UNIVERSITÀ DEGLI STUDI DI FERRARA
DIPARTIMENTO DI ECONOMIA ISTITUZIONI TERRITORIO
Via Voltapaletto, 11 – 44100 Ferrara

Quaderno n. 2/2007

February 2007

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The general profile of the outsourcing firm: evidence for a local production system of Emilia Romagna *

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February 16, 2007

Abstract

The paper aims at 'embedding' the outsourcing firm by considering it as a four-fold unit of analysis: i.e. as an organizational, production, industrial and innovation unit. Theoretical correlations between outsourcing decisions and outsourcing variables are formulated and then tested with respect to a representative cross-sectional sample of firms of a local production system in Emilia Romagna (that is, Reggio Emilia). The main result of the paper is that outsourcing decisions are indeed affected by the organizational and industrial relations typical of the context firms are embedded in. Furthermore, the general profile of the Reggio Emilia outsourcing firm is strategic rather than operative. In particular, tapping-into the provider's resources and competences to eventually promote technological innovation seems more relevant than searching for lower costs by contracting out.

*All the three authors contributed equally in the development of this paper and share the attribution of Section 1 and Section 5. However, Section 2 and Section 4 could be attributed to Sandro Montresor, and Section 3 to Massimiliano Mazzanti and Paolo Pini. Correspondence on the paper should be addressed to Sandro Montresor. We would like to thank Michael Best, David Gann and the other participants to the 2006 DRUID Summer Conference (Copenhagen, June 17-20, 2006) for their comments. We are particulary indebted to Stefano Brusoni for his suggestions on an earlier version of the paper. Sandro Montresor acknowledges funding from the Italian Ministry for Education University and Research (MIUR) - PRIN 2005 on "Fragmentation and local development". The usual disclaimers apply.

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1 Introduction

Empirical evidence shows that both the volume and the value of intermediate inputs and business production services contracted out by firms, that is of outsourcing, have risen dramatically in the last two decays (Domberger, 1998; Spencer, 2005). The determinants and the implications of the "buy-rather-than-make" decision have thus become a core topic in industrial organization. In particular, the attention of standard approaches has focused on transaction costs (e.g. Grossman and Helpman, 2002), ownership allocation and efficient investments (e.g. Grossman and Hart, 1986), formal vs. real authority (e.g. Aghion and Tirole, 1997) and, in general, on the entailed incentive conflicts (Foss, 2000).

Outsourcing has also attracted the attention of 'non-standard' approaches, which have focused on production, rather than transactions, by addressing the role of firms' capabilities and competences (e.g. Mahnke, 2001). Along the same line, the contractual analysis of the vertical scope of the firm has been settled in 'real time' (e.g. Langlois, 1992; Argyres and Liebeskind, 1999) by pointing to path-dependency and inertia.[1]

In spite of the inner differences of these two approaches, it has been recently argued that understanding vertical integration and disintegration could benefit from overcoming the "production-transaction dichotomy" their independent analyses imply (Langlois and Foss, 1999; Montresor, 2004). A combined research effort has thus been recommended from both of the parties (e.g. Jacobides and Winter, 2005; Nooteboom, 2004; Williamson, 1999)).

While sharing this point of view, in this paper we claim that a further effort of combined analysis is required in order to capture the *embedded* nature of the outsourcing firm. Indeed, outsourcing decisions are also affected by the network of relationships the firm hosts internally (in particular, in the form of industrial relations) and establishes externally (in particular, with its suppliers), being embedded in specific economic and institutional contexts.[2]

In order to embed the outsourcing firm it is necessary to abandon the standard view of the firm as a 'monolithic' unit of analysis. Indeed, the firm is simultaneously embedded in several contexts (Granovetter, 1985), out of which four emerge from the literature as the most relevant for the outsourcing decision, namely: (i) the organization which governs its transactions and hosts its resources and competences; (ii) the market of the inputs (labor, in particular) the firm uses in its production process; (iii) the market of the industry in which the firm competes with its output; (iv) the technological system in which the

firm faces and undertakes the innovation process.

Consistently, in the paper we propose a multi-level kind of analysis of the outsourcing firm, by referring to it as: (i) an organizational unit of analysis; (ii) a production unit of analysis; (iii) an industrial unit of analysis; (iv) an innovation unit of analysis. In this way, we aim at identifying a more general theoretical profile of the outsourcing firm, which retains the manifold nature of its embeddedness.

Evidently, this general theoretical profile will turn into different actual ones, depending on the firms which are investigated, and on the relative importance and specification of the four levels of analysis (i.e. contexts). In order to illustrate this point, the paper tries to determine the profile of the outsourcing firm of a specific province of Emilia Romagna (that of Reggio Emilia), where district atmosphere and industrial relations determine an idiosyncratic kind of embeddedness in what has been called a 'local production system'. Indeed, we do expect that in this case (and possibly in other similar), unlike in others (e.g. Gonzalez-Diaz, Arruada, and Fernandez, 2000), the explanatory role of the arguments which emerge by retaining the firm as an (atomistic) organizational unit of analysis is less powerful than those emerging from the other levels of analysis.

The structure of the paper is the following. Section 2 will address the outsourcing arguments one can draw on the literature for each of the four investigated levels of analysis, and translate them into 'expected' correlations. Section 3 will sketch the distinguishing features of the local production system of Reggio Emilia and present the dataset of the application and the econometric model through which the identified theoretical correlations are tested. Section 4 will comment on the emerging profile of the Reggio-Emilia outsourcing firm. Section 5 concludes.

2 From the outsourcing determinants to the outsourcing firm

The theoretical literature on the outsourcing firm is indeed massive. It would be quite difficult to recompile all the contributions in an exhaustive survey, and it would not be strictly functional to this paper's aim.

Since we are looking for the features of the outsourcing firm, and not for "one" or "the" outsourcing theory, we will rather draw on different bodies of literature economic variables and mechanisms which appear relevant in link-

ing the firm's outsourcing decision with the four contexts the paper refers to. In this sense, rather than making a 'shopping-list' review of the topic, we intend to organize the literature in order to have a more general and appropriate understanding of the outsourcing firm.

As we said, the levels of analysis in which we consider the outsourcing firm involved are four, namely: 'organizational' (Section 2.1), 'production' (Section 2.2), 'industrial' (Section 2.3), and 'innovation' (Section 2.4). Indeed, these seem the contexts the outsourcing firm is most sensitive to, according to the four bodies of economic literature in which outsourcing has been investigated at the 'micro level', that is, respectively, i) organizational economics; ii) labour economics; iii) industrial organization; iv) economics of innovation.

2.1 The outsourcing firm as an 'organizational' unit of analysis

To look at the outsourcing firm as an 'organizational' unit of analysis means to consider the role of those "constituencies" with which organizational economics identifies it, such as, depending on the theoretical approach: transactions, property-rights, contracts, resources, competences, and the like. In particular, we here focus on two of the most debated organizational approaches, that is transaction cost economics (TCE) and the resource-competence approach (Williamson, 1999). In trying to combine the two, the main outsourcing arguments at this level of analysis can be organized as follows (Table 1, Appendix A).[3]

Asset specificity and governance inseparability (Table 1: i, ii, iii, iv). According to standard TCE (e.g. Grossman and Helpman, 2002) and, although with differences, property-rights theories (e.g. Antras and Helpman, 2004), outsourcing is an efficient governance mechanism for those transactions which do not create potential hold-up problems among agents. In particular, transactions involving *specific assets*, which spur rent-seeking behaviors by opportunistic agents, would be better managed within the firm boundaries rather than outside (Williamson, 1975). The reverse would hold true for non-specific assets.

By introducing 'history' in TCE, *'governance inseparability'* (Argyres and Liebeskind, 1999) turns out as important as asset specificity: in brief, new contractual arrangements (such as a prospective outsourcing) are interlinked with, and affected by, the existing contractual nexus of the firm, as it has emerged along its history. It has been argued (e.g. Mahnke, 2001) that governance inseparability is typically, although not exclusively, related to the presence and role of

unions in the firm's outsourcing decisions, as a higher union density makes the firm's governance less inseparable. Furthermore, governance inseparability can be expected to be the more relevant, the older the firm, the 'ticker' the nexus of contracts which constitute its model of governance. These two variables should thus be expected to contrast outsourcing.

What is more, governance inseparability might affect the role of specific assets for outsourcing decisions. Indeed, the firm might find impracticable externalizing even non-specific assets - when conflicting with other *governance arrangements* already in place - or end up with outsourcing even specific assets - when this is instead a means for their actual implementation. The interaction of asset specificity with governance inseparability would thus have an ambiguous effect on outsourcing.

Intangible assets and interface knowledge (Table 1: v, vi, vii). TCE explanations of outsourcing also claim that tangible assets are less costly to externalize than *intangible assets* (e.g. intensive of human capital), as the required information is more verifiable in contracts involving 'implementation' rather than 'technical' transactions (e.g. Gonzalez-Diaz, Arruada, and Fernandez, 2000). However, outsourcing is also affected by other knowledge-related features emerging from a resource-competence approach to the firm (e.g. Montresor, 2004). In particular, by the *knowledge about the interfaces* among the firm's assets to be outsourced and those remaining within its boundaries (Nellore and Soderquist, 2000).[4] As firms' activities and capabilities are the easier to separate from each other the more this 'interface knowledge' is explicit (e.g. represented by norms and rules), its codification degree is an important outsourcing factor to account for. For example, the *organizational placement* of the outsourced activities in the firm, typically in a correspondent division, represents an outsourcing enabler with an expected positive effect on its decision. The *hierarchical degree* of the firm's organization, instead, represents both a means for codifying interfaces-knowledge through formal authority, but also a spanner for multiple decision-control mechanisms, which might make outsourcing more conflictive: its expected relationship is thus ambiguous.

Interrelationships among transactions (Table 1: viii, ix). Still according to TCE, the externalization to the market is recommended when the dissimilarity of the firm's products and the geographical dispersion of its plants become so high to make their internal monitoring excessively costly (Coase, 1937, reprint in 1988, pp. 45-46). The degree of *product differentiation* and of *geographical diversification* of the firm could thus be seen as spurring outsourcing, and also by drawing on alternative theoretical accounts: the need of developing intensive

and extensive communication channels is just one of them (Kelley and Harrison, 1990).

Market uncertainty and asset specificity (Table 1: x, xi). Finally, according to TCE the firm's outsourcing decision is convenient providing the *uncertainty* it faces on the market is not so high to make relational contracts inescapable (Williamson, 1975, pp. 23-25). To be sure, still in accordance with TCE, the costs of re-contracting in front of a higher uncertainty actually impede outsourcing only if the relevant transaction requires specific investments, being otherwise unpredictable. It is thus the interaction between these two arguments that should be expected to make outsourcing inconvenient.

2.2 The outsourcing firm as a 'production' unit of analysis

The firm as a 'production' unit of analysis refers to the way standard microeconomics deals with it. A 'technical center', which transforms factors of production into production output by bearing various kinds of costs: labor costs and capital costs, first and above all. In this vein, labor microeconomics and industrial relations have put forward some outsourcing arguments which can be structured as follows (Table 2, Appendix A).[5]

Labor costs and skill content of the firm's activities (Table 2: i, ii, iii). Savings on labor costs are usually retained the most important determinant of what is called 'operative outsourcing': the higher the *relative wage* paid by one firm with respect to its competitors, the greater the opportunity of saving by contracting out to them. However, this interpretation assumes the presence of a sort of 'dual labor market', between the outsourcing client and the provider. If a 'developmental' or a network/cluster approach is instead adopted, for which outsourcing is established between 'similar' firms by following a 'strategic' rational, rather than searching for lower wages (Deavers, 1997), labor costs may however have no impact and thus expected to be non significant (Taymaz and Kilicaslan, 2005).

Of course, higher wages immediately lead us to think about the skill intensity of the outsourcing firm's activities, with respect to which two alternative outsourcing patterns can be prospected, still with an ambiguous outcome (Taymaz and Kilicaslan, 2005). On the one hand, the client with a relatively more skilled labor force might want to specialize more in 'non-production' activities (e.g. R&D, engineering and the like) and thus outsource more standard production activities. Conversely, it might be that firms with high skills are less willing to outsource in order not to lose them and thus impoverishing the organizational

competences which are built up on them. In the latter case, unlike in the former, once *interacted* with the skill content, the effect of the cost of labor in terms of outsourcing should be negative. By retaining both cases, the expected sign of this interactive variable is instead ambiguous.

Union density: labor costs and governance inseparability (Table 2: iv). Another popular determinant of one firm's higher wages is the pervasiveness unions have in it (i.e. *union density*), which should thus be positively correlated with outsourcing (Abraham and Taylor, 1996). On the other hand, we should retain that the unions' bargaining power also increases the firm's 'governance inseparability', and thus its outsourcing constraining effect. Similarly, the outsourcing inducing effect stimulated by the higher cost of unionized labor could contrast that of governance inseparability we have identified at the organizational level. On this aspect, therefore, the two levels clash and the expected sign depends on which of the two prevails.

Firm uncertainty and demand variability (Table 2: v). The costs the firm bears to accommodate the workload in facing an *uneven demand* for its products and services (e.g. Houseman, 2001) are as important as the costs of labor, and they also stimulate outsourcing. First of all, the firm could find smoothing the flow of work by outsourcing less costly than rescheduling peak-demand periods for off-peak periods internally, through flexible work-arrangements (Abraham and Taylor, 1996, p. 398). Second, in deciding the proper 'capacity reservation strategy', installing a fixed capacity and obtaining additional capacity by outsourcing might be less costly - in terms of capacity setting costs - than installing a fixed capacity and postpone the unsatisfied capacity demand to future periods (de Kok, 2000).

2.3 The outsourcing firm as an 'industrial' unit of analysis

As an 'industrial' unit of analysis the firm uses outsourcing as a strategic instrument to compete with its rivals in the sector they operate. "Make-or-buy" is actually represented by industrial organization as a crucial trade-off in facing intra-industry competition (Shya and Stenbacka, 2003, p. 205), in turn dependent on the nature and order of the firms' moves and, more in general, on the features of the relevant market structure. The most remarkable among them are the following (Table 3, Appendix A).[6]

Market competition and output concentration (Table 3: i). At the outset, it would be sensible to argue that, the higher the *competition degree of the market*, that is, the less concentrated its output is among few suppliers, the more

outsourcing is used as an instrument of competition. However, when we think of outsourcing as a special kind of 'governance differentiation' (Argyres and Liebeskind, 1999, pp. 29-30), which 'governance inseparability' makes costly to implement, a higher level of competition might hamper outsourcing by making the entailed welfare losses less bearable. In less competitive markets firms are in fact shielded from competition by the possession of unique resources or capabilities, so that the expected correlation would have a reverse sign: summing up, it is ambiguous.

Firm size (Table 3: ii). If we think of outsourcing as a special kind of labor division - between the client and the provider - according to the Smithian argument, increasing returns from specialization emerge providing the outsourcing firm's demand (and output) is large enough. On the other hand, the outsourcing firm usually intends to benefit from the experience the supplier has in the provision of the relevant production input or service, as it runs the inherent activity at a larger scale and thus with more specialized equipment and more competent skills. Once more, the sign of the *firm size* relationship with outsourcing depends on the relevant theoretical approach to the issue and is far from being conclusive (e.g. Taymaz and Kilicaslan, 2005).

Industrial relations (Table 3: iii). The size of the firm also affects its outsourcing decisions via other channels. An important one among them is the role that, typically in larger firms, is played by *industrial relations* (Hyman, 2003), whose role for outsourcing decisions is to be determined case by case. On the one hand, good industrial relations might entail a larger participation of the workforce representatives to the outsourcing decision, and thus increase its feasibility. Furthermore, outsourcing itself might be thought to improve the quality of industrial relations by transferring part of their responsibility outside the firm (Benson and Ieronimo, 1996). On the other hand, good industrial relations might mean once more higher governance inseparability and thus less outsourcing.

2.4 The outsourcing firm as an 'innovation' unit of analysis

The meaning we attach to the firm as an 'innovation' unit of analysis stems from neo-Schumpeterian and evolutionary economics. Accordingly, it refers to the firm's *capabilities* of accumulating knowledge, learning and introducing relatively new products, production processes and organizational arrangements (e.g. Dosi, 1988). In this last respect, the firm finds in outsourcing an extremely

sensitive variable, for the following set of reasons (Table 4, Appendix A).

Technological uncertainty and technological regimes (Table 4: i, ii). At the outset, outsourcing might favor the firm's capabilities to deal with the inner *uncertainty* a 'technological shock' determines: in fact, the higher the costs of accommodating it through some kind of 'governance switch', the more vertically integrated the firm (Argyres and Liebeskind, 1999). More in general, outsourcing modifies the firm's fitness to the relevant *'tecnological regime'* (TR): in brief, a specific combination of technological opportunity and appropriability conditions, cumulativeness of learning and nature of the knowledge base (Malerba and Orsenigo, 1993). In a TR characterized by 'creative destruction' (i.e. in a "Schumpeter-Mark-I TR"), outsourcing might be strategic and thus expected, as it turns out crucial in upgrading the firm's knowledge and capabilities by tapping into the 'provider', even at the risk of a certain knowledge leakage. The same kind of leakage instead does matter and makes outsourcing non strategic, and thus not expected, in a TR where a competitive advantage is rather guaranteed by 'knowledge accumulation' (i.e. in a "Schumpeter-Mark-II TR") (Mahnke, 2001; Malerba and Orsenigo, 1993).

The firm's technological innovations (Table 4: iii). At the outset, outsourcing could increase the *firm innovativeness* for more than one reason (Robertson and Langlois, 1995; Teece, 1992). Indeed, the 'conventional' wisdom which associates innovation to the advantages of vertical integration has been seriously questioned by a 'relational view' (Mol, 2005, pag. 575), which considers establishing connections with outside suppliers crucial in terms of networking and learning-by-interacting (e.g. Dyer and Singh, 1998; Brusoni, Prencipe, and Pavitt, 2001): in particular, in helping the firm to overcome the 'learning-traps' they face in balancing knowledge exploration and exploitation (Leonard-Barton, 1992). On the reverse side, however, outsourcing might make the firm excessively dependent on external suppliers (Benson and Ieronimo, 1996; Dyer and Nobeoka, 2000) and compromise its 'absorptive capacity' of new, external knowledge (Cohen and Levinthal, 1989) and thus its 'dynamic capabilities' (Teece, Pisano, and Shuen, 1997). Once more, an ambiguous effect.

The innovation radicalness (Table 4: iv). The innovative implications of outsourcing also depend on the kind of technological innovations the firm introduces. *Radical innovations*, for example, have been argued to be more 'suitable' for vertically integrated firms as they better coordinate the interdependent development efforts required by a 'systemic innovation' (Teece, 1986) and/or new 'disruptive' products (Christensen, Verlinden, and Westerman, 2002). However, when radicalness is due to the rearrangement of existing variables in an unknown

framework (Henderson and Clark, 1990), a decentralization process which creates an appreciable diversity in information signals and stimulates networking effects might be more suitable than vertical integration, and not only in front of incremental innovations (Robertson and Langlois, 1995). Accordingly, the sign of the present correlation sign is unpredictable unless a more actual meaning of innovation radicalness is referred to.

The firm's organizational innovations and its flexibility (Table 4: v, vi). As outsourcing could be thought of a special kind of organizational change, one might expect to find it as a substitute for other kinds of *organizational innovations* directed to re-enforce the efficacy and efficiency of the firm production processes. Or, alternatively, as complemented by other changes in the firm's organization (job rotation practices, quality circles and the like). The search for higher *flexibility*, for example, might be carried out by decentralizing some of the firm's activities, in particular when retained peripheral to the firm. Indeed, a relationship between flexibility and outsourcing has been put forward with respect to all the different meanings in which the former can be understood (Benson and Ieronimo, 1996).[7]

3 Outsourcing in a local production system: the case of Reggio Emilia (Emilia Romagna)

As we have argued at the outset, if we look at the outsourcing firm as an embedded one, the theoretical correlations identified in the previous section will take one different specifications in different contexts of analysis. In order to illustrate this point, we here focus on the province of Reggio Emilia (RE) (in Emilia-Romagna, Italy), an area which shares the typical features of what have been called the 'local production systems' of the Italian North-East (Seravalli, 2001). A recent survey, carried out on a population of 257 firms with at least 50 employees in 2002, reports some interesting insights in this last respect (Pini, 2004).

First of all, although the sample of the respondents is characterized by a high density of firms whose size is 'medium', these firms are actually made up of 2 or 3 plants, of which 1 or 2 only are usually located in RE, with an average employment of no more than 145 employees (Pini, 2004, Appendix 1, Tables 11A and 11B of CD data).

Second, a considerable number of the surveyed firms are located in 'industrial districts' (Brusco, 1982), characterized by few but strong production spe-

cializations, namely: non-electrical machinery and equipments - machinery for mechanical energy and agriculture in particular - and non metallic mineral products - ceramic tales in particular. A large-scale kind of specialization is instead represented by other sectors such as clothing and communication equipments (Table 5, Appendix B).

Last, but not least, the analysis of a representative sample of the firm population (described in the following) reveals that RE is characterized by an extensive resort to outsourcing. Nearly 87% of the sample have decentralised some of their activities from 1998 to 2001 (Antonioli and Tortia, 2004, pag. 68), and as many as 52.3% of them to sub-contractors. On the other hand, differences in outsourcing decisions emerge among them by considering the number and the nature of the activities which are externalised. In this last respect, the survey we are referring to distinguishes as many as 17 activities, which we have grouped into 3 classes according to a functional criterion: (i) "ancillary activities", so to say accessory to the production process as such, meant as the transformation of production inputs into output (e.g. janitorial services); (ii) "production supporting activities", not primarily productive but contributing to the production process more directly than the former (e.g. engineering); (iii) "production activities" as such (Table 6, Appendix B). On the basis of this classification, let us observe that cleaning services, for example, have been decentralized in 85.55% of the cases, but the percentage falls to just more than 8% for non purely ancillary activities such as human-resource-management (8.67%) and quality control (8.09%) (Table 6, Appendix B). More in general, a distinction seems to emerge between material, routine-based activities with a low-value added, which are often decentralized, and intangible activities with a higher value-added, which instead are better performed internally.

These and other specific patterns of outsourcing are of course related to the characteristics of the RE firms. In particular, as we will see, the role that unions and industrial relations have in them is quite important.[8] Other features are however important and can be captured when the firms are seen, as suggested in Section 2, as organizational, production, industrial and innovation units of analysis. A consistent empirical application is thus carried out in the following.

More precisely, the empirical application of the paper is carried out by applying the outsourcing arguments of Section 2 to a large sample of RE firms. As it is the core of the empirical analysis, its representativeness is worthwhile commenting at first (Section 3.1). The methodology (Section 3.2) and the variables (Section 3.3) through which it has been applied will be then presented.

3.1 The dataset

The sample of analysis refers to 166 firms drawn on a universe of 257 companies located in the Italian province of Reggio Emilia - listed in both national (Intermediate Census 1996 of the National Institute of Statistics) and local (Camera di Commercio in Reggio Emilia 2001) databases - which have been surveyed in 2002 (for a description of the survey see Pini (2004)). As we said, the 257 firms in the population operate in 19 manufacturing sectors as classified by the ISTAT-ATECO 91 codes and are all firms with at least 50 employees. This fact will have to be considered in the following, as SMEs as such, of which the local production systems of Emilia-Romagna are usually very dense, are not captured by our analysis. Still, the sample comprehends firms with both more and less than 100 employees, thus allowing us to provide some insights about the crucial role of size.

Although the respondent firms were 199 (the questionnaire had a reply ratio of 77.4%), 166 is the number of firms for which economic performance indicators as well as variables concerning firm characteristics were also available. Economic performances indicators cover the period 1998-2001 and are based on the dataset of firm balance sheets registered in Reggio Emilia Chamber of Commerce and reclassified by the balance sheet unit of the Reggio Emilia *Camera del Lavoro* (trade union).

As shown in Table 7 (Appendix C), the firms in the sample are 64.59% of the entire population. Their distribution by sector and size is characterised by a limited bias when comparing the 166 firms with all the surveyed firms. Both the textile sector and 'small-size' firms (50 to 99 employees) are slightly under-represented. However, no significant distortion emerges in all other sectors and dimensional employees' classes, with the number of interviewed firms approaching or reaching 100% of the total in many of them (Table 8, Appendix C).[9]

3.2 The model

In general, the use of outsourcing as a dependent variable of any kind of empirical model poses, as with respect to other kinds of organizational innovations, some methodological problems. In particular, there is not yet a shared reduced form equation to be used in dealing with outsourcing as an 'explanandum', such as instead the case when outsourcing is considered as an explanatory variable, for example, of the different firms' performance (e.g. Gorg and Hanley, 2004). A robust and feasible way to proceed is however to refer to the idea of 'knowl-

edge production function' (Griliches, 1979), and define a reduced form which attempts to provide an explanation of outsourcing by exploiting a theoretically consistent set of covariates. In other words, we estimate a reduced form such as the following:

$$y_{OUT_{i,t}} = \beta_0 + \beta_{1,t} \cdot x_{ORG_{i,t}} + \beta_{2,t} \cdot x_{PROD_{i,t}} + \beta_{3,t} \cdot x_{IND_{i,t}} + \beta_{4,t} \cdot x_{INNO_{i,t}} +$$

$$+\beta_{5,t} \cdot x_{STRU_{i,t}} + e_i \tag{1}$$

In Equation (1), $y_{OUT_{i,t}}$ represents the outsourcing 'output' of firm i at time t. $x_{k_{i,t}}$ is the set of outsourcing related variables identified with respect to a certain level of analysis k, out of the four presented in Section 2, that is: organizational ($k = ORG$), production ($k = PROD$), industrial ($k = IND$) and innovation ($k = INNO$). $x_{STRU_{i,t}}$ is the set of control variables of structural nature, β_{1-5} the correspondent set of coefficients, β_0 the constant term and e_i the error term with usual properties.

From an econometric point of view, the estimation of Equation (1) poses two main problems. First, heteroskedasticity, as it is often found when cross sectional data are used, may reduce the efficiency of econometric estimates. Thus, all estimates will be carried out in the following by adopting a 'robust' estimator which addresses such a source of distortion. Secondly, there is a potential endogeneity problem, such as when investigating the drivers of any other innovation, as they might be conversely thought as innovation effects. Although endogeneity may be tested by proper two stages procedures, we here stress again that the focus of the present application, as others based on purely cross sectional data, is primarily on an extensive analysis of correlations rather than on causal processes (Michie and Sheehan, 2005).

Given that the outsourcing arguments presented in Section 2 are quite complex, the search for proxies suitable to test them empirically through a model such as that in Equation (1) is indeed crucial. In this last respect, the paper brings some elements of originality, as far as both the dependent and the independent variables are concerned.

3.3 The variables

Dependent variable. In order to capture the different implications outsourcing has depending on the involved activity (just think of contracting out R&D rather than janitorial services), in the present application we refer to an index of *out-*

sourcing complexity, $OUTCOM_i$. This index captures the number of activities outsourced by firm i - out of the 17 considered - by weighting differently, and increasingly, "ancillary" activities, "production-supporting" activities and "production" activities as such (Table 6). In other words, our dependent variable is the following (for the sake of simplicity, the temporal index will be omitted):

$$y_{OUT_i} = OUTCOM_i = \\ OUT_{ANC_i} \cdot s_1 + OUT_{SUPROD_i} \cdot s_2 + OUT_{PROD_i} \cdot s_3 \tag{2}$$

In (2), OUT_{j_i} is the share of activities of a certain kind j outsourced by firm i. s_j instead 'weighs' the difficulties of outsourcing an activity of kind j, and takes on the entire values 1, 2 and 3 for, respectively, ancillary ($s_1 = 1$), production-supporting ($s_2 = 2$) and production activities as such ($s_3 = 3$).

The rational of these weights is both theoretical and empirical. From a theoretical point of view, production activities are indeed the core (i.e. the 'primary' activities) of the strategic idea of 'value chain' (Porter, 1980), while ancillary and production supporting activities mainly fit among those retained, still in the value chain framework, 'support activities', whose function is to improve the effectiveness and efficiency of the former. What is more, production activities, intensive as they are of material assets, are those in which the core competences of the firm are actually embodied (Hamel and Prahalad, 1990), and with respect to which outsourcing thus entails a higher risk of impoverishment. These arguments get confirmed from an empirical point of view, as RE firms have (on average, in-between 1998 and 2001) outsourced ancillary activities to a greater extent than product-supporting ones and, in turn, than production activities as such as (Table 6). And this is further confirmed by a more qualitative analysis of the outsourcing decisions of the sample, with the only relevant exception of the textile sector.[10]

The reference to a dependent variable such as $OUTCOM_i$, rather than to a standard discrete one of outsourcing presence/absence, is urged by the nature of our sample in which, as we said, nearly all of the interviewed firms resort to some kind of outsourcing. On the other hand, although continuous, also $OUTCOM_i$ ranges from 0 to 1 [11] and this makes our dependent variable fractional. As is well known, this fact poses some econometric problems (Pindyck and Rubinfeld, 1991). However, since the aim of the paper is detecting significant correlations, rather than estimating any kind of elasticity, the same problems are not very severe and OLS corrected for heteroskedasticity can be used for estimating (1) once plugged Equation (2) into it.

While $OUTCOM_i$ is the main dependent variable, in order to further verify whether correlations may change with regard to discrete choices on specific sub-realms of the all inclusive index, we also examine by probit analysis the discrete decision of outsourcing-or-not production (OUT_{PROD_i}) and ancillary activities (OUT_{ANC_i}).

Independent variables. The indicators used as independent variables are grouped into the 4 conceptual blocks identified in Section 2 and formally defined in the correspondent tables (Appendix A). While some of them are quite standard and thus self-explaining, some others deserve a special attention as they have been devised on purpose to capture the complexity of the outsourcing arguments presented in the paper.

As far as the *organizational level* is concerned (Table 1, Appendix A), $ASPEC_i$ tries to proxy (product) asset-specificity at the firm level objectively, by capturing each firm i's involvement in products whose local market (here meant as regional) is made up by fewer rather than many competitors. Following Gonzalez-Diaz, Arruada, and Fernandez (2000), it is based on the idea that in the former case the assets concerned, possibly having few alternative users and thus generating high expropriable quasi-rents, determine the hold-up problems which are typically induced by their specificity. In order to see how asset-specificity interacts with governance inseparability, the former has been combined: at first, with the firm's union density ($ASPEGOV1_i$), to check for outsourcing binding effects, then, with the unions' role in the externalization process ($ASPEGOV2_i$), to check for governance enhancing effects.

A comment is also due for $ORGPLA_i$, which tries to capture the outsourcing implications of what we called 'interface knowledge' by estimating the degree of matching between the outsourced activities and the organizational divisions which are formally present within the firm. The greater this index, the more explicit is presumably the interface knowledge which links the outsourced activities with those which remain within the firm, as it is mediated by an explicit organizational relationship. Finally, we should make notice that, because of data constraints, $PRODDIF_i$ is just a rough proxy of the heterogeneity of the firm's products/activities, as it checks for the firm being involved in the production of large volumes rather than of small series only (low 'differentiation') or, alternatively, in both the two kinds of production simultaneously (high 'differentiation'). Similarly, $GEODIV_i$ just captures the extent to which geographical diversification gets reflected in shares of total revenues that are distributed, rather than polarized, across different geographical markets, namely regional (REG), national (NAT), European (EU) and international (INT).

As far as the *production level* is concerned (Table 2, Appendix A), we have proxied the firm relative wage ($RELWAGE_{ij}$) by working out the percentage deviation from the mean of sector j revealed by the unit labor cost of each one of its firm i. As in other cases (e.g. $INTASS_i$), contingent fluctuations have been smoothed by referring to average values over time for the available years (1998-2001). $FIRMUNC_i$ tries to capture the firm-specific effects of sectoral uncertainty by relating the standard deviation of firm's i revenues (on average in the 1998-2001 period) to the standard deviation of that branch j to which it can be related.

The indicators used at the *industrial level* (Table 3, Appendix A) are quite standard. The degree of competition of a certain sector, for example, is captured by considering it inversely related to its concentration ratio, as it is measured by a common Herfindahl index of revenues ($HERFREV_j$).[12] The firm size is retained by using, in addition to standard dummy variables applied as controls through the whole application ($FIRMSIZE1_i$), the log of the total number of employees of firm i ($FIRMSIZE2_i$). $INDREL_i$, instead, is an original synthetic indicator of the intensity and quality of the relationships between managers, employees and trade unions within the firm, in particular as far as innovation strategies are concerned (see Antonioli, Mazzanti, Pini, and Tortia (2004) for its construction).

A more careful illustration is required for the *innovation level* of analysis (Table 4, Appendix A). To start with, $TECUNC_j$ tries to proxy the degree of technological turbulence of firm's i business domain by counting the number of technological innovations which have been introduced in its reference branch j (i.e. $TECINNO$)[13] and by controlling for the differences in the relative firm populations. As far as the technological regimes are concerned, following Malerba and Orsenigo (1993), we have tried to identify them through two variables (which expected signs in Table 4 refer to). $HERFINNO_j$ works out the concentration degree of a certain sector j through a standard Herfindahl index, but in terms of innovation rather than production. The higher (lower) it is, the more (less) concentrated are the innovative activities of the sector, the more it resembles a Schumpeter Mark II (Mark I) regime. $SPEARINNO_j$, instead, proxies the innovative turmoil of sector j over time by checking for the average degree of reshuffling in the ranking of its firms in terms of innovative activities, when different periods of time are considered. As usual, the closer the Spearman correlation index is to 1 (-1), the more similar (dissimilar) the two correspondent temporal firm rankings are in terms of asset intangibility, the more sector j resembles a Schumpeter Mark II (Mark I) regime.

As far as the radicalness of the firms' innovations is concerned, $RADINNO_i$ classifies as radical those innovations which are either product or process innovations, retaining incremental the quality ones. Although debatable, such a distinction could be invoked by considering that the former usually requires a new technological base to be developed, while the latter could just require the recombination of the existing one. Furthermore, it seems reasonable to assume that a high degree of novelty of new products and processes entails more pervasive changes in the firm's production and organizational processes than the amelioration of the existing ones (Pini and Santangelo, 2005).

Finally, the other variables of the innovation level ($ORGINNO_i$, $FLEXINNO_i$, $INWORK_i$, $FLEXFUN_i$, $FLEXWAGE_i$ and $INNOREWARD_i$) are, like $INDREL$, synthetic indicators which have been built up in another study, still based on the same RE survey of the present one, but aimed to capture the organizational innovations and the flexibility of the sampled firms (Antonioli, Mazzanti, Pini, and Tortia, 2004).

Once completed the description of the relevant variables, let us now turn to the main results of the application. As a reference for their interpretation, the correspondent correlation matrix is reported in Table 9 (Appendix D).[14]

4 The profile of the Reggio Emilia outsourcing firm

We first present the results of the econometric estimates for each of the four levels of analysis separately (Table 11, Appendix D). Then a regression including only the variables associated with a statistically significant coefficient in the distinct four levels (Table 12, Appendix D). In such a way, the risk of high correlations between factors belonging to the four different sets, which could affect estimated correlations, is mitigated. Furthermore, too highly correlated covariates deriving from the distinct blocks in the pulled regression are verified.

4.1 The organizational level

At the outset, it seems that the firms' involvement in activities in which rent-seeking behaviors are unfavored does not play a significant role for outsourcing (Table 11, Appendix D). Indeed, asset specificity ($ASPEC$) does not turn out significant at the outset. Significant is instead $UNION$[15], whose negative sign supports the idea that the pervasiveness of the unions might counteract externalization decisions by increasing the firm's governance inseparability. On

the contrary, governance inseparability is not fueled by the firm's contractual history. Indeed, the firm's age ($FIRMAGE$), although not very significant at the present level, reveals an unexpected positive sign. Furthermore a positive sign emerges also when the age of the firm is used as a control variable in the regressions of the other levels of analysis: older firms seem willing to experience the opportunities of outsourcing more than the younger ones, and their thicker contractual history does not work as a constraint. A result which is reinforced when the four levels are pulled together.

Quite interestingly, while $ASPEGOV1$ does not turn out significant, $ASPEGOV2$ is instead significant and with a positive sign. In other words, if unions are enabled to enter the outsourcing decisional process actively (being informed or consulted), the firm seems to become willing to externalize activities even if they are intensive of specific assets. Although apparently counter-intuitive, the result is quite interesting. While an increasing level of unionization could be thought to increase the governance inseparability of the firm, the union's participation to the outsourcing decisional process actually turns governance inseparability into *governance separability conditioned on* their involvement. And this would seem to set an organizational deterrence to the hold-up behaviors which are naturally associated to asset-specificity. In this last respect, it is interesting to notice that by controlling, through dummy-variables, for the outsourcing implications of firms which just inform and firms which at least consult the workers' unions about their outsourcing decisions, none of them turn out very significant. While by interacting outsourcing consultation with asset specificity makes the relative variable significant, thus supporting our interpretation. This result represents an important added value of the paper and shapes a peculiar feature of the RE industrial framework, which will be clearer at the end of this section.

As much as asset specificity, other basic insights of TCE find a partial confirmation in our application. On the one hand, the intensity of intangible assets ($INTASS$) shows an expected negative sign on the coefficient, but never reaches a sufficient significance threshold in several specifications (and it has been thus omitted from Table 11). As expected, the uncertainty related proxy ($MKTUNC$) turns out poorly significant, confirming other empirical evidences on the issue (Gonzalez-Diaz, Arruada, and Fernandez, 2000). But also its interaction with asset specificity ($MKTASPE$) is non significant, thus confirming how TCE might not be an appropriate theoretical explanation for outsourcing in the context of Reggio-Emilia. The only relevant confirmation seems to come from product differentiation ($PRODDIF$), which actually hampers vertical integration: its sign with respect to outsourcing is positive, although it is just

moderately significant (10%).

As far as the role of interface knowledge is concerned, its codification into organizational relationship actually seems an enabling factor to "detach" and externalize parts of the firm's value-chain: $ORGPLA$ is actually positive, showing a 10% significance level with respect to $OUTCOM$ and a higher 5% significance with respect to a simple, unweighted outsourcing index as a dependent variable. On the contrary, hierachization, although possibly making interface knowledge more explicit and thus somehow favoring outsourcing, also makes the firm's activities dependent on more control centres and thus hampers it. The latter effect apparently counteracts the former: indeed, the hierarchical ratio ($ORGHIER$) is actually significant (5%-10%), but with a negative coefficient across different specifications, though somehow sensible to the inclusion/omission of other covariates.[16]

4.2 The production level

Although saving on labor costs is usually retained an outsourcing argument, $RELWAGE$ does not turn out significant, in all the different versions of the index we have used[17] (Table 11, Appendix D). On the contrary, $RWSKILL$ turns out significant and with a negative sign, a result which is 'pulled' by the significance and the negative sign of $SKILL$. This seems to corroborate a strategic interpretation of outsourcing, where high skills in-house possibly spur the firms to be more selective in resorting to outsourcing.[18]

Out of the two possible effects the firm's unionization degree ($UNION$) might have on the outsourcing decisions, the negative one, which passes through a possible increase in the firm's governance inseparability, seems to overcome the positive one, which instead passes through a possible increase in the firm's labor cost. The present result should however be read along with that obtained at the organizational level, where an outsourcing enabling role of the unions, rather than a binding one, also emerges when the nature of their intervention in the firm's decision is disentangled.

Finally, outsourcing seems neither a mere labor cost reduction strategy, nor a way of smoothing the costs of adapting to firm specific demand changes: $FIRMUNC$ is in fact not significant.[19] Apparently, the problems induced by market uncertainty are dealt with by resorting to other internal organizational arrangements, possibly of flexible nature, as we will argue in the following.[20]

4.3 The industrial level

That outsourcing would be more a competitive means in low concentrated sectors than a rent appropriating instrument in highly concentrated ones can't be taken as more than a suggestion (Table 11, Appendix D). $HERFREV$ in fact does not emerge as very significant, but its association to a negative sign is worthwhile noting anyway.[21] Quite interestingly, such an argument appears also significant at 1% when a probit regression concerning OUT_{PRO} is assessed.

When we look at the size effects, the only significant and negative sign (ranging over 1%-5% statistical levels) is $SIZE1$, which refers to firms whose employees are in-between 100 and 249. The continuous size variable, when used alternatively, is also associated to a similar, from a significance perspective, negative coefficient, driven by the small-medium firm effect. In other words, it seems possible to conclude that, compared to our "small" firms (in-between 50 and 99 employees), larger ones are possibly less involved in outsourcing activities.[22] In the context of RE, therefore, outsourcing does not appear a 'dual' relationship, where the largest firms simply exploit and subordinate smaller firms to them, but rather a 'developmental' or equivalent kind of relationship, where also the latter could benefit from the former in terms of flexibility and specialization.

Finally, regarding the quality of industrial relations, $INDREL$ is negatively related to outsourcing, and its significance depends on the variable capturing the skill intensity of the firm ($SKILL$): indeed, if the latter is omitted, the significance level is 1%, otherwise it decreases to 10% (the relative specification has thus not been chosen). Accordingly, it seems to us possible to conclude that the more industrial relations are intensive and simultaneosuly involving qualified workers, the less outsourcing tend to characterise firm strategies, with a moderate correlation. This is another extremely interesting result, especially once read along with those obtained at the organizational level. Indeed, on the basis of them it seems possible to interpret the outsourcing processes of the RE firms as two-fold. At a first level, the pervasiveness (captured by $UNION$) and the quality of the relations which involve the unions (proxied by $INDREL$) tend to determine a 'bargaining equilibrium' where outsourcing is less likely to occur. At a second level, once union representatives are more directly involved in the process, which thus occurs under their involvement, outsourcing becomes more possible, and even counteracting other organizational risks (such as those entailed by opportunistic behavior in front of specific assets, as captured by $ASPEGOV2$).

4.4 The innovation level

First of all, let us note that $TECUNC$, that proxies the degree of technological uncertainty, is not significant, although with some caveats on which we will return later (Table 11, Appendix D). Quite interestingly, instead, $SPEARINNO$ is significant and with a negative sign. Although the non significance of $HERFINNO$ somehow weakens this result, outsourcing actually seems a safer strategy to undertake in sectors characterized by the typical turmoil (here reshuffling) of Schumpeter-Mark-I technological regimes.

As far as the firm innovativeness is concerned, $TECINNO$ turns out significant and positively correlated with $OUTCOM$, thus supporting the interpretation, recently put forward by Mol (2005), according to which vertical disintegration is not necessarily inconsistent with technological change, as standard organizational theories instead argue (typically TCE based). The risks of diminishing the firm's innovativeness by impoverishing its absorptive capacity are apparently not confirmed. On the contrary, it seems that outsourcing may be important for RE firms to tap-into the resources and competences of the provider and implement them into superior technological processes. An interpretation consistent with the technological regime which can be more typically associated to outsourcing in RE (that is of the Schumpeter Mark I type).

Quite interestingly, $RADINNO$ turns out significant and with a positive sign, although the significance level is relatively low. Although with a certain arbitrariness, this would suggest that even relatively more radical innovations might benefit from the knowledge specialization induced by outsourcing. However, once product innovations are considered alone and process innovations are left out, the correlation with $OUTCOM$ becomes much more significant, and it appears evident that the significance of $TECINNO$ is actually driven by that of $INNO_{PROD}$. In other words, rather than radicalness, it is the nature of the innovation itself which matters: more precisely, it is mainly the introduction of a new product, so that the selected specification has been chosen accordingly in Table 11 (Appendix D).

As far as the organizational innovations are concerned, also $ORGINNO$ presents a significant correlation with $OUTCOM$, but this time negative. Outsourcing seems therefore an organizational innovation which substitutes for others the firm might adopt in trying to increase its flexibility and, in so doing, its dynamic capabilities and competitiveness. This might suggest that their inspiring rational is actually quite different and amounting to a change in, respectively, the 'external governance' of the firm (outsourcing) and its 'internal' one (the other organizational innovations). In this last respect, let us also observe that

our proxies of functional, wage and total labor flexibility, as well as the variable capturing innovations in reward systems, do not seem to be highly correlated with outsourcing. Only $FLEXWAGE$ emerges with a negative sign on the coefficient, but never overcomes a significant threshold in statistical terms.[23] Non significant is also the interaction between incremental technological innovations (i.e. $INNO_{QUAL}$) and $ORGINNO$, which was instead found significant and positive by another study on the same dataset (Pini and Santangelo, 2005).

4.5 The general profile of the outsourcing firm

As a final stage, we present the results of a regression including only the aforementioned significant factors (Table 12, Appendix D). As expected, this final regression is associated to a high overall fit, regarding both adjusted R squared and F statistics, since it incorporates the full set of relevant explanatory variables.

The extended regression does not present sharply different outcomes with respect to coefficient significance, confirming implicitly that independent variables are exogenous and significant correlations between them are not present. The experience effects that a longer firm history exerts on its outsourcing decision is here reinforced by a higher significance level of $FIRMAGE$. The same holds true for the governance inseparability effects played by the union density ($UNION$).

Among the controls, $GROUP$, $FIRMAGE$ and $SIZE1$ emerge among the others, while $SKILL$ is here reducing its significance. The variables associated to the production, organizational, and innovation level that we have detected above confirm their impact, while the industrial conceptual level is in the end the less relevant in terms of relative weight. We finally note that $SPEARINNO$ reduces its significance to 20%, and is not significant when $ASPEGOV2$ is included.

5 Conclusions

In trying to embed the outsourcing firm, in this paper we have carried out a sort of multi-level kind of analysis in which, not only are TCE and the resource-competence based explanations combined at the organizational level. But the organizational level is in turn combined with other levels of analysis at which important features emerge for qualifying the general profile of the outsourcing firm.

In a specific context, such as that of a North-East Italian province (Reggio Emilia), with the typical traits of a local production system, outsourcing is apparently not well accounted for by TCE. Indeed, the majority of the variables which refer to the outsourcing explanations provided by TCE are either non significant or with a non-expected sign. The interpretative power of TCE found by other studies (e.g. Gonzalez-Diaz, Arruada, and Fernandez, 2000) thus might depend on the specific sector and geographical context investigated (in that case, the Spanish construction sector).

The institutional setting of RE might actually make TCE arguments not very relevant: in particular, the typical industrial relations of the area, and the 'social capital' which is usually associated to a district kind of local production system might make the opportunism of the agents embodied by TCE less explicative. This is somehow confirmed by the strong interpretative power of industrial relations, which seem to play an important role in affecting the outsourcing decisions of the RE firms. In particular, it emerges that unions, so to say, push the brake pedal at the outset, but when outsourcing occurs, they are involved or at least informed. Outsourcing, as other dynamics, is spurring from a bargaining arena including as key topics labor related flexibility, wages, innovation dynamics (with outsourcing inside), employment levels, which are typical historically and institutionally determined features of the industrial system under analysis.

In conclusion, our multi-level kind of analysis suggests that the profile of the RE outsourcing firm seems to be more consistent with a 'network/cluster' approach than with a 'dualistic' one (Taymaz and Kilicaslan, 2005), strategic rather than operative. Indeed, the RE outsourcing firm has the following features: i) it is relatively not very large and does not seem just to 'exploit' smaller sub-contractors; ii) it conceives a hierarchical organizational structure and the organizational matching of outsourcing, respectively, as an obstacle and as an enabler for it; iii) it does not appear to sub-contract to save labor costs or to smooth unexpected demand peaks; iv) it deals with outsourcing strategically, in particular to tap-into the resources and competences of its suppliers, which it then possibly implements into technological, product innovations, without a crucial knowledge leakage; v) it uses outsourcing as a substitute, rather than as a complement, of other organizational innovations, distinguishing different paths of governance change (respectively, external and internal) toward flexibility.

We conclude by setting out what the main directions of future research might be. First of all, grounding on a survey carried out in 2005 on the same industrial area of RE, we will be able to construct either/both a panel dataset consisting

of two waves of observed firms or/and a cross section dataset with lagged terms for the set of explanatory variables. The latter option allows an applied analysis where causality links are more easily assessed. We thus may check both the effects of outsourcing activities on firm performance (i.e. profitability, productivity) and the impact of the set of the described covariates on outsourcing occurred in 2003-2004, by exploiting data for two independent consequential periods: 1998-2001 and 2002-2004. Another additional value added of the future research will be the possibility to extend the dataset to firms having between 20 and 49 employees, for a higher representativeness of our results according to the characteristics of the relevant firm population.

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Notes

[1]A concise survey of these approaches can be found in Cacciatori and Jacobides (2005), where an original link between the dynamics of vertical integration and one industry's life-cycle is put forward.

[2]In this vein, by implying networking and clusters among firms, outsourcing has recently entered the 'unfamiliar' domains of regional and local development (e.g. Taymaz and Kilicaslan, 2005).

[3]To be sure, the list of reported arguments is a sub-set of those organization economics has addressed, somehow filtered by the needs of the empirical test of the paper.

[4]The qualitative and/or quantitative description of an input-output kind of relationship between two establishments is the most common example of such a knowledge. In its absence, outsourcing would be hampered by 'opportunity' costs of specifications (e.g. delays and production interruptions in the transition) and of codification, both direct (i.e. in terms of effort) and indirect (i.e. in terms of loss of richness and details) (Mahnke, 2001).

[5]In this kind of literature outsourcing is dealt with as the resort to 'market mediated work arrangements'. For a survey see Bartel, Lach, and Sicherman (2005). Once more, the set of arguments here addressed is a sub-set of that literature.

[6]The present section instead does not report the outsourcing arguments of the literature on 'strategic outsourcing' drawing on game-theory (e.g. Kamien, Li, and Samet, 1989; Spiegel, 1993; Baake, Oechssler, and Schenk, 1999). And neither those which have been put forward following a network/cluster approach (Taymaz and Kilicaslan, 2005). Although quite important, they have been omitted as their test would have required very detailed data on inter-firm relationships that the dataset of our application does not contemplate.

[7]As argued by Benson and Ieronimo (1996) (p. 60), "outsourcing contributes to all three forms of flexibility [functional, wage and numerical]. Tasks undertaken are contract - not craft related, payment is made only for work completed, and worker numbers can be adjusted to the production requirements of the plant".

[8]Out of the 199 cases in which it has been possible to detect it, for example, 20.5% of the firms informed the unions of their outsourcing decisions, and in 6% of the cases unions were even consulted (Antonioli and Tortia, 2004).

[9]In order to verify whether the firms' sample, distributed by sectors and firm size, is representative, a test was performed (Cochran, 1977) which yielded tolerable results (Table 8, Appendix C).

[10]It should be stressed that Equation (1) has also been estimated by using a non-weighted linear combination of the three OUT_{j_i}, yielding quite similar results but slightly less significant.

[11]In the sample, the 0s are 14 out of 166, while the other limit value, that is 1, is not assumed by any firm. The maximum observed value is 0.88, and mean and median are, respectively, 0.28 and 0.29. Let us observe that we are prevented from transforming $OUTCOM_i$ in a fully continuous logarithmic form (e.g. by applying the formula $\log \frac{y}{1-y}$), given the presence of values equal to 0. Although such firms represent no more than 10% of cases, we decided not to restrict the analysis only to firms adopting at least one of the analysed outsourcing typologies.

[12]The expected sign of the correspondent table thus refers to its reciprocal.

[13]Innovations have been distinguished into three categories by the interviewed managers. While product and process innovations have been indicated to them as the introduction of relatively new products and production processes, respectively, quality ones have been defined

as ameliorations on the quality of an *existing* product and/or process. According to this distinction, consistent dummies have been also built up for each of the three categories, that is $INNO_{PROD}$, $INNO_{PROC}$ and $INNO_{QUAL}$.

[14]The set of explanatory variables here presented and used as covariates in the analysis is the result of a preliminary selection of an extended full set of proxies deriving from the information sources related to the survey questionnaire (Antonioli, Mazzanti, Pini, and Tortia, 2004; Pini, 2004). This first selection has been carried out to reduce collinearity problems and assure the exogeneity of independent factors, mitigating biases. By referring to the full correlation matrix for each level, concerning all potential covariates, and dropping high-correlated potential regressors, the selection has produced a limited set of covariates for testing each specific hypothesis. The final correlation matrix (not shown) highlights low figures concerning main independent variables, never overcoming a threshold fixed around 0.20.

[15]It should be stressed that $UNION$ increases substantially the regression fitness at the present level of analysis, and also makes significant other variables at the same level: $ORGPLA$, in particular.

[16]As far as controls are concerned, sectoral effects seem of minor relevance: at the present organizational level of analysis, only the chemical sector is associated to a 10% statistical significance. Among other controls, skill intensity ($SKILL$) and group membership of the firm ($GROUP$) emerge as quite robust factors, both with negative signs, while performances, training coverage and international market shares do not. We will devote some more words to skills in the following. Size/economies of scale effects (related to $SIZE1$) are also commented in the following. Let us finally observe that the probit analysis of OUT_{PROD} and of OUT_{ANC} does not show any worth noting result in addition to what commented and presents lower statistical robustness for the overall regression. This is an outcome which characterizes all the four levels, with few exceptions we will stress in due course.

[17]The cost of labor emerges as a weak outsourcing determinants also in other studies carried out at the firm level such as Abraham and Taylor (1996) and Taymaz and Kilicaslan (2005).

[18]The specification including $RWSKILL$ has been preferred to that with $SKILL$ having a better fitness in general.

[19]Of course, more accurate proxies are needed to get to such a conclusion. Let us note that the interaction between $FIRMUNC$ and asset specificity turns out significant and negative, thus apparently supporting a TCE kind of interpretation. However, the latter interactive turns out correlated with $ASPEGOV1$: the correlation between the two is around 0.25; not excessively high, but some suspects may remain that the variable significance is driven by the latter.

[20]Concerning controls at the production level of analysis, we note and confirm a 1% significance of $SKILL$ and a 10% significance for the chemical sector dummy, both with a negative sign.

[21]To be sure, the same variable turns out significant and with an expected negative sign if Pavitt sectors, rather than sectors as such, are used as a control variable. See Table 11 (Appendix D).

[22]In general, the size dummy $FIRMSIZE1$ has been preferred to the continuous variable $FIRMSIZE2$ as more significant, but signs are consistent. Let us observe that, though partially unexpected, the size effect we detected is also found by Abraham and Taylor (1996) for most outsourced activities, while Mol (2005) does not find significant size effects in a recent study on the relationship between outsourcing and innovation.

[23]As far as controls are concerned, $SKILL$ and $FIRMAGE$ are both highly significant for this fourth and last conceptual level.

A Expected correlations

Label		Outsourcing variable	Definition	Positions	Relation with outsourcing
i	$ASPEC$	asset specificity	$[\frac{1}{N_j} \cdot LOCREV_j] \cdot REVij$	N_j = n. of firms in branch j $LOCREV_j$ = local share of branch j's revenues REV_{ij} = firm i's share of branch j's revenues	-
ii	$UNION_i$	union density (governance inseparability)	$\frac{UEMP_i}{EMP_i}$	EMP_i = n. of employees $UEMP_i$ = n. of unionized employees	-
iii	$FIRMAGE_i$	firm age (governance inseparability)	lg $(2002 - SETYEAR_i)$	$SETYEAR_i$ = firm i set-up year 2002: latest year of the survey	-
iv	$ASPEGOV_i$	asset specificity conditional on governance inseparability	$ASPEGOV1_i = ASPEC_i \cdot UNION_i$		+/-
			$ASPEGOV2_i = ASPEC_i \cdot UNIOUT_i$	$UNIOUT_i = 1$ unions either informed or consulted $UNIOUT_i = 0$ neither informed nor consulted	+/-
v	$INTASS_i$	intangible assets (intensity of)	$\frac{\sum_{t=1998}^{2001} \frac{INTINV_{it}}{CAPINV_{it}}}{4}$	$INTINV_{it}$ = intangible investments in t $CAPINV_{it}$ = invested capital in t	-
vi	$ORGPLA_i$	organizational placement (interface knowledge)	$\frac{NOUTDIV_i}{NOUT_i}$	$NOUTDIV_i$ = n. of out. activities with division $NOUT_i$ = n. of out. activities	+
vii	$ORGHIER_i$	organizational hierarchy (interface knowledge)	$\frac{NHIER_i}{NDIV_i}$	$NHIER_i$ = n. of hierar. levels among divisions $NDIV_i$ = n. of organizational divisions	+/-
viii	$PRODDIF_i$	product differentiation		$PRODDIF_i = 1$ if both large and small production $PRODDIF_i = 0$ if either one or the other	+
ix	$GEODIV_i$	geographical diversification	$\frac{\sum_g (REV_{ig} - MREV_{ig})^2}{4}$	g = REG, NAT, EU, INT $MREV_{ig}$= mean of the 4 g	+
x	$MKTUNC_j$	market uncertainty	$\sqrt{\frac{\sum_{t=1998}^{2001} (REV_{jt} - MREV_{jt})^2}{4}}$	REV_{jt} = sector j's revenues in t $MREV_{jt}$= mean of REV_{jt}	non signif.
xi	$MKTASPE_i$	mkt uncertainty conditional on asset specificity	$MKTUNC_j \cdot ASPEC_i$		-

Table 1: Expected outsourcing correlations: organizational level

Label		Outsourcing variable	Definition	Positions	Relation with outsourcing
i	$RELWAGE_{ij}$	relative wage	$(LABCOST98\_01_{ij} - MLABCOST98\_01_j)/100$	$LABCOST98\_01_{ij}$ = average labor cost (98-01) of firm i in sector j $MLABCOST98\_01_j$ = sectoral mean of $LABCOST98\_01_{ij}$	+ or non sign.
ii	$SKILL_i$	skill content (of the firm activities)	$\frac{QUALEMP_i}{EMP_i}$	EMP_i = n. of firm i's employees $QUALEMP_i$ = n. of firm i's qualified employees	+/-
iii	$RWSKILL_{ij}$	relative wage conditional on skill content	$RELWAGE_{ij} \cdot SKILL_{ij}$		+/-
iv	$UNION_i$	union density (cost of labor)	$\frac{UEMP_i}{EMP_i}$	EMP_i = n. of firm i's employees $UEMP_i$ = n. of firm i's unionised employees	+
v	$FIRMUNC_i$	firm uncertainty	$\frac{\sqrt{\frac{\sum_{t=1998}^{2001}(REV_{it}-MREV_{it})^2}{4}}}{\sqrt{\frac{\sum_{t=1998}^{2001}(REV_{jt}-MREV_{jt})^2}{4}}}$	REV_{it} = firm i's revenues in t REV_{jt} = sector j's revenues in t $MREV_{it}$ = mean of REV_{it} in 1998-2001 $MREV_{jt}$ = mean of REV_{jt} in 1998-2001	+

Table 2: Expected outsourcing correlations: production level

Label		Outsourcing variable	Definition	Positions	Relation with outsourcing
i	$HERFREV_j$	Herfindhal of revenues (sector concentration)	$\sum_i \left(\frac{REV_{ij}}{REV_j}\right)^2$	REV_{ij} = firm i's revenues in sector j REV_j = sector j's revenues	+/-
ii	$FIRMSIZE_i$	firm size	$FIRMSIZE1_i = SIZE1, SIZE2, SIZE3$	$SIZE1$ = dummy for firms with 100-249 employees $SIZE2$ = dummy for firms with 250-499 employees $SIZE3$ = dummy for firms with more than 500	+/-
			$FIRMSIZE2_i = \log EMP_i$	EMP_i = n. of employees	+/-
iii	$INDREL_i$	industrial relations (quality)	synthetic index of industrial relations	see Antonioli, Mazzanti, Pini, and Tortia (2004)	+/-

Table 3: Expected outsourcing correlations: industrial level

Label		Outsourcing variable	Definition	Positions	Relation with outsourcing
i	$TECUNC_j$	technological uncertainty	$\frac{\sum_i INNO_{K_{ij}}}{n_j}$	$INNO_{K_{ij}}$ = innovation of kind K introduced by firm i in sector j $K = PROD$ (new product) $K = PROC$ (new process) $K = QUAL$ (improved product or process) n_j = n. of firms in sector j	+
ii		technological regime:			
		Schumpeter Mark I			+
		Schumpeter Mark II			-
	$HERFINNO_j$	Herfindhal of innovations	$\sum_i \left(\frac{INNO_{K_{ij}}}{INNO_{K_j}}\right)^2$	$K = PROD, PROC, QUAL$ $INNO_{K_{ij}}$ = firm i's innovations in sector j $INNO_{K_j}$ = sector j's innovations	
	$SPEARINNO_j$	Spearman correlation in innovation rankings	$(SPEARINNO_{j_{1998-1999}} +$ $SPEARINNO_{j_{1999-2000}} +$ $SPEARINNO_{j_{2000-2001}})/3$	$SPEARINNO_{j_{t;t+1}} = 1 - \frac{6 \cdot \sum_i^n d_{ij}{}^2}{n \cdot (n^2-1)}$ $d_{ij} = rank(INTASS_{ij_{t+1}}) - rank(INTASS_{ij_t})$	
iii	$TECINNO_i$	technological innovativeness	$INNO_{PROD_i} + INNO_{PROC_i} + INNO_{QUAL_i}$	$INNO_{K_i}$ = innovation K introduced by i $K = PROD, PROC, QUAL$	+/-
iv	$INNORAD_i$	innovation radicalness		$INNORAD_i = 1$ if either $INNO_{PROD_i}$ or $INNO_{PROC_i} = 1$, or both; $INNORAD_i = 0$ if $INNO_{PROD_i}$ and $INNO_{PROC_i} = 0$ and $INNO_{QUAL_i} = 1$	+/-
v	$ORGINNO_i$	organizational innovations	synthetic index of new organizational practices	see Antonioli et al. (2004)	+/-
vi	$FLEXINNO_i$	firm flexibility	synthetic index of flexibility indicators $INWORK_i$ = index of workers' participation to production decisions $FLEXFUN_i$ = index of plants and labor relations flexibility $FLEXWAGE_i$ = index of wage related flexibility $INNOREWARD_i$= index of compensations linked to performances	see Antonioli et al. (2004)	+/-

Table 4: Expected outsourcing correlations: innovation level

B Descriptive Statistics

Istat Ateco91 Sectors (2 and 3 digit)	**N. of firms** (% **of total**)	**N. of employees per establishment** (% **of total**)	**Average N. of employees per establishment**
Food and Beverage	5.45	6.65	170
Textiles	1.56	1.08	96
Clothing	4.67	6.74	201
Wood and wood products	0.78	0.61	109
(excl. furniture)			
Pulp, paper and paper products	1.56	1.69	152
Printing and publishing	1.17	1.10	131
Chemicals	1.56	1.81	162
(excl. chemicals)			
Rubber and plastic products	6.23	4.70	105
Non-metal mineral products:	21.79	20.94	134
- Ceramic tiles	15.95	15.37	134
- Other non metal minerals	5.84	5.56	133
Iron and stell and other basic metals	1.95	1.86	133
Fabricated metal products	9.73	6.82	98
(excl. machinery)			
Machinery and equipments:	34.63	36.27	146
- Machinery for mechanical energy	8.56	10.74	175
- Other generic machinery	8.56	7.77	126
- Agricultural machinery	4.67	6.19	185
- Machinery for metal transformation	1.17	0.66	79
- Other specific machinery	8.95	6.08	95
- Machinery for domestic use	2.72	4.82	247
Office machinery	0.39	0.23	84
Electrical machinery	3.89	4.51	161
TV, radios and other comm.	0.78	1.63	291
equipment)			
Medical, precision and	0.39	0.39	141
optical instrument)			
Motor-vehicles, trailer	1.56	1.88	169
and semitrailers)			
Other transport equipment	1.17	0.76	91
Furniture and other manufacturing	0.78	0.33	59
Total	257 = 100	35798 = 100	139

Table 5: Reggio Emilia: industrial structure of the firm population (2001)

Outsourced activities		**Outsourcing firms** (% of the total)
Ancillary activities		
1	Inventories management	14.45%
2	Internal logistics	24.86%
3	Distribution logistics	24.28%
4	Cleaning services	85.55%
5	Plants maintenance	77.46%
6	Machinery maintenance	63.01%
7	Data processing	31.79%
Production supporting activities		
8	Marketing	11.56%
9	Engineering	20.81%
10	Research & Development	16.18%
11	Labor consultancy	58.96%
12	Human resource management	8.67%
13	Quality control	8.09%
Production activities		
14	Supply of intermediate products	52.52%
15	Production stages	44.60%
16	Products & Trademarks	14.39%
17	Other production activities	9.35%
		100 = 166 (sample of respondent firms)

Table 6: Reggio Emilia: outsourcing firms of the sample by activity (1998-2001)

C Dataset

Istat Ateco91 Sectors (2 digit aggregated)	**Firm size: N. of employees**						**Total N. of firms in the sample**
	50-99	100-249	250-499	500-999	> 999	Total	
Food and beverage	0.00	60.00	100	100	100	71.43	10
Textiles & clothing	75.00	25.00	14.29	-	100	37.50	6
Paper and printing	75.00	-	100	-	-	85.71	6
Wood products	-	50.00	-	-	-	50.00	1
Chemical products, synthetic fibres and rubbers and plastic materials	87.50	57.14	100	-	0	72.22	13
Non metal minerals	44.00	64.71	80	85.71	100	60.71	34
Metal products, metal working equipments, mechanical machinery, office equipments electrical devices, transport equipments	59.72	68.29	76.92	71.43	88.89	66.2	94
Other industries	100	-	-	-	-	100	2
Total	58.97	63.16	69.7	81.25	86.67	64.59	
Total no. of firms in the sample	69	48	23	13	13		166

Table 7: Reggio Emilia: firms in the sample as a percentage of firms in the population

Istat Ateco91 Sectors (2 digit aggregated)	**Margin of error** θ	**Firms size: N. of employees**	**Margin of error** θ
Food and beverage	0.173	50-99	0.244
Textiles & clothing	0.333	100-249	0.088
Paper and printing	0.166	250-499	0.116
Wood products	1.000	500-999	0.123
Chemical products, synthetic fibres and rubber and plastic products	0.15	> 999	0.104
Non metal minerals	0.108		
Metal products, metal working equipments mechanical machinery, office equipments electrical devices, transport equipments	0.06		
Other industries	0.00		
Total	0.045	Total	0.045
Note: Critical margin of error for small sample $\theta = 0.10$			

Table 8: Reggio Emilia: results of the Marbach test for the sample

D Econometric results

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	ASPEC	1.00														
2	ASPEGOV1	0.98	1.00													
3	ASPEGOV2	0.64	0.58	1.00												
4	INTASS	-0.03	-0.02	0.00	1.00											
5	ORGHIER	-0.04	-0.06	-0.02	-0.09	1.00										
6	ORGPLA	0.04	0.08	0.07	0.15	0.04	1.00									
7	PRODDIF	0.08	0.07	0.03	-0.07	-0.07	0.03	1.00								
8	GEODIV	0.09	0.07	0.15	-0.07	0.13	-0.04	-0.05	1.00							
9	RELWAGE	-0.05	-0.02	-0.04	-0.02	-0.05	0.07	-0.17	0.02	1.00						
10	SKILL	-0.03	-0.02	-0.04	0.01	0.01	0.01	-0.13	0.14	0.24	1.00					
11	UNION	0.00	0.06	0.02	0.09	0.03	0.21	-0.05	-0.03	0.23	0.22	1.00				
12	INDREL	0.02	0.03	0.13	0.07	0.11	0.04	-0.05	0.01	0.33	0.12	0.37	1.00			
13	HERFREV	0.32	0.29	0.09	0.01	0.00	-0.06	0.02	0.21	-0.12	0.02	-0.15	-0.12	1.00		
14	FIRMUNC	0.15	0.14	0.04	0.04	0.07	0.07	-0.05	0.16	0.08	0.07	0.05	0.06	0.31	1.00	
15	UNCSEC	-0.31	-0.28	-0.16	-0.01	-0.02	-0.01	-0.04	-0.25	0.14	0.03	0.04	0.15	-0.72	-0.43	1.00
16	MKTUNC	0.19	0.18	0.00	-0.02	0.00	-0.06	-0.04	-0.01	-0.03	-0.11	-0.14	-0.05	0.39	0.17	-0.02
17	$INNO_{PROD}$	0.08	0.08	0.05	-0.04	0.05	-0.02	-0.05	-0.04	-0.01	0.02	-0.06	0.00	-0.03	0.03	0.06
18	$INNO_{PROC}$	0.07	0.08	0.03	-0.01	0.07	-0.06	0.09	-0.12	0.01	-0.02	0.13	0.04	0.07	0.07	-0.04
19	$INNO_{QUAL}$	-0.04	-0.05	-0.04	0.01	-0.09	-0.05	-0.01	0.05	0.06	0.06	-0.14	0.06	0.03	-0.06	0.01
20	TECINNO	0.06	0.05	0.02	-0.02	0.02	-0.07	0.01	-0.05	0.04	0.04	-0.04	0.06	0.04	0.01	0.02
21	ORGINNO	0.09	0.10	-0.02	0.08	-0.24	-0.07	0.01	-0.06	0.19	0.16	0.10	0.17	0.02	0.02	0.13
22	INWORK	-0.05	-0.06	0.02	0.11	-0.14	-0.11	0.00	0.01	0.03	0.08	-0.07	0.18	0.03	0.03	-0.02
23	FLEXFUN	0.03	0.00	0.08	-0.01	0.11	-0.01	0.18	-0.08	-0.04	0.03	-0.22	-0.13	-0.06	-0.14	0.09
24	FLEXWAGE	-0.12	-0.09	-0.14	-0.01	-0.06	0.13	0.00	-0.01	0.14	0.12	0.18	0.22	-0.11	0.02	0.13
25	INNOREWARD	-0.13	-0.12	-0.10	0.11	-0.08	0.11	-0.07	0.09	0.12	0.04	0.03	0.20	-0.04	-0.06	0.05
26	INNOFLEX	-0.05	-0.04	-0.04	0.05	-0.04	0.02	0.00	-0.11	0.12	0.10	-0.14	0.11	0.05	0.10	0.06
27	HERFINNO	0.36	0.33	0.13	0.01	-0.04	-0.04	0.09	0.17	-0.12	-0.01	-0.14	-0.17	0.78	0.28	-0.65
28	SPEARINNO	-0.02	0.02	-0.26	0.10	0.12	-0.03	-0.21	0.07	0.13	0.21	0.24	0.07	-0.08	0.03	0.05

Table 9: Correlation matrix: Part I

		16	17	18	19	20	21	22	23	24	25	26	27	28
1	ASPEC													
2	ASPEGOV1													
3	ASPEGOV2													
4	INTASS													
5	ORGHIER													
6	ORGPLA													
7	PRODDIF													
8	GEODIV													
9	RELWAGE													
10	SKILL													
11	UNION													
12	INDREL													
13	HERFREV													
14	FIRMUNC													
15	UNCSEC													
16	MKTUNC	1.00												
17	$INNO_{PROD}$	0.19	1.00											
18	$INNO_{PROC}$	0.14	0.13	1.00										
19	$INNO_{QUAL}$	0.08	0.00	0.03	1.00									
20	TECINNO	0.22	0.61	0.62	0.59	1.00								
21	ORGINNO	0.14	0.11	0.24	0.21	0.31	1.00							
22	INWORK	-0.01	0.16	0.03	0.29	0.27	0.19	1.00						
23	FLEXFUN	-0.04	0.11	0.06	0.17	0.19	-0.03	0.08	1.00					
24	FLEXWAGE	-0.08	0.03	-0.10	-0.02	-0.05	0.02	0.01	-0.07	1.00				
25	INNOREWARD	-0.07	0.00	-0.08	0.16	0.05	0.19	0.21	-0.09	0.14	1.00			
26	INNOFLEX	0.11	0.19	0.17	0.11	0.26	0.28	0.24	0.16	-0.09	0.05	1.00		
27	HERFINNO	0.08	-0.01	0.01	0.01	0.01	-0.11	0.12	0.06	-0.15	-0.15	-0.01	1.00	
28	SPEARINNO	0.00	0.12	-0.04	-0.01	0.04	0.03	0.05	-0.05	0.07	-0.03	0.07	0.05	1.00

Table 10: Correlation matrix: Part II

Level:	organizational		production		industrial			innovation		
Dep. variable:	OUTCOM		OUTCOM		OUTCOM			OUTCOM		
Covariates:	Version 1	Version 2	Covariates:		Covariates:	Version 1	Version 2	Covariates:	Version 1	Version 2
constant	2.739	2.751***	constant	2.933***	constant	2.404		constant	2.833	3.185***
SIZE1	-2.521	-2.569***	SIZE1	-2.477**	SIZE1	-1.728*	-1.530	SIZE1	-2.284**	-2.261**
GROUP	-2.027**	-1.965**	RWSKILL	-2.387**	GROUP	-1.687*	-1.728*	SKILL	-2.155**	-2.161**
SKILL	-1.718*	-1.742*	UNION	-2.751***	RI		-2.490**	FIRMAGE	2.006**	2.210**
FIRMAGE	1.414	1.382	FIRMUNC	-1.204	SI		1.661	TECINNO	2.403**	
ASPEGOV2	6.264***	7.258***			HERFREV	-1.066	-1.984**	SPEARINNO	-1.946*	-2.164**
PRODDIF	1.659*	1.808*			INDREL	-2.104**	-1.795*	ORGINNO	-2.435**	-2.163**
ORGPLA	1.785*	1.857*						INNOPROD		2.674***
ORGHIER	-2.265**	-2.281**								
MKTUNC		-2.569***								
UNION	-2.288**	-2.280**								
F test (prob)	3.29 (0.0003)	3.17 (0.0003)		2.58 (0.0015)		2.06 (0.0042)	3.28 (0.0003)		3.02 (0.0002)	3.19 (0.0001)
adj-R-squared	0.142	0.146		0.062		0.048	0.088		0.099	0.106
N	166	166		166		166	166		166	166

Table 11: Regression results: the 4 different levels (see illustrative notes)

Level:	All-levels
Dependent variable:	OUTCOM
Covariates:	
constant	3.079***
SIZE1	-2.556***
GROUP	-2.269**
SKILL	-1.616
FIRMAGE	2.036**
ASPEGOV2	3.213***
PRODDIF	1.909**
ORGPLA	1.758*
ORGHIER	-3.076***
UNION	-2.206**
HERFREV	-1.136
SPEARINNO	-1.067
ORGINNO	-1.959**
INNOPROD	3.288***
F test (prob)	3.11 (0.0001)
adj-R-squared	0.1868
N	166

Table 12: Regression results: the all levels (see illustrative notes)

Illustrative notes for Table 11 and 12

1. t ratios only are shown, since we do not emphasize elasticities. *: significant at 10% significance level; **: at 5% significance level; ***: at 1% significance level. Non relevant covariates (with t ratios lower than 1.645) are generally omitted.
2. All regressions adopt by default a White corrected robust estimator for the variance covariance matrix to address heteroskedasticity.
3. Apart from the production level, two specifications are shown for each of the others by varying the regressors included. Only final specifications, consistent with a 'from general to particular' estimation procedure, are shown.
4. Controls are not shown except for size-related dummies and firm age. Other controls include: macro manufacturing sub-sectors (chemical, machinery, ceramic) or, alternatively, production orientation *a' la* Pavitt (Labour Intensive (LI), Resource Intensive (RI), Specialized Suppliers (SS), Scale Intensive (SI)), firm training coverage, international turnover market share, number of establishments per firm, firm performance and group membership. All control variables are not significant except for group membership (GROUP), which in some regressions arises with a negative sign and on average with a 5% significance coefficient. They are nevertheless included to control for cross section heterogeneity. When highly insignificant they are omitted from final specifications and not shown.