"Slicing the Value Chain" Internationally: Empirical Evidence on the Offshoring Strategy by French Firms*

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Abstract

This paper analyzes the offshoring strategy from an empirical view. It focuses on firm heterogeneity, asset specificity and search costs. On the basis of theoretical models, it extracts a set of testable hypotheses and creates a suitable set of variable to test their validity. This analysis is based on a data set from French manufacturing firms that provides detailed information on the offshoring strategy. The choice of offshoring modes is investigated through the estimation of a multinomial logit model and associated to a set of explanatory variables at the firm, industry and country levels. The results emphasize the role of firm heterogeneity, input specificity and of market thickness.

Keywords: Offshoring, Foreign Direct Investment, Outsourcing, Property Rights Theory, Transaction Costs.

JEL Classification: D23, F14, F23, L22

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1 Introduction

Globalization is changing the patterns of the international economy. Foreign direct investment (FDI) and international trade are growing faster than world GDP. The decline of trade barriers and of transportation costs is the most perceptible explanation of the growing internationalization of economies but it explains only a part of the growth of FDI and trade. Many observations, case studies (Feenstra, 1998; Hummels et al., 1998) and empirical analysis (Campa and Goldberg, 1997; Feenstra and Hanson, 1999; Hummels et al., 2001) indicate that the cause is the changing structure of the economic activity toward vertical specialization.

The increase in international activities and vertical specialization has raised several questions and concerns in the academic sphere as well as in the political and public opinion. The growth of input's trade has created fears of job losses and production delocalizing from developed toward developing and low wages countries. The question of vertical specialization has mainly been addressed theoretically. Grossman and Helpman (2003), Grossman and Helpman (2004) Antras (2003), Antras and Helpman (2004) are examples of the theoretical literature trying to explain firm's offshoring strategy.[1] This literature puts forward the importance of firm heterogeneity and of sector characteristics (headquarter intensity, capital intensity) in the prevalence of one mode

[1]Here we define offshoring as the delocalization of production to a different country. This delocalization can either take place within the firm boundaries, through vertical FDI, or at arm's length, through international outsourcing.

of vertical specialization over the others. Although these models have similar aspects they differ significantly in their conclusions, especially regarding the sorting pattern of heterogenous firms and offshoring choices. As stated by Antras and Helpman (2004): "*Empirical evidence is needed to discriminate between [them] the models*", which is the aim of this paper. For the time being the empirical evidence on the determinants of the offshoring strategy is very scarce especially at the firm level. Antras (2003), Yeaple (2006) and Nunn and Trefler (2008) present evidence from the Unites States (U.S.) while Marin (2006) analyze the case of Germany and Austria. In all these papers data is aggregated by industry and country.[2] The share of intra-firm trade in imported inputs is related to industry and country characteristics. These papers put forward the significance of R&D and capital intensities as well as the development levels of countries.

The aim of the paper is to present evidence on the determinants of the offshoring strategy. It focuses, mainly, on three aspects of offshoring that have received particular interest in the theoretical literature: firm heterogeneity, asset specificity and search costs. On the basis of the theoretical literature the paper will draw a certain number of testable hypotheses related to these three aspects and test their validity. The empirical analysis presented in this paper is based on the "International intra-group exchanges" survey realized by the French ministry of economy for the year 1999. This survey provides very rich information on the structure of French trade and allows the analysis of

[2]The country refers to the country of origin of the imported inputs, where the offshoring is taking place.

the offshoring strategy by combining firm level, industry level and country level characteristics. This investigation corresponds to the estimation of a multinomial logit model at the transaction level.[3]

The analysis shows that firm heterogeneity is a significant determinant of the choice of the mode of offshoring. Most productive firms organize their offshoring transactions through partnerships while the least productive firms vertically integrate. Firms with intermediate levels of productivity outsource their inputs to independent suppliers. The analysis also shows that, as predicted by the property right theory of the firm (Grossman and Hart, 1986), intensity in headquarter services and input specificity favor vertical integration. On the country level, the results show that market thickness enhances arm's length transactions while the quality of the contractual environment is significant for the establishment of partnerships with foreign firms.

2 Vertical FDI vs International Outsourcing: Asset Specificity, Search Costs and Firm Heterogeneity

This section presents the theoretical arguments related to the role of asset specificity, search costs and firm heterogeneity in determining the choice between vertical integration and outsourcing. The analysis of the firm's scope can mainly be connected to three

[3]Each transaction has three dimensions, the offshoring firm, the imported input and the exporting country.

theories of the firm: the transaction costs and the property rights theories (Williamson, 1975; Grossman and Hart, 1986; Hart and Moore, 1990), the theory of the firm as an incentive system (Holmstrom and Milgrom, 1994) and the theory of formal and real authority in organization (Aghion and Tirole, 1997). This paper is based on theoretical models related to the transaction costs and property rights theories since these theories are the most widely used to analyze the organization choices.

The transaction costs and property rights theories stipulate that real word contracts are incomplete. Parties engaged in a relationship need to renegotiate ex-post, after the production has took place and the production costs have been incurred, to set the price of the transaction and to bargain over the rents it generates. Ex-post renegotiation and bargaining are problematic when a transaction requires a relation specific investment (RSI) by one or the two parties. Relation specific investment implies that the input is tailored to the specific needs of the parties engaged in the relationship and that it has no, or a very weak, value for an outside party. Parties with a limited outside option and thus a weak bargaining power fear to be "held-up" and not to receive the full marginal return on their investment. Foreseeing this outcome, they will realize sub-optimal levels of investment.

The property rights theory of the firm, developed by Grossman and Hart (1986), Hart and Moore (1990) and Hart (1995), emphasizes that the optimal allocation of ownership rights needs to depend on the parties specific investment.[4] Ownership rights increase

[4]In the context of this theory, contract incompleteness and hold up problems are not specific to outsourcing. Transactions within integrated firms are also subject to incomplete contracts.

ex-post bargaining power and reduce ex-ante under-investment. The allocation of ownership rights to the party realizing the most valuable specific investment, for transaction, will lead to the optimal outcome by reducing the severity of under-investment by this party.

Antras (2003) and Antras and Helpman (2004) build on the property rights theory of the firm to model the decision to offshore as well as the choice of the mode of organization of the offshored production. Antras (2003) associates asset specificity with investment in capital. His model supposes that inputs are produced using the combination of two factors; capital and labor. Because of contracts incompleteness, relation specific investments in capital and labor are non-contractible ex-ante. Antras (2003) extends the Grossman and Hart (1986) framework and considers that investment decisions in capital are transferable between parties.[5] The model shows that, when the bargaining power of the supplier is weak, the final good producer improves its profit by baring the capital investment costs of its supplier. This will reduce the severity of the hold-up problem. At equilibrium and in the presence of capital cost sharing[6] vertical integration is optimal in capital intensive sectors while outsourcing is optimal in labor intensive ones. At the international level, Antras (2003) shows that, for any pair of countries, the volume of intra-firm imports as well as the share of intra-firm imports in

[5]Labor investment decisions are harder to transfer. Local suppliers may have a better knowledge of the labor market, moreover managing workers may require a physical presence in the plant.

[6]The case where the final good producer covers the costs of capital investment.

total imports of a country increase with the capital-labor ratio of the exporting country. Antras and Helpman (2004) consider a final good producer, located in the North, who faces four choices of production: vertical integration, outsourcing at home, vertical FDI and international outsourcing. The production of the final good requires two inputs, headquarter services and manufacturing components. The first input can only be produced in the North by the final good producer while the manufacturing component can be produced either in the North or the South through vertical integration or outsourcing. The model assumes that the final good producer has a higher bargaining power under vertical integration than under outsourcing and that his bargaining power is higher when the production takes place in the North. Production costs are lower in the South because of the low wages while fixed costs of organization are lower in the North because of the geographical proximity between parties. At equilibrium, the difference in inputs' intensity tends to be a significant determinant of the offshoring strategy. Antras and Helpman (2004) show that a higher headquarter services intensity favors home sourcing over international one and favors the prevalence of integration over outsourcing. The Antras (2003) and the Antras and Helpman (2004) models confirm the conclusions of the property rights theory; when the transaction is intensive in the services of the final good producer, vertical integration is the optimal mode of organization and when the transaction is intensive in the services provided by the supplier, outsourcing is preferred.

Another element that influences the choice between vertical integration and outsourc-

ing as well as the location of the production is the degree of contract incompleteness. Grossman and Helpman (2005, 2003) investigate the influence of contract incompleteness on offshoring modes. Grossman and Helpman (2005) consider the choice between domestic and international outsourcing while Grossman and Helpman (2003) analyze the choice between international outsourcing and vertical FDI.[7] Both models assume that a fraction of the specific investment is verifiable by court. The remaining part of the investment is subject to incomplete contracts. The extent of the verifiable fraction depends on the quality of the legal system in the location where the production is taking place. Grossman and Helpman (2003) show that the relative prevalence of international outsourcing increases with the quality of legal system in the host country. Grossman and Helpman (2005) show that an improvement of the legal system in one location enlarges the profitability of outsourcing in that location but also affects the demand for labor and, hence, the level of wages in that location. The net effect on the flows of outsourcing toward the location is ambiguous and depends on the initial quality of the legal system in both locations.

Antras and Helpman (2008) build on Antras and Helpman (2004) and Acemoglu et al. (2007) to investigate the role of the quality of the legal system in determining the choice of vertical specialization. The final good producer and the supplier realize a continuum of relation specific activities to produce the intermediate inputs needed for the production of the final good. Only a fraction of these activities is verifiable by court and thus

[7] In the Grossman and Helpman (2005) model vertical integration is ruled out of the model and in the Grossman and Helpman (2003) one the international location is endogenously imposed.

contractible. The degree of contractual friction differ across locations but also from one input to the other and depends on the mode of organization.[8] Antras and Helpman (2008) show that an improvement of the quality of the legal system in the South leads to an increase of offshoring. Such improvement can raise either vertical FDI or international outsourcing depending on how it impacts the contractibility of activities provided by final good producers and of activities provided by suppliers. The relative prevalence of one mode of organization over the other depends on the difference of contractual frictions across countries but also on the extent to which the quality of the legal system is biased toward headquarter services or manufacturing components.

An important determinant of the firm's scope is the cost necessary to find a suitable partner. Grossman and Helpman (2002, 2003, 2005) consider the implications of search costs on the firm choice. Unlike the traditional framework of the transaction costs and property rights theories that focuses on the relationship between two agents the Grossman and Helpman (2002, 2003, 2005) models introduce the interdependence among firms choices. These models consider two types of final good producers: integrated ones and specialized ones. The suppliers need to customize the input to the technological needs of final good producers. The cost of customization depends on the technological distance between the supplier and the final good producer. In comparison to vertical integration, outsourcing implies fixed cost of search. Before establishing

[8]The production of headquarter services takes place in the North but the fraction of contractible activities related to the production of this input depends on the location of the supplier, at home or in the South.

a transaction, specialized firms need to search and find a suitable partner depending on the technological compatibility. The interaction between firms is twofold. A rise in the number of specialized suppliers will increase the probability of a match and reduce the search costs faced by a specialized final good producer raising its profit. However, an increase in the number of specialized final good producers will reduces the probability of a match and the profits received by each one of them. An important determinant of the ownership decision, at equilibrium, is the thickness of the market.[9] Grossman and Helpman (2003) show that, at equilibrium, the prevalence of international outsourcing over vertical FDI is enhanced by the size of the downstream industry. More precisely, an increase in the size of the industry, represented by the fraction of aggregated spending addressed to this industry, will increase the number of final good producers and thus the demand for suppliers services. Consequently, the entry by independent suppliers will increase and each final good producer will find more easily a relatively close supplier.[10] Regarding the location decision, Grossman and Helpman (2005) show that final good producers prefer to search for partners in a thicker market in order to increase the likelihood of finding a closer input supplier. The location choice depends also on customizing technologies represented by the use of computer-aided design for

[9]McLaren (2000) considers the interdependence between firms choices as well as the determinant effect of market thickness but the analytical mechanism that he develops is different from the one elaborated by the Grossman and Helpman (2002, 2003, 2005) models. In the Grossman and Helpman (2002, 2003, 2005) models market thickness acts on the vertical specialization choice through the search costs. In the McLaren (2000) model the market thickness influences the industry equilibrium through its impact on parties' outside option.

[10]The distance between the final good producer and the supplier is in terms of technological compatibility. It corresponds to the distance between the supplier expertise and that of the final good producer and will affect the customizing cost.

example, and search technologies, represented by the use of information and communication technologies (ICT). A Disproportionate improvement of these technologies in one location will result in a shift of outsourcing toward this location. The technological catch-up, a larger use of computers and ICTs or a larger internet coverage ratio, in certain emerging and developing countries may explain the boost of production delocalization toward these countries.

Another significant element for the firm's choice between outsourcing and vertical integration on one hand, and between domestic and international outsourcing on the other hand is productivity. Within an industry firms are heterogeneous and present different levels of performance. Each form of vertical specialization requires a certain level of fixed organizational costs. These fixed costs are different from one strategy to the other. It is straightforward to assume that offshoring requires higher organizational costs than domestic sourcing because of the geographical distance between parties and the need to organize a transaction in two different environments.[11] However, the theory on offshoring does not present a definite assumption on the hierarchy of fixed costs between outsourcing and vertical integration. On one hand, vertical integration raises governance inefficiencies but allows the firm to benefit from economies of scope in management. On the other hand outsourcing raises search and transaction costs but reduces governance inefficiencies. The hierarchy of fixed costs is important because it will de-

[11]The parties engaged in offshoring transactions will need to adapt, among others, to the differences of language, of management culture and of legal systems.

termine which firms will adopt which mode of vertical specialization. Only the most efficient firms will be able to support high fixed costs and to generate profits from costly strategies. Since offshoring necessitates higher costs than domestic sourcing, firms that engage in offshoring strategies will be more productive than the ones that source at home. Among the firms that offshore the most productive ones will outsource or integrate depending on the relative extent of fixed costs. Antras and Helpman (2004, 2008) assume that fixed costs of vertical integration are higher and show that, when integration takes place, the most productive firms engage in FDI while the least productive ones outsource at home.[12] Grossman et al. (2005) assume the opposite structure of fixed costs and find that most productive firms engage in international outsourcing.[13]

3 Data Description

The empirical analysis presented in this paper is based on a data set extracted from the "International intra-group exchanges" ("Enquête sur les Échanges Intra-Groupe") survey conducted by the French ministry of economy in 1999. One of the main objectives of the survey was to analyze the strategy of French firms, and especially French groups, toward globalization and how this strategy is affecting the organization of their inter-

[12] Antras and Helpman (2004, 2008) show that in sectors intensive in manufacturing components vertical integration is never profitable. In these sectors, the most productive firms engage in international outsourcing and the least productive ones outsource domestically.

[13] The assumption by Grossman et al. (2005) is more appropriate when "the economies of scope in management exceed the managerial overload integration.

national trade transactions. This investigation resulted in a unique data set of 4305 individual firms located in France and controlled by 2023 international and industrial groups. It covers, on average, 55% of the French imports and 61% of the French exports. Each firm has to provide for each of its international trade transactions the value of the transaction, the classification of the imported or exported product (following the 4 digits CPA classification) as well as the country of origin (imports) or destination (exports). For each transaction, firms have also to precise the organization mode. They report the share of the transaction traded with an affiliated firm, the share traded with partners and the share traded with third parties or independent suppliers. The survey considers as partnership: technological alliances, licensing agreements, franchise and subcontracting agreements. It is thus possible to identify three modes of organization for the offshored production: vertical integration (associated with intra-group trade), partnerships (associated to trade with partners) and arm's length transactions (associated to trade with independent suppliers). Since each firm reports separately each of its transactions, there are several observations per firm. More than half of the transactions are entirely realized with third parties, almost 30% are entirely realized within the group and only 4% of the transactions are partially or entirely realized with partners. This paper focuses on firms in manufacturing sectors. The data set is limited to manufacturing affiliates, from which I exclude natural resources sectors,[14] and to import transactions. The final number of firms is 2790. Figure 1 illustrates the offshoring structure in the

[14] Antras (2003) considers that the patterns of ownership in natural resources sectors may be determined by factors such as national sovereignty.

sample. It shows, that French firms imports their inputs mostly from Northern countries.[15] It shows also that the dominant mode of organization is outsourcing regardless of the location.[16]

The "International Intra-group exchanges" survey focuses on the determinants, motivations and evolution of intra-group trade. It shows that, for the majority of the firms, this decision is taken at the headquarter level and not at the firm level. Regarding the choice of realizing international trade transactions within the group, the survey shows that the control of the production process plays an important role in the decision to trade within the group. For 63% of the firms, the control of the quality of the production is a motivation to supply within the group. The control of the marketing strategies and of the after-sale service is a valid argument in favor of intra-group trade for almost 54% of the firms. Another important matter for firms seems to be the cost of organization; 66% of them prefer intra-group trade in order to reduce organizational costs and 60% of the firms choose internalization in order to be supplied with more stability and at lower costs. This is a significant indication on the structure of fixed organization costs, it tends to confirm the assumption by the Grossman et al. (2005) model.

The data set has been completed with information on the productive activity of firms. This information is extracted from the firm annual survey "Enquête Annuelle

[15]The distinction between the North and the South follows the World Bank definition of developed and developing countries.

[16]Outsourcing combines trade with partners and with independent suppliers.

d'Entreprise (EAE)" realized by the French ministry of industry. The "EAE" survey provides data on the activity of firms such as output, sales, value-added, number of employees, stock of capital, investment and use of intermediates. This data allows the estimation of the total factor productivity (TFP) of firms, the construction of several control variables and the identification of the sector of main activity. Moreover, I have constructed several variables at the industry and country levels using the OECD statistical sources and the World Bank development database.

4 Methodology and Variables

This paper focuses on the offshoring strategy, it does not analyze domestic sourcing nor the choice between domestic and international sourcing. Three modes of offshoring are considered: FDI, partnerships and outsourcing. I assume that a transaction is realized under FDI if 50% or more of its value is imported from affiliated firms. Similarly, I assume that a transaction is organized by a partnership (outsourcing) if 50% or more of its value is imported from a partner (third party). As a robustness check I also present results where the cut-off defining the nature of a transaction is 100%.

I have analyzed the choice of offshoring strategies by estimating a multinomial logit model. Each firm faces three different choices to organize its international trade transactions. A multinomial logit model allows the simultaneous estimation of these three choices. More precisely the specification of the multinomial logit model is as follows:

$$Prob(Y_i = j) = P_{ij} = \frac{e^{\beta_j' x_i}}{\sum_{k=1}^{3} e^{\beta_j' x_i}} \quad j = 0, 1, ...j$$

P_{ij} is the probability that the dependant variable, the choice of an offshoring startegy, takes the value j at the ith observation. As mentioned earlier, j can be FDI($j = 1$), partnership ($j = 2$) or outsourcing ($j = 3$). x_i is the vector of explanatory variables at the firm, the industry and the country levels.

However, the model is unidentified in the sense that there are more than one solution to β_1, β_2 and β_3 that lead to the same probabilities for Y_1,...Y_3. The identification of the model imposes that one of the choices is defined as a base group and its β set to zero. The remaining coefficients would, thus, measure the relative change with respect to the base group. I first set outsourcing as the base group:

$$\frac{Prob(Y_i = j)}{Prob(Y_i = 3)} = e^{\beta_j' x_i}$$

I interpret the point estimates of the multinomial logit as changes, induced by a change in the explanatory variables, to the probability of a choice with respect to the base group. This means that the choice j (FDI, partnership) will be more or less likely relative to the base group (outsourcing). Secondly, I set FDI as the base group in order to have the relative likelihood of partnerships compared to FDI. The choice of each mode of offshoring is associated to a set of variables reflecting firm heterogeneity, asset specificity and search costs.[17]

[17]Details of the variables definition and construction are presented in table 3.

In addition to the analysis of the choice of mode of organization, I present results from a Poisson estimation where the the dependant variable is the share (in percentage) of the value of the transaction traded under a certain mode of organization. The Poisson estimation will analyze the relative prevalence of each mode of organization for each transaction. A Poisson regression takes account of the presence of zeros, the absence of a certain mode of organization for a certain transaction, and since all independent variables are expressed in logarithm the coefficients can be interpreted as elasticities (Silva and Tenreyro, 2003; Yeaple, 2006).

As measures of firm heterogeneity I use the firm's total factor productivity, estimated using the semiparametric methodology proposed by Olley and Pakes (Olley and Pakes, 1996)[18], and scale, measured by the number of employees. I expect the pattern of firm heterogeneity to follow the structure of organizational costs. Larger firms have the possibility to spread the fixed costs of organization on a larger scale and thus maintain a competitive average cost of production. I assume that the productivity may be affected by the offshoring strategy, for this reason I use a two years lag of TFP as explanatory variable. I also include the wage level in the exporting country. Wage represents the cost of production in the offshoring location. Lower wages in a certain location favor international sourcing from this location. Antras and Helpman (2004) show that a fall in the level of foreign wages will reduce the cost of offshoring and pushes some of the

[18]I estimate TFP separately for each sector using the entire "EAE" data set. The purpose of the O&P methodology is to overcome the selection and simultaneity problems faced by the econometrician when estimating productivity.

firms that source domestically to adopt an offshoring strategy. These firms will adopt the mode of offshoring associated with the lowest level of fixed costs, the only one they can afford. The effect of wages on the relative prevalence of one offshoring mode over the other depends on the structure of fixed organization costs.

To control for relation specific investments I create a certain number of variables representing asset specificity at the firm and product levels. I associate asset specificity with R&D and capital intensities. Two variables measure the asset specificity at the firm level: "Headquarter Services Intensity" measured as the ratio of R&D expenditures to total production at the two digit industry level and "Capital Intensity" measured as the ratio of capital (fixed asset) stocks to total employment at the three digit sectoral level.[19] Following the predictions of the transaction costs and property rights theories, these variables are expected to favor vertical FDI. Two other variables represents asset specificity at the product level: "Input Specificity" measured at R&D intensity at the imported product level and "Capital Intensity" measured as the ratio of capital (fixed asset) stocks to total employment at the three digit sectoral level.[20] Input specificity represents the RSI required for the production of the input and indicates the extent of transaction costs related to the transaction. A higher input specificity increases transaction costs as well as the severity of hold-up problems. The input specificity variable is expected to increase the prevalence of vertical FDI. In the presence of investment cost

[19]In the case of these variables the sectoral classification is related to the main activity of the importing firms. I have also measured R&D intensity as the ratio of R&D expenditures to value added but the results are very similar across these two measures.

[20]In the case of these variables the sectoral classification is related to the imported input's industrial classification.

sharing, as proposed by the Antras (2003) model, the capital intensity at the input level is expected to favor vertical FDI. The Antras (2003) models also predicts that, in the presence of investment cost sharing, the prevalence of vertical FDI increases with the relative capital endowment of the exporting country. To verify the validity of this assumption, I add a variable representing the capital endowment measured as the ratio of capital stock to the labor force in the exporting country. I also control for the quality of the legal system in the exporting country by adding a "Rule of Law" variable that corresponds to the "Rule of Law" variable from the Kaufmann et al. (2003) governance database for the year 1999. A better legal system reduces the transaction costs related to contract enforcement, reduces risks related to the hold-up problem and is expected to favor partnerships and outsourcing compared to FDI.

Finally to investigate the significance of search costs I create a series of variables representing the size of the market as well as the state of search technologies. The variable "Market Thickness" represents the easiness to find a suitable supplier, it is thus expect to have a positif impact on partnerships and outsourcing. It corresponds to the employment level in manufacturing industries in the exporting country. Two variables, "ICT" and "Internet Diffusion" represent the state of serach technologies in the exporting country. "ICT" corresponds to the per capita expenditures on information and communication technologies while "Internet Diffusion" is measured as the number of internet users per 1000 people. A good level of search technologies reduces search costs, it is expect to favor partnerships and outsourcing. The variable "Industry Size" represents the

relative significance of the firm's industry. According to Grossman and Helpman (2002, 2003) the size of the firm's industry may have two opposite effects on the organization choice. On one hand, a larger downstream industry increases the demand for suppliers's services, induces the entry by specialized supplier and creates a thicker upstream market. On the other hand, a larger downstream industry means a larger number of final good producers searching for suitable suppliers which makes it harder and more costly for each one of them. In the theoretical framework, with two countries, the size of the downstream industry is measured at the level of the importing country. In the real world, it is more concrete to assume that demand for suppliers' services depends on the global size of the downstream industry and not only on its size in France. The measure of the industry size is constructed using the "Trade and Production" data base of the CEPII.[21] It corresponds to the share of the the industry output in the total manufacturing output worldwide. The vector of explanatory variables include two control variables at the level of the exporting country: the GDP per capita and the Distance from France.

5 The Results

Results of the multinomial logit estimation are presented in table 1. The first (fourth) column compares FDI to outsourcing, the second (fifth) column compares partnership

[21] A detailed presentation of this data base is available in Mayer and Zignago (2005).

to outsourcing while the third (sixth) column compares partnership to FDI. In the first three columns the threshold defining the mode of organization is 50% of the value of the transaction. In the last three columns the threshold is 100%.

The multinomial logit estimation shows that variables representing firm heterogeneity enhance the prevalence of partnerships. Productivity as well as scale reduce the probability of vertical integration relatively to outsourcing, moreover they enhance the probability of establishing partnerships in comparison to outsourcing and FDI. To summarize, more productive firms and larger ones offshore their production through partnerships, firms with intermediate levels of productivity and scale establish arm's length transaction with independent suppliers and relatively small and low productive firms offshore through vertical integration. The pattern of firm heterogeneity suggests that partnerships and outsourcing agreements are associated with higher organization fixed costs than vertical integration and confirms the assumption by Grossman et al. (2005). This result is also in line with the firm's perception and evaluation of fixed costs. As mentioned earlier, a larger share of the firms covered by the survey specified that they turn to vertical integration in order to reduce organizational costs. Partnerships requires higher fixed costs than outsourcing probably because they are associated with complex contracts and a costly search process. The wage level in the exporting country has a negative effect on the relative probability of vertical FDI. This results means that when foreign production costs decrease, a larger share of domestic firms are able to incur the offshoring costs and to switch from domestic to foreign sourcing. Since these firms are

less productive than the ones engaged in offshoring, they will switch to the least expensive mode of organization, vertical FDI.

The second point I consider is related to asset specificity. The transaction costs theory predicts that, when input specificity is significant, transaction costs related to outsourcing are high and vertical integration is more efficient to organize production. The property rights theory puts forward that when the transaction is intensive in the final good producer's specific investment vertical integration is optimal. The results confirm both these hypotheses. Both measures of headquarter services intensity (the headquarter intensity and the capital intensity at the firm level variables) and input specificity favor FDI in comparison to outsourcing as well as partnerships. Interestingly, these measures increase the relative probability of outsourcing compared to that of partnerships. This result means that, in the presence of significant asset specificities, when firms do not integrate they do not establish long term and contractually complex relationships. They prefer to source from independent suppliers probably awaiting the establishment of an affiliate in the exporting country.

The results contradict the assumptions of the Antras (2003) model. More precisely, table 1 shows that capital intensive inputs are traded through arm's length transactions, especially with independent suppliers. The variable representing capital intensity at the input level reduces the probability of vertical integration relative to that of outsourcing and partnerships. The relative capital abundance of the exporting country reduces

the relative probability of vertical FDI. The results of the Antras (2003) models depends on the assumption of transferability of investment decisions. Jabbour (2006) provides an empirical analysis of the transferability of investment decision assumption based on data from French manufacturing industries and shows that this assumption is valid only in industries sensitive to input specificity, especially the ones intensive in R&D expenditures. When input specificity is not significant the hold-up problem does not occur because the supplier can always sell the input to a third party and, thus, will always realize an optimal level of investment. Capital intensive inputs are not necessary specific assets, for this reason final good producers do not need to engage in investment cost-sharing with their suppliers in these industries and thus vertical integration is not optimal for the offshoring of these inputs.

Regarding the impact of the quality of the legal system the theory does not present conclusive predictions. The results show that the rule of law variable matters only in the case of partnerships, it favors partnerships relatively to vertical integration and in some specifications over outsourcing. However, it does not affect the choice between FDI and outsourcing. This result suggests that partnerships are associated with more complex contractual agreements than outsourcing.

Another significant element of the organizational choice of offshored production is the market thickness in the exporting country. Market thickness will determine the search effort required by each final good producer to find a suitable partner. When

the search costs are very high, vertical integration is optimal. The results confirm this assumption. In countries with thicker markets, firms prefer the establishment of contractual relationships. The market thickness variable reduces the relative probability of vertical FDI in comparison to outsourcing as well as partnerships. However, the market thickness variable has no significant impact on the choice between outsourcing and partnerships, since both mode of organization require the search for a suitable partner. The quality of the search technologies also affect the choice of offshoring modes similarly to the market thickness. A higher level of search technologies reduces the search costs and decreases the necessity for vertical integration. The search technologies are represented by two country specific variables, the internet diffusion and the investment in ICTs. Interestingly, these two variables do not have the same effect. The internet diffusion variable favors the relative probability of outsourcing in comparison to vertical FDI as well as partnerships while having no significant effect on the choice between FDI and partnerships. The ICT variable increases the probability of partnerships relatively to that of FDI and of outsourcing while having no significant impact on the choice between FDI and outsourcing. The internet diffusion variable represents a basic level of information technologies while the investment in ICTs represents the effort made to upgrade and improve the available information and communication technologies. The fact that investment in ICTs favors partnerships suggests that this mode of offshoring gives place to an exchange of information and technology as well as monitoring and control. Relationships between parent companies and their affiliates also give place to

flows of information and technology, however these flows are easier to channel between integrated firms and depend, to a lesser extent, on the technological state of the host country. Arm's length relationships with independent suppliers do not seem to engage the firms in information and technology transfer. Moreover, if outsourcing corresponds to relatively short term relationships (in comparison to partnership) it requires recurrent search and matching process which may explain its sensitivity to the basic levels of search technologies.

The size of the downstream industry favors long term relationships, vertical integration and partnership, relatively to outsourcing. It also enhances the probability of partnerships in comparison to FDI. This result may be explained by the double effect of the size of the downstream industry on search costs. A large number of final good producers increases the entry by specialized suppliers as well as the competition for their services. Each final good producer, in a large industry, prefers to establish a long term relationship to avoid recurrent high search costs, and the entry by specialized suppliers enhances the attractiveness of partnerships compared to vertical integration. Most of these results are robust to the definition of mode of organization with the 100% threshold.[22]

Table 2 presents the results from the poisson estimation and confirms the results discussed above. The variables representing firm heterogeneity, productivity and scale,

[22]The use of the 100% threshold results in the loss of a significant number of positive outcomes related to partnerships and may explain why some coefficients become no significant.

reduce the share of intra-firm trade and trade with partners in the value of a transaction and increases the share of partnerships. Moreover, the value of the coefficients are higher in the case of FDI in comparison to outsourcing suggesting a stronger negative effect on intra-firm trade. These results confirm the pattern of firm heterogeneity presented earlier. The coefficients on the variables representing search costs validate the results of the multinomial logit estimation. The thickness of the market in the exporting country reduces intra-firm trade while increasing the modes of organization, partnerships and outsourcing, that are sensitive to the availability of independent suppliers. The investment in ICTs enhances the share of partnerships while reducing that of intra-firm trade and the level of internet diffusion increases the share of outsourcing to the detriment of the two other modes of organization. The size of the downstream industry raises the share of long-term relationships, especially partnerships and reduces that of outsourcing. The variables representing relation specific investment by final good producers as well as by suppliers favor the prevalence of vertical integration and reduce trade outside the firm, especially partnerships. The quality of the legal system in the exporting country has no significant effect on the share of outsourcing and a positive effect on the share of FDI and partnerships but a stronger effect in the case of partnerships.

6 Conclusion

This paper presents an empirical analysis of the offshoring strategy by French manufacturing firms. Offshoring can take place within the boundaries of the firm, through FDI, or at arm's length, with independent suppliers. Offshoring can also be organized through certain "Hybrid" forms of organization such as the establishment of long term partnerships. This paper focuses on three aspects of the offshoring activity: firm heterogeneity, asset specificity and search costs. On the basis of theoretical models analyzing these aspects, it defines a certain number of testable hypotheses and empirically investigates their validity.

The paper studies the offshoring strategy by applying a multinomial logit model as well a Poisson estimation of the relative prevalence of the organization modes. The results confirm the significance of firm heterogeneity as a determinant of firm's offshoring choices as expressed by the models of Antras and Helpman (2004, 2008) and Grossman et al. (2005). The pattern of firm heterogeneity, represented by the productivity and scale, validates the assumption by Grossman et al. (2005) that organizational costs are higher in the case of outsourcing in comparison to vertical integration.

The results validate the conclusions of the transaction costs and property rights theories regarding asset specificity. In the presence of relation specific investment and because of contract incompleteness, contractual agreements (outsourcing and partnerships) raise transaction costs and vertical integration is preferred. The variables representing asset

specificity enhance the relative probability of vertical integration as well as the share of vertical integration in the value of a transaction. The results contradict the conclusions of the Antras (2003) model concerning the effect of capital abundance of the exporting country and of the capital intensity of the imported input on the structure of international trade. The paper also shows that search technologies and market thickness are significant determinants of the mode of offshoring. As expected by Grossman and Helpman (2003, 2005), market thickness as well as the quality of search technologies enhance contractual agreements in comparison to vertical FDI.

Given the scarcity of the empirical evidence on internationalization and vertical specialization, this paper offers a significant contribution to the growing literature on this subject. The empirical analysis is based on a large set of firms and allows the clear definition of organizational modes and to control for determining elements at the firm, industry and country levels. The main contribution is to present empirical answers to the assumptions presented by the theoretical literature. As mentioned earlier, this paper focuses on theoretical models based on transaction costs and the property rights theories of the firm, yet the literature on internationalization includes also theoretical contributions based on alternative theories like the theory of managerial incentives and that of formal and real authority. A natural extension of this work will be to present empirical investigation of these alternative theories and to confront their validity in the explanation of the internationalization strategy.

Table 1: The Choice of Offshoring Strategies: A Multinomial Logit Estimation

Base Group:	Outsourcing		FDI	Outsourcing		FDI
	(FDI)	(Partnership)	(Partnership)	(FDI)	(Partnership)	(Partnership)
TFP (Lagged)	–0.08*	1.29***	1.37***	–0.137***	2.15***	2.29***
	(0.044)	(0.12)	(0.124)	(0.05)	(0.14)	(0.15)
Firm Scale	–0.055***	0.58***	0.63***	–0.084***	0.52***	0.6***
	(0.007)	(0.018)	(0.018)	(0.008)	(0.02)	(0.02)
Wage	–0.21***	–0.36***	–0.16**	–0.23***	–0.22***	-0.008
	(0.036)	(0.069)	(0.075)	(0.04)	(0.08)	(0.09)
Market Thickness	–0.13***	–0.014	0.116***	–0.104***	–0.009	0.095***
	(0.009)	(0.023)	(0.024)	(0.01)	(0.027)	(0.029)
ICT	–0.36	0.45***	0.485***	–0.016	0.179	0.195
	(0.059)	(0.11)	(0.12)	(0.065)	(0.13)	(0.14)
Internet Diffusion	–0.072**	–0.14**	–0.067	–0.098***	–0.052	-0.047
	(0.029)	(0.064)	(0.068)	(0.033)	(0.079)	(0.083)
Industry Size	0.147***	0.59***	0.446***	0.035**	0.57***	0.538***
	(0.014)	(0.039)	(0.04)	(0.016)	(0.04)	(0.04)
Headquarter Intensity	0.166***	–0.176***	–0.34***	0.163***	–0.029	–0.193***
	(0.009)	(0.024)	(0.025)	(0.01)	(0.028)	(0.029)
Capital Intensity	0.077***	–0.26***	–0.338***	0.103***	–0.329***	-0.104***
(Firm level)	(0.017)	(0.047)	(0.049)	(0.02)	(0.05)	(0.02)
Input Specificity	0.143***	–0.026	–0.16***	0.147***	–0.087***	–0.234***
	(0.009)	(0.023)	(0.024)	(0.011)	(0.027)	(0.028)
Capital Intensity	–0.217***	–0.096**	0.121***	–0.233***	–0.207***	0.26
(Product level)	(0.016)	(0.041)	(0.018)	(0.05)	(0.041)	(0.05)
Capital Endowment	–0.549***	0.824***	1.37***	–0.54***	0.317*	0.86***
	(0.065)	(0.13)	(0.14)	(0.073)	(0.17)	(0.18)
Rule of Law	0.32	0.38**	0.35	0.084	0.82***	0.73**
	(0.103)	(0.202)	(0.21)	(0.11)	(0.11)	(0.3)
GDP per capita	0.85***	–1.06***	–1.91***	0.89***	–0.63**	–1.52***
	(0.11)	(0.21)	(0.23)	(0.12)	(0.26)	(0.028)
Distance	0.125***	0.25***	0.128***	0.143***	0.108***	–0.034
	(0.012)	(0.029)	(0.03)	(0.013)	(0.035)	(0.03)
No. of obs	62815	62815	62815	55193	55193	55193
Log Likelihood	-38882.88	-38882.88	-38882.88	-30756.123	-30756.123	-30756.123
Pseudo R2	0.046	0.046	0.046	0.045	0.045	0.045

All independent variable are in natural logarithm. ***, ** and * represent respectively statistical significance at the 1%, 5% and 10% levels. In the first three columns the threshold defining a mode of organization is 50% of the value of the transaction. In the last three columns the threshold is 100%.

Table 2: The Prevalence of Offshoring Strategies: A Poisson Estimation

	(FDI)	(Partnership)	(Outsourcing)
TFP (Lagged)	–0.118***	1.56***	–0.029***
	(0.003)	(0.012)	(0.002)
Firm Scale	–0.046***	0.5***	–0.006***
	(0.0006)	(0.001)	(0.0003)
Wage	–0.145***	–0.25***	0.05***
	(0.003)	(0.007)	(0.001)
Market Thickness	–0.087***	0.007***	0.027***
	(0.0008)	(0.002)	(0.0004)
ICT	–0.036***	0.338***	–0.004
	(0.005)	(0.011)	(0.002)
Internet Diffusion	–0.037***	–0.087***	0.014***
	(0.002)	(0.006)	(0.001)
Industry Size	0.065***	0.49***	–0.024***
	(0.001)	(0.003)	(0.0006)
Headquarter Intensity	0.119***	–0.11***	–0.026***
	(0.0008)	(0.002)	(0.0004)
Capital Intensity	0.074***	–0.306***	–0.013***
(Firm level)	(0.001)	(0.004)	(0.0008)
Input Specificity	0.117***	–0.077***	–0.03***
	(0.0008)	(0.002)	(0.0004)
Capital Intensity	–0.159***	–0.102**	0.046***
(Product level)	(0.001)	(0.0007)	
Capital Endowment	–0.406***	0.629***	0.97***
	(0.005)	(0.013)	(0.003)
Rule of Law	0.018**	0.42**	– 0.25
	(0.008)	(0.02)	(0.004)
GDP per capita	0.62***	–0.925***	–0.145***
	(0.009)	(0.02)	(0.005)
Distance	0.092***	0.135***	–.036***
	(0.001)	(0.002)	(0.0006)
No. of obs	62815	62815	62815
Log Likelihood	1900735.8	-515285.24	-1309246.6
Pseudo R2	0.033	0.13	0.015

All independent variable are in natural logarithm. ***, ** and * represent respectively statistical significance at the 1%, 5% and 10% levels. The dependent variables are the share of the value of transaction traded under the specified mode of organization: FDI, Partnership or Outsourcing.

Figure 1: The Offshoring Structure

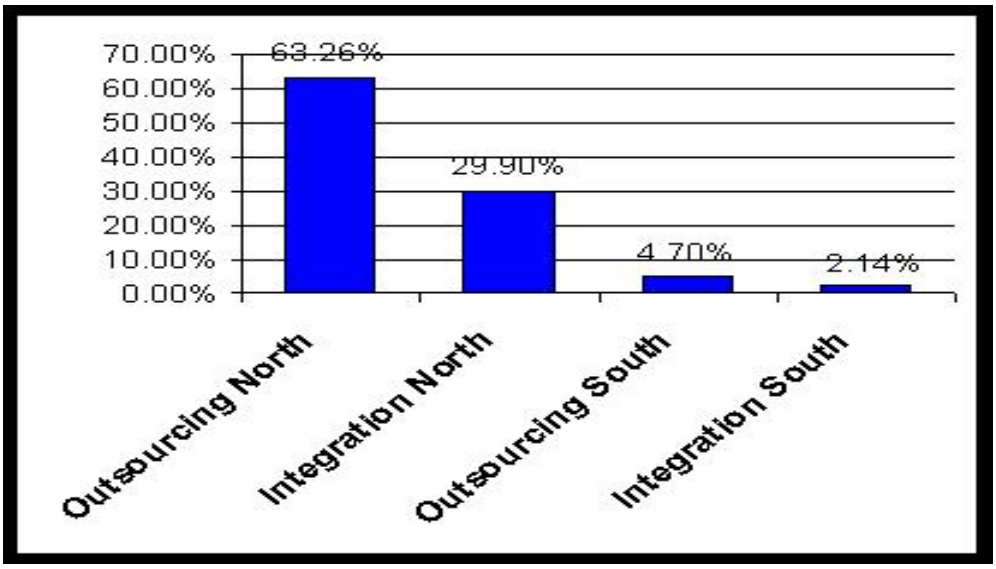

Table 3: Variables Definition

Variable	Description	Source
TFP	Total factor productivity estimated with the Olley and Pakes (1996) methodology separately for each sector using the entire "EAE" data set.	The firm annual survey
Scale	Number of employees.	"EAE"
Headquarter Intensity	Ratio of R&D expenditures to total production at the two digits industry (firm's main activity) level.	OECD Science & Technology database
Capital Intensity (firm)	Ratio of capital (fixed assets) stock to total employments at the three digits (firm's main activity) level.	The firm annual survey
Input Specificity	Ratio of R&D expenditures to total production at the two digits industry (input's classification) level.	OECD Science & Technology database
Capital Intensity (input)	Ratio of capital (fixed assets) stock to total employments at the three digits (input's classification) level.	The firm annual survey
Capital Endowment	Ratio of capital stock to labor force. The measure of capital stock was constructed following the perpetual inventory method using data on fixed capital formation since 1960 and applying a 15% depreciation rate. I have assumed a 5% pre-sample growth rate to approximate the value of the capital stock at the beginning of the period.	World Bank database
Market Thickness	The employment level in manufacturing industries at the exporting country level.	World Bank database
ICT	Per-capita expenditures on information and communication technologies at the exporting country level.	World Bank database
Internet Diffusion	The number of internet users per 1000 people in the exporting country.	World Bank database
Industry Size	The share of the worldwide industry output in the total worldwide manufacturing output. The CEPII's "Trade and Production" data base presents, for each manufacturing industry following the 2-digits ISIC classification, the total output in each of the 183 countries it covers. The output of each industry is aggregated over all countries. The output is also aggregated over all industries and countries to create a measure of worldwide manufacturing production.	The CEPII "Trade and Production" database
Wage	The wage level in the exporting country.	Rama and Artecona (2002)
Rule of Law	The quality of the legal system in the exporting country.	Kaufmann et al. (2003)
GDP per capita	GDP per capita in the exporting country	World Bank database
Distance	The distance between the exporting country and the offshoring firm. The firm annual survey provides, for each firm, the location at the regional level. The distance variable is measured as the great circle distance between the main city of the exporting country and the main city of the firm's region. The countries' geographical coordinates are from the CEPPI's "Trade and Production" database and those of the French regions are from Crozet et al. (2004). New York, Toronto and Frankfurt are the main cities for the U.S., Canada and Germany.	The CEPII "Trade and Production" database, The firm annual survey and Crozet et al. (2004)

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