Determinants for locating Research and development activity in Europe
Sylvie Montout\textsuperscript{\textbeta}, Mina Sami\textsuperscript{\text£}

Abstract

In this paper, we contribute to the literature by analyzing the location determinants of R&D activities in Europe. We do so by studying the location choices of 1,281 investment decisions from 2007 to 2012. We used a dataset from the European Observatory IFA. We began by analyzing the location determinants of R&D activities and then studied the co-location phenomena between production and innovation activities at the firm level. The results confirm that the location of innovation activities is more driven by market access, agglomeration forces and skilled labor pools. Furthermore, we demonstrate there is interdependence between the location decisions for innovation and production units at the firm level.

\textsuperscript{\textbeta} Economist, Head of the Business Intelligence and Competitive Environment Analysis Unit at the Invest in France Agency.

\textsuperscript{\text£} Tours-Orléans Universities, affiliated to GERCIE laboratory.
Introduction

“Location preferences of firms have shifted from traditional requirements.” (Dunning, 1998). Dunning (1998), demonstrated that location strategies for firms are becoming more and more complex. Thus, an analysis of a specific activity at the firm level is vital in order to simplify the complexity of defining these pull factors.

Duranton and Puga (2005) define the activity of a firm as a part of its value-chain and production stage. In other words, it refers to only one stage of production. Analyzing one stage of production enables us to focus on the factors that affect a certain activity. For Pelegrín and Bolancé (2006), the decision to startup a certain industry or activity in a specified region will depend on its traits and the characteristics of the region. The main reason for an analysis based on a firm’s activity is that the activities within a certain firm are very heterogeneous. Each stage of production has its own traits and therefore can have its own determinants. Defever (2002) found that there are different determinants of location for different business activities.

This paper concentrates on the research and development activity of the firms. This activity is an important factor in generating innovation. New theories of economic growth point to the importance of innovation in ensuring growth in the global economy. Therefore, increasing the number of R&D investments becomes essential to ensuring economic growth. R&D activity seems to be a strategic and essential activity. Indicating its determinants and pull factors can be a strategic interest for governments.

José G. (2008) asserts that, “foreign multinational firms are now seen by most governments as a central actor in national innovation systems and as a catalyst for upgrading in global value chains.” For him, it turned into a competition between governments to attract the R&D activities of multinational. These concerns have a significant effect on the relocation of industries, therefore, that can directly affect real wages and employment. The lack of data and the shortage of rigorous pull factor determinants for these multinationals are an obstacle to developing effective strategies to attract them.

In this paper, we contribute to the literature by analyzing the location determinants of R&D activities in Europe. We do so by studying the location choices of 1,281 investment decisions from 2007 to 2012. We used a dataset from the European Observatory IFA. We began by analyzing the location determinants of R&D activities and then studied the co-location phenomena between production and innovation activities at the firm level. The results confirm that the location of innovation activities is more driven by market access, agglomeration forces and skilled labor pools. Furthermore, we demonstrate there is interdependence between the location decisions for innovation and production units at the firm level.

Section 1 of this paper presents the main location patterns for innovation-related investments in Europe. Section 2 sets forth the theoretical model for locating R&D activity. In Section 3, we explain the econometric model. Section 4 describes the data set and the explanatory variables that are introduced in our estimates. Section 5 presents the econometric results and Section 6 contains the conclusion.
1. Main features of R&D investments in Europe

1.1 Firm-level data on location decisions

The data used in this study consist of individual location decisions made by multinational firms in Europe. Each year, the Observatory of the Invest in France Agency (IFA) collects data on the location of tangible investment projects in Europe.

The dataset contains detailed information. For each investment project, the IFA registers the name of the investing firm, the European country of location, the country of origin, the setup date, the sector of activity and the function within the firm. This dataset is compiled from official announcements made by the companies themselves and on the basis of information available in the international economic press and on the Internet (press agencies, websites, etc.).

The European observatory solely relates to Greenfield investments (creation of new entities) and Brownfield investments (expansion of an existing entity). The dataset used in this study covers 2007-2012. During this period, multinational firms from 38 countries made nearly 19,800 investments in 27 European countries.

The main advantage of this database is that projects are registered by function: headquarters, R&D, production, logistics, retail outlets, business-to-business services, business-to-consumer services, and decision-making centers. This classification is particularly important for our purpose: the purpose of this study is to provide new evidence on the international location of innovation-related activities in Europe. The R&D activities represent 6% of inward investment by multinational firms in Europe. American investors were responsible for 43% of the R&D projects and European investors (mostly from Germany, United Kingdom and France) initiated 38%.

1.2 Main location patterns for innovation-related investments in Europe

In Europe, performance figures on inward investments are lopsided; there is a very high concentration of R&D activities. Since 2007, Western European countries have received 86% of the R&D projects relative to all the European countries. Between 2007 and 2012, the top recipient countries were the United Kingdom (20%), France (16%), Spain (9%), and Ireland (9%), which received nearly two-thirds of international R&D investments. The distribution of inward investment between host countries is similar to R&D activities and all functions. Thus, the United Kingdom, Germany and France receive 18%, 16% and 11% of the total investments, respectively. Ireland has a large share of R&D activities out of the total number of investments by 18% of the country’s investments made in R&D activities.

---

1The 27 European countries (excluding Cyprus and Malta). The non-EU countries are Switzerland and Norway.
The United States conducts a large share (43%) of the R&D projects. In accounting for the share of each country in terms of number of projects, the data reveal that 14% of Chinese investments in Europe are R&D activities compared to 10% for the United States and Japan. All the countries with investments in Europe have some percentage of R&D projects: China (14%), United States (10%), and Japan (10%).
Origin of foreign investment projects in the R&D function (2007-2012)

Turning to the sector-based composition of inward investments, the analysis confirms the significance of R&D FDI in the industrial sector. First, 64% of the R&D projects carried out during the period were in the industrial sector. Second, and more importantly, the sector-based composition reveals the considerable attractiveness of electronic components and medications and biotechnologies, which received 25% and 22% of all FDI for R&D projects, respectively.

Sector-based composition of R&D investments in Europe (2007-2012)

Source: European Observatory IFA, 2013
The chart below shows the attractiveness of European countries in terms of investment in R&D and their potential R&D activities estimated by gross domestic expenditure on R&D (GERD). The results reveal a positive correlation and suggest that a national effort on R&D may affect a country’s attractiveness. For example, Austria and Denmark devote a significant share of their GDP in R&D expenses (above the EU average) and have the highest attractiveness index in the region.

Beyond this, many other factors are likely to explain the attractiveness of countries, such as tax advantages or market expansion. Ireland receives 18% R&D activities in total inward investments. Ireland emerges as the most attractive country in terms of R&D investments with a GERD below the European average. In contrast, Sweden and Switzerland, well positioned in terms of R&D, attract proportionally little investment.

2. Theoretical Framework

The existing literature on location determinants is based on the recent development of the New Economic Geography Theory. Our theoretical framework is modeled after Head and Mayer (2004). The underlying models usually assume that a firm chooses a location that maximizes its projected profits.

Take a firm that locates its production in region $i$, $i=1$, etc., $R$, where $R$ is the number of regions. In monopolistic competition theory, each firm decides to locate its R&D activity in a given region. This choice will depend on the profit it expects to generate from locating in this region.

The profit of a firm that offshores its R&D activities in region $i$ will equal the total profits realized in each market $j$ accounting for the fixed costs of the entity in region $i$:

$$\Pi_i = \sum_j \frac{p_{ij}}{\sigma} - F_i$$

(3.1)
Where $P_i$ is the price that the firm will assume in region $i$; $Q_{ij}$ is the output that the firm will generate from its R&D activity; $F_i$ is the fixed cost of establishing a plant in region $i$ to begin the R&D activity.

The output of the activity will depend on the demand. Therefore, output $Q_{ij}$ will equal $D_{ij}$ (the demand on the output of the activity):

$$Q_{ij} = D_{ij} = P_{ij}^{\sigma} \frac{E_j}{\sum_{i=1}^{R} n_i P_{ij}^{1-\sigma}}$$

(3.2)

& assume $G_j = (\sum_{i=1}^{R} n_i P_{ij}^{1-\sigma})^{1-\sigma}$

Thus, the demand on the firm's output will depend on:

- The price of the firm $i$ in country $j$.
- $E_j$ is the expenditure of users for the activity’s output.
- $\sigma$ the elasticity of substitution.
- $n_i$ is the number of competitors in all the other regions, where $R$ is the number of regions and $i=1,2,3,…, R$.

Price $P_{ij}$ is composed of $(P_i)$ the price of the activity itself and $(T_{ij})$ the transportation costs.

We also presume the price of the activity $(P_i)$ is based on the Dixit-Stiglitz model (1977), where a firm’s price $(p_i)$ is a constant markup over marginal cost ($C_i$):

$$p_i = \frac{\sigma}{\sigma - 1} C_i$$

(3.3)

By replacing (3.3) in (3.2), the output that the firm $i$ can have in the region that corresponds to consumer demand (other firms or final consumers):

$$Q_{ij} = P_i^{\sigma} T_{ij}^{1-\sigma} G_r^{1-\sigma} E_j$$

(3.4)

By replacing (3.4) and (3.3) in (3.1), the profit of locating the activity in potential region $r$ will be:

$$\Pi_r = \frac{C_r}{\sigma} M_r - F_r$$

(3.6)

Where $M_r = \sum_{i=1}^{R} T_{ij}^{1-\sigma} G_r^{1-\sigma} E_j$ & $C_r = \frac{\sigma C_r^{1-\sigma}}{\sigma - 1}$

$M_r$ is the market potential because it is the total capacity of all the markets including transportation costs.

We can see that the profit is negatively affected by the costs of business, but will be positively affected by the potential market. Therefore, the tradeoff between a high potential market and lower operational costs will maximize the firm’s profits. 

By breaking it down by the function of the R&D activity’s costs, it could be expressed as:

$$c_r = z_r^{\sigma} P_{s,r}^{\sigma} v_r^{\sigma}$$

(3.7)

Where:

- $v_r$ is the costs of coordination of the firm due to R&D overseas investment.
- $P_{s,r}$ is the price of intermediate inputs by sector $s$.
- $z_r$ is production-related costs in region $r$.

By substituting (3.7) in (3.6) and transforming the equation to a logarithm format, we can break down the profit from the R&D activity into four components: the potential market ($MP_r$),
coordination costs \((v_r)\), the price of intermediate input \((P_{s,r})\) and the production-related costs \((z_r)\) depending on agglomeration forces, transaction costs, infrastructure, etc.:

\[
\ln \Pi_r = \alpha \ln M_P + \beta \ln v_r + \delta \ln P_{s,r} + \gamma \ln z_r + \varepsilon_i
\]  

(3.8)

The empirical literature suggests that market size, measured by local demand or accounting for demand from neighboring areas, appears to be a fundamental location determinant (Crozet, Mayer and Mucchielli, 2004; Amiti and Javorcik, 2008). In the context of international value chain fragmentation, a firm’s foreign investment strategy incorporates the market access motive (horizontal FDI) and the tradeoff between production costs based on international differences in factor endowments (vertical FDI). Regarding the R&D centers, the empirical literature shows that R&D centers specialized in adapting products have a strong propensity for setting up operations close to their final markets (Sachwald and Chassagneux, 2007). In the empirical model, we assumed a degree of coordination costs will affect the R&D location decision due to the pre-investments in the production activities of the same firm.

In this context, we test the location determinants of the innovation activities, using the following simplified format:

\[
\Pi = \alpha_1 \text{Market potential} + \alpha_2 \text{Distance} + \alpha_3 \text{ULC} + \alpha_4 \text{Education} + \alpha_5 \text{Agglomeration} + \alpha_6 \text{Coordination costs} + \varepsilon_i
\]

Where Market potential is the distance-weighted GDP of other countries, ULC and Education control for the cost of efficient labor, Agglomeration stands for agglomeration economies, and Distance is the physical distance and cultural distance is the proxy for the transaction costs.
3. Econometric model: the conditional logit

The simplified format we want to test will be estimated using the conditional logit model. The investor will decide on a certain country to locate its R&D activities according to a number of alternatives. The dependent variable takes the value 0 or 1 depending on whether the company is located in the sample area. The principle is to assume that a firm’s location decisions are based on maximizing a profit function that is subject to uncertainty. The main advantage of the conditional logit is including the fixed effects in order to control for unobserved heterogeneity between firms. It can control for the variability across time and different sectors.

We note the location choices made by firms in countries with observable characteristics. R = (1, …, r, … N) all potential locations. Each potential location offers to firm f profit Π fr expressed as:

Π fr = β0 + X fr β + ε fr

Where X fr β depends on the observable characteristics X fr of each location r, on vector β of coefficients to be estimated and on a set of unobservable characteristics captured in the error term.

Firm f chooses the location of R&D activities that provide it the highest profits. The probability of firm f choosing region r is expressed as:

P r = \frac{e^{X fr \beta}}{\sum_{i=1}^{j} e^{X ir \beta}}

Since conditional logit assumes that the total number of firms n is given and does not depend on x, the expected number of firms in r is:

E(n r ) = n P r = n \frac{e^{X fr \beta}}{\sum_{i=1}^{j} e^{X ir \beta}}

The elasticity of region j will be:

θ jk = \frac{∂ log E(n r )}{∂ X jk} = (1 - P j ) β k

Where k is the location characteristics of region j

Thus, this equation explains the change effect of regional characteristics in country j on the expected number of new entrants. This means countries that enhance their characteristics and become more attractive will have an increasing number of R&D investments.

4. Data

As previously noted, the data are based on individual location decisions made by multinational firms in 27 European countries. The dataset we used was compiled by the Invest in France Agency and contains information on 19,800 investment decisions from 2007 to 2012. In our final sample, we retained 866 investment decisions in R&D activities over from 2007 to 2012. The independent variables were constructed based on the information available on host country characteristics from 2007 to 2012 (see Table 1 for statistical sources). To gauge the size of national markets, we used two types of measures. The first was GDP by country at constant prices (Eurostat). The second was a market potential indicator, constructed according to the Harris model (1954). This measure takes into account local market demand and the demand from neighboring countries weighted by bilateral distance:
\[ PM_i = GDP_i + \sum_{i \neq j}^{i} \frac{GDP_j}{d(i,j)} \]

We used two variables to measure the agglomeration effects and foreign investor dynamics. The first was designed to measure the agglomeration effects between firms in the same function from the investor’s country of origin. The indicator is approximated by the total number of investments from the same country of origin in the year preceding the location decision. The second was designed to account for the overall size of the sector in the host country. This variable was constructed in the same way. The size was approximated by the total number of foreign R&D projects for firms in the same sector in the year preceding the investment.

Two criteria characterize the local labor market: the cost of labor and the skill level of workers. Regarding labor costs, the benefit of the labor unit cost was it provides productivity-weighted wages. Labor costs are measured by the cost of labor per hour. The skill level of workers is measured by two variables: the number of doctorates by country and the number of employees in high-value-added sectors (index of specialization). This variable is also designed to measure the existence of labor specialization for a country, which can be an environment conducive to clustering. The value of these variables may be expected to be positive.

Three distance variables were introduced to measure the volume of transaction costs associated with the organization and management of an affiliate located abroad. The first, designed to measure geographic distance, relates to the physical distance between the country of origin and the country of investment. The second, designed to measure cultural distance, is a dummy variable approximating the potential existence of a common official language. The last one is a dummy variable approximating the existence of a common official history. These data were provided by the CEPII.

To capture the effect of the political context, we introduced the domestic expenditure on R&D. One would expect the value of this variable to be positive.

Lastly, if there are coordination costs, firms may have an incentive to locate different stages of their value chain in the same location. Thus, we introduced two variables to analyze the co-location phenomena between innovation activities and production units. The first was the co-location index at the company level, which is measured by counting the number of projects registered as production activities in the years preceding the investment in innovation activities. We verify the existence of co-location effects between production and innovation activities at the firm level. The second was designed coordination costs, which accounts for the physical distance between the investment in production and in innovation for the same firm. We expected coordination costs to positively affect the location of innovation activities.
### Table of independent variables

<table>
<thead>
<tr>
<th>Variables</th>
<th>Source</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>GDP</td>
<td>Eurostat</td>
<td>GDP in millions of euros</td>
</tr>
<tr>
<td>Market Potential</td>
<td>Constructed using Eurostat &amp; CEPII</td>
<td>Harris model on market potential (1954)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$MP_i = GDP_i + \sum_{i \neq j} \frac{GDP_j}{d(i,j)}$</td>
</tr>
<tr>
<td>Agglomeration countries</td>
<td>Constructed using the IFA database</td>
<td>Number of registered investments from the same country of origin in the year preceding the investment in innovation activities (2007-2012)</td>
</tr>
<tr>
<td>Agglomeration sector</td>
<td>Constructed using the IFA database</td>
<td>Count of the number of registered investments from the same sector, in the year preceding the investment, for the innovation activities (2007-2012)</td>
</tr>
<tr>
<td>DERD</td>
<td>Eurostat</td>
<td>The domestic expenditure on R&amp;D (millions of euros)</td>
</tr>
<tr>
<td>PhDs</td>
<td>Eurostat</td>
<td>Number of PhDs by country</td>
</tr>
<tr>
<td>Skill</td>
<td>European Cluster Observatory</td>
<td>Employees in high value-added sectors by country</td>
</tr>
<tr>
<td>Unit Labour Cost</td>
<td>Constructed using Eurostat</td>
<td>The unit labour cost (in euros). $ULC=\frac{\text{labour cost per hour}}{\text{productivity}}$</td>
</tr>
<tr>
<td>Distance</td>
<td>CEPII</td>
<td>Geographical distance between the investor’s country of origin and the recipient country</td>
</tr>
<tr>
<td>Language</td>
<td>CEPII</td>
<td>Dummy equals 1 when the official language is the same in both countries</td>
</tr>
<tr>
<td>Colony</td>
<td>CEPII</td>
<td>Dummy equals 1 when both countries share a historical link</td>
</tr>
<tr>
<td>Coordination costs</td>
<td>Authors' calculations</td>
<td>Geographical distance between the investor’s country of origin and the destination country if a company decided to invest in innovation activities where a production unit is located in the preceding years.</td>
</tr>
<tr>
<td>Co-location</td>
<td>Authors' calculations</td>
<td>Dummy variable equals 1 when the company decided to invest in innovation activities and in the preceding years made a location decision for production, otherwise it is 0</td>
</tr>
</tbody>
</table>
5. Empirical results

We begin by analyzing the location determinants of multinational firms for Greenfield investments related to innovation activities.

5.1. Location determinants of innovation activities in Europe

The results of the conditional logit estimation took into account the fixed effects as it matched case-control groups. The model controls for time variation, specific countries and the sector within the activity. Table (2) presents the results of the Greenfield investment model related to innovation activities. In column (1) of Table 2, we consider GDP as a proxy for market size. In column (2), we introduce and only retain the market potential measurement of the market size variable. In columns (3) and (4), different variables are incrementally introduced to measure the agglomeration effects. In column (5), we present our baseline specification. The results are very consistent with our theoretical framework.

<table>
<thead>
<tr>
<th>Variables</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(6.68***</td>
<td>0.50***</td>
<td>0.50***</td>
<td>0.46***</td>
<td></td>
</tr>
<tr>
<td>MarketPotential</td>
<td>(0.14)</td>
<td>(0.14)</td>
<td>(0.14)</td>
<td>(0.14)</td>
<td></td>
</tr>
<tr>
<td>Unit labor cost</td>
<td>0.053</td>
<td>0.08</td>
<td>-0.01</td>
<td>-0.01</td>
<td>-0.07</td>
</tr>
<tr>
<td></td>
<td>(0.07)</td>
<td>(0.07)</td>
<td>(0.07)</td>
<td>(0.07)</td>
<td>(0.07)</td>
</tr>
<tr>
<td>PhDs</td>
<td>0.07*</td>
<td>0.13***</td>
<td>0.11***</td>
<td>0.11***</td>
<td>0.10***</td>
</tr>
<tr>
<td></td>
<td>(0.03)</td>
<td>(0.04)</td>
<td>(0.04)</td>
<td>(0.04)</td>
<td>(0.04)</td>
</tr>
<tr>
<td>Domestic expenditure on R&amp;D</td>
<td>-0.06</td>
<td>0.09</td>
<td>0.12*</td>
<td>0.12***</td>
<td>0.14***</td>
</tr>
<tr>
<td></td>
<td>(0.07)</td>
<td>(0.06)</td>
<td>(0.06)</td>
<td>(0.06)</td>
<td>(0.06)</td>
</tr>
<tr>
<td>Specialization index</td>
<td>0.22**</td>
<td>0.65***</td>
<td>0.52***</td>
<td>0.52***</td>
<td>0.49***</td>
</tr>
<tr>
<td></td>
<td>(0.08)</td>
<td>(0.04)</td>
<td>(0.05)</td>
<td>(0.05)</td>
<td>(0.05)</td>
</tr>
<tr>
<td>GDP</td>
<td>0.50***</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.07)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Distance</td>
<td>0.00</td>
<td>-0.04</td>
<td>-0.01</td>
<td>-0.01</td>
<td>-0.04</td>
</tr>
<tr>
<td></td>
<td>(0.11)</td>
<td>(0.09)</td>
<td>(0.09)</td>
<td>(0.09)</td>
<td>(0.09)</td>
</tr>
<tr>
<td>Common language</td>
<td>1.03***</td>
<td>1.05***</td>
<td>0.92***</td>
<td>0.92***</td>
<td>0.74***</td>
</tr>
<tr>
<td></td>
<td>(0.11)</td>
<td>(0.11)</td>
<td>(0.11)</td>
<td>(0.11)</td>
<td>(0.12)</td>
</tr>
<tr>
<td>Colony</td>
<td>0.23*</td>
<td>0.23*</td>
<td>0.07</td>
<td>0.07</td>
<td>-0.05</td>
</tr>
<tr>
<td></td>
<td>(0.12)</td>
<td>(0.12)</td>
<td>(0.13)</td>
<td>(0.13)</td>
<td>(0.13)</td>
</tr>
<tr>
<td>Agglomeration sectors</td>
<td></td>
<td></td>
<td>0.52***</td>
<td></td>
<td>0.38***</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(0.06)</td>
<td></td>
<td>(0.07)</td>
</tr>
<tr>
<td>Agglomeration countries</td>
<td></td>
<td></td>
<td></td>
<td>0.52***</td>
<td>0.34***</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(0.06)</td>
<td>(0.07)</td>
</tr>
</tbody>
</table>

Standard errors in parentheses: ***p<0.01, **p<0.05, *p<0.10, Number of observations: 864
Firstly, the findings confirm that demand is a major determinant in location decisions. In column (1), the coefficient associated with GDP is positive and significant. By construction, GDP and market potential are correlated. Therefore, in column (2) we introduce and only retain market potential. The coefficient for market potential is larger: a 10% increase in market potential corresponds to a 6.3% rise in the probability of attracting new investors. This result confirms the notion that in the European Union, the perception of a market that is accessible from a given location extends well beyond the borders of the host country. Our results are consistent with the empirical observation on R&D centers, that shows that R&D centers specialized in adapting products have a strong propensity to locate close to their final markets.

Secondly, important agglomeration effects also influence firm location decisions in Europe (columns 3 and 4). The coefficients on the pre-existing presence of firms in the same sector from the same country of origin are positive and significant. Location decisions for innovation activities appear especially sensitive to the presence of investors of the same nationality. In addition, firms tend to locate in countries where a high number of firms from their business sector are already established. In this case, the networks are a constraint to guiding R&D investments, which explains why partnerships play such an important role in R&D investments.

The results confirm the importance of cultural proximity in location decisions, reflected by the historical link established between the investor’s country of origin and the host country. There are significant transaction costs associated with organizing and managing operations in a foreign country and they are likely to increase with the cultural distance between the investor’s country of origin and the country where she decides to locate. Unlike the theoretical and empirical literature, physical distance does not affect location decisions. As mentioned above, the biggest investor in innovation activities is the United States, which accounts for 48% of the total investment in innovation in European countries.

Regarding the skill-level effect, location choices for innovation activities are highly sensitive to skilled labor pools. The specialization index and the number of PhDs have a positive and significant impact on investments. These findings suggest that multinational firms might prefer to locate their skilled-labor-intensive activities in countries with abundant skilled labor.

Our findings show that unit labor cost has no effect on the overseas investment in R&D activities. This proves that the firms are seeking for skilled labor pools as the most important trait within the host country’s labor market structure. In order to make a robustness check on this variable, we used the relative unit labor cost between origin and destination country. Our results assisted no changes as the variable had no effect on the location decision.

### 5.2 Co-location plays a significant role

Lastly, among the factors that determine investment location decisions, co-location phenomena can play a significant role. Since these effects are frequently observed in practice, it seemed worthwhile to confirm their existence using an econometric approach. We tested for the existence of such phenomena at firm level and the results confirm there are direct correlations between the activities. We demonstrate that the location of innovation activities is sensitive to the prior existence of production sites. These findings confirm the results obtained by Nefussi and Schwellnus (2010), who showed that the overseas location of business services from French firms is positively affected by the location of French manufacturing affiliates. In addition, Py and Hatem (2011) demonstrated that at the country level, the location of R&D centers is positively affected by the location of production plants in Europe.
Finally, the coordination costs, variable is positive and significant. The location of R&D activities appearing to be sensitive to the coordination costs, there might be an incentive for firms to locate production and innovation activities in the same country. In order to reduce and manage coordination costs, investors are motivated to locate production and R&D activities in the same country.

More generally, the results show that the location of production positively influences the location of innovation activities.
6. Conclusion

Innovation activities have undergone a steady globalization process in recent years. This involves fierce competition between potential host countries for the location of new projects and the preservation of existing sites. This trend has consequently led to a growing awareness of host countries in terms of the need to offer a favorable environment to companies willing to develop their innovation activities in the most attractive location.

As the firms that invest in a preceding time in the production activities have a big propensity to locate their R&D activities in the future in Europe, the government must deepen its production investment networks. It’s cogent now to head some policies in order to attract a higher level of production investments, especially for the automotive industry sector, energy and recycling sector and medication sector, as these sectors have realized the highest number of colocation projects. Furthermore, the role of government to encourage the firms to make a research partnership and increase their absorptive capacity will increase the network effect between firms. (Goes & Park, 1997; Hurry, Miller, & Bowman, 1992). These partnership researches can be partly funded by the governments in order to motivate firms to work together and deepen their relationships network.

Also, increasing the agglomeration effect in the European country is very important by trying to attract new country investor in order to make new agglomeration for new countries. There is a need to deepen the strategies that purport to increase the number of scientists and technologists in the European countries, by providing subsidies and increasing the budgets of universities and research centers, and by facilitating the exchange of researchers in the European countries. It’s important to attract highly skilled labor from other countries that can be motivated by a lot of policies: facilitate immigration procedures, offer high skilled labor opportunities for cutting their income taxes. It’s also recommended to produce a climate of exchange experiences between those skilled labors. This can make a deep network of exchanging high value added ideas and mechanisms.

To sum up, in this paper, we studied the location determinants of innovation activities in Europe. Our empirical analysis was based on 1,281 location decisions of multinational firms between 2007 and 2012. First, the results of this econometric study showed the importance of market size, agglomeration effects, skilled-labor pools and, to a lesser degree, public governance estimated by gross domestic expenditures on R&D and cultural proximity. Another important finding of the study is the complementarity in location decisions between innovation and production activities: R&D centers, mostly specialized in adapting products to local demand, might follow the relocations of production plants in Europe.

In the future, we would like to extend the analysis location decisions of multinational firms to analyze the effects of inward investments in innovation activities in terms of economic activity. It would also important to study the location decisions of domestic firms, to compare the determinants between firms.
Bibliography


