This paper examines, from both a theoretical and empirical point of view, the relevance of firm heterogeneity in the internationalization strategy and location choices of EU multinational firms. This study emerges as an extension within the line of research started by Hepman, Melitz and Yeaple (2004) that shows how the heterogeneity of firms is a key factor in the internationalization strategies of firms (and particularly on the firm’s choice between export and FDI). Our model determines the extent to which the heterogeneity of firms affects not only the decision about how to serve foreign markets (exports versus foreign direct investment) but also to the location choice of both vertically and horizontally integrated multinational firms. We distinguish among $n$ geographically separated markets with different attributes such as market size, production costs and fixed investment costs. The empirical study is based on a dataset that comprised harmonized and detailed firm-level data across European countries for 2008. The results obtained through the estimation of multinomial logit models are consistent with the predictions of our theoretical model, confirming that firms’ internationalization strategy and location decision reflect the underlying dissimilarities of multinational firms.

**Key words:** multinational firms, firm heterogeneity, location choices, Europe

**JEL classification:** F14; F21; F23; D24
1. INTRODUCTION

In the last few decades, the multinational firms had increased exponentially the volume of investments in worldwide, playing an important role in the process of globalization. Linked to these foreign direct investments (FDI) is the establishment of global supply chains and the creation of international trade networks. According to 2013 data from UNCTAD, about a third of total world exports is accounted for by the sales of multinational enterprises (MNEs) that engage in FDI.\(^1\) As a result of these recent trends, there has been a growing interest to establish the location determinants underlying the firms’ investment decisions by economic literature. The vast majority of the studies about this topic however has focused at macroeconomic level and put the emphasis on the role played by host country characteristics\(^2\) rather than firms’ inherent attributes and their strategic motivations to explain the firms’ internationalization process.

How firms’ heterogeneity affects the location decision of multinational firms has been largely ignored until recently. The role of firm productivity as a key factor into the firm’s internationalization decision was initially introduced by Helpman et al. (2004). Following Melitz (2003) and Bernard et al. (2003),\(^3\) these authors stressed the importance of firms’ productivity to explain the mode to entry to a foreign market (exports versus foreign direct investments). They further provide evidence for US firms showing that the most productive firms engage in FDI, while the least productive firms export to foreign countries. Later, as an extension of the model by Yeaple (2003), Grossman et al. (2006) analyze theoretically the links between firm’s heterogeneity and the different integration strategies of multinationals firms, such as horizontal, vertical and export-platform FDI. They conclude that the least productive firms produce in home market, firms engaging in FDI are more productive, and the most productive firms will move both intermediate and assembly stages into the South. This work however does not offer any empirical evidence.

The growing availability of micro level datasets has allowed to empirically testing the conclusions of the theoretical model proposed by Helpman et al. (2004) in other countries. This is for instance the case of Girma et al. (2004) for Irish firms, Girma et al. (2005) for UK multinational firms, Head and Ries (2003) and Tomiura (2007) for Japanese multinationals, Yeaple (2009) for US multinationals and Chen and Moore (2010) for French firms. However, these studies assume that firms’ decisions depend only on a market-seeking motivation, that aims to avoid trade costs to serve a foreign country (exports versus horizontal FDI), not taking into account the efficiency-seeking motivation that seeks to exploit the factor prices differences across countries (vertical FDI). They even not considered an assumption that is increasingly accepted in the real world, where firms adopt more complex internationalization strategies with elements of both horizontal and vertical FDI, and that has been pointed out by some studies (such as Yeaple, 2003, and Ekholm et al., 2007). These works theoretically investigated more complex firms’ internationalization strategies,\(^4\) suggesting that these strategies depend

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\(^3\) Melitz (2003) and Bernard et al. (2003) have shown that exporter firms are more productive than domestically oriented firms.

\(^4\) While Yeaple (2003) developed a theoretical model where firms can engage both Horizontal and Vertical FDI, Ekholm et al. (2007) include the Export-Platform as firms’ internationalization strategy and
on production and transport costs, but also on relative fixed costs. However, their theoretical models not take into consideration firm heterogeneity in the firms’ strategies decisions as in Helpman et al. (2004) or Grossman et al. (2006).

In spite of the increase emphasis of the recent literature to explain the firms’ heterogeneity and their internationalization decisions, the theoretical models including complex FDI strategies and their empirical evidence are still largely missing. A notable exception to this respect is the work of Aw and Lee (2008). Based on the model by Grossman (2006), these authors provide empirical evidence about how the firms’ heterogeneity affects the location decision of multinational firms taking into account horizontal and export-platform FDI. In their three-country model, heterogeneous firms in a middle income country optimally decide where locate foreign affiliates to serve domestic, foreign high-income or foreign low-income market.

In this paper, we go a little further, considering more complex firms’ strategies. Concretely, we model how firms’ heterogeneity explains the location decision of both horizontal and vertical multinational firms that face the decision to invest in \( n \) different potential locations. Additionally, unlike previous studies, we include the third country effects on the firms’ strategy decisions as pointed by Baltagi et al. (2007) and Bloningen et al. (2007). According to these authors, third countries market potential is the major explanatory variable in the firms’ location decision. Our model shows that taking into consideration firms’ productivity level as endogenous, the firms’ location decision depends on a combination of fixed investment and production costs, but also on the market potential from the host location. Moreover, the empirical findings are consistent to our theoretical model.

In short, this paper provides three important contributions to the literature. Firstly, we develop a theoretical model that predicts the relationship between firm’s heterogeneity and their strategic location decisions abroad allowing for both horizontal and vertical motivations. Secondly, we account for a novelty in the literature; the analysis of the links between the location decisions and firms’ heterogeneity taking into account that firms can serve globally to \( n \) different markets. Existing theoretical studies have focused mainly in the firms’ heterogeneity and their location decisions considering that firms that engage in FDI only serve one country. Finally, we include the market potential from the host country as a relevant factor into firms’ location decisions in order to explain a more firm’s complex integration strategies between different host locations.

The rest of the paper is organized as follows. In the next section we develop the theoretical model for each different firm’s strategies on location decisions. Section 3 shows stylized facts of European firms. Section 4 describes the econometric methodology. Section 5 presents the estimation results and the final section concludes.

consider three types of Export-Platform FDI according to the destination market of the overseas plant: home-country export platform, third-country export platform and global export platform.

5 They found that firms investing in both U.S. and China are the most productive firms, but also that firms investing only in U.S. are more productive than those investing only in China.

6 But they not include in their model the vertical strategy.

7 In their model firms from a middle-income country locate a plant in a southern country to serve local (South) market and export part of their production to the North. Finally they also consider the strategy to locate a plant in both countries to serve each local market.

8 Previous models only consider one northern and one southern or two northern and one southern. See, for instance, Helpman et al. (2004) and Grossman et al. (2006).
2. THE MODEL

In this section, we develop a theoretical model in which firms face the decision where locate a plant to serve all markets. We suppose that each firm $i$ produces only one variety of the differentiated product $h$ and the consumers across countries have the same constant elasticity of substitution (CES) function over product $h$ as the following:

$$ U = \left( \sum_{h=1}^{n} q_h^a \right)^{\frac{1}{\alpha}}, \quad 0 < \alpha < 1 $$

(1)

Given the above utility function, the demand function $q_{hj}$ for firm $i$ in country $j$ is given by

$$ D(p) = q_{hj} = y_j p_{hj}^\sigma, $$

where $y_j$ is the income level of country $j$ that is exogenous to the firm, $p_{hj}$ is the price index of product $h$ in country $j$ and $\sigma = \frac{1}{E_j^{1-\alpha}} > 1$ is the elasticity of substitution between products. We also note that $y_j = \frac{E_j}{\Sigma_{h=1}^{n} p_{hj}^\sigma}$, where $E_j$ measures the total expenditure in country $j$.

We also consider that each firm incurs in fixed investment costs $f_j$ of setting up a production plant in location $j$ and faces a marginal cost production $c_{ij} = \frac{w_j}{\theta_i}$, that is determined by factor prices $w_j$ and firm productivity level $\theta_i$. We also assume that countries are separated by iceberg trade costs $\tau_{ijk} > 1$ for the shipment product to country $k$ from country $j$, $\forall j \neq k$ and $\tau_{ijk} = 1$, $\forall j = k$.

Finally, given a CES utility function, the optimal pricing rule of firm is $p_{ij} = \frac{\sigma}{\sigma-1} c_{ij}$, thus we obtain the profit function $\pi_{ij}$, for firm $i$ in country $j$ as:

$$ \pi_{ij} = \frac{1}{\sigma} \left( \frac{\sigma}{\sigma-1} \frac{w_j}{\theta_i} \right)^{1-\sigma} \sum_{k} A_k (\tau_{jk})^{1-\sigma} - f_j $$

(2)

where $A_k \equiv (1-\alpha) y_k \left( \frac{1}{\alpha} \right)^{1-\sigma}$ and denoting $\beta = \frac{1}{\sigma} \left( \frac{\sigma}{\sigma-1} \right)^{1-\sigma}$, $MP_j = \sum_k A_k (\tau_{jk})^{1-\sigma}$ which is reflecting the market potential from locate a plant in $j$ and $\theta_i = \theta_i^{\sigma-1}$, the final expression is

$$ \pi_{ij} = -f_j + \beta \frac{MP_j}{w_j^{\sigma-1}} \theta_i $$

(3)

The above expression suggest that $\pi_{ij}$ is linear and increasing in a given firm’s productivity level $\theta_i$, which depends on fixed investment costs $f_j$, market potential $MP_j$ and production costs $w_j$. So, re-writing expression (3), we can finally derive Eq. (4) which is the minimum productivity level to locate a plant in $j$ which shows that firms’ productivity level $\theta_i$ is an increasing function of fixed investment costs $f_j$ and production costs $w_j^{\sigma-1}$, and a decreasing function of market potential $MP_j$. 
\[
\theta_{ij} = \frac{f_j}{\beta \left( \frac{MP_j}{w_j^{-\sigma-1}} \right)} \quad (4)
\]

Note that Eq. (3) and (4) are exactly the same equations for another location \( k \neq j \), so denoting \( x_{ij} = 1 \) if firm \( i \) locate a plant in \( j \) and equal to 0 if not locate a plant in \( j \), that is locate a plant in location \( k \)

\[
x_{ij} = \begin{cases} 
1 & \text{if firm } i \text{ locate in } j \\
0 & \text{if firm } i \text{ locate in } k 
\end{cases} \quad (5)
\]

Therefore according to these equations it is clear that firm \( i \) prefers to locate a plant in location \( j \) rather than another location \( k \) only if \( \pi_{ij} > \pi_{ik} \), which implies that \( \theta_{ij} > \bar{\theta}_i > \theta_{ik} \)

\[
Pr(x_{ij} = 1) = Pr\left\{ \bar{\theta}_i > \left[ \frac{f_j - f_k}{\beta \left( \frac{MP_j}{w_j^{-\sigma-1}} - \frac{MP_k}{w_k^{-\sigma-1}} \right)} \right]^{\frac{1}{\sigma - 1}} \right\} \quad (6)
\]

From Eq. (6) it can be derived that the sorting of firms doing business in locations \( j \) or \( k \) on the basis of their productivity depends on the scale of fixed investment costs, \( f_j \) and \( f_k \). Therefore, if we assume that \( f_j > f_k \) and taking natural logarithm, we obtain the following expression from Eq. (6),

\[
Pr(x_{ij} = 1) = Pr\left\{ \ln \bar{\theta}_i > \frac{1}{\sigma - 1} \left[ \ln(f_j - f_k) - \ln \left( \frac{MP_j}{w_j^{\sigma-1}} - \frac{MP_k}{w_k^{\sigma-1}} \right) \right] \right\} \quad (7)
\]

which suggests that an rise of fixed investment and production costs, as well as a reduction of the market potential in location \( j \) relative to location \( k \), increase the cutoff productivity index, suggesting that only the most productive firms can pay the greater fixed investment costs to locate a plant in \( j \).

However, as can be noted from Eqs. (6) and (7), for both \( j \) and \( k \) to be attractive locations to invest, we need to impose that \( f_j \neq f_k; \; \forall \; j \text{ and } k \). Under this assumption, it is clear that if \( f_j > f_k \), we need to assume that \( \frac{f_j}{f_k} > \frac{MP_j}{w_j^{\sigma-1}} \; \text{ and } \; \frac{MP_j}{w_j^{\sigma-1}} > \frac{MP_k}{w_k^{\sigma-1}} \).

Therefore, under these conditions, the most productive firms locate a plant in \( j \) and the less productive firms in \( k \).

\[9\] This is similar as in Helpman et al. (2004), where \( F_{\text{EXPORT}} \neq F_{\text{FDI}} \). Particularly they assume that \( f_{\text{EXPORT}} < f_{\text{FDI}} \).

\[10\] Note that if \( f_j < f_k \), in order that firms invest in both locations, we need to assume the opposite case explained above.
3. THE PATTERN OF EUROPEAN MULTINATIONAL FIRMS

3.1 Data source and description

The present paper is based on firm-level data collected from EIFIGE dataset. This database comprised quantitative and qualitative homogenous information about European manufacturing firms for the period 2007-2009. Concretely, in this study, we have used firm-level data from six developed EU countries (Austria, France, Germany, Italy, Spain and United Kingdom)11 about TFP, human capital, R&D activities and age of the firm (see Table 1.A for variable description). In Table 1, we provide some descriptive statistics of these variables for firms that locate in home country (EU) and firms that engage FDI, on the one hand, and for firms in each location different than home, on the other hand.

Table 1. Descriptive statistics of European manufacturing firms by investment location, 2007-2009

<table>
<thead>
<tr>
<th>Firm Characteristics</th>
<th>Home Country (EU/exporter)</th>
<th>FDI North America</th>
<th>FDI China and India</th>
<th>FDI Latin America</th>
</tr>
</thead>
<tbody>
<tr>
<td>TFP</td>
<td>-0.159</td>
<td>0.048</td>
<td>0.050</td>
<td>-0.004</td>
</tr>
<tr>
<td>Human Capital</td>
<td>0.292</td>
<td>0.361</td>
<td>0.461</td>
<td>0.328</td>
</tr>
<tr>
<td>R&amp;D</td>
<td>0.589</td>
<td>0.866</td>
<td>0.961</td>
<td>0.820</td>
</tr>
<tr>
<td>Age</td>
<td>4.261</td>
<td>4.262</td>
<td>4.240</td>
<td>4.257</td>
</tr>
</tbody>
</table>

Source: EIFIGE dataset.

From the first two columns in Table 1, we can identify a clear ranking of firm characteristics with respect to the degree of involvement in international activities depending on the investment location decision. In particular, these figures show that firms that engage FDI tend to be more productive and enjoy higher human capital and R&D levels. However, when we observe the characteristics of firms that engage in FDI in different locations (three last columns), it is only clear that firms engaging FDI in Latin America seem to be the most productive and firms in China and India the least productive, showing no much differences between other characteristics, which suggest that firms that engage FDI seem to be similar between them.

Fig. 1. FDI destination for European firms

![Fig. 1. FDI destination for European firms](image)

Fig. 1 and 2 present the main destinations of FDI and exports by European manufacturing firms, respectively. In Fig. 1, we see that for European manufacturing

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11The Efige dataset consists of a representative sample (at the country level for the manufacturing industry) of almost 15,000 surveyed firms in seven European economies (Germany, France, Italy, Spain, United Kingdom, Austria, Hungary). However in our analysis we have removed data from Hungary because there aren’t firms that engage in FDI in this dataset from this country.
firms, the most frequent production locations outside European countries are China and India. As we can appreciate, a relevant share of European firms is more likely to plant a foreign affiliate in China and India than in North America, even though North America is the most important non-European export market destination (see Fig. 2). An explanation for this could be that through FDI European firms try to overcome sizeable trade barriers and also to benefit from lower production costs to serve third countries.

![Fig. 2. Export destinations by EU firms](image)

A different indicator of the European firms’ behavior is the number FDI destinations. We found that the rate of European firms investing in other markets dramatically reduce with the increase of the number of FDI destinations. Concretely, Fig. 3 shows that the vast majority of European firms locate their production activities in a single destination (82%) and only a small share of firms locate their production in two (16%) or three (2%) possible locations. So, our empirical analysis is focused on firms that invest in a single location, but also because by this way we can appreciate more precisely the firm heterogeneity across firms’ investments in different locations.

![Fig. 3. Share of European firms by number FDI destinations](image)

In Fig. 4 we can appreciate clearly that European firms investing in foreign locations pursue complex and diversified geographical strategies and serve markets globally. On the one hand we find that for European firms that are located in both European countries and China and India, the main market production destination is the European market. All firms locating their production in European countries serves mainly European countries, selling in host country or importing back to home country, but also export to
the third countries outside Europe.\textsuperscript{12} We also find that the vast majority of firms investing in China and India import back to home country, but also sell a great production to both host and third countries.\textsuperscript{13} It seems that European firms that locate their production plants in Europe try to pursue to save the transport costs and firms that locate in China and India try to benefit from lower production costs in these countries to serve in both cases mainly the European market.\textsuperscript{14} On the other hand, if we focus on European firms investing in North America and Latin America, we find that the main purpose is to serve the local markets. However, while FDI inflows to the manufacturing sector in Central America are concentrated in Mexico where foreign-owned firms are closely tied to export to the United States. In South America, FDI inflows to manufacturing activities are mostly concentrated in Brazil, and more oriented to the internal market and to export destinations other than the United States.\textsuperscript{15}

Fig 4. Destination of European foreign affiliates production.

The stylized facts presented in the above figure suggest us that firms which locate in a particular location try to serve markets globally, corroborating thus the importance of the market potential from the host country, such as we pointed in our theoretical model. But even more important, Fig.4 shows the relevance of FDI as a component of firm global location strategies given the differences in production costs and market potential from the host country.

3.2 Productivity distribution across firms.

In this section, we compare the productivity distributions across the different modes of internalization. To do that, we depict the probability density functions of productivity for export (Home/EU) and FDI firms (North America, China and India and Latin America) by the Kernel function. Concretely, each figure represents the share of firms (‘density’) that attain each productivity level or, to say in other words, the probability of picking a firm with a certain productivity level when the firm is randomly drawn from each type. Fig. 5a shows the productivity distributions for export firms and total FDI

\textsuperscript{12} Note that 20\% of third countries destinations for European firms located in Europe outside correspond to North America, 10\% to China and India and 5\% to Latin America.

\textsuperscript{13} Mainly other European countries and North America.

\textsuperscript{14} See Tables 2.A. and 3.A. in the Appendix.

\textsuperscript{15} WIR 2009, UNCTAD.
firms, whereas Fig. 5b refers to the productivity distributions for firms investing in each location different than home country.\footnote{Concretely, each figure show the share of firms (‘density’) that attain each productivity level, depicting the probability of picking a firm with a certain productivity level when the firm is randomly drawn from each type.}

**Fig 5.a.** Density of productivity for exporters and FDI firms  
**Fig 5.b.** Density of productivity for FDI firms, by location

According to Fig. 5.a a randomly drawn FDI firm is likely to be more productive than a randomly drawn exporter firm. Fig. 5.b suggest that firms investing in China and India are the least productive firms, medium productive firms invest in North America and the most productive firms engage in FDI in Latin American countries.

### 4. ESTIMATION METHODOLOGY

The theoretical model presented in Section 2 predicts the location choice of multinational firms which try to serve markets globally on the basis of their productivity level; this depending on the fixed and production costs and the market potential. Given that we only observe each firm’s location choice, to empirically analyze the underlying location decision problem, we employ a discrete-choice approach, as we only observe each firm’s location choice. Concretely, we estimate a multinomial logit model (MNL). This methodology provides an adequate framework to analyze firm location decisions when the election among alternatives is modeled as a function of the characteristics of firms (rather than the characteristics of the alternatives).

Consistent with the random profit maximization framework (McFadden, 1974), the MNL assume that each investor $i$ that face a finite set of mutually exclusive locations, $L$, selects the strategy or location $j$ that yields the highest profit (i.e. $\pi_{ij} > \pi_{il} \forall l \neq j$).

The expected profit of firm $i$ from each strategy $s$ consists of two components, the deterministic part, which depends on a location specific parameter, $\alpha_s$, and on a set of observed firm characteristics determining the firm’s productivity, $X_i$, and the unobservable part, which is capture by a stochastic term, $\varepsilon_{is}$. That is

$$\pi_{is} = \alpha_s + \beta_sX_i + \varepsilon_{is} \quad s = j \text{ and } l$$
Given that $\epsilon_i$ is unknown, the final choice is predicted in terms of probability. More specifically, the probability that a firm selects location $j$ rather than $l$ can be described as,

$$P_{ij} = P(\pi_{ij} > \pi_{il})$$

To solve the above equation, we should impose a probability density function on $\epsilon_i$. In concrete, if we assume that the error term is independently and identically distributed (iid) with type I extreme value distribution\(^{17}\), the probability that firm $i$ choose alternative $j$ is,

$$P_{ij} = \frac{\exp[\alpha_j + \beta_j X_i]}{\sum_{s=1}^{L} \exp[\alpha_s + \beta_s X_i]}$$

Since $\sum_{s} P_{is} = 1$, the $L$ sets of parameters ($\alpha$, $\beta$) are not unique. So, to identify the parameters $\alpha_i$ and $\beta_i$, we need to fix the coefficients for one alternative, in this case location 1, home country destination, to zero (that is, $\alpha_i = 0$ and $\beta_i = 0$).\(^{18}\) In fitting such a model, the estimated MNL model becomes,

$$P_{ij} = \frac{\exp[\alpha'_j + \beta'_j X_i]}{1 + \sum_{s=2}^{L} \exp[\alpha'_s + \beta'_s X_i]}$$

where the coefficients $b'_j = (b_{1,j} - b_{1})$ represent now the effect of the $X_i$ variables on the probability of choosing the $j^{th}$ alternative over the first alternative (to serve global market by exporting). In the above equation, the constant term $\alpha'_j = (a_{1,j} - a_{1})$ depicts the fixed investment costs for each foreign investment strategy that are invariant across firms, capturing thus both physical costs and informational barriers that are specific to each location.

In addition to the productivity level of firms, which rely on the production costs and the market potential, we have also included other firms’ characteristics that have been identified in the literature as important factors for the firm’ location choice. Concretely, we use R&D intensity (Helpman et al., 2004; Castellani and Zanfei, 2007), human capital intensity and age of the firms (Aw and Lee, 2004).\(^{19}\)

\(^{17}\)But the iid assumption on the error term imposes the property of independence of irrelevant alternatives (IIA). According to this property, the ratio of probabilities of investing in two locations depends only on the attributes of these two locations, and is independent of the attributes of other alternatives.

\(^{18}\)In the MNL, the $L$ sets of parameters have not a unique solution. To identify parameters in the MNL model, it is necessary to identify one of the possible strategies as the base strategy and to set its parameters to zero. Thus the remaining coefficients would measure the relative change with respect to the base group or strategy.

\(^{19}\)According to Helpman et al. (2004), the dispersion of firm size captures the joint effect of the dispersion firm productivity and the elasticity of substitution. Thus, in order to distinguish the size effect from productivity, we include also the total employment as a measure of firm’ size (Kimura and Kiyota, 2006; Aw and Lee, 2008). However while we find that firms that locate at Home country are smaller than firms that engage in FDI, as suggested Helpman et al. (2004), we don’t find differences between firms that engage in FDI in different locations and we also obtain the same effects when we control by capital intensity (Results available on request).
5. RESULTS

Following the results of Eq. (6), we start estimating the MNL model using only firms’ TFP as explanatory variable. These estimations provide an initial valuation of the role played by firms’ productivity on different internationalization strategies. Next, and in line with previous empirical works, we estimate an extended MNL model including other firm-specific factors, such as human capital (HK), R&D and the age of the firm.

Table 2. MNL regression of European firms investment location decision, 2008. Basic model.

<table>
<thead>
<tr>
<th>Independent Variables</th>
<th>North America</th>
<th>China and India</th>
<th>Latin America</th>
<th>North America vs China and India</th>
<th>North America vs Latin America</th>
<th>China and India vs Latin America</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>-5.86 (0.19)*</td>
<td>-4.91 (0.12)*</td>
<td>-6.78 (0.30)*</td>
<td>0.95 (0.23)*</td>
<td>-0.92 (0.35)*</td>
<td>-1.87 (0.32)*</td>
</tr>
<tr>
<td>TFP</td>
<td>0.98 (0.34)*</td>
<td>0.75 (0.20)*</td>
<td>1.79 (0.26)*</td>
<td>-0.22 (0.39)</td>
<td>0.81 (0.42)*</td>
<td>1.03 (0.32)*</td>
</tr>
<tr>
<td>Observations</td>
<td>9824</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Likelihood</td>
<td>-660.43</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: Standard errors are in parentheses where a, b and c represent significance at 1%, 5% and 10% level respectively.

Table 2 presents the results of the basic MNL model. On the one hand, the first three columns show the effect of TFP on the likelihood of a firm belonging to each location relative to the base group of exporting firms and the fixed investment costs. Taking into account that the constant terms in the regressions are capturing the country-wide characteristics which are invariant across firms, these could be proxied by the fixed investment costs to plant a foreign affiliate in each location. On the other hand, the last three columns report the differences in the coefficients to belong to one FDI location relative to the others FDI locations, which allow us ranking the firms’ TFP that invest in each location, as well as the relative fixed investment costs.

Our estimates confirm that the fixed investment costs are higher for firms investing in China and India, North America and Latin America than for firms which are located in the home country (EU). Additionally, the positive and significant coefficients on TFP in the first three columns in Table 2 show us that firms investing in a location different than home are more productive. Moreover, we find that firms investing in China and India are less productive, following by firms investing in North America, while the firms with highest productivities invest in Latin American countries. These patterns on fixed investment costs and productivity level are consistent with the prediction presented by theoretical model, which suggest that when the fixed investment costs are greater in a particular location in comparison to the others (in our case Latin America) only the most productive firms will locate there, as long as the combination of the market potential and production costs be greater than other locations. Note that we obtain the same behavior between firms in North America and China and India. Concretely, we find that there are a greater fixed investment costs in North America than in China and India relative to firm in Home Country (Europe) and Latin America and consequently the firms in North America have a greater TFP than firms in Asia and China. As we can appreciate in Table 3.A. and 4.A. in the appendix, which depict the production costs and the market potential in each location, if we let constant the production costs among locations (given the ranking of fixed investment costs obtained

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20 A similar interpretation is made in Aw and Lee (2008).
21 This agrees with Helpman et al. (2004).
22 Note that this ranking is similar as we obtained in Figs. 5a and 5b. These results are also robust when we include industry fixed effects.
23 Note that production costs are obtained without differentiated manufacturing sectors.
in Table 1), firms only would invest in Europe and North America because both locations have greater market potential than China and India and Latin America. However, in the opposite side, if we let de market potential constant among locations firms only would locate a plant in Europe and China and India. Therefore, given a rank in fixed investment costs, the combination of both market potential and production costs determine that firms with different productivity levels locate a plant in all possible locations.

### Table 3. MNL regression of European firms investment location decision, 2008. Extended model.

<table>
<thead>
<tr>
<th>Independent Variables</th>
<th>North America</th>
<th>China and India</th>
<th>Latin America</th>
<th>North America vs China and India</th>
<th>North America vs Latin America</th>
<th>China and India vs Latin America</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>-8.17 (1.12)</td>
<td>-5.72 (0.51)</td>
<td>-8.34 (1.28)</td>
<td>2.45 (1.36)</td>
<td>0.16 (1.38)</td>
<td>-2.61 (1.47)</td>
</tr>
<tr>
<td>TFP</td>
<td>0.81 (0.36)</td>
<td>0.65 (0.20)</td>
<td>1.65 (0.28)</td>
<td>-0.16 (0.41)</td>
<td>0.83 (0.45)</td>
<td>1.00 (0.34)</td>
</tr>
<tr>
<td>HK intensity</td>
<td>0.60 (0.39)</td>
<td>0.05 (0.26)</td>
<td>-0.02 (0.60)</td>
<td>-0.54 (0.47)</td>
<td>-0.57 (0.72)</td>
<td>-0.02 (0.66)</td>
</tr>
<tr>
<td>R&amp;D intensity</td>
<td>2.62 (1.02)</td>
<td>1.15 (0.34)</td>
<td>1.76 (1.10)</td>
<td>-1.46 (1.07)</td>
<td>-0.86 (1.47)</td>
<td>0.60 (1.11)</td>
</tr>
<tr>
<td>Age</td>
<td>-0.03 (0.17)</td>
<td>-0.01 (0.10)</td>
<td>-0.03 (0.27)</td>
<td>0.02 (0.19)</td>
<td>0.07 (0.32)</td>
<td>0.05 (0.29)</td>
</tr>
<tr>
<td>Observations</td>
<td>9809</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Likelihood</td>
<td>-629.68</td>
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</tr>
</tbody>
</table>

Note: Standard errors are in parentheses where a, b and c represent significance at 1%, 5% and 10% level respectively.

An identical ranking of fixed investment costs and productivity level are obtained when we control for other firm specific variables. However, the coefficients of these new control variables reflect that there are not so much differences between European exporter firms and firms that engage in FDI beyond than the productivity levels and R&D. The coefficients on these variables only suggest us that firms involving in FDI are more productive and R&D intensive than exporter firms. By contrast, there not seem to exist much discrepancy among firms that participate in internationalization activities in terms of human capital and size.

### Table 4. Multinomial logit results of investment location decision by industries, 2008. Basic model.

<table>
<thead>
<tr>
<th>Independent Variables</th>
<th>North America</th>
<th>China and India</th>
<th>Latin America</th>
<th>North America vs China and India</th>
<th>North America vs Latin America</th>
<th>China and India vs Latin America</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Manufacture of basic metals and fabricated metal products</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>-7.01 (0.70)</td>
<td>-6.01 (0.39)</td>
<td>1.00 (0.80)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TFP</td>
<td>0.73 (0.12)</td>
<td>-0.73 (0.37)</td>
<td>-1.47 (0.38)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Observations</td>
<td>2432</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Likelihood</td>
<td>-63.56</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Manufacture of food, products, beverage and tobacco</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>-5.34 (0.50)</td>
<td>-6.73 (1.00)</td>
<td>-7.38 (0.98)</td>
<td>-1.39 (1.11)</td>
<td>-2.04 (1.10)</td>
<td>-0.65 (1.40)</td>
</tr>
<tr>
<td>TFP</td>
<td>1.55 (0.87)</td>
<td>1.73 (0.18)</td>
<td>3.45 (0.54)</td>
<td>0.18 (0.84)</td>
<td>1.90 (0.91)</td>
<td>1.71 (0.38)</td>
</tr>
<tr>
<td>Observations</td>
<td>1023</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Likelihood</td>
<td>-38.67</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Manufacture of transport equipment</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>-6.70 (0.99)</td>
<td>-5.81 (0.70)</td>
<td>0.89 (1.22)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TFP</td>
<td>3.47 (0.47)</td>
<td>3.15 (0.42)</td>
<td>-0.32 (0.10)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Observations</td>
<td>305</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Likelihood</td>
<td>-15.46</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Manufacture of machine and equipment n.e.c.</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>-6.70 (0.71)</td>
<td>-4.26 (0.25)</td>
<td>-6.08 (0.58)</td>
<td>2.43 (0.75)</td>
<td>0.62 (0.91)</td>
<td>-1.81 (0.63)</td>
</tr>
<tr>
<td>TFP</td>
<td>2.85 (0.30)</td>
<td>1.45 (0.51)</td>
<td>2.18 (0.28)</td>
<td>-1.40 (0.54)</td>
<td>-0.66 (0.33)</td>
<td>0.73 (0.55)</td>
</tr>
<tr>
<td>Observations</td>
<td>1139</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Likelihood</td>
<td>-114.39</td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

Note: Standard errors are in parentheses where a, b and c represent significance at 1%, 5% and 10% level respectively.

Even results in Tables 2 and 3 show that the differences in TFP coefficients between North America and China and India are not statically significant. However, these estimations may mask relevant differences within sectors across each FDI location. To verify this, we next estimate the above regressions for each sector separately. As we can appreciate in Table 4 and 5, in some sectors there are not European firms investing in Latin American countries. This could be because Latin American countries are not
intensive in these industries. The main host countries in Latin America (Brazil, Mexico, Argentina and Chile)\textsuperscript{24} are driven largely by commodity production, which are the main attraction of inward FDI flows in these economies. Looking at deep inside at specific industries, food, beverages and tobacco, transport equipment, and machinery and equipment n.e.c., accounted for roughly the vast majority of inward FDI on this location in 2008.\textsuperscript{25}

\begin{table}[h]
\centering
\caption{Multinomial logit results of investment location decision by industries, 2008. Extended model.}
\label{table:multinomial_logit}
\begin{tabular}{lcccccr}
\hline
\textbf{Independent Variables} & \textbf{North America} & \textbf{China and India} & \textbf{Latin America} & \textbf{North America vs China and India} & \textbf{North America vs Latin America} & \textbf{China and India vs Latin America} \\
\hline
\textbf{Manufacture of basic metals and fabricated metal products} & & & & & & \\
Constant & -25.02 (1.58)$^a$ & -3.32 (1.70)$^a$ & -19.70 (2.32)$^a$ & & & \\
TFP & 0.50 (0.11)$^b$ & -0.72 (0.42)$^c$ & 1.23 (0.43)$^a$ & & & \\
HK intensity & 0.77 (1.41) & 0.66 (0.81) & 0.11 (1.63) & & & \\
R&D intensity & 16.28 (0.73)$^a$ & 0.77 (0.89) & 15.51 (1.15)$^a$ & & & \\
Age & 1.41 (1.38) & -1.01 (0.99) & 2.43 (1.70) & & & \\
Observations & 2432 & & & & & \\
Likelihood & -60.72 & & & & & \\
\hline
\textbf{Manufacture of food product, beverage and tobacco} & & & & & & \\
Constant & -24.55 (0.46)$^a$ & -30.70 (0.64)$^a$ & -62.20 (14.52)$^a$ & 5.83 (0.75)$^a$ & 37.65 (14.54)$^a$ & 31.81 (14.30)$^a$ \\
TFP & 1.26 (0.86) & 1.34 (0.19)$^a$ & 7.98 (2.54)$^a$ & -0.07 (0.90) & -6.62 (2.61)$^a$ & -6.55 (2.47)$^a$ \\
HK intensity & 0.85 (0.99) & -91.98 (8.78)$^a$ & -463.6 (146.2)$^a$ & 92.83 (8.94)$^a$ & 464.5 (146.1)$^a$ & 371.69 (143.1)$^a$ \\
R&D intensity & 19.35 (0.52)$^a$ & 18.81 (1.00)$^a$ & 15.59 (1.68)$^a$ & 0.53 (1.12) & 3.35 (1.76)$^a$ & 2.82 (1.92) \\
Age & 0.02 (0.12) & 3572 (0.40)$^a$ & 21.59 (6.69)$^a$ & -3.72 (0.43)$^a$ & -21.56 (6.98)$^a$ & -17.83 (6.84)$^a$ \\
Observations & 1022 & & & & & \\
Likelihood & -52.13 & & & & & \\
\hline
\textbf{Manufacture of transport equipment} & & & & & & \\
Constant & -31.51 (3.37)$^a$ & -20.71 (3.43)$^a$ & -10.97 (4.58)$^a$ & & & \\
TFP & 2.93 (0.75)$^a$ & 3.55 (0.54)$^a$ & -0.62 (0.76) & & & \\
HK intensity & -18.61 (1.29)$^a$ & 1.48 (1.20) & -20.09 (1.65)$^a$ & & & \\
R&D intensity & 17.82 (1.06)$^a$ & 17.67 (0.73)$^a$ & 0.14 (1.24) & & & \\
Age & 5.19 (1.96)$^a$ & -2.38 (2.35) & 7.58 (2.88)$^a$ & & & \\
Observations & 304 & & & & & \\
Likelihood & -13.44 & & & & & \\
\hline
\textbf{Manufacture of machine and equipment n.e.c.} & & & & & & \\
Constant & -18.07 (2.40)$^a$ & -4.98 (0.40)$^a$ & -16.22 (2.27)$^a$ & -13.09 (2.47)$^a$ & 1.85 (3.24) & -11.23 (2.35)$^a$ \\
TFP & 3.12 (0.24)$^a$ & 1.44 (0.52)$^a$ & 2.37 (0.40)$^a$ & -1.68 (0.52)$^a$ & -0.74 (0.38)$^a$ & 0.93 (0.62) \\
HK intensity & 0.45 (1.38) & 0.41 (0.50) & -0.28 (1.23) & -0.04 (1.46) & -0.74 (1.83) & -0.69 (1.32) \\
R&D intensity & 13.70 (0.91)$^a$ & 0.79 (0.76) & 14.12 (0.82)$^a$ & -12.91 (1.14)$^a$ & 0.41 (1.11) & 13.32 (1.10)$^a$ \\
Age & -1.67 (2.64) & -0.07 (0.10) & -2.67 (0.87) & -1.59 (2.64) & -1.85 (3.24) & -2.59 (1.83) \\
Observations & 1137 & & & & & \\
Likelihood & -110.98 & & & & & \\
\hline
\textbf{Note:} Standard errors are in parentheses where a, b and c represent significance at 1%, 5% and 10% level respectively.
\end{tabular}
\end{table}

The industry analysis is also consistent with our theoretical model, finding that in locations with higher fixed investment costs locate the most productive firms. Moreover, this analysis reveals that the combination of fixed investment costs, market potential and production costs change depending on the industry. Particulariy, we find that firms that engage in FDI in North America in manufactures of basic metals and fabricated metal products, transport equipment and machine and equipment n.e.c. are more productive than firms that invest in China and India in the same sectors. Additionally, our results suggest that while in the manufacture of food product, beverage and tobacco industry the most productive firms locate in Latin America, and that firms in China and India are more productive than firms in North America. Conversely, in the manufacture of machine and equipment n.e.c. firms which locate in North America are the most productive. Overall, these results confirm that each industry has different characteristics in terms on fixed investment costs, market potential and production costs, which determine the location decisions of European firms.

\textsuperscript{24} These four countries accounted for 89% of the subregion’s total inflows (UNCTAD, 2009).

\textsuperscript{25} WIR 2009, UNCTAD.
6. CONCLUSIONS

In this paper, we examine theoretically and empirically the links between firms’ heterogeneity and their internationalization strategic. Unlike previous theoretical that are inadequate in explaining more complex patterns about firms’ choice of production location that exist in reality, we developed a model that analyzes firms’ location decision taking into account both horizontal and vertical motivations of foreign investment, on the one hand, and considering, on the other hand, that firms serve all markets globally. We also study the role of the market potential in their location decision. Our theoretical model shows that firms investing abroad choose a specific location depending on their productivity level, costs considerations and the market potential.

Our empirical study based on harmonized and detailed firm-level data across European countries provide support to our model, showing that the least productive firms produce at home country and serve globally through exports while the most productive firms engage in FDI in different locations based on their productivity level and fixed cost. Concretely, we find that in the locations where fixed investment costs are higher only the most productive firms can invest there to obtain greater profits derived from the combination of the market potential and production costs in this location. Our estimates also show that the role of firms’ productivity on their internationalization strategies would depend also on the industry activity.
REFERENCES


APPENDIX

Table 1.A. Definition of variables.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>TFP</td>
<td>Solow residual of a Coob-Douglas production function estimated following the semi-parametric algorithm proposed by Levinsohn and Petrin (2003), 2002-2008</td>
</tr>
<tr>
<td>Human Capital</td>
<td>Dummy for Human Capital: firm has a higher share of graduate employees with respect to national average share of graduates.</td>
</tr>
<tr>
<td>R&amp;D</td>
<td>Dummy for R&amp;D: firm employ more than 0 employees to R&amp;D activities.</td>
</tr>
<tr>
<td>Age</td>
<td>Age of current CEO/Company Head.</td>
</tr>
</tbody>
</table>

Source: EFIGE dataset (Bruegel).

Table 2.A. Manufacturing transport costs between locations, 2007

<table>
<thead>
<tr>
<th>Region</th>
<th>EU15</th>
<th>North America</th>
<th>China and India</th>
<th>Latin America</th>
</tr>
</thead>
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<tr>
<td>EU15</td>
<td>61.5</td>
<td>101.7</td>
<td>118.0</td>
<td>131.6</td>
</tr>
<tr>
<td>North America</td>
<td>101.7</td>
<td>29.5</td>
<td>106.4</td>
<td>93.1</td>
</tr>
<tr>
<td>China and India</td>
<td>118.0</td>
<td>106.4</td>
<td>108.2</td>
<td>143.6</td>
</tr>
<tr>
<td>Latin America</td>
<td>131.6</td>
<td>93.1</td>
<td>143.6</td>
<td>57.4</td>
</tr>
</tbody>
</table>

Own elaboration based in ESCAP World Bank: International Trade Costs (World DataBank).

Table 3.A. Manufacturing production costs per hour by locations, 2007

<table>
<thead>
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<th>Region</th>
<th>EU</th>
<th>North America</th>
<th>China and India</th>
<th>Latin America</th>
</tr>
</thead>
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<td>34.1</td>
<td>32.3</td>
<td>0.7</td>
<td>2.0</td>
</tr>
</tbody>
</table>

Own elaboration based in LABORSTAT Database (International Labour Organization).

Table 4.A. Market Potential by regions, 2007

<table>
<thead>
<tr>
<th>Region</th>
<th>EU</th>
<th>North America</th>
<th>China and India</th>
<th>Latin America</th>
</tr>
</thead>
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<tr>
<td></td>
<td>4.5</td>
<td>8.5</td>
<td>3.4</td>
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</tbody>
</table>

Own elaboration based in World Databank.