

Multiple Offshoring: Evidence for French Firms

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Abstract

Using rich data on the international transactions of intermediate inputs by French firms we document the extent of international second sourcing, the simultaneous use of outsourcing and FDI to procure the same input, or using outsourcing or FDI from different locations. We also explore the firm and component characteristics that make procurement of this type more likely. Initial investigations suggest that international second sourcing is important: indeed in terms of both the number and value of transactions of intermediate inputs they represent the dominant pattern of procurement.

Key Words
JEL Codes

*Preliminary and incomplete
(not for citation at this stage)*

Extensions of the transaction-cost and property-rights models of vertical integration to include the costs of offshoring have generated a rich set of predictions about the patterns of trade in intermediate inputs between countries (Antras, 2003; Antras & Helpman, 2004). Firms source inputs from abroad, they offshore, to take advantage of lower production costs, but whether they source those components in-house or at arm's-length depends on the costs of contracting specialised inputs. The greater are the relationship specific investments involved the more likely the component will be supplied through a vertically integrated affiliate. Other key determinates of these procurement modes and their location include, the factor intensities of industries, such as their intensity in capital or in headquarter services (Antras, 2003; Antras and Helpman, 2004), the size of the market (McLaren, 2000; Grossman and Helpman, 2002, 2005), and the production costs and the degree of contractual frictions in foreign locations (Grossman and Helpman, 2005; Antras and Helpman, 2008) More recent developments in this literature have further allowed for differences in procurement choices across firms within the same industry (Antras and Helpman, 2004, 2008; Grossman et al, 2005). Antras and Helpman (2004) show for example, that only the most efficient firms in an industry engage in offshoring activities where does that undertake vertical foreign direct investment are more efficient that those that outsource the production of inputs.

A number of the hypotheses generated by these new theories have now been tested. Focusing on the input and country level determinants of outsourcing versus FDI Antras (2003), Yeaple (2006) and Nunn and Trefler (2007) for the Unites States (U.S.) and Marin (2006) for Germany and Austria show how a measure of intra-firm imports is explained by industry characteristics, such as intensity in research and development (R&D) and capital, and country characteristics, such as capital abundance and levels of development. Bernard et al. (2008) develop this idea considerably and construct a measure of the share of intra-firm imports in total imports for an input measured at the 10-digit HS level. In addition to confirming previous results generated using more aggregated data they should how product contractibility, measured by the extent of intermediation for the product, combines with governance levels of a country. The share of intra-firm trade is higher for products with low levels of product contractibility sourced from countries with weak governance.

Motivated by the heterogeneous firm models of offshoring a separate branch of the empirical literature has focused alternatively on the firm characteristics that determine different types of supplier relationship. Often, because information on import transactions through outsourcing and FDI is still comparatively rare, the focus is on a single aspect of offshoring

or their total. Examples here include {references}.). Tomiura (2007) compares the characteristics of Japanese firms engaged in international outsourcing, in exports and in foreign direct investment. He shows that globalised firms are larger and more productive than firms that serve just the domestic market; that outsourcers are less capital intensive than globalised firms; and that amongst globalised firms those engaged in foreign direct investment are the most productive and those that export are the least productive.

Using data on all international intermediate input transactions made by a sample of French firms, that includes the relationship with the supplier (whether it is from an affiliate from the same group or a third-party), allows Jabbour (2008) and Defever and Toubal (2007) to model the firm, input and country characteristics that determine the mode of offshoring. In the case of Defever and Toubal (2007) the explanatory variables are those suggested from a theoretical model of offshoring they develop, while in Jabbour (2008) this is a larger number so as to test a number of the predictions from the broader literature on offshoring. Both papers find that firm productivity significantly increases the relative probability of contractual agreements in comparison to vertical integration. Jabbour (2008) also finds this decision to be affected by the size of the firm and average wages, while Defever and Toubal (2007) find a role for extent to which the firm relies on externally produced inputs. Of the country level variables the papers differ in their finding for the quality of the rule of law, this is significant only in Defever and Toubal (2007), while Jabbour (2008) additionally finds that GDP per capita and distance to be important. Finally, of the input characteristics that matter Jabbour finds that asset specificity and the intensity in headquarter services favour the offshoring within the boundaries of the firm and that the market thickness in foreign locations enhances the prevalence of contractual agreements.

In this paper we build on this literature to test a specific prediction of the property rights model of vertical integration: that the optimal integration strategy depends on the party realising the specific investment. The party that realises the specific investment should control ownership rights. As argued by Acemoglu et al. (2005) in the context of domestic outsourcing, this affects the incentives for vertical integration versus outsourcing of producers and suppliers in opposite directions. In this regard the property rights model differs from the transaction cost model of vertical integration, which also suggests that when asset specificity is significant vertical integration is optimal because it reduces opportunistic behaviour by one or both parties, but where the incentives to integrate are symmetric. We apply this model to the data on the imports of intermediate inputs of French firms used previously by Jabbour (2008) and Defever and Toubal (2007).

As in Acemoglu et al. (2005) we also depart from the existing empirical literature on offshoring to focus on technological investments, rather than those in capital, as the source of the hold-up problem. We differ from Acemoglu et al. (2005) in our focus on outsourcing versus integration in an international context. This has an advantage in the current context

We further extend the existing literature on offshoring in two directions. Firstly, the availability of information on offshoring of inputs for each firm at a more disaggregated level allows us to explore the role that the share in total costs of an input has on the method of procurement. By developing the property rights model of Grossman and Hart (1986), Acemoglu et al. (2005) show the greater the share an input accounts for in the total cost for the firm the more likely the supplier will be vertically integrated. Using information on UK firms and a measure of the share in costs calculated from input-output tables¹ and the industry of its plants² find support for their theoretical model. We similarly find strong positive effects from the share in costs on the likelihood of vertical integration in an offshoring model and using a firm-specific measure of cost shares that includes the relationship with the supplier.

The second contribution we make in the paper is to document the extent of mixed offshoring, the simultaneous procurement of the same 4-digit input using both outsourcing and FDI. There are some 22,322³ international transactions of intermediate inputs at the 4-digit level, with a total value of representing €52.6bn. Of these 16 per cent of the number of transactions representing 42 per cent of the total value of imported inputs (a value of €22bn.) refers to procurement through both FDI and outsourcing.

An obvious explanation of this finding is that the HS 4-digit level is too aggregated to fully reflect the procurement choices being made by the firm. Or, given the positive correlations with size and productivity we find, that these source a greater range of inputs internationally, perhaps because they are producing a greater range of products {references}.

An alternative, that we find some evidence in support for, is that this reflects international second sourcing. A separate, and somewhat smaller, branch of the theoretical literature on offshoring extends the strategic interactions that take place between firms and their suppliers, allowing firms to simultaneously source the same components from different

¹ Measured at the 2/3 digit level.

² Measured at the 4-digit level.

³ We define a transaction as the importation of a 4-digit product by a certain firm. Each firm may report several import transactions for the same product (from different location), but we aggregate all these transactions into one observation.

sources. In a direct extension of the Antras and Helpman (2004) framework Du et al. (2006, 2009) for example, show that international second sourcing can be used to counter-balance the disadvantages of the hold-up problem and incentives to invest that occur when procurement is from a single supplier through either FDI or outsourcing. Second sourcing obviously incurs additional set-up and monitoring costs of multiple supplier relationships such that when combined with firm heterogeneity they find that, in both headquarter and component intensive industries, the most productive firms will choose some form of international second sourcing. We are aware of no prior literature that tests the empirical validity of this model, although anecdotal support does exist. Du et al. (2009) cite for example, evidence from Johnson (2007) on the dual sourcing of die-casting molds by Mattel and from Carey and Frangos (2005) on similar arrangements for heavy overhaul work by many U.S. airlines.

From our empirical analysis...

The rest of the paper is organised as follows...

Literature Review

Outsourcing Versus Vertical Integration

Most theories of offshoring rely on either the transaction cost or property rights models of firm boundaries developed by Williamson (1975), Grossman and Hart (1986) and Hart and Moore (1990) amongst others.⁴ Important within both approaches are the concepts of incomplete contracts and the idea that some investments are highly specific to the production of a particular input (Helpman, 2006). For investments of this type, such as those in specialised tools and specific training programmes for workers, their value is greater inside than outside the relationship (Lafontaine and Slade, 2007). Those parties with a weak outside option, and therefore weak bargaining power in the ex-post renegotiation to set prices and bargain over rents that occurs, fear being 'held-up' and not receive the full marginal return on their investment. The transaction costs theory assumes that when asset specificity is significant vertical integration is optimal because it reduces opportunistic behaviour by one or both parties. Within the property rights models the optimal integration strategy depends the party realising the specific investment; the party that realises the specific investment should control ownership rights.

⁴ Leahy and Montagna (2008) show how outsourcing and vertical integration choices might differ amongst otherwise identical firms according to cost and strategic interactions.

The prediction that the that vertical integration affects the investment incentives of firms and their suppliers in opposite directions in the property rights model is exploited in the theoretical and empirical work contained in Acemoglu et al. (2005). Focusing on technological intensity, rather than the capital intensity that has been the focus in the offshoring literature that we discuss below, as the form of relationship specific investment then they show using an extension to the Grossman and Hart (1986) model that the importance of technological intensity of the producer and the supplier have opposite effects on the likelihood of vertical integration. In the setting that we consider in this paper, the purchase of intermediate inputs, vertical integration is more likely when the firm is technologically intensive and less likely when the supplier is more technologically intensive. They also show that these outcomes are more likely the greater is the share of total costs accounted for by the input accounts. This occurs because the scope for holdup up by the supplier is greater when the input accounts for a large share of total costs.

These predictions are tested by Acemoglu et al. (2005) using a combination of plant level information for the UK and input output tables between 1996 and 2001. They generate two measures of vertical integration. The first is a dummy indicating whether the firm owns a domestic plant producing an input (measured at the 4-digit level) used in the production of a product, where input-output tables are used to determine the range of used in the production of a given product. The second captures the proportion of each input that the firm can produce itself. Their empirical results suggest support for their model. The technological intensity of the firm and its suppliers have oppositely signed effects on the probability whether the firm is vertically integrated in that industry pair and these effects are magnified the greater is the share of that input in total costs.

Offshoring

Extended to offshoring, sectoral differences in contract dependency interact with the differences in location specific costs to generate patterns of procurement that differ across industries and geographies. While both outsourced and integrated production have the ability to take advantage of differences in production costs across locations, most obviously lower wage costs, they are assumed to differ in the fixed costs of establishing such relationships. The fixed costs associated with vertical integration refer to the governance costs need to manage a larger hierarchical structure, while those associated with outsourcing refer to the costs needed to search and match with a suitable partner (Grossman and Helpman, 2002) and to write and enforce contracts (Antras and Helpman, 2008). The literature on firms boundaries does not agree on the hierarchy of fixed costs

between vertical integration and outsourcing; for example Antras and Helpman (2004, 2008) assume that these fixed costs are higher in the case of vertical integration while Grossman Helpman and Szeidl (2005) assume the opposite structure.

The two methods of offshoring inputs are also assumed to differ in the efficiency with which they produce the input. Vertically integrated firms are considered to be less efficient (higher variable costs) in the production of intermediate inputs in comparison to specialised suppliers. However, because of contract incompleteness and of asset specificity, transaction costs are higher in the case of outsourcing (Williamson, 1975; Grossman and Hart, 1986).⁵

The main predictions of these models brought to the data include whether capital intensive imports are more likely to be produced inside the firm and sourced from capital abundant countries. Antras (2003), Yeaple (2006) and Nunn and Trefler (2008) using industry level data and Bernard et al (2008) using 10-digit HS level data find support for both of these. Other measures of the characteristics of the input have however proved less robust. Yeaple (2006) finds the share of intra-firm imports is increasing in the R&D intensity of the industry, but like Antras (2003) no role for human capital intensity. In contrast Nunn and Trefler (2008) and Bernard et al. (2008) find a positive correlation with human capital. Bernard et al. (2008) also include in their specifications a measure of product contractibility, measured by the level of intermediation, and find that this leads to lower levels of imports from vertically integrated suppliers.

Offshoring with Heterogeneous Firms

Building on the recent heterogeneous firm models of international trade, Antras and Helpman (2004) and Grossman et al. (2005) consider the possibility that firms within the same industry make different choices about the mode of supply because they have different abilities (productivity) to cover the costs associated with those different organisational forms. In Antras and Helpman (2004) it is the most efficient firms in an industry that engage in offshoring. In the industries intensive in manufacturing components vertical integration is not profitable. In these industries, the most efficient firms establish international outsourcing relationships while the least productive outsource domestically. In the industries intensive in

⁵ Many extensions have now been made to these models. For example, Grossman and Helpman (2003, 2005) consider the extent of contract incompleteness. There may also be further differences across countries because locations have characteristics that make one procurement modes more likely, for example higher quality legal systems as in Nunn (2007), Antras and Helpman (2008) and Acemoglu et al. (2007).

headquarter services both vertical integration and outsourcing take place. The firms sort themselves into the different sourcing strategies according to their efficiency. The most efficient firms engage in vertical foreign direct investment and the least efficient firms outsource in the domestic market. Altering the assumptions about the structure of fixed costs leads Grossman et al. (2005) to the opposite conclusions.

This theoretical extension to allow for differences in the offshore procurement choices made by firms within the same industry is supported by an empirical literature modelling the firm characteristics that determine these choices. Often, because information on both intra inter firm level imports is lacking, these studies are focused on the decision to offshore through outsourcing and/or FDI or not, rather than on the comparison between offshoring and FDI. A small number of studies have considered this second question however.

Consistently this literature has found that firms that have affiliates abroad, or import goods and services, are different from those firms that do not. Tomiura (2005) and Kurz (2006) using data for Japan and the US, respectively, model a firm's decision to outsource and find that more productive firms are more likely to outsource. Similarly Görg et al. (2007) and Criscuolo and Leaver (2005) use firm level data for Ireland and the UK respectively to look at differences in productivity between firms that outsource (i.e., import services inputs from abroad) and those that do not. They also find that outsourcers are more productive than firms that do not engage in offshoring. In a somewhat different exercise, Geishecker et al. (2007) use a large European firm level dataset and investigate the decisions of firms to set up affiliates abroad. They find that firms which locate abroad account for over-proportionally large shares of output, employment and profits in their home countries. They also have higher survival rates and productivity growth than firms that do not locate abroad. Additional evidence can be found in...and Tomiura (2007).

Tomiura (2007) also compares the characteristics of those firms that are engaged in FDI and international outsourcing for Japan, finding that those firms which undertake FDI are more productive than those that outsource.

Jabbour (2008) and Defever and Toubal (2007) use the same data source as this paper, that on the international transactions of French firms. In both cases the dependent variable is a dummy variable indicating whether the firm buys an input from a given country through outsourcing or FDI, and in the case of Jabbour (2008) also through partnerships. Defever and Toubal (2007) focus on a small number of explanatory variables, suggested from a theoretical model of offshoring they develop. Their main explanatory variables are a measure of productivity of the firm, the quality of the contracting environment in the exporting

country and what they label as the supplier's input intensity of production.⁶ Jabbour (2008) in contrast is focused on testing a larger number of predictions from the recent theoretical models of offshoring, in particular the relative productivity of those firms choosing international outsourcing versus FDI, as well as country characteristics such as capital intensity, the quality of the legal system and market thickness and input characteristics such as capital and R&D intensity.

Both find that the probability of vertical integration is decreasing in firm productivity, but interestingly where Defever and Toubal (2007) find an effect from the contracting environment Jabbour (2008) does not, even though both are measured using the 'rule of law' variable from Kaufmann et al. (2006). This is perhaps explained by the additional inclusion of GDP per capita, which are typically strongly correlated with institutional quality variables, within the regression. Of the other explanatory variables used, Defever and Toubal (2007) find that outsourcing is more likely the greater is the firms' use of externally supplied inputs (supplier input intensity), while Jabbour finds this choice is affected by market thickness, headquarter intensity, industry size, distance and in contrast to previous findings in this literature in the capital intensity of the input.

Second Sourcing

Second sourcing⁷ through the simultaneous use of outsourcing and FDI occurs as a means to access the advantages of each procurement method and minimise the disadvantages were they used alone. The most direct extension of the offshoring literature to consider international second sourcing is offered by Du, Lu and Tao (2006, 2009). Using Antras and Helpman (2004) as their starting point they show that by taking advantage of the benefits of outsourcing and vertical integration and balancing their disadvantages. The ownership of the assets influences each party's incentives for investment and the size of the trading surplus. Vertical integration provides the final good producer with a better outside option and a higher effective bargaining power in comparison with outsourcing. Under the second sourcing strategy, the final good producer can use the payoff from his relationship with one supplier as a backup option in its negotiations with the other supplier. This cross-threat effect increases the investment incentives of the final good supplier in comparison with vertical

⁶ This later variable is measured at the firm level and is calculated as the share in total output of all externally supplied inputs, where the numerator is defined by the total amount of inputs supplied to the firm by independent and affiliated suppliers irrespective of their location. They predict that outsourcing is more likely the greater is the share of output that a firm produces externally (the greater is the supplier's input intensity).

⁷ Second sourcing is also referred to as concurrent sourcing; strategic sourcing; bi-sourcing; partial outsourcing; split award contracts.

integration and outsourcing. Du, Lu and Tao (2006) assume that the final good producer negotiate sequentially with the integrated and independent suppliers and show that it is optimal for the final good producer to negotiate first with the integrated supplier. The model shows that second sourcing provides the highest level of production efficiency in all types of industries. In headquarter intensive industries vertical integration is more efficient than outsourcing and is the second best strategy while outsourcing is the least efficient organisation strategy. In component intensive industries outsourcing provides higher level of efficiency than vertical integration and is the second best strategy.

Firms within the industry are assumed to be heterogeneous in their productivity. They find as a consequence that only the most productive firms in the headquarter intensive industry use second sourcing, those with intermediate productivity choose FDI and those with the lowest productivity outsource internationally. In component intensive industries the most productive firms second source, whereas those with lower productivity choose outsourcing. In industries of this type the incentive to make relationship specific investments is high, but an element of vertical integration is useful to reduce the hold-up problem. They further derive results on the mix of outsourcing and FDI in the high-wage North and the low-wage South. The South has the obvious advantage of cost, but the buyer also tries to use what the authors label the balancing effect. For second sourcing to work neither supplier can be too strong. The firm can manage this risk by locating the overly strong (weak) supplier in the high cost North (low cost South).

Other mechanisms have been used to generate second sourcing within the literature. Of those containing an international dimension Alvarez and Stenbacka (2007) use a real options approach allowing firms to manage the supply of inputs in the presence of demand uncertainty. They find that increased uncertainty increases the threshold beyond which firms start to outsource input supply. However once the firm has crossed this threshold and starts to outsource increased uncertainty means this mode of supply is used more intensively. Lin and Mukherjee (2008) show that in the presence of knowledge transfer the firm uses second sourcing to eliminate the incentive for the supplier to enter the final goods market. Finally, Creane and Davidson (2004) consider the motivation for horizontal mergers rather than vertical integration, although it seems likely the specific mechanisms at work could be generalised to the case of intermediate inputs. In their quantity setting model firms merge but leave multi-divisions in order to take advantage available to multi versus single division firms.

The merged firm affects the type of competition that exists between affiliates in such a way as to harm firms outside of the merger.⁸

Data Description:

The data we use in this survey is a combination of the "Enquête Annuelle d'Entreprise (EAE)" and the "International Intra-group exchanges" survey conducted by the French Ministry of Economy via the SESSI (Service Des Etudes Statistiques Industrielles). From the "Enquête Annuelle d'Entreprise (EAE)" we gather information on firm characteristics. This survey is exhaustive, obligatory and concerns all firms with more than twenty employees in the French manufacturing industries. The data on international transactions of intermediate inputs we use is our analysis is from the "International Intra-group exchanges" survey conducted by the French Ministry of Economy via the SESSI (Service Des Etudes Statistiques Industrielles) for the year 1999.⁹ This survey covers all manufacturing firms that own at least 50 per cent of the equity of an affiliate outside of France (so called international industrial groups).¹⁰ We use the import transactions of each of 2535 manufacturing sector plants located within France.¹¹ In part because of limitations on those firms sent the survey, but also because importing firms are relatively rare, the affiliates in the survey represent 12% of the number of affiliates active in census of French manufacturers (the Enquête Annuelle d'Entreprise)¹², but 55 per cent of all total French imports.¹³ We provide further information on the method through which the sample was collected within the Appendix.

The data on import transactions are rich in detail. For each affiliate we have information on each import transaction, the HS classification of that input, how much of that input was with imported from an affiliate in the same group or a third-party and the country from which it

⁸ After the merger the game is structured such that there is staggered competition between the affiliates and Cournot competition between the merger firm and those outside of the merger.

⁹This survey was conducted in order to have a clear picture of the organization and of the structure of international trade by French firms. 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 international trade transactions.

¹⁰ Control rate at least equal to 50 %.

¹¹The information relates to affiliates. These are sub-units of a firm and refer to the level at which operating decisions are made. Within the data an affiliate may include a number of plants. The theoretical literature discusses the role of firms. As a consequence we use firms and affiliates interchangeably when discussing the empirical results.

¹² This coverage ratio varies across industries; from 3.9% in the leather and wearing apparel industry to 30% in the pharmaceutical industry.

¹³ We measure the total number of firms on the basis of the firm annual survey for the year 1999. The firm annual survey covers only the firms with more than twenty employees. Small firms are not accounted for in the survey and in our calculations.

was imported. The import transaction is recorded at the (4 digit) Harmonised System industry. Examples of 4-digit HS codes include 'spark-ignition reciprocal or rotary internal comb piston engines' (4707) and 'compression-ignition internal combustion piston engines' (4708). A consequence of the survey design is that there are many more import transactions than there are HS 4-digit industries. In the first instance we aggregate the information on each transaction to the HD 4-digit level. In Section ~ we exploit the information at the level of the transaction to consider further the idea of second sourcing (each transaction includes the share imported from a foreign affiliate or third-party). Given our focus on the predictions of the models regarding firm and input characteristics we also aggregate the data to ignore the information on country of origin within the data.

Restricting the sample to affiliates that imported at least one input, we define the range of intermediate inputs that a affiliate within a given industry might potentially source internationally by the number of intermediate inputs (HS 4-digit codes) that at least one affiliate in that industry has imported¹⁴. We prefer this over the use of input-output tables, which are available only for a higher level of aggregation (2-3 digit level). Ignoring the different modes through which importing takes place gives 749,506 observations. Defined in this way, just under 3 per cent of the possible combinations of inputs that might be sourced internationally are non-zero. Importing an intermediate input, even when recorded at the 4-digit level, is a rare event.

Figure 1 summarises the distribution of offshoring by mode. There are 22,322 international transactions of intermediate inputs by 2,535 firms within the data, with a total value of representing €52.6bn. Of these transactions 70 per cent of components purchased solely from unaffiliated firms, labelled as outsourcing in the figure, and 14 per cent solely from affiliates within the same group, labelled as FDI. Sixteen per cent or all import transactions within the data involve some a mixture of outsourcing and FDI.¹⁵ In terms of the value of import transactions the mixed transactions involving both outsourcing and FDI are much more important, accounting for some €22bn (42 per cent). This value is about the same as that for outsourcing (41.8 per cent), while that of imports through FDI is 16.1 per cent.

In Table 1 we consider the same information according to the (2-digit) industry in which the firm operates. The table shows for example that there are 370 firms that import at least one

¹⁴ We assume that every firm within each industry uses the same range of inputs, some of which are sourced domestically and some are imported, but do not restrict the quantities it combines these within the production function.

¹⁵ The ability to observe only international purchases on intermediate inputs makes it likely we are underestimating the true extent of second sourcing within the data.

input in the food and beverage sector. Across these 370 firms a total of 295 different inputs (4-digit codes) are imported. No single firm imports all of these inputs, with the average firm importing just 6.6. There is some, but not dramatic variation across industries in the share of imported intermediates in total inputs. At its highest about 9 per cent of all inputs are imported in the leather and wearing apparel sector and 7 per cent in Other Transport. The remaining industries are all in the range 2.2 per cent (Food and Chemicals industries) to 4.8 per cent (Printing and Motor industries).

We also present in the table information on the percentage of transactions of imported intermediates that are sourced using outsourcing, FDI or a mixture of these two across industries. Here the differences across the industry in which the firm operates are much larger, with the greatest variation being in the extent of outsourcing versus second sourcing. Outsourcing represents over 80 per cent of transactions within the Leather and Printing and Publishing industries, and as low as 35 and 38 per cent in the Electric and Electronic Products and Electronic Components industries. Firms in these industries are much more likely to combine outsourcing with FDI, where 53 and 44 per cent of import transactions are of this combined type.

In Table 2 we organise the data according to the industry in which the input originates. As can be there are large differences in the number of inputs that are imported across 2-digit industries, but this does not appear to be related in any way to the prevalence of outsourcing, FDI or second sourcing. A stronger connection is suggested with technological intensity. Products from what are typically thought of as low-technology sectors, such as textiles, leather and wearing apparel and wood and paper are most commonly purchased through outsourcing, whereas those sectors thought of as being R&D intensive such as Electronics, the Motor Industry have lower levels. For these industries the levels of both FDI and second sourcing are more common.

Firms and International Second Sourcing

In Table 3 we display information on output, sales, value-added, number of employees, TFP¹⁶, stock of capital, average wage, investment and use of intermediates by firms within our sample according to the method of procurement by transaction. The firms that appear in the different columns overlap depending on whether the firm uses that combination of

¹⁶ Total factor productivity is estimated using the Olley and Pakes (1996) semi-parametric methodology. We estimate TFP industry by industry on the basis of the “EAE” survey.

outsourcing, FDI or both. For example, a firm might use FDI to source some inputs and outsource others. The firm will therefore appear in the mean for both columns.

In column 1 we present the mean values for the whole sample, while columns 2, 3 and 4 compare the mean values for those firms that source internationally, through either outsourcing (column 3) FDI (column 2), or a mixture of both (column 4), one or more of their intermediate inputs. Compared to the full sample mean, firms that import intermediates are on average larger in terms of employment, have higher value added and capital intensity, but do not have obviously higher TFP, total sales, investment and material inputs. Across columns 2 and 3 and 4 it would appear that firms that outsource have greater sales, TFP, capital stock and investment than those observations for procurement through foreign affiliates, although they are slightly smaller when measured by their number of employees in France. These firms that single source appear somewhat different compared to those who use multiple suppliers in column 4. The firms in column 4 appear noticeably larger, more productive to pay higher wages etc. compared to those that single source.

Products and International Second Sourcing

R&D stock (Table 4) {to be completed}: This variable measures the R&D stock at the 2-digits product level. The R&D stock is calculated using the perpetual inventory method on the basis of R&D expenditures for the OECD countries.¹⁷ The data is extracted from the OECD Science and Technology data base for the period 1990-1999.

Table 5 provides information on the ratio of the imported value of the input over the firm's total cost, where total costs are measured as the sum of the wage bill, the taxes and input purchases. We break this into 5 groups, that less than 5%; 5%-10%; 10%-20%; 20%-50% and greater than 50%. Interestingly most transactions are a very small percentage of total costs: 87% of the transactions are less than 5 per cent of total costs and a further 6 per cent are between 5 and 10 per cent. We also present in the table the share of each of the different cost groups the percentage of observations within each of the 5 different ranges of cost share that involve, FDI outsourcing or a mixture. The table shows for example that of those transactions that represent less than 5 per cent of total costs, 14 per cent are through FDI. In the final row of the table we present the share of the total transactions in each of the procurement modes within the sample more generally (equivalent to Figure 1). Of interest are the deviations from this figure for all observations. The most obvious pattern within the

¹⁷ We assume a 15% annual discount rate and a 5% pre-sample growth rate.

data are that inputs imported through FDI or a mixture of outsourcing and FDI are much more prevalent within the data when the share of the input in total costs increases. Correspondingly transactions involving outsourcing are more common when the value of the transaction in total costs is small. For example, outsourcing accounts for 71 per cent of the transactions with a value of less than 5 per cent and 53 per cent when the value is above 50 per cent. In contrast offshoring using affiliates within the same group accounts for 14 per cent of transactions of less than 5 per cent and 17 per cent when the value is above 50 per cent. The effect for those 4-digit inputs that are imported through FDI and outsourcing is even stronger. These mixed transactions account for 15 per cent of the total when their value is below 5 per cent of total costs and 29 per cent when their value is above 50 per cent.

Market Thickness: This variable is measured as the total number of active establishments at the 2-digits product level. It is calculated as the sum of establishments within the OECD countries. The data is extracted from the OECD Industry Indicators data base. This variable represents the the availability of specialized suppliers. In thicker markets, the probability of finding a suitable partner increases and the viability of outsourcing is higher (Grossman and Helpman, 2005).

Volatility can be used as a proxy for uncertainty. As discussed by Lafontaine and Slade (2007) uncertainty can have different effects on the vertical integration decision depending on the theory. TC theory predicts that uncertainty at the upstream or downstream level should increase vertical integration. PR theory presents different predictions depending on the level where the uncertainty takes place and the effect of uncertainty on the marginal productivity of investment. Lafontaine and Slade (2007) mention several measures of uncertainty among which the variance of sales.

Econometric Evidence

Conclusions

References

{to be completed}

Figures

Figure 1: Percentage of Transactions Through Different Procurement Modes

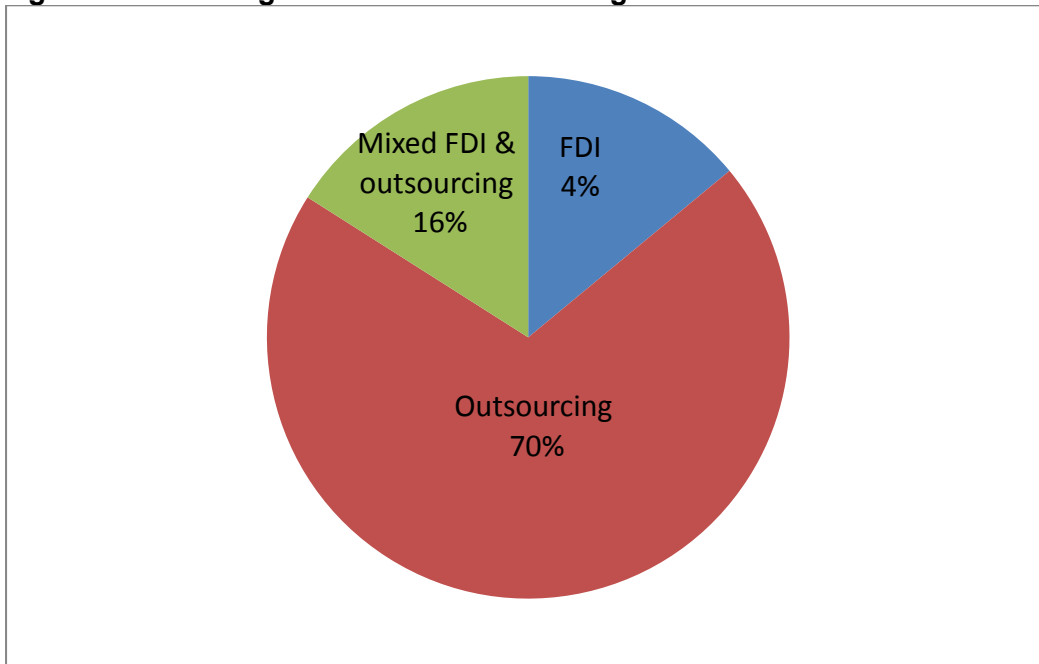


Figure 4: Relative odds from Multinomial Logit Model: Table

Figure 5: Relative odds from Multinomial Logit Model: Table

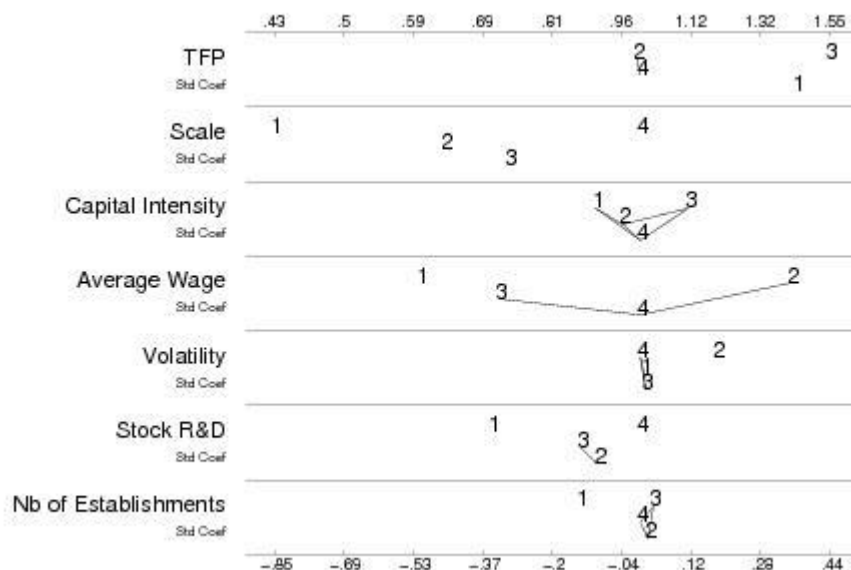
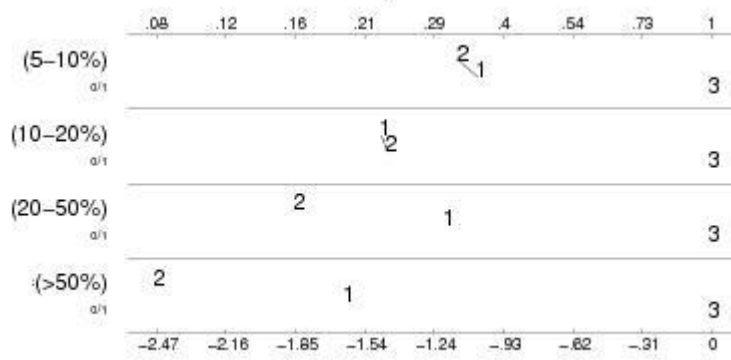


Figure 6: Relative odds from Multinomial Logit Model: Table



Tables

Table 1: Single and Second Sourcing Transaction by Industry of the Firm

Industry	No. of Firms	Set of Inputs	Ave. No. Of Imported Inputs per Firm	% of all Obs.	Offshored by		
					<i>Outsourced</i>	<i>FDI</i>	<i>Second Sourced</i>
Food industry	370	295	6.63	9.29	77.75	7.61	14.63
Leather & wearing apparel	66	169	15.91	5.64	83.35	5.79	10.86
Printing and Publishing	77	80	3.83	1.20	80.84	10.37	8.79
Pharmaceutical	169	304	10.85	6.80	69.59	14.32	16.09
Home equipment	169	356	8.91	6.61	53.76	11.77	34.47
Motor industry	122	219	10.33	6.50	52.02	5.70	42.28
Other transport industry	54	189	13.20	3.47	72.88	4.44	22.68
Mechanical products	391	259	6.27	11.45	56.14	12.46	31.40
Electric & electronic products	208	230	9.06	11.88	35.00	11.57	53.43
Textile	103	228	8.14	3.80	69.67	8.26	22.07
Wood & paper	165	217	8.12	5.51	75.75	8.40	15.84
Chemicals, rubber & plastic products	484	476	10.62	19.31	61.59	11.09	27.32
Electronic components	157	228	9.92	8.54	38.27	17.95	43.79

Table 2: Single and Second Sourcing Transaction by Industry of the Intermediate Input

<i>Product (2 digits)</i>	<i>Set of Inputs</i>	<i>% of all Obs.</i>	Offshored by		
			<i>Outsourced</i>	<i>FDI</i>	<i>Second Sourced</i>
Food industry	120	9.29	66.96	10.59	22.44
Leather & wearing apparel	56	5.64	75.10	6.62	18.28
Printing and Publishing	12	1.20	68.87	13.77	17.36
Pharmaceutical	31	6.80	58.99	17.84	23.16
Home equipment	92	6.61	48.93	10.02	41.05
Motor industry	13	6.50	43.46	8.64	47.90
Other transport industry	18	3.47	60.95	5.81	33.23
Mechanical products	95	11.45	61.53	11.15	27.32
Electric & electronic products	35	11.88	42.30	13.84	43.87
Textile	90	3.80	81.03	7.68	11.29
Wood & paper	51	5.51	71.54	8.74	19.72
Chemicals, rubber & plastic products	205	19.31	66.21	10.52	23.26
Electronic components	26	8.54	38.37	10.59	51.04

Table 3: Firm Characteristics by Single and Second Sourcing

Variable	Total Sample	FDI	Outsourcing	Mixed
TFP	4.21	4.15	4.21	4.32
Output	114003	106482	122677	207092
Sales	127271	128576	134843	232100
Value Added	31842	36757	33395	53893
Scale	521.48	592.85	552.19	821.98
Average Wage	22.80	24.38	22.51	24.03
Investment	12622	6893	14290	26880
Capital Stock	51789	56518	55458	90369
Material Inputs	64252	62460	68075	125623

Note: All monetary figures are expressed in thousands of Euros.

Table 4: Firm Characteristic, Product and Industry Summary Statistics

Variable	Total Sample	FDI	Outsourcing	Mixed
Stock R&D	168596.8	268799.2	249849	285890.8
Market Thickness	36454.7	42774.61	43911.73	40614.77

Note: The Stock R&D variable is expressed in millions of Euros.

Table 5: Share in Total Costs by Single and Second Sourcing

Share in total costs	Percentage share in positive transactions	FDI	Outsourcing	Mixed
Share in total costs (<5%)	86.76%	13.96%	71.41%	14.60%
Share in total costs(5-10%)	6.24%	12.14%	65.55%	22.28%
Share in total costs(10-20%)	3.82%	10.28%	64.43%	25.28%
Share in total costs(20-50%)	2.51%	17.10%	55.21%	27.69%
Share in total costs(>50%)	0.65%	17.23%	53.78%	28.94%
<i>Share in Total Sample</i>		14.00%	70.00%	16.00%

This table presents the share of each threshold in the total number of positive transactions, and the share of each mode of sourcing in the total number of transactions within a certain threshold. For example, the second line of the table show that 86.7% of the transactions represent less than 5% of the total cost of the affiliate and that 38.53% of the transactions, where the value is less than 5% of the cost, are imported through mono-outsourcing.

Table 6: Probit Estimation with industry dummies. Marginal Fixed effects.

VARIABLES	(1) Offshore vs. not offshore	(2) FDI vs. Outsourcing	(3) FDI vs. Outsourcing
<i>Firm Characteristics</i>			
TFP	0.0681*** (0.0120)	-0.0717* (0.0396)	-0.0725* (0.0397)
Scale	0.012*** (0.00796)	-0.0567* (0.0322)	-0.0509 (0.0327)
Average Wage	0.0857*** (0.0131)	0.185*** (0.0571)	0.204*** (0.0581)
Volatility	0.0615 (0.0468)	0.504** (0.221)	0.506** (0.221)
Foreign	0.0818*** (0.0171)	0.557*** (0.0743)	0.554*** (0.0743)
<i>Product Characteristics</i>			
R&D Intensity Producing	-0.0600*** (0.00714)	0.0557* (0.0294)	0.0548* (0.0294)
R&D Intensity Supplying	0.0943*** (0.00598)	0.0123 (0.0194)	0.0141 (0.0195)
Cost Share(5-10%)			0.0493 (0.0527)
Cost Share(10-20%)			-0.0485 (0.0758)
Cost Share(20-50%)			0.342*** (0.0876)
Cost Share(>50%)			0.471*** (0.141)
Market Thickness	0.118*** (0.00506)	0.00811 (0.0169)	0.00957 (0.0170)
Constant	-5.011*** (0.104)	-1.635*** (0.433)	-1.784*** (0.443)
Observations	723385	18267	18267

Notes: Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

Table 6: Probit Estimation with industry dummies. Marginal Fixed effects.

VARIABLES	(1) Offshore vs. not offshore	(2) FDI vs. Outsourcing	(3) FDI vs. Outsourcing
<i>Firm Characteristics</i>			
Labour Productivity	0.0893*** (0.0131)	-0.0742 (0.0556)	-0.0780 (0.0560)
Scale	0.231*** (0.00808)	-0.0631** (0.0316)	-0.0580* (0.0321)
Average Wage	0.0664*** (0.0148)	0.190*** (0.0670)	0.211*** (0.0681)
Volatility	0.0685 (0.0458)	0.454** (0.220)	0.456** (0.220)
Foreign	0.0737*** (0.0172)	0.573*** (0.0733)	0.570*** (0.0733)
<i>Product Characteristics</i>			
R&D Intensity Producing	-0.0668*** (0.00777)	0.0661** (0.0286)	0.0653** (0.0286)
R&D Intensity Supplying	0.0979*** (0.00597)	0.00890 (0.0193)	0.0106 (0.0194)
Cost Share(5-10%)			0.0387 (0.0523)
Cost Share(10-20%)			-0.0609 (0.0762)
Cost Share(20-50%)			0.330*** (0.0871)
Cost Share(>50%)			0.473*** (0.144)
Market Thickness	0.121*** (0.00508)	-0.00214 (0.0172)	-0.000857 (0.0172)
Constant	-5.314*** (0.116)	-1.283*** (0.446)	-1.411*** (0.453)
Observations	744537	18566	18566

Table 7: Multinomial Logit with industry dummies. Base category: Mixed sourcing

VARIABLES	FDI	Outsourcing
<i>Firm Characteristics</i>		
TFP	-0.105 (0.0887)	0.0358 (0.0820)
Scale	-0.452*** (0.0728)	-0.366*** (0.0600)
Average Wage	-0.0969 (0.133)	-0.477*** (0.118)
Volatility	1.117** (0.502)	0.164 (0.309)
Foreign	-0.0390 (0.165)	-1.081*** (0.131)
<i>Product Characteristics</i>		
R&D Intensity Producing	-0.0441 (0.0640)	-0.152*** (0.0564)
R&D Intensity Supplying	-0.101** (0.0416)	-0.130*** (0.0381)
Cost Share(5-10%)	-1.004*** (0.121)	-1.112*** (0.0954)
Cost Share(10-20%)	-1.406*** (0.171)	-1.380*** (0.115)
Cost Share(20-50%)	-1.053*** (0.178)	-1.689*** (0.139)
Cost Share(>50%)	-1.328*** (0.312)	-2.185*** (0.254)
Market Thickness	-0.0261 (0.0394)	-0.0458 (0.0319)
Constant	3.375*** (0.986)	6.573*** (0.817)
Observations	21668	21668

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 9: Transaction level mixed sourcing

VARIABLES	(1) Mixed	(2) Mixed	(3) Mixed
<i>Firm Characteristics</i>			
TFP	-0.237*** (0.0372)	-0.263*** (0.0373)	-0.272*** (0.0378)
Scale	0.153*** (0.0126)	0.169*** (0.0131)	0.173*** (0.0134)
Capital Intensity	-0.0737*** (0.0173)	-0.0760*** (0.0174)	-0.0729*** (0.0176)
Average Wage	0.170** (0.0709)	0.190*** (0.0735)	0.193*** (0.0747)
Volatility	-0.670*** (0.109)	-0.683*** (0.108)	-0.676*** (0.105)
<i>Product Characteristics</i>			
R&D Intensity Producing			
R&D Intensity Supplying			
Cost Share(5-10%)			0.241*** (0.0597)
Cost Share(10-20%)			0.360*** (0.0783)
Cost Share(20-50%)			0.356*** (0.0749)
Cost Share(>50%)			0.389*** (0.135)
Market Thickness		0.00816 (0.0104)	0.00939 (0.0105)
Constant	-1.412*** (0.451)	-2.127*** (0.445)	-2.199*** (0.445)
Observations	61279	61279	61279

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Appendix

The sample to be used in the "International Intra-group exchanges" survey was determined as follows. The identification of international industrial groups is based on the Financial Liaisons survey (LIFI). The LIFI survey provides information on the financial relations between affiliates: it identifies the parent firm as well as the country of origin. The survey was further restricted to affiliates for which the firm has majority control as well as to those belonging to a joint-venture. This generated a sample of 38414 affiliates controlled by 4826 firms. However, only 15 205 affiliates (belonging to 4661 firms) were active in international trade. The framework was then further narrowed to affiliates having an industrial or a commercial activity since they represent 96% of the international trade of the international industrial groups. This limited the sample to 12055 affiliates (belonging to 4582 firms). Finally, the survey was addressed only to commercial or industrial affiliates with more than one million Euros of trade flows or more than 500 thousands Euros of trade flows toward the emerging countries. This limitation reduced sharply the number of affiliates to 8239 (controlled by 4032 firms) while providing a significant coverage of the trade flows. Among these 8239 affiliates, only 4367 answered the survey. This rate of answer covers 53% of the affiliates but 82% of the trade flows of firms. The surveyed firms account for on average 55% of French imports and 61% of exports.

Within this survey each affiliate was asked to provide for every international trade transaction it conducted, the precise relationship between itself and the supplier; the share of the total value of the transaction conducted with an affiliate located abroad, 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.¹⁸ In this paper we consider trade with partners and trade with independent suppliers as "Outsourcing" and that with affiliates located abroad as FDI. This transaction relates to the origin country of the import and the (4 digit) Harmonised System industry. Unfortunately while there are multiple transactions within a 4-digit code from a given destination within the data, relating to different intermediate inputs, the industry classification is not available at a more disaggregated level. Examples of 4-digit HS codes include 'spark-ignition reciprocal or rotary internal comb piston engines' (4707) and 'compression-ignition internal combustion piston engines' (4708). We discuss the implications of this for our definition of second sourcing below.

¹⁸ Since each firm reports separately each of its transactions, there are several observations per firm.

Table 2: Sample Coverage by Industry

Industry	Total Nb of Firms	Nb of Affiliates in the Sample	Coverage Ratio
Food Industry	3110	370	11.9%
Leather and Wearing Apparel	1689	66	3.9%
Printing and Publishing	1823	77	4.22%
Pharmaceutical	554	169	30.5%
Home Equipment	1378	169	12.26%
Motor Industry	554	122	22.02%
Other Transport Industry	305	54	17.7%
Mechanical Products	3639	391	10.7%
Electric and Electronic Products	1205	208	17.26%
Textile	1378	103	7.47%
Wood and Paper	1252	165	13.2%
Chemical, Rubber and Plastic Products	2116	484	22.8%
Electronic Components	876	157	17.9%
Total	19879	2535	12.75%