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The Location of Japanese MNC Affiliates: Agglomeration, Spillovers and Firm Heterogeneity

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NON-TECHNICAL SUMMARY

We examine the location choices of the foreign affiliates of Japanese manufacturing firms, using a new data set that matches parents to the affiliates they created over the 1995-2003 period. We are thus able to determine whether heterogeneous firms respond differently to host country features (such as proximity, wages, institutional quality or access to markets) or to networks and spillovers. One first sign that FDI motivation is context-specific comes from the cross-country variation in the share of affiliates reporting that more than 80% of their sales are local. While this is 59.7% in our sample, it is only 50% in China but reaches 65% in developed countries. In contrast, the share of affiliates reporting that more than 80% of their purchases are local is 36.6% in our sample, but with an analogous figure of 44% for China and 34% for developed countries. This arguably attests to the role of vertical motives, particularly in low-income countries such as China.

Our motivation is two-fold. First, we expect our results to shed light on the controversial productivity-internationalization nexus. Our second motivation relates to the identification of potential information barriers to the internationalization of Japanese firms. We investigate whether Japanese parents of different productivity and size respond differently to host-country features such as distance, institutional quality, access to markets, and networks and spillovers. Much evidence suggests that Japanese affiliates tend to cluster in the same regions. We consider three forms of relatedness. The first two concern the host location: (1) affiliates in the same industry originating from the same country (Japan); and (2) downstream affiliates originating from the same country. The third form (3) captures proximity at home (in the same Japanese prefecture) to parents having affiliates in the same destination country. Clusters of Japanese affiliates may form regional production networks, selling intermediate inputs to each other, sharing knowledge and therefore lowering production costs. We also investigate whether location choices are influenced by the presence of a JETRO agency.

Overall, our results confirm the economic importance of information-sharing and network effects, both at home and in the host country, as well as the traditional determinants such as production and transaction costs, and market and supply access. The effects of the key determinants of location choice vary substantially with the characteristics of the investing firm and the affiliate. Less-productive and smaller parents are more likely to create affiliates in China rather than in Western Europe or an OECD country. This result suggests that the choice of investing in more distant and competitive markets is positively correlated with firm productivity. This is in line with recent advances in the literature explaining FDI decisions by firm-specific features (Helpman *et al.* 2004). Moreover, less-productive firms appear to be more sensitive to distance-related costs and low institutional quality, but are more responsive to the presence of Japanese firms and JETRO presence in the host country.

ABSTRACT

We examine the location choices of the foreign affiliates of Japanese manufacturing firms, using a new data set that matches parents to the affiliates they created over the 1995-2003 period. The analysis is based on new economic geography theory, and thus focuses on the effect of market and supplier access, as well as production and trade costs. Our aim is twofold. First, we investigate the importance of agglomeration and spillover effects on firms' decisions via variables showing the presence of Japanese affiliates in the host countries, and Japanese multinational firms at home. Our results confirm the economic importance of information-sharing and network effects, both at home and in the host country, in addition to traditional factors relating to production and transaction costs, and market and supply access. Second, we explore whether the effects of the key determinants of location choice vary according to the characteristics of the investing firm and the affiliate. We find that less productive and smaller parents are more likely to create an affiliate in China rather than in Western Europe or an OECD country. Moreover less-productive firms seem more sensitive to distance-related costs and low institutional quality, but are more responsive to the presence of Japanese firms and the presence of a Japanese External Trade Organization (JETRO) agency in the host country.

Classification JEL: F12, F15.
Keywords: Location choice, Multinational firms, Conditional logit model.

LA LOCALISATION DES FILIALES JAPONAISES :
LE RÔLE DES FORCES D'AGGLOMERATION, DES EXTERNALITES
ET DE L'HETEROGENEITE DES FIRMES

RÉSUMÉ NON TECHNIQUE

Ce travail examine le choix des firmes manufacturières japonaises en matière de localisation de leurs filiales à l'étranger en exploitant une nouvelle base de données qui apparie les entreprises-mères à leurs filiales établies entre 1995 et 2003. Notre objectif est double : éclairer le lien entre productivité des firmes et internationalisation ; identifier les éventuelles barrières informationnelles à l'internationalisation des firmes japonaises. Nous étudions si les entreprises-mères caractérisées par des productivités ou des tailles différentes répondent diversement aux caractéristiques des pays d'accueil (éloignement, qualité institutionnelle, accès aux marchés…) ainsi qu'à l'existence de réseaux. Un premier signe que le choix de localisation des investissements directs étrangers dépend du contexte se trouve dans la variation entre les pays de la part des filiales reportant que plus de 80% de leurs ventes ou achats sont réalisées localement. Elle n'est que de 50% en Chine mais atteint 65% dans les pays développés. A l'inverse, la part des filiales effectuant plus de 80% de leurs achats localement est de 44% en Chine et de 34% dans les pays développés. Ces écarts attestent du rôle des motivations verticales particulièrement dans les pays à faible revenu comme la Chine.

En ce qui concerne l'importance des réseaux, les filiales japonaises tendent à se regrouper dans les mêmes régions. Ces regroupements peuvent favoriser les réseaux de production, les ventes de biens intermédiaires, le partage de connaissances et ainsi réduire les coûts de production. Nous considérons trois formes de réseaux. Les deux premières portent sur le lieu d'accueil : (1) les filiales japonaises dans la même industrie, et (2) les filiales japonaises dans les secteurs en aval. La troisième forme (3) capte la proximité de la maison-mère (au niveau de la préfecture japonaise) avec des multinationales japonaises ayant implanté une filiale dans le même pays d'accueil. Nous nous intéressons également à la possibilité que les choix de localisation soient influencés par la présence ou non du Japanese External Trade Organization (JETRO) dans le pays d'accueil

Globalement, nos résultats confirment l'importance économique du partage d'informations et des effets de réseaux (au lieu d'implantation comme au lieu de départ) ainsi que celle des déterminants traditionnels des choix de localisation (coûts de production et de transaction, accès au marché et aux fournisseurs). Ces déterminants du choix de localisation interviennent différemment selon les caractéristiques de la firme investisseur et de la filiale. Les maisons-mères les moins productives et les plus petites sont davantage susceptibles d'implanter leur filiale en Chine plutôt qu'en Europe de l'Ouest ou dans un pays de l'OCDE. Ce résultat suggère que le choix d'investir dans des marchés plus distants ou plus concurrentiels est positivement corrélé avec la productivité. Par ailleurs, les firmes les moins productives semblent être plus sensibles à la présence de firmes japonaises au lieu

d'implantation et à l'existence d'un bureau du JETRO. Ceci est cohérent avec les avancées récentes de la littérature expliquant les décisions d'IDE par les caractéristiques spécifiques à la firme (Helpman et al. 2004).

RÉSUMÉ COURT

Ce travail examine le choix des firmes manufacturières japonaises en matière de localisation de leurs filiales à l'étranger en exploitant une nouvelle base de données qui apparie les entreprises-mères à leurs filiales établies entre 1995 et 2003. Cette analyse est basée sur un modèle théorique dérivé de la nouvelle économie géographique (NEG) et porte sur l'effet de l'accès au marché et aux fournisseurs ainsi qu'aux coûts de production et de commerce. Notre objectif est double. Premièrement, nous étudions l'importance des effets d'agglomération et de réseaux sur la décision du choix de localisation à travers des indicateurs de la présence de filiales japonaises sur le lieu d'implantation et de firmes multinationales japonaises dans la préfecture de départ. Nos résultats confirment l'importance économique du partage d'informations et des effets de réseaux (au lieu d'implantation comme au lieu de départ) ainsi que des déterminants traditionnels comme les coûts de production et de transaction et l'accès au marché et aux fournisseurs. Deuxièmement, nous analysons si les effets des déterminants clefs du choix de localisation varient en fonction des caractéristiques de la firme investisseur et de la filiale. Nous trouvons que les maisons-mères les plus petites et les moins productives sont plus susceptibles d'implanter leur filiale en Chine plutôt qu'en Europe de l'Ouest ou dans un pays de l'OCDE. Par ailleurs, les firmes les moins productives semblent être plus sensibles aux coûts liés à l'éloignement et aux défaillances institutionnelles mais semblent répondre plus à la présence de firmes japonaises au lieu d'implantation et l'existence d'un bureau du Japanese External Trade Organization (JETRO) sur place.

Classement JEL : F12, F15.
Mots Clés : Choix de localisation, firmes multinationales, logit conditionnel

THE LOCATION OF JAPANESE MNC AFFILIATES: AGGLOMERATION, SPILLOVERS AND FIRM HETEROGENEITY

Tomohiko Inui[1]*, Toshiyuki Matsuura*[2] *& Sandra Poncet*[3]

1. INTRODUCTION

A buoyant literature has recently emerged on the FDI-productivity nexus (see Greenaway and Kneller (2007) and Helpman (2006) for surveys). The causal effect of internationalization on Japanese firms' business performance has also been the focus of recent work (Murakami (2005), Hijzen, Inui and Todo (2008) and Hijzen, Inui and Todo (2006)). To date, the empirical evidence has been somewhat mixed, but results have emphasized the importance of the context. Recent empirical work (Sakakibara and Yamawaki (2008), Kiyota *et al*. (2007) and Ito and Fujao (2006)) has suggested that the profitability of Foreign Direct Investment is conditional on parent and host country features.

Our analysis assesses the importance of various determinants of investing abroad. It focuses on the effect of market and supplier access, as well as production and trade costs, and explores whether key determinants of location choice vary according to the characteristics of the investing firm and the plant.Our study is based on new economic geography theory and builds on previous literature on the location choices of the foreign affiliates of Japanese firms (Belderbos and Carree, 2002; Head *et al*., 1995; Urata and Kawai, 2000; Kimura and Kiyota, 2006).

Foreign direct investment by Japanese manufacturing firms is of interest as the internationalization of Japanese firms has expanded greatly since the mid-1980s. Paralleling this increase, a large body of literature on Japan's outbound foreign direct investment (FDI) has sprung up, which provides a useful benchmark for our results. Moreover, detailed datasets have been created to examine the behavior of Japanese multinational enterprises. Here, we use a new data set on Japanese firms that matches affiliates and parents over 1995–2003. We are thus able to determine whether heterogeneous firms respond differently to host country features (such as proximity, wages, institutional quality or access to markets) or to networks and spillovers. One first sign that FDI motivation is context-specific comes from the cross-country variation in the share of affiliates reporting that more than 80% of their sales are local. While this share is 59.7% in our sample, it is only 50% in China but reaches 65% in developed countries. In contrast, the share of affiliates reporting that more than 80% of their purchases are local is 36.6% in our sample, but with an analogous figure of 44% for China and 34% for developed countries. This arguably attests to the role of vertical motives, particularly in low-income countries such as China.

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Our analysis is close in spirit to Belderbos and Carree (2002),[4] who investigate the location of Japanese Electronics Investments in China while focusing on agglomeration effects and potential heterogeneity in investor responses to location determinants, depending on the characteristics of the investing firm and the plant.

Our motivation is two-fold. First, we expect our results to shed light on the heterogeneity of motives behind outward FDI. Helpman *et al.*'s (2004) assume that the decision to establish foreign production facilities is based purely on considerations of market access. In this context where all FDI is horizontally motivated, the ex-ante productivity of the parent firm is the key determinant of the investing abroad decision. Multinational firms are expected to be much more productive than non-multinational firms (Greenaway and Kneller, 2007).[5] However new evidence has stressed that it is not necessarily straightforward to draw conclusions regarding the relative productivity of multinationals and non-multinationals. Head and Ries (2003) show that when there are factor-price and market-size differentials, firms also invest abroad for vertical motives and the productivity ranking between multinationals and non-multinationals may even be reversed. Further investigation of the determinants of location choices is thus required.

Our second motivation relates to the identification of potential information barriers to the internationalization of Japanese firms. We investigate whether Japanese parents of different productivity and size respond differently to host-country features such as distance, institutional quality, access to markets, and networks and spillovers. Much evidence suggests that Japanese affiliates tend to cluster in the same regions. We consider three forms of relatedness. The first two concern the host location: (1) affiliates in the same industry originating from the same country (Japan); and (2) downstream affiliates originating from the same country. The third form (3) captures proximity at home (in the same Japanese prefecture) to parents having affiliates in the same destination country. Clusters of Japanese affiliates may form regional production networks, selling intermediate inputs to each other, sharing knowledge and therefore lowering production costs. We also investigate whether location choices are influenced by the presence of a JETRO agency.

Our paper contributes to a better understanding of the determinants of affiliate location and especially the importance of agglomeration forces and spillovers. Our empirical estimation of firm location relies on a model directly derived from new economic geography (Krugman, 1991; Fujita *et al.* 1999). Our results are based on a comprehensive data set that covers nearly all of the affiliates created by Japanese manufacturing firms in 54 host countries over the period 1995-2003. Using information on bilateral trade flows, sales of Japanese affiliates by country, and the Japanese national input/output table we construct

[4] Who use a conditional logit model to analyze the influence of regional characteristics on the decisions of 229 Japanese plants in the broadly-defined electronics industry in 29 Chinese regions and provinces over 1990-1995.

[5] An important literature investigates another aspect of the productivity-internationalization nexus, that is the export decision (refer to Greenaway and Kneller (2007) for a survey). Several papers also investigate the choice between exporting and making FDI (Brainard 1997; Head and Ries, 2003). Our data do not unfortunately report country-level export data to match with FDI data preventing us to cover this issue. Our paper deals exclusively with the outward FDI decision.

measures of market and supplier access, which we relate to the location choice of affiliates by country and year. We also control for a variety of host-country characteristics: proxies for trade costs include transportation costs and tariffs, and the proxies for production costs include country-specific wages and international business risk indicators.

Overall, our results confirm the economic importance of information-sharing and network effects, both at home and in the host country, as well as the traditional determinants such as production and transaction costs, and market and supply access. The effects of the key determinants of location choice vary substantially with the characteristics of the investing firm and the affiliate. Less-productive and smaller parents are more likely to create affiliates in China rather than in Western Europe or an OECD country. This result suggests that the choice of investing in more distant and competitive markets is positively correlated with firm productivity. This is in line with recent advances in the literature explaining FDI decisions by firm-specific features (Helpman *et al*. 2004). Moreover, less-productive firms appear to be more sensitive to distance-related costs and low institutional quality, but are more responsive to the presence of Japanese firms and JETRO presence in the host country.

We interpret our findings of the greater sensitivity to distance and institutional quality for less-productive firms as evidence of greater impediments to internationalization when productivity is low. Alternatively, the greater responsiveness of low-productivity firms to the presence of a JETRO agency or a Japanese community indicates that networks and spillovers may help to mitigate those impediments. These results would appear to support policies encouraging collaboration between Japanese firms and the dissemination of information targeted at small and less-productive firms.

The remainder of the paper is organized as follows. The next section outlines the theoretical framework from which the location-choice model estimated in the subsequent sections is derived, and discusses market access. Section 3 describes the data and the construction of variables, and Section 4 investigates how Japanese MNC affiliate location responds to our key variables, and how this depends on both parent and affiliate characteristics. Section 5 concludes.

2. THEORETICAL FRAMEWORK AND EMPIRICAL IMPLEMENTATION

We derive our estimating equation from a new economic geography model (Krugman, 1991; Fujita *et al*. 1999). Our theoretical framework follows that of Mayer *et al*. (2007), Head and Mayer (2004) and Amiti and Javorcik (2007), and compares the expected profits of an affiliate in each of the prospective locations to predict the equilibrium number of affiliates in each country (Amiti and Javorcik, 2007) or the probability that a firm invests in a given country (Mayer *et al*. 2007; Head and Mayer, 2004). One of our empirical contributions is to integrate the results of Head and Ries (2003) into this framework, interacting heterogeneity in firm productivity with host-country heterogeneity.

The underlying model assumes that firms maximize profits subject to uncertainty when choosing a location.[6] While the real underlying profit yielded by alternative locations is not observed, we do see the actual choice of each firm and the characteristics of the alternative locations.[7]

The theoretical framework underlying the empirical analysis is a reduced version of a standard New Economic Geography model of monopolistic competition based on Dixit and Stiglitz (1977), similar to that used by Fujita *et al*. (1999) and Redding and Venables (2004).

We consider a world with R locations, composed of firms operating under increasing returns to scale and producing differentiated manufactured products. Consumer utility increases with the number of varieties. The demand for differentiated products is modeled in the usual symmetric constant elasticity of substitution way, with σ ($\sigma > 1$) being the elasticity of substitution between any pair of products.

The final demand for goods in location j (the destination) is derived from the maximization of the representative consumer's (which may be either a firm or an individual) CES utility function.[8] Country j's demand for a variety produced in r (origin) is:

$$demand_{rj} = p_{rj}^{-\sigma} \frac{E_j}{G_j^{1-\sigma}} \tag{1}$$

where E_j is location j's total expenditure on manufactured goods and p_{rj} is the price of varieties from location r sold in j (consisting of the mill price p_r plus iceberg transportation costs T_{rj} between the two locations: $p_{rj} = p_r T_{rj}$). G_j is the aggregate price index for manufactured goods, $G_j = \left[\sum_{r=1}^{R} n_r p_{rj}^{1-\sigma} \right]^{1/1-\sigma}$, with n_r being the number of firms in r.

Taking into account that T_{rj} units must be shipped in order for one unit to arrive, we obtain the effective demand x_{rj} faced by a firm in r from location j:

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[6] The deterministic component of the profit function consists of the various location attributes that may influence the profitability of building a plant in a particular location. The random component consists of maximization errors, unobserved choice characteristics and measurement errors.

[7] As emphasized by Mayer and Mucchielli (1998), the economic decision studied in theoretical location models is by its nature a discrete choice made by individual firms between a number of alternatives. Empirically, the econometric model should therefore ideally exhibit these features too. For this reason, models with qualitative dependent variables, and in particular conditional logit models, have been widely used in the preceding empirical work on industrial location.

[8] See Fujita *et al*. (1999) for a complete statement of the underlying model.

$$x_{rj} = T_{rj} p_{rj}^{-\sigma} G_j^{\sigma-1} E_j = T_{rj}^{1-\sigma} p_r^{-\sigma} G_j^{\sigma-1} E_j \quad (2)$$

As demonstrated by Redding and Venables (2004), the own price elasticity of demand is σ, and the term $G_j^{\sigma-1} E_j$ shows the position of the demand curve faced by each firm in market j. This latter is referred to as the "market capacity" of country j. It corresponds to local expenditure E_j adjusted for the "market crowding" effect G_j, which summarizes the number of competing firms and the prices they charge. Intuitively, a greater number of competitors and thus a lower value of G_j will reduce the attractiveness of j for any firm exporting there.

Equation (2) underlines that trade costs will influence demand more when the elasticity of substitution is high. We follow the literature in referring to $\phi_{rj} = T_{rj}^{1-\sigma}$ as the "phi-ness" of trade (see Baldwin *et al*., 2003). This takes on values between 0 (when trade costs are prohibitive) and 1 (when trade costs are negligible).

2.1. The profit equation for foreign affiliates

Each firm sets its mill price to maximize profits. Following the Dixit-Stiglitz-Krugman model, we obtain the usual marginal revenue equals marginal cost condition, with the resulting mill price for each origin r as a simple mark-up over the marginal costs of production, c_r, which are region-specific (Head and Mayer, 2004):

$$p_r = \frac{c_r \sigma}{\sigma - 1} \quad (3)$$

All varieties produced in a given region r are thus valued at the same price (before transport costs). The gross profit earned in each market j for a variety produced in region r is given by $\pi_{rj} = p_r x_{rj} / \sigma$.

Substituting in Equation (3), summing up the profits earned in each market and subtracting the fixed costs f_r necessary to establish a plant in region *r*, we obtain the aggregate net profit, Π_r which can be earned in each potential location r:

$$\Pi_r = \sum_j p_r x_{rj} / \sigma - f_r = \frac{1}{\sigma} C_r \sum_j \left[\phi_{rj} G_j^{\sigma-1} E_j \right] - f_r \quad \text{with} \quad C_r = \frac{\sigma c_r^{1-\sigma}}{\sigma - 1} \quad (4)$$

Following the literature we write:

$$\sum_j \phi_{rj} G_j^{\sigma-1} E_j = \sum_j \phi_{rj} m_j = MA_r \tag{5}$$

where MA_r is the "market access" of region r. This is simply the sum of the market capacities of all destinations j, m_j, weighted by the measure of bilateral trade costs, ϕ_{rj}, between r and j. This summarizes how well a location is endowed with access to markets for the goods it produces.[9]

We define the marginal costs of production, c_r, as $c_r = w_r^{\xi} P_{i,r}^{\zeta} z^{\psi}$, where w_r is the wage, $P_{i,r}$ is the intermediate input-price index in sector *i* and region r, and *z* is the price of other factors of production (including transaction costs, business impediments and pecuniary externalities).

Taking the natural logs of Equation (4) and allowing all variables to be time-varying, we have:

$$\ln \Pi_r = \alpha_1 \ln MA_r + \alpha_2 \ln w_r + \alpha_3 \ln P_{i,r} + \alpha_4 \ln z_r \tag{6}$$

Our theoretical framework thus decomposes the operating profits of affiliates into three main components: i) access to relevant markets in terms of demand; ii) various components of production costs, including the price of intermediates and local wages; and iii) transaction costs and agglomeration effects related to networks. We proxy the price of intermediates by supplier-access (SA) measures. Theory suggests that a lower input-price index has a positive effect on profits. The more input varieties are available and the lower is the cost of accessing these varieties, the lower is the price index and the higher is profitability. Since individual input prices are unavailable, we follow Amiti and Javorcik (2007) and Mayer *et al.* (2007) in constructing an inverse measure of the price index (described below), by measuring the proximity to potential suppliers. We hypothesize that profits are positively related to better access to intermediate inputs ($\alpha_3 > 0$).

In our empirical analysis, we include, in addition to market and supply access, wages which vary across countries. Theory predicts a negative coefficient on wages ($\alpha_2 < 0$): other things equal, firms prefer to locate in countries with lower wages. As in the model, we assume that new entrants are too small individually to influence the local wage, so they take it as given. The other country-specific costs, z_r, will include any other factors of production whose

[9] As pointed out by Head and Mayer (2006), market access bears a close resemblance to Harris's (1954) market potential. The difference lies in the fact that Harris's market potential implicitly treats G_r, the price index, as a constant and ϕ_{rj} is approximated by $1/dist_{rj}$. In this sense, MA_r is real, not nominal, since it incorporates the notion that large markets that are extremely well-served by existing firms might offer considerably less profit potential than smaller markets with fewer competitors.

costs vary between countries. We will consider factors which push costs upwards, such as transactions costs (proxied by the distance to Japan) and impediments to business practices (proxied by the International Country Risk Guide (ICRG) index), as well as factors which drive costs downwards, such as spillovers, agglomeration and network effects.

2.2. Specification of the location choice model

We estimate the parameters of the profit function (6) using a discrete-choice model. As we do not observe the potential profitability of each location, we assume that firms choose the country yielding the highest profit. The location-choice literature makes extensive use of the conditional logit model (CLM). This model requires that the error terms be independent across locations. As it is likely that the unobserved component of profitability will be correlated across countries in the same continent, we use a generalization that allows this structure in the errors, the nested logit model (NLM: Train, 2003). This method allows substitution patterns to differ across alternatives by partitioning the set of alternatives into several "nests" corresponding to continents and assuming nest-specific substitution patterns. In our framework, there are six nests corresponding to Asia, Western Europe (WEurope), the Rest of Europe (OEurope), Latin America (LAmerica), North America (NAmerica) and Oceania. Under this nested tree structure, location choice can be decomposed into two steps, the choice of a nest and the choice of location within the chosen nest.

For estimation purposes it is useful to decompose the nested model into two logit functions. The profit function for the investing firm *f* can be split into i) a component W that is constant for all alternatives within a nest and ii) a component Y that varies over alternatives within the nest: $\Pi_r(f) = Y_r(f) + W_k(f) + \varepsilon_r(f)$ with *k*(=Asia, WEurope, OEurope, LAmerica, NAmerica and Oceania) being an index denoting the nest to which location *r* belongs and ε_r an error whose marginal distribution is univariate extreme value. This random term can be viewed as a shock to the specific firm-country marginal cost. The probability that country *r* be chosen as a location can be expressed as the product of two probabilities: the probability $P_k(f)$ that nest *k* be chosen, and the conditional probability $P_{r|k}(f)$ that location *r* be chosen among the different countries in the chosen nest: $P_r(f) = P_{r|k}(f)P_k(f)$

McFadden (1978) shows that with the specified logistic error structure, each of those probabilities can be expressed using the information contained in $W_k(f)$ and $Y_r(f)$, with nest-specific variables being used to explain the choice of nest and location-specific variables to explain the conditional probability: $P_k(f) = \exp(W_k(f) + \rho_k Z_k(f) - \tilde{Z}(f))$, with $\tilde{Z}(f) = \ln \sum_k \exp\left[W_k(f) + \rho_k IV_k(f)\right]$ and $P_{r|k}(f) = \exp(\rho_k^{-1} Y_r(f) - Z_k(f))$, where $Z_k(f) = \ln \sum_k \exp\left[\rho_k^{-1} Y_r(f)\right]$ is denoted the inclusive value for nest *k*, and the parameter ρ_k is the "log-sum coefficient" reflecting the degree of independence between the unobserved components of expected profits in the alternative nests *k*.

Countries are perfect substitutes between continents for $\rho_k = 0$, whereas for $\rho_k = 1$ there is full independence and patterns of substitution are the same within and between nests. In this latter case, the NLM collapses to the CLM. The choice of continent is modeled as depending on the continental level of development (average GDP per capita), dynamics (growth rate of GDP in the five years preceding the investment) and the average time difference with Japan. We will show that results are only marginally different between the two models.

Once a continent is selected, the specific country of location is chosen to maximize profits. Following the theoretical model, the key determinants are market and supply access, as well as agglomeration and spillover effects which mitigate transaction costs. The following sub-section describes how market access is constructed. Section 3 then discusses the data sources and the definition of the other variables in our model.

2.3. Market Access calculation

Summing the effective demand x_{rj} faced by a firm in r from location j over all products produced in r (Equation 2), we obtain the "trade equation" (Redding and Venables, 2004). The total value of exports of region r to region j is therefore:

$$n_r p_r x_{rj} = n_r p_r^{1-\sigma} \phi_{rj} G_j^{\sigma-1} E_j \tag{7}$$

As emphasized by Redding and Venables (2003), this equation for bilateral trade flows provides the basis for the estimation of a gravity trade model. While the last term on the right-hand side of Equation (7) reflects the "market capacity" of region j, $G_j^{\sigma-1} E_j$, the first term measures what is referred to as the "supply capacity" of the exporting region, $n_r p_r^{1-\sigma}$. This corresponds to the product of the number of varieties and their price competitiveness.[10]

As shown in Equation (5), for each country r, market access is defined as $MA_r = \sum_j \phi_{rj} G_j^{\sigma-1} E_j$. Since neither market access itself nor its components, market capacity ($G_j^{\sigma-1} E_j$) and freeness of trade (ϕ_{rj}), are directly observable, we rely on the two-step procedure pioneered by Redding and Venables (2004). In this approach, the market capacities, $G_j^{\sigma-1} E_j$, of international and national trading partners, as well as transport costs, ϕ, can be estimated using a gravity equation.

Taking natural logarithms in Equation (7) yields the basic econometric specification used for the trade equation, so that the total value of exports to region j from all firms based in region r is given by:

[10] Redding and Venables (2003) discuss the concepts of market and supply capacity in greater depth.

$$\ln(X_{rj} = n_r p_r x_{ij}) = FX_r + \ln \phi_{rj} + FM_j \tag{8}$$

The empirical estimation of Equation (8) provides us with estimates of the two components of market access: freeness of trade and market capacity. Importer fixed effects correspond to the log of the unobserved market capacity of the importer region j, $FM_j = \ln(G_j^{\sigma-1} E_j)$, while exporter fixed effects (FX_r) capture the log of the exporter's supply capacity, s_r.

Assuming that transport costs, ϕ_{rj}, in our gravity equation depend on bilateral distances,[11] and a series of dummy variables indicating whether the two partners r and j share a common language and colonial links, or are contiguous, Equation (8) yields the following trade regression:

$$\begin{aligned} \ln X_{rj} = {} & FX_r + FM_j + \delta \ln dist_{rj} + \varphi \text{ common language}_{rj} \\ & + \psi \text{ colonial link}_{rj} + \zeta \text{ contiguity}_{rj} + \varsigma_{rj} \end{aligned} \tag{9}$$

Equation (9) is estimated separately for each year, yielding country-specific estimates of market capacity and transportation costs to construct country market access. This article employs the BACI dataset,[12] a cross-country dataset developed in CEPII covering the period 1995-2003. A detailed description of the original sources and procedures to obtain data is contained in Gaulier *et al*. (2007). Dyadic information (common language, distance, colonial links and contiguity) are obtained from the CEPII Distances database.

3. DATA AND VARIABLES

3.1. The dependent variable: investments abroad

Our dependent variable consists of investments by Japanese firms. Data on Japanese affiliates abroad are obtained from the basic survey on Overseas Business Activities conducted annually by the Ministry of Economy, Trade and Industry (METI).[13]

More than 15,842 Japanese investments in operation in 2001-2003 are listed in our sample with corresponding data on when the operation started, sector, the country of location and other details of the nature and objective of the investment. The initial selection of 6,084 Japanese investments[14] (initiated over the period 1995-2003) was essentially driven by the

[11] In equation 9, $dist_{rj}$ denotes the great circle distance between r and j.

[12] BACI aims to provide an international trade database over the greatest number of countries (over 200) and years (from 1995), with particular attention to the treatment of unit values. Original procedures have been developed to reconcile the data reported by countries with United Nations COMTRADE. The data is downloadable from http://www.cepii.fr/anglaisgraph/bdd/baci.htm.

[13] We obtain access to the answers for three consecutive years 2001-2003.

[14] These include 1,458 investments in the wholesale and retail sector, 1,281 in other services, 93 in the primary sector and 3,252 in the manufacturing sector.

availability of host-country data and the requirement of covering only affiliates providing consistent information over time (notably on the sector of operation and the date of entry). Information on the affiliates' parent (such as location in Japan, size and productivity) is incorporated by merging the affiliates dataset to the Basic survey of Japanese Business Structure and Activity through the Japanese parent identification code. The strength of the survey is its sample coverage and the reliability of data, as the survey is compulsory for manufacturing and non-manufacturing firms with more than 50 employees and with capital of more than 30 million yen. One limitation however is that it excludes information on financial matters and institutional arrangements such as keiretsu.[15] Following the theoretical model which applies to firms operating under increasing returns to scale and producting differentiated manufactured products, our empirical estimations will only include affiliates operating in manufacturing. Because some affiliates do not report their parent's identity, and due to a number of inconsistency issues (changes in the parent's identity, unavailability[16] or inconsistency of parent statistics), our final sample covers 3,252 Japanese manufacturing investments, of which 3,124 provide both host-country and parent-specific information. Since the information on affiliates is restricted to the period 2001-2003, our empirical estimations will rely throughout on the average features over that period.[17] Our final dataset covers a universe of possible location choices in 54 countries.

Further details concerning the data used in the estimations can be found in the data appendix (Appendix A), which includes Tables A-1 and A-2 showing the number of Japanese firms by country and manufacturing sectors[18] respectively.

Map 1 uses this data to plot the accumulated number and total employees of Japanese affiliates as of 2003 in the countries in which they invested between 1995 and 2003. A number of important features of Japanese investment patterns are immediately apparent: the

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15 The results of the Basic Survey of Japanese Business Structure and Activities are prepared annually by the Research and Statistics Department, METI (1994-2003). This survey was first conducted in 1991, then again in 1994, and annually thereafter. The main purpose of the survey is to paint a comprehensive statistical picture of Japanese corporate firms, including their diversification-, globalization-, R&D- and information technology-related activities. The survey is compulsory for manufacturing and non-manufacturing firms with more than 50 employees and with capital of more than 30 million yen (some non-manufacturing sectors such as finance, insurance and software services are not included). The sample firms account for about one-third of the total national workforce, 99 percent of total exports, and 69 percent of total imports for Japan in 2002 (Kiyota and Uruta, 2007).

16 One rationale for missing parents is that the affiliates survey has no sample restriction in terms of firm size or sector, while the Basic survey of Japanese Business Structure and Activity covers firms above 50 employees and excludes some non-manufacturing sectors such as finance, insurance and software services.

17 We would ideally explain location decisions in year *t* by information on the affiliates for that year. Unfortunately, unavailability forces us to use the average value between 2001 and 2003 and implicitly assume that the sales and local sales ratio of affiliates remain constant over time. The explanatory variables concerned here are supply access and backward linkages, as they incorporate the sales value of affiliates.

18 The decomposition into sectors follows a 15-sector nomenclature including Textile, Chemicals, Basic Metal, Fabricated metal products, Industry machinery and equipment, Office, service industry and household equipment, Household electric appliances, Electronic data processing machines, Communication equipment, Electronic parts and devices, Miscellaneous electrical machinery, Motor vehicles, parts and accessories, Miscellaneous transportation equipment, Precision instruments and Other Manufacturing.

concentration in Asia (especially China), the attraction of the US and the UK, and their quasi absence from the non-Asian developing world.

3.2. The explanatory variables

3.2.1. Supply Access

Supplier access is measured via the price indices of intermediate inputs. As is explicit in the theoretical framework of the NEG, a large number of local suppliers of inputs in a host country reduces the price index of intermediate inputs and therefore production costs, which makes the country more attractive (Krugman and Venables, 1995). Since individual input prices are unavailable, we follow Amiti and Javorcik (2007) who were the first to approximate this effect using information on the relative availability of inputs and their use by downstream sectors. We expand Amiti and Javorcik (2007) by incorporating additional hypotheses as in Mayer *et al*. (2007) which address the unavailability of sector-specific values for output data. First, we assume that an affiliate abroad uses intermediate inputs in the same proportion as firms in the same industry in Japan; consequently Japanese affiliates' technical coefficients will be proxied by those from the national Japanese IO table. Second, our measure of the relative availability of inputs will only account for the location of Japanese affiliates' input producers in the host country. As explained by Mayer *et al*. (2007) this approach implicitly corresponds to assuming that Japanese affiliates abroad are more likely to buy intermediate inputs from other Japanese affiliates or that the location patterns of Japanese affiliates abroad are a good measure of the distribution of other firms that supply inputs.

Our measure of the availability of inputs within a country *r* that are used by industry *i* in year *t* is defined as $SA_{i,t}^{r} = \sum_{s=1}^{S} a_{si} \psi_{s,t}^{r} D_{rr}^{-1}$, where D_{rr} is the internal distance of country *r* and $a_{si}\ \psi_{s,t}^{r}$ measure the intensity of use of input *s* by industry *i*.

The term $\psi_{s,t}^{r}$ stands for the share of the world output of industry *s* produced (by Japanese affiliates) in country *r*. Since industries use more than one intermediate input, these output shares are weighted by a_{si}, the technical coefficients from the Japanese national input/output (I/O) table for 2000.[19]

As a proxy for output shares, we use sales shares: $\psi_{s}^{r} = \frac{sales_{s}^{r}}{sales_{s}^{W}}$, with $sales_{s,t}^{W}$ being the overall sales of industry *s* in country *r* (by Japanese affiliates present in year *t*). As argued by Amiti and Javorcik (2007), even though individual prices are unavailable, the effects should still be well measured since the price index is lower the higher the share of intermediate inputs produced in close proximity. This measure is divided by the internal

[19] The Japanese national I/O table has 516 sectors and 108 consolidated sectors, which we match to the 15 manufacturing sectors covered in our empirical analysis.

distance of country *r,* D_{rr}, in order to account for the ease of access to suppliers inside *r*. We assume that countries are circular: as in Leamer (1997), intra-national distance is modeled as the average distance between producers and consumers in a stylized representation of regional geography, which gives $D_{rr} = dist_{rr} = \left(\frac{2}{3}\sqrt{area_r / \pi}\right)$. We lag supplier access by one year, in order to limit endogeneity. When controlling for other production costs, supply access is a proxy for a lower intermediate price index in the country under consideration, and should therefore enter with a positive sign.

3.2.2. Standard covariates

Our other covariates include the standard determinants of location choice emphasised in the theoretical and empirical literatures.

The key measure of final demand, industry-level market access, $MA_r = \sum_j \phi_{rj} G_j^{\sigma-1} E_j$, is calculated according to the estimation procedure presented in Section (2.3). This variable is calculated for the year of investment.

Host-country distance from Japan and international business risks (proxied by the index from the International Country Risk Guide) are also included in order to capture the extent to which it is easier and cheaper for a Japanese investor to operate its business in a proximate and business-friendly country. We rely on the composite risk rating for which 0 denotes the highest risk and 100 the lowest risk. The composite index is based on 22 variables in three subcategories of risk: political, financial, and economic. Those components measure the level of risk to international business operations present in different countries across the globe. They include, among others, government stability, socio-economic conditions, internal and external conflict, corruption, "law and order" and ethnic tensions.[20]

Another key proposed explanation for investing abroad concerns production costs. We follow the literature and proxy labour costs, w_r, by the level of GDP per capita (in current dollars), which is expected to enter negatively once demand (MA_r) has been controlled for.

Other country/year features relating to agglomeration and spillover effects may have an impact on the profitability of an affiliate. We consider three forms of relatedness. The first two concern the host location: (1) affiliates in the same industry originating from the same country (Japan) [***Japanese agglomeration***]; and (2) downstream affiliates originating from the same country [***Backward linkages***]. The third form (3) captures proximity at home (in the same Japanese prefecture) to parents having affiliates in the same destination country [***FDI spillovers***].

Global agglomeration effects relating to the number of producers and customers ought to be captured by our MA and SA indicators. They will account for the effect of positive externalities associated with the proximate location of downstream and similar

[20] More information on this data can be found on http://www.prsgroup.com/ICRG_Methodology.aspx.

manufacturing activities. Such externalities are associated with greater availability of and variety in parts and components (Head and Ries, 1996; Belderbos *et al*., 2000).

We investigate the possibility that agglomeration benefits are stronger when the proximate manufacturers are Japanese-owned. There is some empirical evidence that a Japanese firm investing in a country where there is already a developed Japanese business "community" will benefit from lower costs there, everything else equal (Belderbos and Carree, 2002).

We construct an indicator of ***Japanese agglomeration*** which is intended to account for the Japanese presence in a given country at a given period as the total number of affiliates established since 1990 by Japanese firms (in all industries). This is computed excluding information from the affiliate in question.

Finding a positive and significant effect of Japanese agglomeration on location choice may reflect experienced Japanese firms sharing useful information on how to operate manufacturing plants in a country with prospective investors. Belderbos and Carree (2002) argue that the greater benefits of clustering can be attributed to information-sharing among Japanese firms through joint membership of industry associations, national preferences for amenities such as schools and restaurants, greater advantages of proximity due to the use of just-in-time delivery and inventory control systems (Reid, 1994), and the use of specialized components and intermediates the specifications of which are developed within long-term supplier–assembler relationships in Japan. Mayer *et al*. (2007) note that the number of Japanese firms has an ambiguous effect in theory. While it may capture positive technological spillovers, agglomeration dynamics and unobserved attractive features of countries, a greater number of firms may also mean more intense local competition for both sales and inputs, which reduces attractiveness. We anticipate and actually observe that, once controlling for country fixed effects that pick up previously-omitted factors, the negative competition effect becomes more powerful, and the coefficient on the number of Japanese firms variable consequently becomes negative.

We also investigate the economic impact of the presence of a **JETRO** agency in the host country.[21] A positive coefficient on this variable when explaining location choice would suggest positive spillovers from JETRO services to Japanese investors.

Beside these network effects, that are identical for all Japanese investors, there may be some firm-specific information/transaction costs across countries. In particular, the literature has highlighted the economic significance of *keiretsu* networks (Belderbos and Carree, 2002; Head and Ries, 1996; Smith and Florida, 1994; Mayer and Muchielli, 1998; O'Huallachain and Reid, 1997; Head *et al*., 1999; Head and Mayer, 2004; Blonigen *et al*., 2005). Unfortunately we have no specific information on whether our affiliates or parent firms belong to the same vertical keiretsu. We nevertheless attempt to account for linkages

[21] The list of JETRO offices around the world was taken from http://www.jetro.org/content/97. JETRO provides useful market intelligence information and support to Japanese companies looking for successful entry and expansion abroad.

between Japanese firms[22] through two indicators relating respectively to the host and home location.

First, we anticipate in line with Venables (1996) that vertical linkages may induce clustering of suppliers and assemblers in specific locations. It is often argued that numerous suppliers of Toyota followed the international steps of their downstream partner.

Our strategy in computing a measure of **Backward linkages** adopts the same hypotheses as those for Supply Access. While Supply Access captures forward linkages (relating the affiliate to downstream sectors which process its output), this measure captures backward linkages (relating the affiliate to its Japanese upstream suppliers). We assume that Japanese affiliates' technical coefficients can be proxied by those from the national Japanese IO table and that Japanese affiliates abroad are more likely to sell their output to other Japanese affiliates (or that the location patterns of Japanese affiliates abroad are a good representation of the distribution of other firms to which the firm can sell). Our measure of backward linkages within a country *r* that applies to firms in industry *i* in year *t* is defined as:

$$BL_{i,t}^{r} = \sum_{s=1}^{S} b_{si} \psi_{s,t}^{r}$$

where b_{si} is the share of output from sector *i* that is used as an input by sector *s*, taken from the Japanese national input/output (I/O) table for 2000, and $\psi_{s,t}^{r}$ stands for the share of the world output of industry *s* produced (by Japanese affiliates) in country *r,* defined as in section 3.2.1.

Our second strategy to capture firm-specific network effects relates to the presence of ***FDI spillover*** effects at home, in the spirit of the literature looking at export behaviour (Bernard and Jensen, 2004). Direct evidence of the positive impact of proximity to other exporters is provided in a number of papers, including Aitken, Hanson and Harrison (1997), Greenaway, Sousa and Wakelin (2004), Koenig (2005) and Koenig, Mayneris and Poncet (2008). Assuming that FDI requires specialized knowledge of foreign markets that can be shared through exchanges between employees or imitation, we expect the probability of FDI to be greater for firms surrounded by other multinationals. We investigate the significance of destination-specific FDI spillovers for a parent investing in a country by the number of surrounding (defined at the prefecture level[23]) firms having at least one affiliate in the same host country at the time of entry. Japanese prefecture-level FDI spillovers are

[22] See Kiyota *et al.* (2007) for the determinants of the backward vertical linkages of Japanese foreign affiliates, focusing on local backward linkages, or local procurements in the host country. While the Market Access indicator should capture demand coming not only from consumers but also from downstream firms, finding a statistically significant backward linkage in the regressions suggests additional effects between Japanese upstream and downstream firms.

[23] The prefectures of Japan are the country's 47 sub-national jurisdictions: one "metropolis" (都), Tokyo; one "circuit" (道), Hokkaidō; two urban prefectures (府), Osaka and Kyoto; and 43 other prefectures (県). A map of Japanese prefectures can be found on http://en.wikipedia.org/wiki/Prefectures_of_Japan.

computed without including information from the parent of the affiliate in question, as such the measure is specific to the FDI project under investigation. We argue that FDI spillovers may also partly help to capture spillovers from domestic *kereitsu* agglomeration, since *kereitsu* network firms tend to agglomerate in Japan, and thus that knowledge of foreign markets might be shared among *kereitsu* firms.

We lag our indicators of Japanese agglomeration and backward linkages by one year, in order to limit endogeneity problems.[24]

Table A-3 provides summary statistics for our main explanatory variables, while Table A-4 shows the correlation matrix.

4. ECONOMETRIC ESTIMATIONS

We begin by analyzing the determinants of the location choice of Japanese affiliates, relying on the conventional specification used in the literature: the conditional (fixed-effect) logit where $Y_{r,t}(f)$ is 1 when firm f choses country r to locate its affiliate at time t and 0 for alternative countries.

The estimated regression is:

$$\begin{aligned} Y_{r,t}(f) &= \alpha(f) + \beta_0 \ln dist_r + \beta_1 \ln \text{GDPper capita}_{r,t} \\ &+ \beta_2 \ln \text{MA}_{r,t} + \beta_3 \ln \text{SA}_{r,t-1} + \beta_4 \ln \text{BackwardLinkages}_{r,t-1} \\ &+ \beta_5 \text{ICRG}_{r,t} + \beta_6 \ln \text{Jap. Agglo}_{r,t-1} + \beta_7 \ln \text{Spillovers}_{r,t} + \beta_8 \text{JETRO}_{r,t} + \varepsilon(f)_{r,t} \end{aligned} \quad (10)$$

We then turn to a nested logit specification in which we first estimate the choice of country within a given continent, and then estimate the choice of continent taking into account the attractiveness of its constituent countries. Our first main empirical contribution relates to the importance of agglomeration forces and spillovers. Our second contribution corresponds to the analysis of how location determinants depend on the investing firm's and the plant's characteristics.

[24] We investigated the importance of host countries' infrastructure quality based on World Bank indicators (http://econ.worldbank.org), such as the density of roads, railways or phones. In the results (available upon request) none of the infrastructure indicators enters the regression significantly. Since the results for the other determinants remained unchanged, but the sample size was reduced due to the limited coverage of the infrastructure data, we chose not to include these indicators here.

4.1. Benchmark estimations

4.1.a. Conditional logit

The first column of Table 1 shows the results of a very simple model of location choice based on distance to Japan, host country GDP and GDP per capita. As expected while distance and GDP per capita proxying labor costs enter with a negative and significant coefficient, GDP enters positively.

Column 2 substitutes market access for GDP to proxy demand potential in the destination country, while Column 3 further includes the proxies for supply access and backward linkages. Those variables are found to positively explain the location choice. Our international business risks variable is then introduced in Column 4. Column 5 adds the variable for Japanese agglomeration, while Column 6 further accounts for FDI spillovers. The coefficients on both variables are positive and significant, and are of the same order of magnitude as other results in the literature (Belderos and Carree, 2002; Mayer *et al.*, 2007). This highlights the powerful influence of Japanese networks both at home and abroad on location choice. Note that introducing these two indicators simultaneously reduces the point estimates for the other explanatory variables (which are potentially common to firms in the networks), which is as expected (comparing Columns 4 and 6) although they remain significant. Column 7, which is our preferred specification, complements the model with a dummy variable reflecting the potential positive impact of a JETRO agency in the host country: this attracts the expected positive significant coefficient.

All of the explanatory variables have a sizeable impact on location choice, explaining 40% of the variation in the location choices of Japanese affiliates between countries. Profits are negatively related to production and transactions costs: our proxy for labor costs (GDP/capita) and the two transaction cost variables (distance and international business risks) enter in the expected way, negatively for the first two and positively for the latter. Moreover, location choice is positively related to better access to intermediate inputs, reflected in a lower intermediate input price index, proxied by SA_r. Firms are also concerned about good market access, MA_r, which enters with the expected sign and of a magnitude matching typical findings in this literature. Supply access always has a significant and positive effect, which is consistent with the results in Amiti and Javorcik (2006) and Mayer *et al*. (2007): affiliates tend to be located where it is easier to find suppliers and outlets. This latter feature is highlighted by the positive and significant impact of our Backward Linkages variable. The positive and significant coefficients on the three indicators introduced in Columns 5 though 7 provide supportive evidence for the importance of agglomeration and economic spillover effects. With the variables measured in logs (and a large number of location choices), the coefficient on each variable is very close to the elasticity of the probability of choosing a country for the average investor (see Train, 2003). The estimates in Column 7 indicate that a 10% increase in market access and supply access increases the probability of attracting Japanese investors by about 2% and 1.3% respectively. The impacts of backward linkages, agglomeration and spillover effects are quite similar in magnitude, a 10% rise in these variables increasing the probability of

location by 3%. The presence of a JETRO agency raises the probability of investing in a country by 28%,[25] *ceteris paribus*.

In the last two columns, we include country fixed effects in the estimation. These account for all of the characteristics of location countries (some observable, some not) that do not vary over our time frame (1995-2003). Distance to Japan and the JETRO variables are naturally dropped in this specification, which identifies time-varying coefficients only. The proxy for business risks loses significance, possibly due to little variation over time in institutions over the short period under investigation. We see an increase in the size of most coefficients, with the exception of the spillover indicator. However, this does not change the flavor of our results, except with respect to the impact of the Japanese agglomeration indicator.[26] As anticipated above, controlling for country fixed effects, which pick up previously-omitted characteristics making a country a desirable place to invest for Japanese investors, makes the negative competition effect more powerful, and the coefficient on the now purged number of Japanese affiliates negative in consequence.

Evaluating explanatory variables should go further than comparing elasticities (approximated by coefficients here), since our different variables have different variances, as shown in Table A-3. We follow Head and Mayer (2004), who propose the following thought experiment: take a hypothetical country with the mean value of the explanatory variables, and simulate a one standard deviation shock in the variable of interest (market access, say). The ratio of the new to the baseline probabilities of being chosen is $[1+cv(MA)]^{\beta MA}$, where βMA is the estimated coefficient in our benchmark estimation (Column 7), and cv(MA) the coefficient of variation of the variable in question. This one standard deviation shock exercise produces an increase in the probability that the "mean country" be chosen of 27% for market access, 20% for supply access, 63% for backward linkages, 50% for Japanese agglomeration and 48% for spillovers at home.

4.1.b. Nested logit

We now address the problem of non-independent errors across countries in the same region. The use of the country dummies in specifications 8 and 9 in Table 1 should help to mitigate the problem, but does not resolve issues revolving around cross-industry and inter-temporal differences in the attractiveness of locations. By considering the choice of continent for a given choice of country, we condition on all aspects of the continent that do not vary across its constituent countries from the perspective of a given investor. We consider that the choice of a given region depends on its total size and dynamics as well as its distance. These three dimensions are picked up by the average continental development level (GDP per capita), average GDP growth over the five-year period prior to the investment, and the average time difference with Japan respectively. The results are shown in Table 2. The five

[25] Corresponding to exp(0.25)-1.

[26] As an additional robustness check, we introduced a variable for exchange rate misalignment and/or volatility between the potential affiliate's location and Japan. We relied on the relative change in the country's exchange rate with respect to the Yen over the five years preceding affiliate creation. This did not attract a significant estimate in the regressions.

columns here reproduce Columns 3 though 7 of Table 1 using the nested logit estimator. The LR-test statistic in the last row of the Table rejects the null hypothesis of equivalence between the nested and conditional logits in all of the specifications. In most specifications, inclusive values are equal to one for all continents while the reverse is true for the other two nests (Asia and, in some cases, Other Europe). Nevertheless the signs and sizes of the estimated coefficients are very similar (compare Column 7 of Table 1 to Column 5 of Table 2). Overall, our results confirm the economic importance of information-sharing and network effects, both at home and in the host country, as well as the traditional determinants pertaining to production and transaction costs, and market and supply access.

4.2. Heterogeneity in location determinants

One novel contribution of our paper is to explore whether the determinants of location choice depend on parent and affiliate features. We investigate Helpman *et al*.'s (2004) argument that FDI decisions depend on firm-specific features. Some preliminary evidence in the case of Japanese firms has been provided by Belderbos and Carree (2002), who consider the determinants of location of Japanese Electronics Investments in China and the heterogeneity in the responses of investors to location determinants, depending on the characteristics of the investing firm and the plant. We rely on a two-step approach to explore the conditionality of location determinants for our more complete survey of Japanese overseas business activities.

4.2.a. Interactions between parent's characteristics and destination

Our first approach is to see whether the odds of choosing China (the main destination), OECD, US or Western Europe as a destination depend on the parent's size (proxied by the number of employees) or TFP at the time of investing abroad.[27] The results displayed in Table 3 suggest that firms choosing to locate their affiliates in China tend to be less productive and are of smaller size. The picture is exactly the opposite for location in Western Europe or OECD countries. This suggests that the costs associated with Europe and OECD locations are greater, requiring higher TFP and greater size in order to afford them. The US market does not seem to require higher than average TFP or size. The probability that Japanese firms invest in China is much less pronounced when the firm is more productive.

[27] We rely on Hijzen et al.'s (2006) estimates of Japanese firms' Total Factor Productivity growth. Their calculation follows the method of Good, Nadiri and Sickles (1997), taking 1994 as the base year.

Table 1: Benchmark results: Conditional (fixed-effects) logit

	1	2	3	4	5	6	7	8	9
Ln Distance to Japan	-0.615***	-1.356***	-0.352***	-0.353***	-0.300***	-0.244***	-0.258***		
	(0.042)	(0.041)	(0.069)	(0.072)	(0.074)	(0.077)	(0.077)		
Ln GDP per capita	-0.287***	-1.442***	-0.777***	-0.897***	-0.654***	-0.554***	-0.525***	-0.940***	-0.866***
	(0.017)	(0.033)	(0.037)	(0.043)	(0.049)	(0.052)	(0.053)	(0.308)	(0.320)
Ln GDP	0.838***								
	(0.019)								
Ln Market Access		1.329***	0.361***	0.371***	0.244***	0.192***	0.200***	1.215***	1.006***
		(0.031)	(0.041)	(0.043)	(0.044)	(0.045)	(0.046)	(0.136)	(0.143)
Ln Supply Access, t-1			0.434***	0.384***	0.175***	0.128***	0.134**	0.321***	0.327***
			(0.050)	(0.051)	(0.055)	(0.057)	(0.057)	(0.080)	(0.082)
Ln Backward Linkages, t-1			0.441***	0.440***	0.317***	0.321***	0.308***	0.281***	0.285***
			(0.027)	(0.027)	(0.030)	(0.031)	(0.032)	(0.043)	(0.046)
Ln ICRG, t-1				1.814***	1.278***	1.121***	0.942***	-0.088	0.221
				(0.287)	(0.284)	(0.298)	(0.308)	(0.430)	(0.459)
Jap. Agglomeration (Ln no. of Jap. affiliates), t-1					0.406***	0.318***	0.322***		-0.586***
					(0.037)	(0.041)	(0.041)		(0.143)
Spillover Ln no. of surrounding parents having an affiliate country/year						0.268***	0.269***		0.185***
						(0.037)	(0.037)		(0.040)
JETRO presence dummy							0.252**		
							(0.121)		
Continent dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	n/a	n/a
Country-specific dummies	No	No	No	No	No	No	No	Yes	Yes
Investment * Country	269 916	269 916	269 916	239 587	239 587	219 964	219 964	239 587	219 964
Investment	3 252	3 252	3 252	3 143	3 141	2 924	2 924	3 143	2 924
Pseudo R-squared	0.33	0.33	0.39	0.40	0.40	0.40	0.40	0.42	0.41

Standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 2: Benchmark results: Nested logit

	1	2	3	4	5
Ln Distance to Japan	-0.303***	-0.300***	-0.275***	-0.189**	-0.202**
	(0.071)	(0.075)	(0.074)	(0.080)	(0.080)
Ln GDP per capita	-0.736***	-0.859***	-0.592***	-0.527***	-0.499***
	(0.037)	(0.048)	(0.047)	(0.048)	(0.050)
Ln Market Access	0.304***	0.323***	0.171***	0.146***	0.153***
	(0.043)	(0.047)	(0.042)	(0.042)	(0.043)
Ln Supply Access, t-1	0.475***	0.431***	0.235***	0.167***	0.173***
	(0.053)	(0.055)	(0.051)	(0.055)	(0.055)
Ln Backward Linkages, t-1	0.444***	0.437***	0.297***	0.304***	0.291***
	(0.027)	(0.027)	(0.029)	(0.032)	(0.032)
Ln ICRG, t-1		1.815***	1.142***	1.329***	1.150***
		(0.344)	(0.257)	(0.224)	(0.241)
Jap. Agglomeration (Ln no. of Jap. affiliates), t-1			0.409***	0.347***	0.351***
			(0.032)	(0.042)	(0.042)
Spillover Ln no. of surrounding parents having an affiliate country/year				0.237***	0.237***
				(0.053)	(0.053)
JETRO presence dummy					0.244**
					(0.120)
Explanatory variables for choice of Nest (continent)					
Continent GDP per capita	0.067	1.021*	1.826**	0.273*	0.249
	(0.811)	(0.580)	(0.749)	(0.152)	(0.157)
Continent GDP growth (t-5)/t	8.457***	8.388***	4.957***	6.220***	6.192***
	(1.144)	(1.157)	(1.292)	(1.200)	(1.206)
Average time difference	-0.997	0.104	0.112	-0.768	-0.712
	(3.099)	(1.603)	(1.376)	(0.520)	(0.538)
Investment * Country	269 916	239 587	239 587	219 964	219 964
Investment	3 252	3 143	3 143	2 924	2 924
LR test (IV=1)	77.73***	57.47***	69.57***	56.71***	54.28***

Standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

4.2.b. Sample decomposition depending on affiliate's and parent's characteristics

Our second approach divides the sample according to the affiliates' local sales ratio and the parent's size and TFP respectively.[28] The latter two indicators are measured in the same way as in the previous sub-section, while the local sales ratio of the affiliates corresponds to the average share of sales absorbed in the local market as declared by the affiliates. Table 4 displays results based on our benchmark specification while splitting the dataset into above and below median observations with respect to the three affiliate and parent characteristics listed above.[29] Results are reported for both the conditional (fixed effects) and nested logit estimators. While the coefficient point estimates are somewhat different across the estimation methods, significant differences emerge between subsamples that are robust across the estimation methods. The left-hand side panel of Table 4 explores heterogeneity between affiliates with a local sales ratio above or below the median of 92% (the median is greater than the mean, which is 72%). Affiliates with higher local-sales ratios are more sensitive to distance, market access, supply access and the presence of a JETRO agency. Greater responsiveness to these four determinants for affiliates providing appropriate and cheap products to local customers is arguably logical. Conversely, affiliates with less of an interest in the local market appear to be more sensitive to Japanese agglomeration. Possibly their activities are mostly in relation to sourcing from or to other Japanese firms, and they are thus less dependent on local market (demand and supply) conditions.

Regarding parent's characteristics, only limited heterogeneity is found with respect to size, although below median size parents respond more to JETRO presence and less to distance. Turning to the TFP cut-off, more productive parents appear to be less sensitive to almost all the explanatory variables, possibly because their above-median productivity mitigates the difficulty pertaining to distance or outlet constraints. Their location choices seem to value supply access to a greater extent. These findings may relate to the capacity for productive firms to better exploit competition between suppliers. On the contrary, location decisions by less-productive parents seem to be more sensitive to location advantages such as proximity, market access and quality of institutions. Moreover, less-productive parents are more responsive to Japanese agglomeration as well as JETRO. It is indeed likely that less-productive firms rely heavily on information networks (from JETRO agencies and other Japanese firms in the host country) to reduce the costs of entering and operating in foreign countries.

[28] Additional decompositions were conducted, notably based on the previous overseas investment experience of the parent firm. No major difference was found between the subsamples with and without previous overseas experience.

[29] Very similar findings result from using the mean as the split-sample criterion. These are available upon request from the authors.

Table 3: Investigation of destination parent-related specific features (Conditional logit)

	1	2	3	4	5	Nested Logit
Ln Distance to Japan	-0.361***	-0.015	-0.261***	-0.253***	-0.339***	-0.256***
	(0.081)	(0.089)	(0.078)	(0.077)	(0.081)	(0.081)
Ln GDP per capita	-0.582***	-0.625***	-0.525***	-0.522***	-0.572***	-0.554***
	(0.056)	(0.057)	(0.054)	(0.054)	(0.057)	(0.050)
Ln Market Access	0.184***	0.214***	0.197***	0.196***	0.182***	0.172***
	(0.047)	(0.046)	(0.046)	(0.046)	(0.047)	(0.043)
Ln Supply Access, t-1	0.191***	0.179***	0.136**	0.141**	0.202***	0.193***
	(0.059)	(0.058)	(0.058)	(0.058)	(0.060)	(0.054)
Ln Backward Linkages, t-1	0.266***	0.285***	0.308***	0.306***	0.265***	0.248***
	(0.033)	(0.032)	(0.032)	(0.032)	(0.034)	(0.033)
Jap. Agglomeration (Ln no. of Jap. affiliates), t-1	0.388***	0.355***	0.315***	0.313***	0.378***	0.421***
	(0.046)	(0.042)	(0.041)	(0.041)	(0.046)	(0.045)
Spillover Ln no. of surrounding parents having an affiliate	0.298***	0.270***	0.271***	0.279***	0.305***	0.234***
	(0.039)	(0.038)	(0.038)	(0.038)	(0.039)	(0.044)
Ln ICRG, t-1	1.215***	1.382***	0.987***	0.964***	1.160***	1.603***
	(0.319)	(0.321)	(0.312)	(0.310)	(0.319)	(0.261)
JETRO presence	0.234*	0.043	0.256**	0.259**	0.238**	0.306***
	(0.121)	(0.127)	(0.121)	(0.121)	(0.121)	(0.118)
China*Ln(parent's TFP)	-0.647**				-0.303	-0.324
	(0.291)				(0.315)	(0.325)
China*Ln(parent's employment)	-0.045***				-0.045***	-0.029**
	(0.014)				(0.014)	(0.014)
OECD*Ln(parent's TFP)		0.908***				
		(0.287)				
OECD*Ln(parent's employment)		0.064***				
		(0.014)				
US*Ln(parent's TFP)			0.489		0.600	0.526
			(0.373)		(0.403)	(0.343)
US*Ln(parent's employment)			0.001		-0.014	-0.006
			(0.023)		(0.025)	(0.022)
Western Europe*Ln(parent's TFP)				1.464***	1.469***	2.055**
				(0.423)	(0.446)	(0.879)
Western Europe*Ln(parent's Employment)				0.179***	0.164***	0.083
				(0.042)	(0.043)	(0.079)
Fixed effects by continent	Yes	Yes	Yes	Yes	Yes	Yes
Investment * Country	218 381	218 381	218 381	218 381	218 381	218 381
Investment	2 903	2 903	2 903	2 903	2 903	2 903
Pseudo R-squared	0.40	0.40	0.40	0.40	0.40	
LR test (IV=1)						54.57***

Standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 4: Results depending on parent and affiliate features: local sales content of affiliates and size and TFP of parent (Conditional & nested logits)

	Affiliates local sale ratio				Parent's size (number of employees)				Parent's Total Factor Productivity			
	Conditional Logit		Nested Logit		Conditional Logit		Nested Logit		Conditional Logit		Nested Logit	
	Above median	Below median	Above median	Below median	Above median	Below median	Above median	Below median	Above median	Below median	Above median	Below median
	1	2	3	4	5	6	7	8	9	10	11	12
Ln distance	**-0.341*** **	-0.161	**-**	-0.091	**-0.282*** **	-0.201	**-**	-0.174	-0.207**	**-0.344*** **	-0.223**	**-**
	(0.098)	(0.127)	(0.100)	(0.113)	(0.091)	(0.147)	(0.095)	(0.162)	(0.104)	(0.116)	(0.106)	(0.112)
Ln GDP per capita	-0.555***	-0.498***	-	-0.577***	-0.550***	-	-	-0.476***	-0.509***	-0.547***	-0.488**	-
	(0.070)	(0.084)	(0.064)	(0.071)	(0.063)	(0.102)	(0.059)	(0.093)	(0.070)	(0.084)	(0.072)	(0.073)
Ln Market Access	**0.274*** **	0.098	**0.219** **	0.138**	0.207***	0.179**	0.143**	0.158**	0.144**	**0.270*** **	0.121*	**0.243** **
	(0.060)	(0.070)	(0.056)	(0.059)	(0.054)	(0.086)	(0.050)	(0.079)	(0.061)	(0.070)	(0.062)	(0.063)
Ln Supply Access, t-1	**0.177** **	0.031	**0.214** **	0.104	0.103	**0.212***	0.142**	0.245**	0.173**	0.074	0.193***	0.183**
	(0.073)	(0.094)	(0.070)	(0.070)	(0.067)	(0.113)	(0.065)	(0.110)	(0.076)	(0.0887)	(0.074)	(0.080)
Jap. Agglo (Ln no. of Jap. aff.), t-1	0.268***	**0.435*** **	0.261**	**0.531*** **	0.330***	0.273**	0.365**	0.292***	0.275***	**0.403*** **	0.330***	**0.394** **
	(0.051)	(0.069)	(0.051)	(0.052)	(0.048)	(0.077)	(0.052)	(0.074)	(0.052)	(0.066)	(0.063)	(0.057)
Ln Backward Linkages, t-1	0.308***	0.309***	0.304**	0.239***	0.301***	0.333**	0.283**	0.325***	0.334***	0.262***	0.318***	0.240**
	(0.040)	(0.053)	(0.041)	(0.046)	(0.036)	(0.064)	(0.038)	(0.065)	(0.041)	(0.050)	(0.042)	(0.049)
Spillovers Ln no. of aff. Created by	0.243***	0.286***	**0.262** **	0.111***	0.282***	0.262**	0.260**	0.203**	0.287***	0.241***	0.194***	0.190**
surrounding firms (country/year)	(0.048)	(0.061)	(0.054)	(0.034)	(0.045)	(0.070)	(0.067)	(0.080)	(0.049)	(0.058)	(0.069)	(0.050)
Ln ICRG, t-1	0.925**	1.071**	1.115**	1.584***	**1.035*** **	0.886	1.185**	1.165**	0.591	**1.461*** **	0.478	**1.458** **
	(0.394)	(0.501)	(0.307)	(0.318)	(0.360)	(0.609)	(0.292)	(0.521)	(0.398)	(0.496)	(0.403)	(0.331)
JETRO presence	**0.326** **	0.099	**0.302** **	0.080	0.148	**0.573** **	0.141	**0.556** **	0.119	**0.419** **	0.131	**0.407** **
	(0.152)	(0.198)	(0.153)	(0.198)	(0.139)	(0.250)	(0.139)	(0.250)	(0.164)	(0.179)	(0.164)	(0.178)
Observations: Investment* Country	136 165	83 799	136165	83799	157 317	61 064	157317	61064	122 7640	95 617	122 7640	95 617
Investment	1811	1113	1811	1113	2091	812	2091	812	1632	1271	1632	1271
Pseudo R-squared	0.39	0.42			0.40	0.41			0.39	0.41		

Standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

Overall, our results are consistent with recent findings (Sakakibara and Yamawaki, 2008; Kiyota *et al*., 2007 and Ito and Fujao, 2006) suggesting that the profitability of Foreign Direct Investment is conditional on parent and host country features. They point to significant heterogeneity in the responses of investors to the determinants of location, depending on the characteristics of the investing firm and the affiliate. Diversity emanates from the parents' different strengths and weaknesses: greater size and TFP appear to mitigate the need for an easy outlet (high market access and low distance) and thus the sensitivity to networks (Japanese agglomeration) and spillovers (JETRO agencies). Conversely, more-productive parents seem to make the best out of a developed Japanese community and intense competition between local suppliers.

5. CONCLUSION

This paper has examined the determinants of location choices of foreign affiliates by Japanese firms, using a new data set that matches affiliates and parents over the 1995–2003 period. The analysis is based on new economic geography theory, thus integrating the effect of market and supplier access, as well as production and trade costs.

We first investigate, in addition to the traditional determinants of location choice, the importance of agglomeration and spillover effects on firms' decisions through the use of proxies relating to the presence of Japanese affiliates in the host country as well as Japanese multinational firms at home. Our results confirm the economic importance of information-sharing and network effects, both at home and in the host country, as well as the traditional determinants such as production and transaction costs, and market and supply access.

These findings help explaining why affiliates tend to cluster in the same regions. We confirm the economic importance of three forms of relatedness for Japanese firms. The first two concern the host location: the choice of a country depends positively on the number of already established affiliates in the same industry and on the number of downstream affiliates originating from the same country. The third form captures proximity at home (in the same Japanese prefecture) to parents having affiliates in the same destination country. Our results suggest that clusters of affiliates from the same country of origin (here Japan) may form regional production networks, selling intermediate inputs to each other, sharing knowledge and therefore lowering production costs.

Our second contribution relates to heterogeneity of determinants of outward investment location depending on parent and host country features. We find that the effects of the key determinants of location choice vary substantially with the characteristics of the investing firm and the affiliate. Less-productive and smaller parents are more likely to create affiliates in China rather than in Western Europe or an OECD country. This result suggests that the choice of investing in more distant and competitive markets is positively correlated with firm productivity. This is in line with recent advances in the literature explaining FDI decisions by firm-specific features (Helpman *et al*. 2004). Moreover less-productive parents appear to be more sensitive to location advantages such as proximity, market access and the quality of institutions. Also they seem to value more the information networks provided by JETRO agencies and other Japanese affiliates abroad. More productive firms on the other hand tend to be more responsive to supply access. Regarding differences pertaining to

affiliates, our results suggest that affiliates with higher local sales ratios tend to be more sensitive to distance and also to factors facilitating the provision of products suited to local customers (market access, supply access and the presence of a JETRO agency).

We interpret our findings of the greater sensitivity to distance and institutional quality for less-productive firms as evidence of greater impediments to internationalization when productivity is low. Alternatively, the greater responsiveness of low-productivity firms to the presence of a JETRO agency or a Japanese community indicates that networks and spillovers may help to mitigate those impediments. These results would appear to support policies encouraging collaboration between Japanese firms and the dissemination of information targeted at small and less-productive firms.

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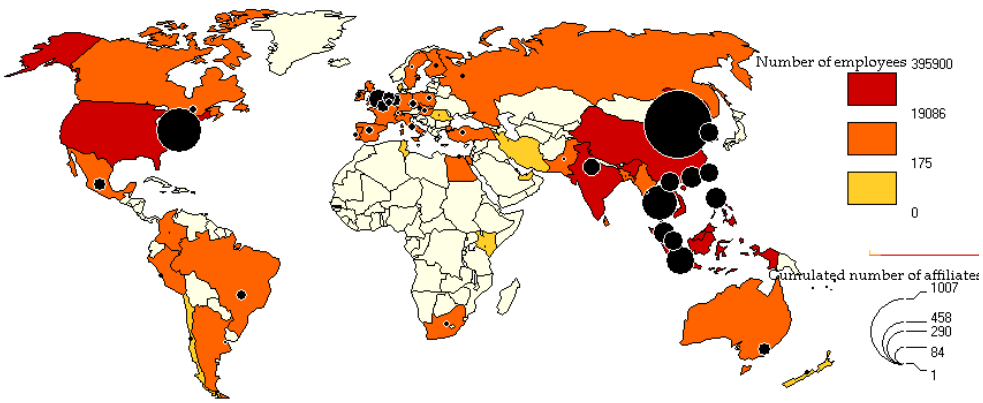
APPENDIX A

Table A-1 Explanatory variables: creation of Japanese affiliates 1995-2003 (by sector)

Sector	Name	Number of projects
1	Textile	124
2	Other Manufacturing	553
3	Chemicals	467
4	Basic Metal	166
5	Fabricated metal products	100
6	Industry machinery and equipment	306
7	Office, service industry and household eqt	32
8	Household electric appliances	61
9	Electronic data processing machines,	65
10	Communication equipment	166
11	Electronic parts and devices	271
12	Miscellaneous electrical machinery	194
13	Motor vehicles, parts and accessories	614
14	Miscellaneous transportation equipment	32
15	Precision instruments	101
	Total	3,252

Map 1: Cumulated number of affiliates created between 1995 and 2003, and number employees (2002)



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