); expenditures in technology acquisition (e.g. machinery); training expenditures; innovation expenditures; and expenditures for preparing and distributing innovations. For descriptions of each of these types of expenditures see Annex 1. The selection of the variables measuring R&D expenditures is in accordance with the criteria of the Oslo Manual to determine the scale of innovative activities (OECD/Statistical Office of the European Communities). PITEC reports the amounts in Euros spent by each firm for each different type of expenditure. We compare this with the respective amounts spent by the average F&B firm. Then, we calculate an aggregated index of intensity taking values from 0 to 7. When the value of the

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intensity variable is 0, this means that the FS displays below average expenditures for all types of R&D expenditures. By contrast, if the intensity variable is 7, the FS reports above average expenditures for all of these categories of expenditures. We use *i_RDexpend* to test for H1a and H1b.

We also include some control variables in our model in accordance with the literature. Descriptions of the variables can be found in Annex 1.

i_size (sales, as compared to industry average) Some authors have argued that the F&B industry is "one of the most Schumpeterian industries" because the size of an F&B company is an outstanding predictor of innovative intensity (Galizzi & Venturini, 1996). Moreover, a study on the agro-food Spanish sector, finds that larger companies are more likely to use scientific advances (Acosta et al., 2011). On the other hand, size has been reported as a predictor of R&D cooperation, and more specifically of local R&D cooperation, in some cross-sectional studies (see, for instance, Holl & Rama, 2014; Miotti & Sachwald, 2003). It has been argued that size reflects the absorptive capacity of the firm for benefitting from cooperation (Carboni, 2013;Lopez, 2008). Nevertheless, according to a pan European study, size has no statistically significant effect on cooperation in low tech industries, such as F&B (Ebersberger et al., 2011).

i_ownfund (share of own resources of the focal company in its total resources to finance R&D, as compared to share in the average F&B industry)*.* According to the RBV of the firm, companies engage in R&D partnerships to compensate for their strategic resource needs (Miotti & Sachwald, 2003). According to some cross-sectional studies, cost-sharing seems to be actually a powerful reasons for cooperation for French and Spanish firms (Lopez, 2008;Miotti & Sachwald, 2003). However, Carboni (2013) finds that credit rationed firms, in Italy, are not necessarily more prone to engage in R&D partnerships.   In contrast to the RBV of the firm, network theory (Ahuja, 2000) would maintain that a company lacking own funding to finance innovation is less attractive to potential partners; this circumstance could discourage R&D cooperation.

Our variable indicates the share of own resources of the focal FS (credits included) in total resources used to finance internal R&D.   As in the case of

other independent variables, we calculate whether the FS's availability of own funding is above that of the average F&B firm.

   i_RDpers (number of employees involved in internal R&D, as compared to industry average*).*   This dummy variable indicates whether the focal FS hires more R&D personnel than the average F&B company. Following Cohen and Levinthal (1989) our variable may indicate whether the focal FS enjoys more absorptive capacity than the average R&D company. A substantial absorptive capacity may be a crucial consideration for a firm attempting to benefit from R&D cooperation.

   i_new (share of new or improved products in turnover as compared to industry average)*.*   Faems et al (2005) find that Belgian firms with a large share of new or improved products in turnover are more likely to engage in R&D collaborations with a variety of partners. Bayona-Sáez et al (2013) also report an association, in Spanish agro-food firms, between open innovation practices and innovation, as measured by the share of sales attributable to new foodstuffs.   Here, we calculate a variable which indicates the share of new products in the focal FS's total turnover; then, we observe whether this percentage is above the share of new products in the sales of the average F&B company. *i_RDpers* and *i_new* are also useful variables to help us understand whether quality F&B FDI is likely to engage in local cooperation for innovation.

   Factors hampering innovation. As stated, the RBV of the firm and the management literature on networks hold antagonistic theoretical positions concerning the influence of factors hampering innovation on the formation of innovative networks. Here, we take into account 12 obstacles to innovation (see Annex 1). The obstacles variables were aggregated and re codified into four categories: *knowledge*, *economic*, *market* and *competitive* obstacles. Then, we compared the focal FS and the average F&B firm; when the variable is 1, the focal FS encounters higher obstacles to innovation (see codification of variable on Annex 1). Our independent variables, for obstacles, in the econometric model are *i_knowobst*, *i_econobst*, *i_marketobst* and *i_competobst* for, respectively, knowledge, economic, market and competitive obstacles

   i_intinfo (FS' s perception about the usefulness of internal information for innovation as compared to the average F&B firm's perception)*.* The IB literature suggests that innovative FS are likely to combine their own knowledge with

local knowledge (Cantwell, 2013).   Following this view, one may infer that subsidiaries that highly value information obtained from internal sources would be likely to engage in R&D collaboration with local partners, especially if they are innovative subsidiaries. Here, the variable denotes the perception of the FS regarding the usefulness of internal information for their own innovative activities. Internal information includes the company itself and its business group. The FS' perception about the usefulness of this source is compared to that of the average F&B company about its own internal source. When the variable is 1, the FS has a higher opinion than average about the usefulness of its own sources (see codification of variable on Annex 1).

We also control for intensity of exports as share of turnover (definition on Annex 1).

It should be stressed that all the independent variables included in the model denote intensity as compared to the sector; for instance, above average R&D expenditures, above average size and so on.

Description of sample

FS account for 8,4% of the F&B companies surveyed by PITEC. Around one third of the sample FS are R&D intensive, i.e. they tend to report above average R&D expenditures. 30.0% cooperate with local partners. 77.8% of the cooperative food and beverage FS engage in R&D cooperation with local suppliers, apparently the most important local partners. They are followed in importance by universities and private consultants (around 66.7% of FS each), clients/ consumers (22.2%) and research institutes (22.2%).

Results and discussion.

The Wald chi ^{2} has a Prob = 0.000 both for a model including all the independent variables (available upon request) and for the restricted model including the significant independent variables (Table 1). This suggests that our model is adequate for explaining the influence of the selected variables concerning differences among food and beverages FS about local cooperation in Spain. On the other hand, the Likelihood-ratio test of rho=0 (Prob = 0.000) and estimations of rho (around 99%) suggest that the variance concerning the propensity to cooperate locally may be attributable to individuals. This result

was expected since our definition of intensity compared with the industry average eliminates fixed effects.

Table 1 presents the results of the econometric analysis; as stated, it includes only the variables with statistically significant coefficients.

Table 1

Results of logistic regression for R&D local cooperation

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Random-effects logistic regression          Number of obs      =         121
Group variable: ident                        Number of groups   =          43

Random effects u_i ~ Gaussian                Obs per group: min =           1
                                                            avg =         2.8
                                                            max =           4

                                             Wald chi2(5)       =       33.30
Log likelihood  = -35.428053                 Prob > chi2        =      0.0000

------------------------------------------------------------------------------
    domRDcoop |    Coef.    Std. Err.     z     P>|z|     [95% Conf. Interval]
--------------+---------------------------------------------------------------
    i_ownfund |  13.42819    3.913896    3.43   0.001     5.757092    21.09928
 i_interninfo |  4.402842    2.308788    1.91   0.057    -.1222993    8.927984
 i-knowlobst  | -4.258969    2.157062   -1.97   0.048    -8.486733    -.031205
   i_econobst |  -9.504707   2.297008   -4.14   0.000    -14.00676   -5.002655
              |
 i_competobst |
          L1. | -4.475232    2.266168   -1.97   0.048     -8.91684   -.0336238
              |
        _cons | -23.09153    4.675316   -4.94   0.000    -32.25498   -13.92808
--------------+---------------------------------------------------------------
     /lnsig2u |  6.007698    .4739615                      5.07875    6.936645
--------------+---------------------------------------------------------------
      sigma_u |  20.16299    4.778241                     12.67175    32.08288
          rho |  .9919727    .0037741                     .9799231     .996814
------------------------------------------------------------------------------
Likelihood-ratio test of rho=0: chibar2(01) =    56.94 Prob >= chibar2 = 0.000

Note: Dependent variable: Local R&D cooperation for innovation (Y/N)
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The coefficient for *i_RDexpend*, i.e. above/below average R&D expenditures, is not statistically significant. H1b is supported (*R&D intensive FS are not necessarily more likely to engage in local R&D cooperation than less R&D intensive FS*). By the same token, the coefficients of the two other variables which approximate an outstanding technological endowment of the subsidiary, *i_RDpers* and *i_new*, are not statistically significant. FS intensive in R&D personnel and FS intensive in new products are not necessarily prone to cooperate for innovation with local partners.

i_ownfund displays a positive and statistically significant coefficient, the largest coefficient in our model (Table 1). FS which have at their disposal a larger share of own funding for innovation than the average F&B company have

more possibilities to build local networks of innovation than less well endowed FS.

The coefficient for internal information *(i_interninfo)* is also positive and statistically significant (Table 1). FS which value internal sources are more likely to be also interested in local R&D cooperation (see codification of variable on Annex 1). This finding suggests that FS use both internal knowledge and local knowledge -- a result in accordance with IB theory.

Three of the four independent variables denoting *factors hampering innovation* have negative and statistically significant coefficients. The coefficients of *i_knowobst*, *i_econobst*, and *i_competobst* are negative and statistically significant. These three variables display the second highest coefficients, after that of the *i_ownfund* variable (Table 1). FS not facing knowledge, economic or competitive obstacles to innovate or facing them to a lesser extent than the average F&B firm seem better prepared to launch local R&D collaboration networks. Conversely, FS facing more obstacles than average to innovate seem less able to engage in such networking activities (see codification of variable). Note that FS facing fewer than average difficulties concerning insufficient internal funding, insufficient external funding and high innovation costs (*i_econobst)* have more chances than other FS to engage in local R&D collaboration. To summarise, FS encountering less than average economic difficulties to innovate are more likely to engage in local R&D cooperation; together with the results for the *i_ownfund* variable, this new finding seems to confirm that economic strength is an important feature of FS engaged in local cooperation for innovation. Concerning *i_competobst*, a possible explanation of our results is as follows. The possession of market power provides companies with financial resources to invest in R&D (Cohen, 1995) and, probably, also to build local networks around meaningful common projects. As held by the IB theory, the search for reliable local partners may be costly for FS because they often lack social capital. Secondly, a dominant position in the market may signal that the FS enjoys market abilities and owns important brands and labels (Kokko, 1994). Such market position is often related to the possession of power in a network of firms (Easton, 1992). Finally, FS encountering fewer than average knowledge obstacles (*i_knowlobst*) are more likely to build local R&D cooperation networks; knowledge refers here to

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both technical and market knowledge. In addition to the possession of own funding, fewer economic, market or knowledge difficulties may also be viewed as attractive characteristics by potential local R&D partners.

These results disprove H2a (*Factors hampering innovation are likely to encourage local cooperation for innovation)* and, instead, provide support to the alternate hypothesis, H2b (*Factors hampering innovation are likely to be a deterrent for local cooperation for innovation).* FS facing more difficulties to innovate than the average F&B firm have fewer chances to build local R&D networks probably because such difficulties, especially their difficulties to finance innovation, may be a deterrent for local partners. At least concerning local R&D cooperation of F&B MNEs, our results seem to support the management literature on networks (Ahuja, 2000) rather than the RBV of the firm.

The coefficients *of size and exports* are not statistically significant. FS with a larger than average industrial plant and those with more exporting activities than the average F&B firm are not necessarily more prone to cooperate locally for innovation. Concerning *size*, our results support those of Ebersberger et all (2011) for European companies in low tech industries.

Conclusions.

We attempted to identify some of the main characteristics of food and beverage foreign subsidiaries engaged in local R&D cooperation. We were especially interested in subsidiaries more R&D intensive than the average food and beverages company. We found that foreign subsidiaries which spent more than average in R&D and innovation were not especially interested in such type of cooperation; nor were those which hired more R&D employees than average; or those which sold relatively more new products than the average F&B firm, domestic or foreign. Our results confirm those of a pan European study which established that innovation intensity and high levels of cooperation were not likely to be associated in low tech industries.

Our findings suggest that R&D intensive foreign subsidiaries are not likely to make a significant technical contribution to the host country. This result seems to confirm the view held by the IB school in that MNEs would tend to

avoid spillovers of knowledge and probably internalise their most important activities (Caves, 1996). This result does not mean, however, that food and beverages foreign subsidiaries do not contribute to local networks of innovation. But their contribution seems to be mainly financial and, probably, commercial. Foreign subsidiaries possessing own funding for innovation and facing fewer obstacles than the average food and beverages firm to innovate had more chances to build local networks probably because they were more attractive to local innovators.   This was especially true for those of them facing fewer economic constraints than average to innovate.

Size of the industrial plant and export activities do not seem to be associated to R&D local cooperation of food and beverage subsidiaries.

Annex 1. Description of variables

Name (1)	Description	Values
General information about the company		
Size (*size*) (*i_size*)	• Sales • Sales over industry average	In € 1= above industry average 0 =below industry average
Exports (*export*) (*i_export*)	• Share of sales in foreign countries in total sales of firm • Share of sales in foreign countries over industry average	% 1= above industry average 0 =below industry average
Innovation		
Own resources (*ownfund*) *i_ownfund*	Share of own resources of the focal company (including credits) in total resources used to finance internal R&D Share as compared to industry average	% 1= above industry average 0 =below industry average
R&D personnel (*RDpers*) i_ *RDpers*	No. of employees involved in internal R&D No. of employees as compared to industry average	No. of employees, including researchers, technicians and auxiliary personnel 1= above industry average 0 =below industry average
Internal R&D expenditures (*intRDexp*)	Internal expenditures in R&D, including personnel, equipment, acquisition of software, etc. in previous year	In €
External R&D expenditures (*extRDexp*)	External expenditures in R&D, including personnel, equipment, acquisition of software, etc. in previous year	In €
New products (*new*)	Percentage of products new to the company in total sales	%

Internal information (*interninfo*)	Importance of internal source (the company and its business group)	1-4 Likert scale 1= Very important 4 Not used this source of information
Factors hampering innovation		
Obstacles to innovation (*knowlobst*) (*econobst*) (*marketobst*) (*competobst*)	12 different obstacles to innovation faced by the firm in the last two years. Knowledge obstacles : - insufficient availability of qualified personnel - insufficient technological information - insufficient market information - difficulties in accessing knowledge Economic obstacles : - insufficient internal funding - insufficient external funding - high innovation costs Market obstacles: - availability of previous innovations - insufficient demand for innovation Competition obstacles: - market dominated by other firms - demand uncertainties	1-4 Likert scale 1= Highly important obstacle 4 = Has not found this obstacle
Aggregated obstacles variables For each of four previous group of obstacles we built one category	The obstacles variables were aggregated and re codified into four categories: technological, economic, market and competition obstacles (the 12 obstacle variables were aggregated through factor analysis and re codified)	1-4 Likert scale 1= Highly important obstacle 4 = Has not found this obstacle
Intensity in (aggregated) obstacles: *i_knowlobst* *i_econobst* *i_marketobst* *i_competobst*	Importance of obstacles as compared to those encountered by the average F&B firm	1 = The FS faces higher obstacles than the average firm 0 = otherwise
Innovation intensity (as compared to industry average)		
Internal R&D expenditures (*i_intRDexp*)	Internal expenditure in R&D over industry average	1= above industry average 0 =below industry average
External R&D expenditures (*i_extRDexp*)	External expenditure in R&D over industry average	1= above industry average 0 =below industry average
External knowledge acquisitions for innovation (*i_extknowlexp*)	Expenditures with acquisitions of services and licences related to the use of patents and to non patentable technical knowledge over industry average	1= above industry average 0 =below industry average
Expenditures in technology acquisition (*i_maqquipexp*)	Expenditures in acquisition of machinery, equipment, advanced hardware or software over industry average	1= above industry average 0 =below industry average
Training expenditures (*i_trainingexp*)	Internal or external training of the workforce with the specific aim to	1= above industry average 0 =below industry average

	developing or introducing new or significantly improved products or industrial processes over industry average	
Introduction of innovation expenditures (*i_marketexp*)	Introduction of new or significantly improved goods and services into the market, including market research and advertisement over industry average	1= above industry average 0 =below industry average
Expenditures for preparing and distributing innovations (*i_prepexp*)	Design and other expenditures for producing and distributing innovation that are not included in R&D expenditures over industry average	1= above industry average 0 =below industry average
Aggregate index of innovation intensity (*i_aginnoexp*)	The 7 previous dummy variables are aggregated by summing up the "Yes" responses over industry average	1= above industry average 0 =below industry average
Cooperation variable		
Domestic R&D cooperation (*domRDcoop*)	Have you cooperated for innovation with local partners in the last two years?	Y/N

Notes: (1) Name in dataset in brackets

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