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Cities and Innovation

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Postal Address:
Institut d'Economia de Barcelona
Facultat d'Economia i Empresa
Universitat de Barcelona
C/ Tinent Coronel Valenzuela, 1-11
(08034) Barcelona, Spain
Tel.: + 34 93 403 46 46
Fax: + 34 93 403 98 32
ieb@ub.edu
http://www.ieb.ub.edu

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INTERNATIONAL INDUSTRY MIGRATION AND FIRM CHARACTERISTICS: SOME EVIDENCE FROM THE ANALYSIS OF FIRM DATA [*]

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ABSTRACT: This article examines firm characteristics associated with the probability of relocating part of the activity in a foreign country. Using manufacturing firms' micro data for the 1999-2005 period, we find evidence that cost-cutting objectives are the main determinants for offshoring production, that firms with lower profits are more likely to undertake in-house offshoring, and that imports from low-wage countries increase the likelihood that part of the activity will be relocated. We also find that most offshoring firms are foreign – nearly 76% of the total.

JEL Codes: L23, F23, D21

Keywords: Offshoring, offshoring determinants, manufacturing firms, firm micro data.

Àngels Pelegrín Solé
Universitat de Barcelona & IEB
Facultat d'Economia i Empresa
Dpt. d'Economia Política i Hisenda Pública
Av. Diagonal, 690
08034 Barcelona
E-mail: apelegrin@ub.edu

Catalina Bolance Losilla
Universitat de Barcelona
Facultat d'Economia i Empresa
Dpt. d'Econometria i Estadistica
Av. Diagonal, 690
08034 Barcelona

[*] We want to thank the creators of the data base, especially Rafael Myro and Carlos Manuel Fernández-Otheo and the participants at the Economic Policy Congress, Granada, Spain (October 2009), for helpful comments and suggestions.
We thank the Spanish Ministry of Education and Science for the SEJ2007-63298 / FEDER grant.

I. Introduction

The economic literature and the media have often used the terms “offshoring” and “outsourcing” indistinctly. For some authors (Feenstra and Hanson, 2001) outsourcing is the import of intermediate inputs by domestic firms, using a general definition which considers goods produced by subcontractors external to the firms and goods provided by the firms’ subsidiaries abroad. For others (Girma and Görg, 2004) outsourcing is defined as the contracting out of activities that were previously performed within the firm to subcontractors outside the firm; in this case the authors do not distinguish between domestic and foreign activity and consider outsourcing as a substitute for in-house production.

Baldwin and Robert-Nicoud (2000) use the term “delocation” to express “the loss of manufacturing jobs to trading partners”. The authors refer to Japan, where the phrase “hollowing out of the economy” reflects the fears that globalization will promote the loss of manufacturing jobs, especially to Southeast Asia. They consider “delocation” as the transfer of productive establishments from one country to another.

For other authors, the point is the fragmentation of the production process. Helpman (2006), Grossman and Rossi-Hansberg (2008) and Bjerrin (2006) consider the sourcing of intermediate goods and services as a decision problem of business firms. The firm has to consider two dimensions. The first is ownership: the producer must decide whether to undertake the activity in-house or whether to purchase the input or service from outside through the market (at arm’s length). The second is geography: that is, whether the production can be performed domestically or in a foreign country.

The interaction of these two dimensions allows the firm to choose between four possibilities: insource at home, outsource at home, insource abroad and outsource abroad. Thus offshoring can be conducted in-house (in-house offshoring), via intrafirm trade through foreign direct investment (FDI); or via arm's length trade (offshore outsourcing).

Globalization and the easy access to information and communication technologies allow firms to organize their activity and decide their production strategies in a global framework. Whether purchasing intermediate goods and services from foreign suppliers or locating some parts of the production process in other countries through FDI, the objective pursued is to maximize production value. The relocation of the activity in a foreign country is a part of the firm's strategy that allows the externalization of relatively inefficient production processes. For firms that operate in very competitive industries and/or those that are performing poorly, the international fragmentation of production may be a very effective strategy for cost reduction.

In Spain, Myro and Fernandez-Otheo (2004, 2008) highlight two main waves of intense manufacturing offshoring. The first took place in the early 1990s; most of the offshoring involved the movement of a part of the production chain by firms in traditional and high technology-intensive activities; only a few were in medium technology-intensive activities. The firms in traditional sectors, textile firms especially, moved part of their production to low cost countries such as Morocco, Portugal and China. The firms in high technology-intensive sectors moved mainly to European Union countries; more than 90% of these electric and electronic firms were foreign. The second wave, which began in 2000 and continues today, is rather different: as the authors point out, most of the offshoring is undertaken by foreign firms

in the high and medium technology-intensive sectors, which look to the countries of Eastern European as location substitutes for Spain.

This study focuses on firms that transferred part of their production process to a foreign country through FDI between 1999 and 2005. As the scale of this phenomenon is increasing, it seems important to explore the main motives or determinants of in-house offshoring. The new theories that seek to explain offshoring phenomena focus on the different organizational strategies of firms and the decision to relocate in a foreign country either by internalizing (FDI) (the aspect studied in this paper), or through a foreign supplier, and centre primarily on transaction costs, asset specificity and incomplete contracts (Helpman, 2006; Williamson, 2005; Antràs and Helpman, 2004; Grossman and Helpman, 2002).

Our main objective is to identify the factors that determine in-house offshoring. Bearing in mind firm heterogeneity, we try to determine which firm characteristics are directly related to the strategic decision to restructure the company and to transfer production to a foreign country, paying particular attention to size, productivity, technology intensity and international experience. The analysis uses a micro database of firms operating in Spain. Most empirical studies of firm or industry characteristics and offshoring centre on outsourcing (Girma and Görg, 2004; Paul and Wooster, 2008; Díaz-Mora and Triguero, 2007; Holl, 2007; Díaz-Mora, 2008). Our study adds more empirical evidence to the limited data on in-house offshoring that are currently available.

We find evidence that cost-cutting objectives are the main determinants of offshoring production. Firms with lower profits are more likely to undertake in-house offshoring, and imports from low-wage countries increase the likelihood that firms will relocate part of their

activity. We also find that offshoring firms are mainly foreign – nearly 76% of the total during the period analysed.

Pelegrín and Bolance (2008) show that the location of foreign direct investment in manufacturing in Spain is dependent on specific industry traits, and that agglomeration economies and labour costs are stronger pull factors. This makes Spain a good laboratory case for the study of offshoring. First, Spain experienced rapid growth in FDI following its entry into the European Community in 1986. The country was an active recipient in the world flow of FDI, doubling its participation from 3.7% in the period 1981-1986 to 7% in 1991 (OECD, 1991). Venables *et al.* (2000) shows that at the beginning of the 1970s, 5.8% of all EU manufacturing was located in Spain, and that from late 1970s to the late 1990s this share rose to 6.5%. Secondly, as Myro and Fernandez-Otheo point out, Spain is undergoing a strong process of in-house offshoring, suggesting that the country is losing its traditional cost advantage. A large proportion of foreign firms that entered Spain in the 1980s are now offshoring; here, using a micro-database of firms, we study their characteristics in order to obtain a clearer idea of the offshoring process.

Following on from this introduction, section two presents a review of the main theoretical approaches and the empirical literature. Section three describes the data base and introduces the econometric methodology. The fourth section reports the estimation results, and we end with a summary and conclusions.

II. Determinants

The new theories that try to explain the qualitative and quantitative changes in foreign trade and FDI focus on the different organizational strategies of firms. According to the seminal work of Coase (1937), when firms grow, the cost of organizing additional transactions increases and the entrepreneur may not allocate production factors efficiently; in this case, it is possible that the loss in resources will be greater than the cost of the transaction through the market.

In short, a firm will tend to internalize whenever the cost of carrying out transactions (such as organization, management, and supply) is lower than the cost of subcontracting this transaction via the market. So, the decision of whether to internalize production or to subcontract externally depends on the costs and benefits associated with each alternative, and the factors that influence the decision are related to production costs and transaction costs.

Offshoring (the relocation of activity in a foreign country) is a part of a firm's strategy that allows it to externalize the relatively inefficient parts of the production process. Most of the literature on the decision to relocate activity, internalizing the process through FDI, or through subcontracting, revolves around transaction costs – that is, the costs related to looking for a suitable supplier, management costs, design costs and control of contracts (which tend to be imperfect), costs of coordinating the production process and the risk of transmitting strategic knowledge, which can generate opportunistic behaviour. As Williamson (2005) points out, internalization appears when the degree of asset specificity and uncertainty is so high that the different parts need a high level of cooperation and adaptation. On the other hand, subcontracting capitalizes on supplier specialization and scale economies; it offers

greater flexibility in the case of market fluctuations and, in general, lowers both management costs and labour costs.

Grossman and Helpman (2002), Antràs and Helpman (2004) and Helpman (2006) consider that transaction costs, asset specificity and incomplete contracts play an important role in the "make or buy decision". In deciding on one industrial structure – vertical integration or outsourcing – the firm has to choose between having a large, less specialized organization, with higher production and control costs, or looking for a suitable partner and negotiating the incentives to adjust the intermediate product quantities and specifications to its needs. The search is costly and many times contracts are imperfect, mainly because it is difficult to test the quality and attributes of the components. These limitations on the contracts can generate potential holdup problems; this kind of inefficiency is an important argument in favour of vertical integration. As regards the location for the production of intermediate inputs, producers have to choose between domestic and foreign suppliers with lower labour costs. All these trade-offs induce firms with different productivities to organize in different ways. In Helpman (2006) outsourcing dominates integration in component-intensive industries with low headquarter intensity, given that outsourcing has a lower fixed cost. However, firms with low productivity source in the domestic market, and firms with high productivity source in foreign markets. In the case of headquarter-intensive industries, four different forms of organization can coexist: foreign integration through FDI for high productivity firms, foreign outsourcing for average productivity firms, domestic integration for lower than average productivity firms and domestic outsourcing for the least productive firms. So, as the author points out, different productivities between firms in the same industry lead to different organization strategies for production and distribution.

Taking these studies as our starting-point, we formulate the following hypotheses:

H1- firms with higher labour costs are more involved in in-house offshoring.

H2- operating performance tends to be worse in in-house offshoring firms.

According to Antràs and Helpman (2004) and Helpman (2006), outsourcing dominates integration in component-intensive industries with low headquarter intensity, while integration is preferred when there are strong ownership advantages; in the latter case the most productive firms integrate through FDI. Marin (2006) conducted an empirical study related to outsourcing and offshoring determinants for 2,200 FDI projects from 660 German and Austrian firms in Eastern Europe.[1] The results show that intrafirm imports between German firms and their subsidiaries grow when the headquarters is more labour intensive, when headquarter services are more intensive and when distances are shorter. This suggests that German firms want to offshore to low wage countries when labour costs are high and transport costs are not. Tomiura (2005) investigated the characteristics of firms that outsource part of their production across national borders, using micro data from 118,300 companies. The author focuses on inter-firm heterogeneity in foreign outsourcing, in characteristics such as size, productivity, research and development activity, human skills and capital-labour ratio. The analysis includes both types of offshoring: through FDI, and outsourcing.[2] The empirical results prove that firms with higher size, human skills and experience with FDI are more likely to outsource abroad, revealing the existence of entry costs. Firms whose productivity is higher and whose products are more labour-intensive also show a higher probability of outsourcing, revealing the pressure to cut high labour costs, and firms more active in R&D tend to be more involved in foreign outsourcing. In later work, Tomiura (2007) studies the

[1] Such as vertical integration or internalization

[2] The study only considers contracting out tasks previously done internally, tasks that follow the firm's orders and specifications

productivity variation with globalization modes (export, international outsourcing and/or FDI), finding that firms offshoring a part of their activities are more productive than foreign outsourcers and exporters, which in turn are more productive than domestic firms.

Based on these studies, we formulate the following hypotheses:

H3- firms with labour intensive activities will be more likely to in-house offshore than other firms.

H4- firms with higher productivity are more likely to in-house offshore.

Butter and Hayat (2008) study whether FDI of Dutch firms in China is a major determinant of the growth in Dutch imports from that country. The results of the empirical analysis prove that FDI is significant for differentiated goods. Dutch firms offshore via the market to China when the asset specificity is low, and offshore via FDI when the specificity is high. Using a different approach, Feenstra and Hanson (2001) examine how firms respond to import competition and how these responses are transmitted to the labour market. In their view, an increase in imports from low-wage countries prompts the offshoring of non-skill-intensive activities. The empirical analysis also shows a high correlation between industries with large imports of final goods and industries with large imports of intermediate inputs, which is consistent with the idea that outsourcing is a response to import competition from low-wage countries.[3]

[3] Outsourcing is considered the import of intermediate inputs from foreign subsidiaries and from other foreign firms

We can now formulate the following hypothesis:

H5- We expect industries with higher imports from low-wage countries to be more likely to engage in in-house offshoring to these low-wage countries.

Finally, as previous research has emphasized (Girma and Görg, 2004) foreign firms that are part of a larger multinational company can be expected to use higher levels of technology than domestic firms, due to the easy access to the parent firm's specific assets. At the same time, their relationship with the parent and other subsidiaries abroad facilitates the disintegration of production structures.

After establishing the existence of a sunk entry cost, we can propose the following hypotheses:

H6- due to their international experience, export firms are more likely to in-house offshore.
H7- due to the learning effect, we expect older firms to engage more in in-house offshoring activities.
H8- firms involved in in-house offshoring tend to be larger in terms of employment and sales.
H9- foreign firms are more likely to in-house offshore than domestic firms.

III. Data and Model

We aim to analyse in-house offshoring determinants using a data base of firms that offshore part of their production activity to foreign countries (in-house offshoring) and firms that do not offshore. Offshoring information was obtained from a data base produced by the research

group "Foreign Capital, Location and Delocation" (*Capital Extranjero, Localización y Deslocalización*) at the University Complutense of Madrid. The data base was constructed using reports appearing in the media, which were then verified and complemented. This data base includes information on 350 cases of offshoring.[4] The information is at plant level, identifying mainly the nationality of the plant, location in Spain, the reason for offshoring, the country of destination and year of the announcement of the offshoring in the media. The firm Alcatel (France) for instance, has 14 plants/cases of in-house offshoring in Spain: in eight plants there have been staff cuts, four plants have closed down and two have been sold. In all cases, all or part of the production process has been transferred to foreign areas, mainly European Union and Asia for reasons of corporate restructuring. We finally obtain information from 116 firms that take one of the three following actions between 1999 and 2005: announce a redundancy plan (Spanish acronym ERE), close a plant, or close a product line in Spain, in order to transfer production to a foreign country.[5] To these 116 firms we add a sample of firms that do not offshore. The sample selection process is described below.

We obtain the individual firm information from the "Sistema de Análisis de Balances Ibéricos (SABI)", managed by Bureau Van Dijk. The SABI provides information on annual accounts (for up to 10 years, consolidated and unconsolidated), financial ratios, activities and ownership for approximately 1,201,000 companies throughout Spain.[6]

The offshoring information is obtained from the media, the group of in-house offshoring firms is a biased sample of the population but it is the only firm data base with information related to offshoring in Spain. The selection of the sample of non-offshoring firms is done in the

[4] Including outsourcing
[5] In an ERE the firm or the workers' representatives ask the employment authorities to suspend or terminate the working relationship between the firm and its employees, without jeopardizing the workers' rights.
[6] SABI is a part of the European Amadeus data base, but has information only for Spanish and Portuguese companies.

industries represented in the sample of in-house offshoring firms; we thus guarantee that both groups (offshore and non-offshore firms) represent the same industry structure. Due to the sample biases, the estimation models do not allow predictions, but the models are good enough to provide information on the traits of in-house offshoring firms, which is the main objective of our study.

One main trait of the in-house offshoring firms is that they are in the upper quartile of firms with the highest employment levels, so in all the sectors in which our 116 in-house offshoring firms operate (corresponding to the 4-digit level of NACE) we first select all the non-offshore firms in the 25% with the highest employment levels, and thus eliminate the smallest firms.[7] In any case, the employment variable presents a high dispersion, as it is one of the main determinants to explain the in-house offshoring. Next we select 25% non-offshoring firms from the total, using stratified random sampling.

To explain the differences between in-house offshoring and non-offshoring firms, we use two types of variables: firm-related, and industry-related. The information for individual firms is obtained from the SABI data base and the industry information is obtained from different sources, as Table 1 shows.

The individual information for firms is measured in different ways, depending on whether they offshore or not. For non-offshoring firms, we calculate the average of individual information for the period 1999-2005.[8] For in-house offshoring firms, we calculate the average for the available years until the year of the announcement of in-house offshoring in the media, when the company had already decided to move part of its production to a third

[7] We do not consider firms outside this 25% because they employ fewer than four workers.
[8] The SABI data base does not always have information for all the years in the period; in these cases we calculate the average for the years available.

country. Finally, the industry information is calculated as the average for the period 1995-1999. [9] In Table 1 we show the variables in our data base: minimum efficiency scale (MES), margin (Marg), research and development activities (RD) and imports (Imports), most of the information is at 2-digit level. We introduce this sector information to complement the individual firm data, and we impute the 2-digit level sector average to each firm.

To proxy the firm size (Size) we use two variables (see Table 1): number of employees and sales. The linear correlation coefficient between the variables is 0.1362. The sample has a strong heterogeneity; this means that firms with the same employment levels show different levels of sales, and vice versa. As the correlation is low, we can introduce both variables in the same model. The productivity (Product) proxy is the added value by efficiency unit of labour. To obtain the variable imports (Imports), we consider imports in each industry originating in East European countries, Maghrib, Turkey and Asia related to total imports in each industry. The countries of origin, which represent 78% of all in-house offshoring destinations, are cited in Table 1.

In Table 2 we present the frequencies of firms' in-house offshoring following the classification of R+D intensity industries provided by the OECD, which would mainly consider our industries as follows: electronic equipment – high technology; transport equipment, chemicals, machinery and electrical equipment – medium-high technology, and finally textile, clothing, leather and footwear, food and beverages, metal, paper, printing and publishing – low technology. We observe that the propensity to in-house offshore increases with technology intensity.

[9] We consider the sector information as previous to the in-house offshoring decision.

To study the determinants of in-house offshoring we estimate the following logit model:

$$P(OFF=1) = F(\beta_1 + \beta_2 Firm\ Age + \beta_3\ Size + \beta_4 Pers\_expend + \beta_5 KvsL + \beta_6 Profit + \beta_7 Product + \beta_8 Export + \beta_9 Foreign + \beta_{10} MES + \beta_{11} Marg + \beta_{12} RD + \beta_{13} Imports + \varepsilon) = F(t)$$

Where $F(\cdot)$ is the logistic cumulative distribution function:

$$F(t) = \frac{\exp(t)}{1+\exp(t)}$$

Where OFF, the dependent variable, is equal to 1 if the firm moves productive activity to a foreign country (in-house offshoring) and 0 if it does not and .

IV. Results

With the data base described above, we estimate 4 logit models. In all cases the dependent variable is OFF, which is equal to 1 if the firm moves productive activity to a foreign country (in-house offshoring) and 0 if it does not. The results are shown in Table 3.

The difference between models 1 and 2 is that in the first case we introduce the research and development activity (RD) as explanatory variable, and in the second case the research intensity effect is incorporated through two binary variables f2 and f3, which are described in Table 1. Binary variable f2 takes value 1 if the firm activity is considered medium technology-intensive and 0 if not, and f3 takes value 1 if the firm activity is considered high technology-intensive and 0 if not.

In model 1, Table 3, we observe that the significant parameters, at least at 5%, are the ones associated with the firm size variables (Sales, Size, $Size^2$), the capital/labour coefficient (KvsL), Profit, Foreign, industry minimum efficient scale (MES), industry margin (Marg) and Imports. The parameter associated with the variable personal expenses (Pers_expend) is significant at 10%.

In model 2, we eliminate the RD variable and replace it by adding two binary variables f2 and f3; the latter is significant at 5% and personal expenses are no longer significant. From these two models we observe that with greater size and higher technology intensity the firms engage in more in-house offshore activities. For the rest of determinants it will be interesting to analyse whether the effect of the variables varies depending on the technology intensity; models 3 and 4 try to reflect this. In model 3 the dummy variables f2 and f3 are incorporated in an additive and multiplicative in the variables Firms Age, Pers_expend, Profit, Product and Imports, for the rest of the variables the multiplicative effects are not significant. In model 4 we eliminate the additive effect of f2 and f3 in model 3, the results for the rest of parameters associated to the variables are the same, except for the parameter associated with Imports×f3 which is now positive and significant.

The final results appear in model 4 (Table 3), which is a model with multiplicative effects for technology intensity f2 and f3 (where f2 and f3 take value 1 if the firm's technology activity is considered medium technology-intensive or high technology-intensive respectively). At the same time, Table 4 shows statistics for the contrast of some restrictions on the parameters in models 3 and 4, according to whether the determinant effects are positive, negative or null.

In model 4 the parameters associated with the variables that do not include multiplicative effects (because these effects are not significant) show roughly the same sign and significance as in models 1 and 2. They show that the larger the size of the firm, the higher the probability of in-house offshoring; this effect is significant both at firm (Size and Sales) and at industry level (MES). Moreover, the negative parameter associated with the variable $Size^2$ shows that the effect is non-linear, as the effect decreases as the size increases. The effect of the variable capital-labour ratio (KvsL) is significant and negative, so the more labour-intensive the firm, the more likely it is to carry out in-house offshoring. We observe too that foreign firms are more given to offshore activities.

Model 4, Table 3, shows that the parameters associated with the variables Firm Age and Firm Age×f2 are significant at 10% and 5% respectively. The first has a positive sign and the second a negative sign. However, the parameter associated with Firm Age×f3 is not significant. These results show that the age of the firm has a positive effect on offshoring in traditional and high technology-intensive activities. For medium technology-intensive firms, Table 4 shows that the statistic for the contrast of H_0: Firm Age + Firm Age ×f2 = 0 is not significant, so we do not reject the possibility that for these firms the effect of firm age may be zero.

The parameters associated with the variable personal expenses (Pers_expend) are positive and significant, showing that the probability of in-house offshoring increases for firms in traditional activities with higher personal expenses. In contrast, the parameters associated with Pers_expend×f2 and Pers_expend×f3 are negative and significant. Table 4 shows the results for the contrast of H_0: Pers_expend + Pers_expend ×f2 = 0 and H_0: Pers_expend + Pers_expend ×f3 = 0. In both contrasts we do not reject the possibility that for medium and

high technology-intensive firms the personal expenses effect is zero, so in those cases personal expenses do not affect the in-house offshoring decision.

The effect of profits appears in the parameters associated with the variables Profit, Profit×f2 and Profit×f3. The first parameter is negative and significant and the second is not significant. These results show that profit has a negative influence on the probability of offshoring. For high technology-intensive firms, the statistic associated with this contrast, H_0: Profit + Profit ×f3 = 0, is not significant, and so for these firms the profit effect is zero.

In the case of the parameters associated with the variable productivity we carry out similar contrasts to the variables above with multiplicative effects. The productivity determinant is negative and significant only for the high level technology firms; for the rest the effects are zero. In high level technology firms, then, the in-house offshoring probability increases as productivity decreases.

Finally the parameters associated with the variable imports are positive and determinant for the medium and high technology-intensive firms, so these firms increase their in-house offshore activities to the countries where imports increase.

Using the results obtained in Table 3, we analyse the support for the hypotheses formulated in section two. With regard to hypotheses 1 and 2 (H1 and H2) we observe that firms in traditional activities with high labour costs, worse operating performance and low margins are more likely to carry out in-house offshoring; cost-saving through offshoring constitutes a strategy for firms performing poorly, firms in textiles, clothing, leather and footwear, and food and beverages, which face strong competition from Asian and north African products in

the domestic market. The medium level technology firms with worse operating performance are also likely to carry out in-house offshoring (H2).

With regard to H3, firms with high labour intensity (KvsL) are more likely to engage in in-house offshoring, confirming that labour costs (H1) are decisive for all the firms in the sample, regardless of their technology intensity.

Productivity is only determinant in high technology intensity firms, but is negative. Therefore, in disagreement with Helpman's (2006) theoretical models, the more R&D intensive firms do not confirm the H4 hypothesis, as firms with lower productivity are more likely to in-house offshore. For the rest of the firms the estimation results show that productivity is not a determinant factor.

The models estimated prove that firms in industries with higher imports from low-wage countries also show a higher propensity to in-house offshoring in these countries (H5). This is true for medium and high technology-intensive firms, but not for traditional firms in which costs remain a much more important consideration than imports from low-wage countries. For most firms (71.5% of in-house offshoring firms, Table 2) in-house offshoring is a response to import competition from countries with locational advantages, such as labour costs. These results corroborate those of Feenstra and Hanson (1996).

In contrast, export experience does not seem to be a determinant factor in in-house offshoring (H6). However H9 is borne out: foreign firms are more likely to relocate production abroad, as shown by the fact that 76% of the in-house offshoring from the sample are foreign firms. Görg and Strobl (2003) and Bernad and Sjöholm (2003) prove that, controlling for other plant

and industry characteristics, multinationals are more likely to exit the market than domestic firms. Other studies already mentioned such as Girma and Görg (2004) and Tomiura (2005) also obtain empirical evidence related to the offshoring activities of multinationals. The estimations of Tomiura (2005) suggest that firms that own affiliates overseas are four times more likely to choose foreign offshoring than firms without experience in FDI (p. 268). In medium and high technology-intensive industries, the percentage of foreign participation is very high: 93.1% for high technology firms and 77.8% for medium technology firms.

In this connection, Merino de Lucas' (2003) study, which works with the statistics from the Survey of Business Strategy (*Encuesta de Estrategias Empresariales*), finds that during the nineties (1990-1998) manufacturing foreign capital in Spain decreased its activity, and that this reduction caused firms to concentrate their activities on a smaller number of products and plants rather than to leave the country for good. The author argues that maintaining a certain level of activity in Spain can help these firms to introduce foreign products in the Spanish market.

Firm Age (H7) increases the in-house offshore probability for traditional and high technology-intensive firms (53% of in-house offshoring firms, Table 2), so business experience is determinant in the internationalization of production, making it easier for longer-established firms to find suitable locations, suppliers, and partners when necessary. In the case of medium technology-intensive firms, age does not seem to influence the probability of in-house offshoring. Larger firms have greater capacity to relocate production abroad (H8). At industry level, it is also confirmed that the larger the minimum efficient scale (MES), the greater the likelihood of in-house offshoring. The fact that the squared effect size is negative means that for bigger firms the effect is minor. Girma and Görg (2004) and Tomiura (2005)

also find empirical evidence showing that large firms have a greater capacity to establish and manage offshoring activities.

V. Concluding Remarks

This study analyzes firm characteristics associated with the probability of relocate part of the activity in a foreign country, using Spanish manufacturing firms' micro data for the 1999-2005 period.

The results of our paper provide immediate answers for a number of the questions raised at the beginning. First, we show that, together with business experience, in-house offshoring practices by firms are much more likely to be cost driven. We note the special prominence of foreign firms among those that engage in in-house offshoring.

Second, concerning the technology level of firms, we observe that profits are a major issue for traditional and medium technology-intensive firms (75% of the sample of in-house offshoring firms); firms with poorer operating performance are more likely to relocate production abroad.

Third, imports from low-wage countries in medium and high technology-intensive industries (71.5% of the sample of in-house offshoring firms) increase the probability that part of the activity will be relocated to these countries.

Our results suggest that firms need to be financially viable in an increasingly competitive global environment. In this context, the relocation of production to low-wage countries, as a form of corporate restructuring, will increase in near future.

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Table 1: Variables in the data base

Variable	Description
Firm Information	
OFF	Equal to 1 if the firm offshores and 0 otherwise
Firm Age	Number of years between year of creation and 2005
Sales	Sales
Size	Number of workers
Pers_expend	Personal expenses per worker
KvsL	Tangible fixed assets divided by number of workers
Profit	Profit before tax
Product	(Operating revenues-costs of goods sold-other operating expenses) divided by Personal expenses
Export	Equal to 1 if the firm exports and 0 otherwise
Foreign	Equal to 1 if the firm is foreign and 0 if it is domestic. We consider a firm as foreign when its capital participation is at least 10%
Industry Information	
MES	Minimum Efficiency Scale: the average number of staff employed in firms with more than 10 workers (*Generalitat de Catalunya*)
Marg	Industry margin: operating surplus divided by gross added value (*INE*)
RD	Number of full time researchers (*INE*)
Imports	Share of industry imports from East European countries, Maghrib, Turkey and Asia[a] (*Datacomex*, foreign trade statistics)
f1	Equal to 1 if the firm activity is considered traditional and 0 otherwise
f2	Equal to 1 if the firm activity is considered medium technology-intensive and 0 otherwise
f3	Equal to 1 if the firm activity is considered high technology-intensive and 0 otherwise

[a]Industry imports with origin in India, Vietnam, China, Czech Republic, Slovakia, Hungary, Romania, Croatia, Slovenia, Poland, Turkey, Tunisia and Morocco

Table 2: Cross frequencies between RD activity and in-house offshoring

Frequencies **% total** **% row** **% column**	**OFF=0**	**OFF=1**	**Total**
Low Technology Level Industries	4362.00 71.83 99.25 73.22	33.00 0.54 0.75 28.45	4395.00 72.37
Medium-High Technology Level Industries	1362.00 22.43 96.19 22.86	54.00 0.89 3.81 46.55	1416.00 23.32
High Technology Level Industries	233.00 3.84 88.93 3.91	29.00 0.48 11.07 25.00	262.00 4.31
Total	5957.00 98.09	116.00 1.91	6073.00 100.00

Table 3: Estimation Results

Coefficients	MODEL 1	MODEL 2	MODEL 3	MODEL 4
Intercept	-2.7773**	-3.1232**	1.0213	0.5384
f2		0.2600	-0.3454	
f3		1.1106**	-0.0725	
Firm Age	0.0037	0.00316	0.0223*	0.0224*
Firm Age×f2			-0.0381**	-0.0385**
Firm Age×f3			0.0144	0.0143
Sales	0.0036**	0.00347**	0.00239*	0.0025*
Size	3.7208***	3.6924***	4.2322***	4.2139***
Size^2	-0.3394***	-0.3337***	-0.3364***	-0.3367***
Pers_expend	0.0236*	0.0210	0.0944***	0.0956***
Pers_expend×f2			-0.0905***	-0.0926***
Pers_expend×f3			-0.1174***	-0.1185***
KvsL	-0.0091**	-0.0083**	-0.0093**	-0.0093**
Profit	-0.0383**	-0.0384**	-0.0891**	-0.0891**
Profit×f2			0.0389	0.0396
Profit×f3			0.3123*	0.3121*
Product	0.0131	0.0141	0.0246	0.0244
Product×f2			0.3146	0.2986
Product×f3			-2.1159**	-2.1112**
Export	0.2871	0.2782	0.1483	0.1460
Foreign	3.0033***	2.9198***	2.6851***	2.6861***
MES	0.0024***	0.00231***	0.00525***	0.0051***
Marg	-0.1361***	-0.1346***	-0.3456***	-0.3321***
RD	-0.0001			
Imports	0.0591**	0.0799**	0.0403	0.0465
Imports×f2			1.3377**	1.2598***
Imports×f3			1.6155	1.6160***
N=6076	χ^2=586.9416***	χ^2=592.2541***	χ^2=628.4908***	χ^2=628.4599***

* denotes test statistic significance at the 10% level.
** denotes test statistic significance at the 5% level.
*** denotes test statistic significance at the 1% level.

Table 4: Inference results

Parameters restriction	**MODEL 3**	**MODEL 4**
Firm Age + Firm Age×f2 = 0	1.8551	1.9352
Pers_expend + Pers_expend×f2 = 0	0.0554	0.0356
Pers_expend + Pers_expend×f3 = 0	0.3665	0.3786
Profit + Profit×f2 = 0	7.7871***	7.9836***
Profit + Profit×f3 = 0	1.9298	1.9597
Product + Product×f3 = 0	3.9870**	4.1143**

* denotes test statistic significance at the 10% level.
** denotes test statistic significance at the 5% level.
*** denotes test statistic significance at the 1% level.

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