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*Market Thickness, Sunk Entry Costs, Firm Heterogeneity and the Outsourcing
Decision: Empirical Evidence of Manufacturing Firms in France*

by

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Market Thickness, Sunk Entry Costs, Firm Heterogeneity and the Outsourcing Decision: Empirical Evidence of Manufacturing Firms in France

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Abstract

In this paper I investigate, empirically, the outsourcing strategy by firms in French manufacturing industries. I particularly focus on the effect of the market thickness and of firm heterogeneity on the outsourcing strategy. For this purpose, I estimate a dynamic probit model where I link the decision to outsource to previous outsourcing behaviour. I am able to estimate the sunk entry costs incurred by the firms when adopting an outsourcing strategy. The results show that outsourcing is a persistent strategy adopted by more productive firms and larger ones. They also show that market thickness reduces search costs and enhances the establishment of outsourcing relationships.

JEL classification: D23, L22

Keywords: Outsourcing, Firm Heterogeneity, Dynamic Binary Choice Models, Market Thickness

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Non-Technical Summary

This paper presents an empirical investigation of the outsourcing decision by manufacturing firms located in France. Recent years have witnessed an increase in the outsourcing strategy. A growing share of firms is contracting-out a wide range of activities related to their production process.

The outsourcing strategy is related to a "Make or Buy" decision. A large body of the industrial organization literature has focused on this strategy and on the boundaries of the firm. This literature has put forward the role of asset specificity, specific investment, transaction costs and contract incompleteness (Williamson, 1975, 1985; Grossman and Hart, 1986). While the traditional literature on outsourcing focuses on the relationship between two agents, new theoretical works try to endogenize the firm governance decision and to consider the possible interaction between firms' decisions. For example, Grossman and Helpman (2002) develop a model of organization choice that introduces the possibility of interaction between the strategies of firms.

Most of the existing empirical literature on outsourcing is based on the conclusions of the transaction costs theory and puts forward the determinant role of asset specificity and market conditions. Due to the limited availability of data, a large share of this empirical literature considers the particular case of an industry or a firm. Very few existing studies consider a cross-section of industries and only just recently studies at the firm level have been presented (Klein, 2005; Joskow, 2005).

This paper aims to investigate the outsourcing strategy on the basis of a large panel of firms in sixteen manufacturing industries. It emphasizes the impact of the presence of sunk costs related to outsourcing, the relation between firm heterogeneity and the outsourcing behaviour, and the implication of upstream and downstream market thickness on outsourcing. The outsourcing strategy requires sunk entry costs related to the search and matching process, to monitoring, and to the enforcement of contracts. Because of the presence of these sunk costs, outsourcing is expected to be a persistent strategy. Moreover, firm heterogeneity will impact the outsourcing decision. More productive firms will choose outsourcing while the others will vertically integrate. The size of the market is expected to lower search costs and, hence, to favour the prevalence of the outsourcing strategy (Grossman and Helpman, 2002; McLaren, 2000).

The empirical study is based on the annual firm survey covering all manufacturing firms with more than 20 employees for the period 1990-2001 on the French metropolitan territory.

This survey provides data on the firm's production activity as well as on the firm's characteristics. I am able to identify the firms that contract-out some of their activities and connect the outsourcing decision to the firm and industry characteristics. The results provide evidence on the persistence of the outsourcing strategy. Past outsourcing activity raises the probability of current outsourcing. They also show a significant causality between firm heterogeneity and the decision to outsource. More productive firms and larger ones have a higher probability of outsourcing. Finally, the size of the market seems to favour the establishment of outsourcing relationships.

1 Introduction

"We live in an age of Outsourcing" stated Grossman and Helpman (2005). A growing share of firms is delegating tasks of the production process to independent suppliers. Further, a wider range of tasks is contracted out. Today, not only low-technology manufacturing tasks are outsourced but also services and even Research and Development (R&D) activities.

The outsourcing strategy is related to a "Make or Buy" decision. A large body of the industrial organization literature has focused on the "Make or Buy" strategy and on the boundaries of the firm. This literature has put forward the role of asset specificity, specific investment, transaction costs and contract incompleteness (Williamson, 1975, 1985; Grossman and Hart, 1986). The industrial organization literature assumes that vertical integration imposes costs of governance and is less efficient than arm's length transactions. However, because of asset specificity (related to technology, human capital and localization) arm's length transactions are costly. The production of specific inputs, tailored to the specific needs of a final good producer, requires a specific investment from the supplier. Because of contract incompleteness, the supplier fears to be held up and is thus tempted to realize a suboptimal level of investment.

While the traditional literature on outsourcing focuses on the relationship between two agents, new theoretical works try to endogenize the firm governance decision and to consider the possible interaction between firms decisions. For example, Grossman and Helpman (2002) develop a model of organization choice that introduces the possibility of interaction between the strategies of firms. More precisely, a firm's decision to outsource or to vertically integrate depends on the ownership decision adopted by other firms. The model also shows that firms are sensitive to market thickness, to the degree of competition, to search technologies and to the sensitivity of the production to input specificities.

Most of the existing empirical literature on outsourcing is based on the conclusions of the transaction costs theory and puts forward the determinant role of asset specificity and market conditions. Due to the limited availability of data, a large share of this empirical literature considers the particular case of an industry or a firm. Very few existing studies consider a cross-section of industries and only just recently studies at the firm level have been presented

(Klein, 2005; Joskow, 2005). For example, empirical analysis of the outsourcing decision at the firm level have been presented by Girma and Görg (2004) for the United Kingdom (U.K.), Swenson (2004) for the United States (U.S.), Kimura (2001) and Tomiura (2005) for Japanese manufacturing firms and Holl (2004) and Díaz-Mora and Triguero (2007) for the Spain. Despite these contributions, evidence on the decision to outsourcing based on firm level data is limited and many questions remain open for discussion and analysis.

This paper aims to investigate the outsourcing strategy on the basis of a large panel of firms in sixteen manufacturing industries. It also emphasizes the impact of new elements discussed by the theoretical literature, McLaren (2000) and Grossman and Helpman (2002) for example, such as the presence of sunk costs related to outsourcing, the relation between firm heterogeneity and the outsourcing behavior, and the implication of upstream and downstream market thickness on outsourcing.

The outsourcing strategy requires sunk entry costs related to the search and matching process, to monitoring, and to the enforcement of contracts. Because of the presence of these sunk costs, outsourcing is expected to be a persistent strategy. In other words, firms with previous outsourcing engagements are expected to maintain this strategy. Moreover, firm heterogeneity will impact the outsourcing decision. More productive firms, the ones able to incur the sunk costs, will choose outsourcing while the others will vertically integrate. Regarding the impact of the market thickness, I expect the size of the market to lower search costs and, hence, to favor the prevalence of the outsourcing strategy (Grossman and Helpman, 2002; McLaren, 2000).

These elements have been neglected by the empirical literature on outsourcing. To my knowledge, no other study considers the determinant role of firm heterogeneity nor that of market thickness on the outsourcing activity. The dynamic aspect of the outsourcing behavior has been considered by very few studies that do not present conclusive results.

The empirical study, presented here, is based on the annual firm survey, "Enquête Annuelle d'Entreprises" realized by the French ministry of industry, covering all manufacturing firms with more than 20 employees for the period 1990-2001 on the French metropolitan territory. This survey provides data on the firm's production activity as well as on the firm's characteristics. I am able to identify the firms that contract-out some of their activities and connect the

outsourcing decision to the firm and industry characteristics.

I estimate the sunk costs related to outsourcing by conditioning the current outsourcing decision on the past outsourcing strategy. I measure firm heterogeneity by the total factor productivity (TFP), estimated by the Olley and Pakes (Olley and Pakes, 1996) methodology. I measure the market thickness by the number of employees in upstream industries as well as in the firm's own industry. The thickness of the market at the firm's industry level may have two opposite effects on the outsourcing decision. On one hand, as the number of final good producers increases the demand for suppliers' services increases and thus the entry by independent suppliers will increase which facilitates the search and the matching process for a final good producer. On the other hand, the growth of the number of final good producers may have a crowding-out effect and the intensity of competition may discourage the entry by final good producers.

The results provide evidence on the persistence of the outsourcing strategy. Past outsourcing activity raises the probability of current outsourcing. They also show a significant causality between firm heterogeneity and the decision to outsource. More productive firms and larger ones have a higher probability of outsourcing. Finally, the size of the market seems to favor the establishment of outsourcing relationships.

2 The Determinants of the Firms' Outsourcing Strategy

The aim of this paper is the empirical analysis of the outsourcing decision with a special focus on sunk costs, firm heterogeneity and market thickness. I choose to emphasize the role of these elements to provide evidence on the recent theoretical contributions to the analysis of outsourcing, also because the dynamic aspect of the outsourcing strategy as well as the significance of sunk costs have been neglected by previous empirical work.

2.1 Sunk Entry Costs

As discussed in the introduction, the contracting-out of production engages the firm in fixed costs necessary for the search for a suitable partner, the establishment and enforcement of

contracts, the monitoring of the partner's work and the communication, and technology exchange with the partner. Some of these costs, related to the search for partners and to contracts enforcement, are sunk. Some other costs, related to monitoring and communication with partners may be subject to "learning-by-doing" effects. In this case, the accumulated experience of a firm in dealing with its suppliers will reduce the costs of future transactions with these suppliers or with new partners. The nature of these organizational costs suggests that outsourcing must be a persistent strategy. Firms will want to avoid incurring the same costs repeatedly, they will also want to benefit from their accumulated experience.

A look at the data shows that transition in and out of outsourcing is relatively weak. Figure 1 presents the percentage of firms beginning to outsource as well as the percentage of firms quitting the outsourcing strategy. The first part of the figure presents the annual average and shows that only 5% of firms initiate an outsourcing strategy while only 4% of firms engaged in outsourcing relationships stop their outsourcing strategy. The second part presents the average of entry and exit in each industry and shows a certain degree of heterogeneity among industries. The entry and exits percentages varies from around 8% in the wearing apparel and wood and paper industries to around 2% in the energy sector.

In order to verify the significance of sunk costs related to outsourcing and the persistence of the outsourcing strategy I link the actual outsourcing decision to the past outsourcing behavior. I estimate a discrete choice model (probit) where the actual outsourcing status is conditional on the previous outsourcing status. The sign, the significance as well as the magnitude of the coefficient on the lagged outsourcing status will indicate the presence of sunk costs and their relevance in the outsourcing decision.¹

2.2 Firm Heterogeneity

The presence of significant fixed organizational costs raises the question of firm heterogeneity. From the literature on the export strategy, mainly the papers by Melitz (2003), Bernard and Jensen (2004), and more recently on offshoring like the papers by Antras and Helpman (2004) and Grossman and Helpman (2004), it has been established that, within an industry, firms are not symmetric. Firms display several heterogenous characteristics like differences in

scale, intensity in human capital, and productivity. This strand of the literature usually takes productivity as a measure of firm heterogeneity and shows that the more productive firms are the ones to engage in costly activities, exporting in the case of Melitz (2003) and Bernard and Jensen (2004) or foreign direct investment (FDI) in the case of Helpman et al. (2004).

I assume that organization costs are higher under outsourcing, in comparison to vertical integration, because of the necessity to search for a partner, to enforce contracts and to monitor and exchange expertise with the partner.² Figure 2 compares the cumulative curves of the distribution of the fixed costs of firms engaged in outsourcing relationships and firms that are not for the years 1990, 1996 and 2001.³ Figure 2 shows that, in each of these years, the fixed costs of firms engaged in outsourcing are higher than those of firms without outsourcing relationships.

If fixed costs of organization are higher under outsourcing, I expect productivity to raise the probability of outsourcing. Furthermore, if the firm is large it can spread the costs on a higher number of produced units. Firm's scale is therefore an additional determinant of the outsourcing decision. However, outsourcing gives small firms the opportunity to specialize and to benefit from scale effects. The impact of scale on the outsourcing decision is thus ambiguous. Girma and Görg (2004) have analyzed the impact of scale on outsourcing, measured as the amount of contracted-out industrial services, and have found a significant positive effect of scale on outsourcing. On the other hand, Díaz-Mora and Triguero (2007) have introduced firm's scale as a determinant of the choice of outsourcing and have found no significant effect.

2.3 Market Thickness

The theory of transaction costs as well as that of property rights have, traditionally, considered the vertical relation between two agents. Both theories have neglected the possibility that the decision by one agent might influence the decision by other agents. Recent literature, like the papers by McLaren (2000) or Grossman and Helpman (2002), considers this interaction and proposes new elements like market thickness, the openness to international trade and the degree of competition, as determinants of the "Make or Buy" decision.

McLaren (2000) developed a model of vertical integration that investigates the impact of globalization, or more precisely the openness to international trade, on the vertical integration decision. The McLaren (2000) model considers an industry with a certain number of final good producers requiring a specialized input. The inputs are produced by specialized suppliers. Each pair of final good producer and specialized supplier have two possibilities of organizing their relationship: outsourcing (market transactions) or vertical integration. The novelty of the McLaren (2000) model is that the organizational choice of each pair of firms depends on the choice of the other pairs. Each specialized supplier has the outside option of selling the input to another final good producer. This outside option increases with the number of non-integrated final good producers in the market. The equilibrium price received by a specialized supplier depends on its ex-post bargaining power and increases with its outside option. As the number of non-integrated final good producers grows (a thicker downstream market), the outside option of the specialized supplier as well as the attractiveness of market transactions increase. *"([Specialized Supplier1] is more likely to be able to find an alternative interested buyer to use as a threat point, the more unintegrated firms there are among [final good producers-specialized suppliers] pairs 2 through n"* (McLaren, 2000).

Grossman and Helpman (2002) offer a different view of the link between market thickness and the vertical integration decision. The framework of this model is a world of incomplete contracts, asset specificities and hold-up related risks, where a final good producer needs to obtain a specific input either through vertical integration or through arm's length transactions. In addition to hold-up and ex-post bargaining frictions, market transactions generate search and matching costs. Non-integrated firms need to search for a suitable partner and thus incur fixed search costs. Market thickness will affect the viability and the prevalence of a mode of organization through its impact on search costs. The expected profit of a specialized firm (final good producer or supplier) increases with the number of specialized firms of the other type because it raises the probability of a match. However, the expected profit is reduced with the number of specialized firms of the same type because it increases search costs and lowers the probability of a match.⁴ In the presence of increasing returns to matching, the viability and prevalence of outsourcing will increase with the size of the industry.

In a given industry, a firm's decision to engage in outsourcing agreements is unambiguously enhanced by the thickness of the market in the upstream industries. Nonetheless, it can be positively or negatively affected by the thickness of the market in its own industry. A higher number of firms in the same industry raises competition for supplier services but, at the same time, will create incentives for suppliers to enter the market thus enlarging the thickness of upstream industries. I analyze the link between market thickness and the outsourcing decision through the creation of three market thickness variables; one at the firm's 4 digit industry level, one at the firm's 2 digit industry level and a third one at the level of other industries.

2.4 Other Determinants of Outsourcing

In addition to these elements, I consider other determinants of the outsourcing strategy. I take into account the firm's average wage assuming that a higher average wage increases the probability of outsourcing for two reasons. First, average wage may be an indicator of the firm's labor quality and thus of the firm's productivity. Second, by contracting-out a certain amount of production or a certain set of tasks, firms are able to reduce their variable costs (Abraham and Taylor, 1996). Firms paying relatively high wages may therefore be more sensitive to the possibility of reducing their wage bill and are, thus, more incline to contract-out production. I also control for the presence of economies of scale at the industry level. I consider that, in industries where the economies of scale are significant, firms prefer to outsource in order to capture the gains from the scale effects.

3 The Empirical Analysis

The empirical strategy consists of estimating the following dynamic binary-choice model:

$$Outsourcing_{it} = \begin{cases} 1 & \text{if } \beta X_{it} + \gamma Z_{it} - N \cdot (1 - Outsourcing_{it-1}) + \epsilon_{it} > 0, \\ 0 & \text{otherwise.} \end{cases} \quad (1)$$

where $Outsourcing_{it}$ represents the outsourcing status of firm i in year t , X_{it} is the vector of firm characteristics, Z_{it} is the vector of industry characteristics and N represents the sunk costs related to the entry into the outsourcing strategy.⁵ To avoid potential simultaneity problems between the outsourcing status and the explanatory variable, especially the firm's characteristics, all independent variables are lagged one year. Hence, I estimate the following equation:

$$Outsourcing_{it} = \beta X_{it-1} + \gamma Z_{it-1} + \theta Outsourcing_{it-1} + \epsilon_{it} \quad (2)$$

The estimation of equation 2 raises several econometrical issues, especially the identification of the coefficient on the lagged dependent variable. The persistence in the outsourcing behavior, as in any binary choice setting, can arise from firm heterogeneity and serial correlation in the error term ϵ_{it} or from state dependence. In my specification I control for a set of firm characteristics that reflect firm heterogeneity, however, other firm fixed effects may remain unobservable. If these firm unobservable characteristics affect the outsourcing decision and if they have a permanent aspect their presence will induce a serial correlation in the error term. In the presence of firm heterogeneity, the error term corresponds to: $\epsilon_{it} = \alpha_i + v_{it}$ where α_i is a firm specific effect and v_{it} follows the distribution $N(0, \sigma_v^2)$. The omission of these unobserved variables and the ignorance of the serial correlation will attribute the persistence in the outsourcing status to the presence of sunk costs and will lead to an overestimated coefficient on the lagged dependent variable. This corresponds to the "spurious state-dependence" discussed by Heckman (1981a,c). The inclusion of firm specific dummies (the estimation of a fixed effect model), is usually used to control for firm heterogeneity. But, in the case of binary choice models (probit or logit) with a limited time period the use of fixed effects will lead to an inconsistent estimation (Heckman, 1981b).

Furthermore, the estimation of a dynamic binary choice model in the presence of unobserved heterogeneity needs to take account of the "initial conditions problem". The first observation: $Outsourcing_{i1}$ can have an impact on the entire path of outcomes and can not be treated as an exogenous determinant of $Outsourcing_{it}$ (Heckman, 1981b; Wooldridge, 2001; Greene, 2003). Heckman (1981b) presents a solution to the "initial conditions problem". It proposes to approximate the reduced form equation for the dependent variable's initial value by a probit function depending on pre-sample exogenous information:⁶

$$Outsourcing_{i1} = \beta_1 X'_{i1} + \eta_i \quad (3)$$

where $\eta_i = \theta\alpha_i + v_{i1}$ is correlated with α_i , when θ is different from zero⁷, and uncorrelated with v_{it} for $t \geq 2$. Heckman (1981b) suggests the following joint probability of $(Outsourcing_{i1} \dots Outsourcing_{it})$ for firm i given α_i :

$$\Phi[(\beta_1 X'_{i1} + \theta\alpha_i)(2Y_{i1} - 1)] \prod_{t=2}^T \Phi[(\beta X_{it} + \gamma Z_{it} + \theta Y_{it-1} + \alpha_i)(2Y_{it} - 1)] \quad (4)$$

where Φ is the standard normal cumulative distribution function and Y represents the dependent variable (the outsourcing status). For a random sample of firms, the likelihood to be estimated is given by:

$$\prod_i \int_{\alpha^*} \Phi[(\beta_1 X'_{i1} + \theta\sigma_\alpha \alpha^*)(2Y_{i1} - 1)] \prod_{t=2}^T \Phi[(\beta X_{it} + \gamma Z_{it} + \theta Y_{it-1} + \sigma_\alpha \alpha^*)(2Y_{it} - 1)] dF(\alpha^*) \quad (5)$$

where $\alpha^* = \alpha/\sigma_\alpha$ and F is the distribution function of α^* . Under the adopted normalization $\sigma_\alpha = \sqrt{\lambda/(1-\lambda)}$, λ being the correlation between the error term (ϵ_{it}) in any two different periods: $\lambda = Corr(\epsilon_{it}, \epsilon_{is}) = \frac{\sigma_\alpha^2}{\sigma_\alpha^2 + \sigma_v^2}$ for $t, s = 2, \dots, T; t \neq s$.

To obtain an estimate of the extent of state dependence I need to calculate the average partial effect and the predicted probability ratio of the lagged depended variable. Just as Wooldridge (2005) and Stewart (2007), I estimate two counter-factual probabilities that take Y_{it-1} as fixed at 0 and 1 and are evaluated at $X_{it} = \bar{X}$ and $Z_{it} = \bar{Z}$:

$$\hat{P}_j = \frac{1}{N} \sum_{i=1}^N \Phi(\bar{X}'\hat{\beta} + \bar{Z}'\hat{\gamma} + \hat{\beta}_j) \sqrt{1 - \hat{\lambda}} \quad ; \quad \hat{P}_0 = \frac{1}{N} \sum_{i=1}^N \Phi(\bar{X}'\hat{\beta} + \bar{Z}'\hat{\gamma}) \sqrt{1 - \hat{\lambda}} \quad (6)$$

The average partial effect corresponds to the difference between the two counter-factual probabilities $(\hat{P}_j - \hat{P}_0)$ while the predicted probability ratio corresponds to the ratio of the two counter-factual probabilities (\hat{P}_j/\hat{P}_0) .⁸

4 Data Description and Variables

The empirical analysis proposed in this paper is based on a data set derived from the annual firm survey, "Enquête Annuelle d'Entreprises (EAE)", conducted by the French ministry of industry. The "EAE" survey covers all firms with more than twenty employees. The data set used here covers the period 1990-2001 and sixteen manufacturing sectors. The sectoral classification of firms follows the two digits French classification "NAF36". The data set is an unbalanced panel with a number of firms per year varying from 24506 firms in 1990 to 22053 firms in 2001. The "EAE" survey provides, among other, data on the productive activity of firms: output, exports, number of employees, stock of fixed capital, investment, value added, use of intermediate inputs, the wage bill, and the outsourcing activity.⁹ Each firm reports the amount of output contracted-out to other firms (in this case the firm acts as a buyer or an outsourcer). The availability of data on contracted-out production allows the construction of the variable of interest, the firm's outsourcing status. The availability of this information along the data set period gives the possibility of linking the outsourcing decision in a certain year to the previous outsourcing behavior.

One of the main focuses of this paper is the presence of entry fixed costs related to the outsourcing activity and the role of firm heterogeneity in the decision to engage in outsourcing agreements. I associate firm heterogeneity with total factor productivity and scale. I have measured scale by the number of employees and have estimated TFP, industry by industry following the 2-digits classification, by the semi-parametric methodology proposed by Olley and Pakes (1996). This methodology controls for the simultaneity and selection problems associated with the estimation of TFP.

Another matter of interest for this empirical analysis is the impact of market thickness on the outsourcing decision. I have measured market thickness on three levels, the firm's 4-digits industry, the firm's 2-digits industry and the other industries. I have created three variables of market thickness, the first one, "MarketThickness-4", corresponds to the total employment in the same 4-digits industry excluding the firm's employees. The second one, "MarketThickness-2", corresponds to the total employment in the same 2-digits industry excluding employment in the firm's 4-digits industry and the third one, "MarketThickness-Upstream" corresponds to the total employment in the remaining manufacturing industries.

I have also controlled for other elements at the firm and industry levels. At the firm level, I have added the average wage defined as the ratio of the wage bill over the number of employees and have taken into account the firm's affiliation to a group as well as the nationality of the group (foreign vs domestic). Information on group affiliation are from the Financial Liaisons "LIFI" survey. The "LIFI" survey is realized annually by the French national statistic office "INSEE". It covers financial links between firms, identifies the firm's affiliation to a group, and gives the identity of the parent firm as well as its country of origin. I have created two dummy variables, the first one "group" takes the value one if the firm is a member of a group and zero otherwise while the second one "foreign" takes the value one if the group is foreign and zero otherwise. At the industry level, I have controlled for the presence of economies of scale. Since the, assumed, production function corresponds to a Cobb-Douglas function of output in labor, capital and intermediates and it is estimated in natural logarithm, economies of scale are calculated as the sum of the estimated coefficients on labor, capital and intermediates.

Table 1 presents a comparison based on a mean difference test between outsourcing and non-outsourcing firms in each year over all sectors. Table 1 shows that a large number of firms, in the French manufacturing industries, are engaged in outsourcing relationships. Almost 85% of firms are outsourcers. This share has been relatively steady in the time period covered by the survey. Even though a large share of firms contract-out some of their production, the share of output that is outsourced is relatively small (between 8 and 9%).¹⁰ Table 1 shows that, in all the years in the data set, outsourcing firms are significantly more productive, larger and pay higher wages than non-outsourcing firms.

Table 2 displays the comparison of firm characteristics within each sector of activity (following the 2-digits French classification) for all years. Similarly to the annual analysis, it shows that, within each sector, a large share of firms (75 to 90%) outsource part of their production. The share of contracted-out production in the total output differs across industries. It is only 4% in the wood and paper industry or 5.5% in the mineral products industry but 11% in the sector of energy, 12% in the mechanical equipment industry or 13% in the printing and publishing industry. The results from table 2 confirm that, within each sector, outsourcing firms are, on average, significantly more productive, larger and pay higher wages than non-

outsourcing ones.¹¹ The "outstanding" performance of firms engaged in outsourcing is an indicator of the link between firm heterogeneity and the outsourcing activity.

5 Results

The information I have on the outsourcing activity does not allow me to determine if the outsourcing relationships are within the boundaries of a group or not. The organization of relationships with affiliated firms may differ from that with independent ones. Risks of maladaptation and of opportunistic behavior may be lower when both partners are governed by the same parent company. Moreover, affiliated firms face lower search costs because they have a privileged contact with other affiliates of the same group as well as an access to the network of specialized suppliers connected to the group. For this reason, and in order to verify the existence of differences in the outsourcing behavior between affiliated firms and others, I have split the sample in two sub-samples one for firms member of a group and the other for single firms.

Table 3 reports the results from the Heckman's estimator of equation 2 while table 4 presents results from a random effects probit estimator. Table 5 reports the marginal effects based on the random effects probit model and estimated at the sample mean values. Columns 1 and 2, of each table, display results based on the entire sample whereas column 3 contains results of the estimations based on the sub-sample of unaffiliated firms and column 4 results are those of estimations based on the sub-sample of affiliated firms.

The first point of interest of the empirical investigation is the presence of sunk costs associated with the outsourcing activity. The Heckman estimator (table 3) as well as the random effects probit model (table 4) bring evidence on the persistence of the outsourcing strategy. As expected, the coefficient on the lagged outsourcing variable is over estimated with the random effects probit estimator. Both tables show that the present outsourcing decision significantly depends on past outsourcing behavior. This persistence reveals the existence of sunk costs related to outsourcing. The average partial effects (APE) of the lagged depended variable as well as the predicted probability ratio (PPR), reported at the bottom of table 3, reflect the magnitude of the state dependence of outsourcing. These two indicators show that

firms engaged in outsourcing in year $t-1$ have a 1.27 higher probability to outsource in year t than the others.

When I distinguish between affiliated and non-affiliated firms, I find that the degree of state dependence is slightly lower in the case of firms affiliated to a group. The average partial effect of the previous outsourcing status is of 0.17 in the case of affiliated firms and of 0.2 in the case of non-affiliated ones. Furthermore, the predicted probability ratio is of 1.22 for affiliated firms and of 1.28 for non-affiliated ones. As mentioned earlier, affiliation to a group may lower the organizational and search costs associated with outsourcing. Firms facing lower sunk costs do not need to persist in their outsourcing activity, thus showing a lower degree of state dependence.

The persistent aspect of the outsourcing activity has been neglected by the economic literature. To my knowledge, only two other papers have introduced past outsourcing activity as a determinant of present outsourcing decisions. The first is the Girma and Görg (2004) study which is based on three U.K. manufacturing industries: chemical, electronic, mechanical and instrument engineering industries for the period 1982-1992. Girma and Görg (2004) focus on the intensity of the outsourcing activity, measured as the ratio of the cost of industrial services over the total wage bill and find that past outsourcing activities have a negative and significant effect on present outsourcing. The second is the Díaz-Mora and Triguero (2007) analysis of the outsourcing decision by Spanish manufacturing firms. They find a positive and significant impact of past outsourcing on current outsourcing decision however they do not control for firm heterogeneity and do not consider the problems of serial correlation, unobserved fixed effects and initial conditions related to the estimation of dynamic discrete choice models.

The second point of interest in this paper is the link between firm heterogeneity and the outsourcing behavior. The presence of significant sunk costs associated with outsourcing suggests that only more efficient firms will engage in this strategy.

The results in tables 3 and 4 confirm that more productive firms and larger ones are more likely to contract-out production. The productivity of firms has a positive and significant impact on the probability of outsourcing. Firm scale also has a positive and significant impact on outsourcing. As discussed earlier, firm size may have two opposite effects on the outsourcing decision. A positive effect through the reduction of per-unit costs of search, matching and

organization of vertical relationships and a negative one through the presence of economies of scale. The results suggest that the first effect, the positive one, is more substantial. The positive and significant effect of TFP and scale holds when we control for group affiliation. When I distinguish between affiliated and non affiliated firms, the coefficient on both variables remain positive and significant. However, the marginal effect of scale, reported in table 5 is lower for affiliated firms (0.014 compared to 0.03 in the case of non-affiliated firms). This result confirms the previous finding of lower sunk costs in the case of affiliated firms. To my knowledge, no evidence of the impact of firm heterogeneity on outsourcing has been documented in the empirical literature. Girma and Görg (2004) and Díaz-Mora and Triguero (2007) consider the impact of firm scale and find a positive and a non significant effect respectively. However, they considered firm size as an indicator of the economies of scale and not of heterogeneity. I am not aware of any other paper considering the impact of firm productivity on the outsourcing activity. All the studies analyzing the link between outsourcing and productivity focus on the impact of outsourcing on productivity (Görg et al., 2007).

The third point of interest of this analysis is the influence of market thickness on the outsourcing decision. The results confirm the expectations that higher market thickness in upstream industries increases the probability of outsourcing by downstream firms. The presence of a large number of suppliers reduces search costs, raises the probability of a match, and enhances the profitability of outsourcing relationships.

Market thickness in the firm's own industry, at the 4-digit level, also have a positive impact on the probability of outsourcing. A larger number of firms in the same area of specialization of firm i , increases the outside option of specialized suppliers providing inputs to this area of specialization and favors entry by these specialized suppliers. Thus, at a disaggregated level, the positive effect of market thickness, through the attraction of suppliers, offset the negative effect caused by the higher competition for suppliers services. Market thickness at the firm's 2-digit industry has no significant effect on the outsourcing decision. At a more aggregated level, the degree of specialization of firms diverges and the effect on the suppliers outside option is weakened. It is worth noting that the market thickness variables are not significant in the case of affiliated firms as reported by column 4 in tables 3 and 4. Affiliated firms seem to benefit from the network of suppliers associated to the group as well as from privileged

relationships with other firms within group. They face lower search costs and are less affected by the availability of independent suppliers and by the thickness of the market.¹² Just as for firm heterogeneity, this empirical analysis is the first, to my knowledge, to bring evidence on the determining role of market thickness on the outsourcing decision at the firm level.

Tables 3 and 4 display other results of interest. The positive and significant coefficient on the "group" variable indicates that being a member of group favors outsourcing for the reasons mentioned earlier. However, the origin of the parent company has no significant effect on the affiliates outsourcing decision. The variable, Foreign, indicating whether the firm is affiliated to a foreign group or to a domestic one, has no significant impact on the probability to outsource. Furthermore, firms paying higher wages have a higher probability of outsourcing. The average wage variable indicates either the variable costs of the firm or the productivity of its labor force. In the first case, firms paying higher wages will seek the outsourcing of some of their activities to lower their variable costs and substitute supplier services to their labor force (Abraham and Taylor, 1996). In the second case, labor productivity is another indicator of firm heterogeneity. The positive sign on the average wage variable can therefore be interpreted as a positive impact of productivity on the probability of outsourcing. Finally, in industries with a high level of economies of scale, firms seem to have a greater probability of outsourcing. In these industries, firms seek a higher level of specialization in order to benefit from economies of scale. Hence, they tend to outsource some of their production process and focus on their main activity.

6 Conclusion

Is outsourcing a recurrent strategy? Is it associated with substantial sunk entry costs? Are firms engaged in outsourcing relationships subject to state dependence and do their heterogeneity affects their decision to outsource? The empirical analysis presented in this paper tend to answer these questions on the basis of a data set of French manufacturing firms for the period 1990-2001.

Domestic and international outsourcing are becoming a widely adopted strategies among firms and it is important to understand what are the economic motivations driving these strategies. The decision to outsource corresponds to a "Make or Buy" choice and is discussed in details by the literature on the firm's scope. This literature puts forward the governance and inefficiency costs associated with vertical integration and maladaptation costs, hold-up and underinvestment problems and opportunistic behavior risks that may occur under outsourcing (Williamson, 1975; Grossman and Hart, 1986; Joskow, 2005). More recently, McLaren (2000) and Grossman and Helpman (2002) have added new aspects to the firm's organization theory by allowing the strategic interaction between the firms' governance decisions and the endogenization of the outsourcing strategy.

The empirical analysis, presented in this paper, particularly focuses on the presence of significant sunk costs of outsourcing. These costs result from the necessity to search and find a partner, to write and enforce contracts, to monitor and control the input's production and to exchange technology and knowledge with the partner. Due to the presence of these costs, firms may want to make outsourcing a long term strategy. The presence of substantial sunk costs puts forward the question of firm heterogeneity. Not all firms can afford paying these sunk costs and, thus, only more efficient ones will adopt the outsourcing strategy. Since some of the outsourcing sunk costs are related to the matching process (searching and finding a partner), I have also considered, in this paper, the impact of market thickness on the outsourcing decision.

I have analyzed the outsourcing strategy through the estimation of a dynamic probit model where the current outsourcing decision depends on the past outsourcing status. In this purpose, I have applied the Heckman's estimator (Heckman, 1981c) to control for the initial condition problem and serial correlation issues associated with dynamic discrete choice models with unobserved fixed effects (Heckman, 1981a,b; Wooldridge, 2001). In addition to past outsourcing status I have controlled for firm heterogeneity, represented by the firm's TFP and its scale, for market thickness measured as the number of employees in upstream and downstream industries as well as for a set of control variables at the firm and industry levels.

The results show a significant presence of sunk costs and a persistence in the outsourcing strategy. Outsourcing in the previous year increases, by 1.27%, the probability of outsourcing in the current year. The significance of sunk costs is also revealed through firm heterogeneity. Both productivity and scale raise the probability of outsourcing. I have found that market thickness, especially in upstream industries enhances the outsourcing strategy. The availability of specialized suppliers increases the probability of a match and reduces search costs raising thereby the profitability of outsourcing.

The contribution of this analysis is, first to present evidence on the determinant of the outsourcing strategy on the basis of a large panel of firms covering several industries. A large share of the empirical literature on the "Make or Buy" decision consists of case studies considering a single firm or a single industry (Klein, 2005). Second, it focuses on new elements of the firm's organization theory such as the market thickness and firm heterogeneity and brings evidence on the significant implications of these elements on the outsourcing decision.

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Notes

¹ This methodology is similar to the one used by Roberts and Tybout (1997) and Bernard and Jensen (2004) to analyze the export decision and to test for the presence of sunk costs, related to the export behavior, in the case of a panel of Colombian plants and U.S. plants respectively.

² Jabbour (2008) analyzes the offshoring strategy by French firms and show that fixed costs of organization are higher under international outsourcing (in comparison to vertical FDI) and that the prevalence of outsourcing increases with the productivity of firms.

³ I have measured the fixed costs by the firm's stock of fixed assets. I have created the curves in table 2 by cumulating the distribution of fixed assets expressed in natural logarithm.

⁴ The expected profit of a specialized supplier (final good producer) grows with the number of specialized final good producers (suppliers) and decreases with the number of specialized suppliers (final good producers).

⁵ Z_{it} includes a firm subscript because the market thickness variables vary at the firm level.

⁶ I include in X'_{i1} all independent variables except for TFP, at the firm and industry levels, evaluated in the first year of the sample. The results are robust to the inclusion of TFP in the X'_{i1} vector.

⁷ In the case where $\theta = 0$ initial conditions are considered exogenous.

⁸ Stewart (2006) has developed a STATA program, "redprob", for the Heckman's estimator of the dynamic random effects probit model where the integral over α^* , in equation 5, is evaluated using Gaussian-Hermite quadrature (Stewart, 2007). The estimations presented in this study are realized with the "redprob" program.

⁹ All monetary variables are expressed in thousands of French francs and deflated using sectoral price indices.

¹⁰ It is important to note that the annual firm survey covers relatively large firms. It covers

around 20% of the number of manufacturing firms, small firms being very numerous. However it covers around 80% of the employment in the manufacturing industries. Thus, the share of firms engaged in outsourcing is overestimated since, as shown in the next section, the scale is an important determinant of the outsourcing strategy.

¹¹ These results hold for all industries except for the energy sector.

¹² As a robustness check, I have calculated the market thickness variables using the number of firms instead of the number of employees and the results were similar to those presented here. I consider that the measure of market thickness based on the number of employees is better. As mentioned earlier, the EAE survey is more representative of the industry in terms of number of employees than in terms of number of firms.

Figure 1: Transition In and Out of Outsourcing

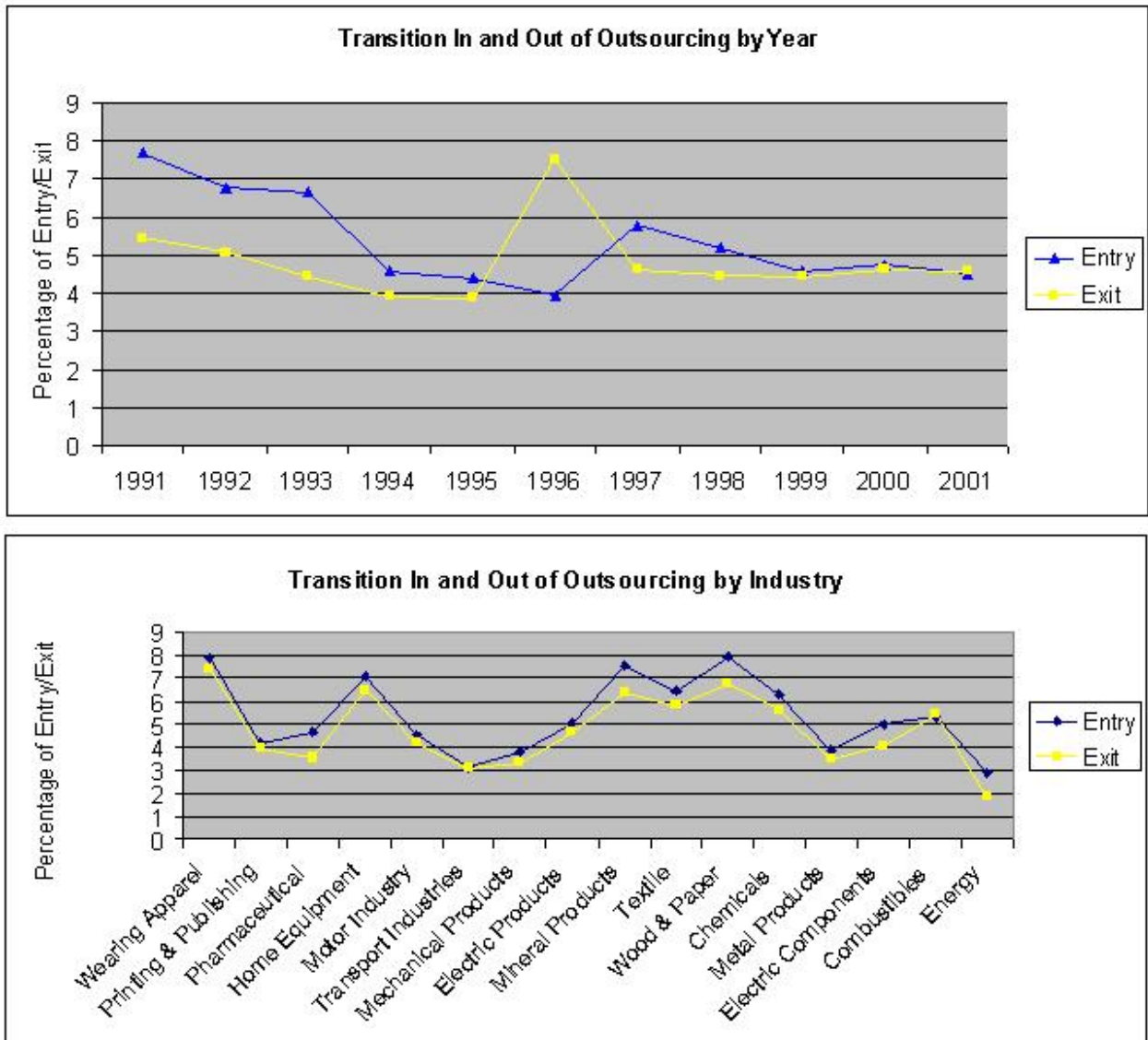


Figure 2: Structure of Fixed Costs

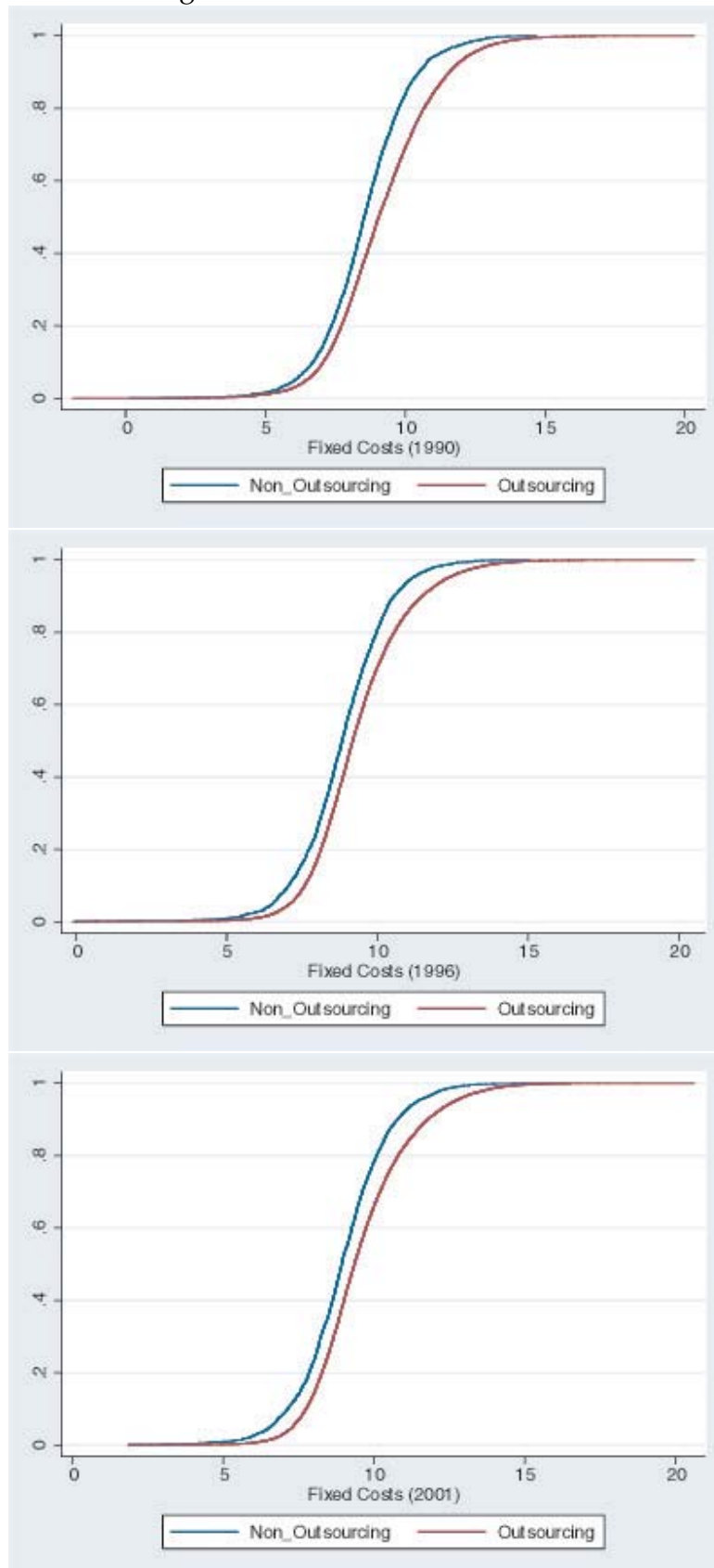


Table 1: Table of Descriptive Statistics: A Yearly Analysis

Year	Total number of firms	Percentage share of outsourcing firms	Average share of outsourcing in total sales of outsourcers firms	Average TFP		Average number of employees	
				non-outsourcing firms	outsourcing firms	non-outsourcing firms	outsourcing firms
1990	23361	79.38	8.5	4.58	4.86	60.91	168.37
1991	24127	81.80	8.5	4.58	4.87	60.95	159.1
1992	23688	83.86	8.3	4.56	4.86	58.05	155.05
1993	22272	86.55	8.3	4.59	4.85	61.09	153.61
1994	22093	87.13	8.3	4.55	4.85	62.23	151.39
1995	21872	87.73	8.5	4.56	4.86	63.5	152.62
1996	21615	84.17	8.12	4.61	4.85	62.4	159.59
1997	21631	85.26	9.11	4.62	4.86	59.97	158.24
1998	21670	86.05	9.27	4.69	4.9	61.06	160.03
1999	21473	86.15	8.2	4.72	4.92	63.22	161.59
2000	21376	86.44	9.4	4.74	4.93	66.12	166.09
2001	21488	86.25	9.5	4.76	4.94	66.68	166.91

The differences between outsourcing and non-outsourcing firms are all statistically significant at the 1% level.

The statistical test for differences between the mean values of the two groups is a t-test not assuming equal variances for the groups.

Table 2: Table of Descriptive Statistics: A Sectoral Analysis

Sector	Total number of firms	Percentage share of outsourcing firms	Average share of outsourcing in total sales of outsourcing firms	Average TFP non-outsourcing firms	Average TFP outsourcing firms	Average number of employees non-outsourcing firms	Average number of employees outsourcing firms
Wearing and Apparel	22300	75.07	10.16	5.27	5.49	58.37	89.83
Printing and Publishing	22202	90.98	13.05	5.25	5.36	53.03	83.67
Pharmaceutical	6413	86.43	7.4	3.34	3.5	94.65	303.35
Home Equipment	17982	80.06	5.11	3.8	3.9	61.7	138.28
Motor Industry	6539	88.84	6.5	4.96	5.15	87.45	621.66
Other Transport Industries	3564	92.54	15.5	5.78	6	68.96	455.65
Mechanical Equipment	44960	91.4	11.9	4.97	5.05	52.54	99.03
Electric and							
Electronic Equipment	14500	87.03	9.01	4.76	4.93	59.73	217.01
Mineral Products	15245	74.26	5.56	4.6	4.76	56.64	149.08
Textile	16582	79.38	8.9	5.02	5.14	63.1	97.2
Wood and Paper	16022	75.45	4	3.89	3.98	65.36	117.26
Chemicals	24369	81.54	5.4	4.38	4.49	70.68	190.52
Metal Industries	42911	90.91	8.7	5.00	5.11	49.69	104.38
Electric and							
Electronic Components	10222	88.08	8.36	4.57	4.69	79.96	237.39
Combustibles	905	80.66	10.01	4.86	4.86	121.44	803.49
Energy ¹³	1950	90.51	11.06	5.34	5.32	118.41	1330.88

The differences between outsourcing and non-outsourcing firms are all statistically significant at the 1% level except for the difference in TFP in the energy sector which is non significant. The statistical test for differences between the mean values of the two groups is a t-test not assuming equal variances for the groups.

Table 3: Determinants of the Outsourcing Strategy: The Heckman's Estimator

	(1)	(2)	(3)	(4)
Outsourcing last year	1.12*** (0.017)	1.12*** (0.017)	1.07*** (0.02)	1.252*** (0.05)
TFP	0.293*** (0.06)	0.271*** (0.06)	0.237*** (0.067)	0.553** (0.22)
Scale	0.295*** (0.01)	0.265*** (0.011)	0.256*** (0.015)	0.251*** (0.21)
Average Wage	0.22*** (0.028)	0.213*** (0.028)	0.229*** (0.034)	0.205*** (0.072)
Economies of Scale	1.87*** (0.61)	1.9*** (0.61)	1.43** (0.69)	4.86** (1.8)
Market Thickness-4	0.066*** (0.01)	0.067*** (0.01)	0.09*** (0.012)	0.009 (0.026)
Market Thickness-2	-0.053 (0.07)	-0.056 (0.067)	-0.088 (0.08)	0.246 (0.17)
Market Thickness-Upstream	2.48*** (0.83)	2.44*** (0.71)	2.84*** (0.83)	2.53 (2.82)
Group		0.14*** (0.019)		
Foreign		-0.02 (0.032)		
No. of obs	267139	267139	197981	69158
Log Likelihood	-46047.14	-46011.77	-35675.03	-5830.7
Wald Chi2	8590.16	8694.45	5668.6	1282.17
λ	0.391	0.39	0.411	0.38
θ	1.004	1.004	0.961	1.1
APE	0.2	0.11	0.2	0.17
PPR	1.27	1.13	1.28	1.22

In all regressions I have controlled for industry and time fixed effects. ***, ** and * represent respectively statistical significance at the 1%, 5% and 10% levels.

Table 4: Determinants of the Outsourcing Strategy: Random Effects Probit Estimation

	(1)	(2)	(3)	(4)
Outsourcing last year	1.340*** (0.014)	1.339*** (0.014)	1.343*** (0.016)	1.623*** (0.030)
TFP	0.249*** (0.046)	0.228*** (0.046)	0.176*** (0.051)	0.478*** (0.098)
Scale	0.275*** (0.009)	0.246*** (0.009)	0.230*** (0.012)	0.222*** (0.013)
Average Wage	0.205*** (0.021)	0.194*** (0.021)	0.209*** (0.026)	0.139*** (0.034)
Economies of Scale	2.031*** (0.477)	2.050*** (0.477)	1.763*** (0.532)	3.259*** (1.045)
Market Thickness-4	0.058*** (0.008)	0.059*** (0.008)	0.072*** (0.010)	0.025 (0.015)
Market Thickness-2	-0.031 (0.058)	-0.035 (0.058)	-0.079 (0.067)	0.085 (0.113)
Market Thickness Other	1.633** (0.765)	1.587** (0.765)	1.820** (0.837)	0.479 (1.810)
Group		0.149*** (0.017)		
Foreign		-0.034 (0.029)		
No. of obs	192009	192009	133219	58790
Log Likelihood	-49590.06	-49547.72	-38591.017	-11082.48
Wald Chi2	15517.03	15650.98	11688.29	5159.00

In all regressions I have controlled for industry and time fixed effects. ***, ** and * represent respectively statistical significance at the 1%, 5% and 10% levels.

Table 5: Determinants of the Outsourcing Strategy: Marginal Effects

	(1)	(2)	(3)	(4)
Outsourcing last year	0.282*** (0.006)	0.282*** (0.006)	0.320*** (0.007)	0.315*** (0.014)
TFP	0.026*** (0.005)	0.024*** (0.005)	0.023*** (0.007)	0.031*** (0.006)
Scale	0.029*** (0.001)	0.025*** (0.001)	0.031*** (0.002)	0.014*** (0.001)
Average Wage	0.021*** (0.002)	0.020*** (0.002)	0.028*** (0.003)	0.009*** (0.002)
Economies of Scale	0.211*** (0.050)	0.212*** (0.049)	0.234*** (0.071)	0.209*** (0.067)
Market Thickness-4	0.006*** (0.001)	0.006*** (0.001)	0.010*** (0.001)	0.002 (0.001)
Market Thickness-2	-0.003 (0.006)	-0.004 (0.006)	-0.010 (0.009)	0.005 (0.007)
Market Thickness Other	0.169** (0.079)	0.164** (0.079)	0.242** (0.111)	0.031 (0.116)
Group		0.015*** (0.002)		
Foreign		-0.004 (0.003)		
No. of obs	192009	192009	133219	58790

In all regressions I have controlled for industry and time fixed effects. ***, ** and * represent respectively statistical significance at the 1%, 5% and 10% levels.