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Vicolo del Gregorio 13 – 44100 Ferrara (Italy) Tel. +39-0532-293044
Email: creic@economia.unife.it web page: www.creic.it

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Outsourcing and Innovation. Evidence for a Local Production System of Emilia Romagna

Massimiliano Mazzanti – Sandro Montresor – Paolo Pini

Università di Ferrara- Dipartimento Economia Istituzioni Territorio

Outsourcing and innovation. Evidence for a local production system of Emilia Romagna*

Massimiliano Mazzanti† Sandro Montresor‡ Paolo Pini§

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Abstract

The paper investigates how innovation relates to outsourcing for firms located in a specific local production system. A set of theoretical correlations between innovation related variables and outsourcing decisions is formulated by drawing on a heterogeneous body of literature. Correlations are tested with respect to a representative sample of firms of a local production system in Emilia Romagna: Reggio Emilia. The main result of the paper is that, in the district-like context investigated, where networking intertwines with market mediated mechanisms, the firm's innovativness correlates positively with the complexity of the outsourcing strategies. Once the firms' embeddedness is controlled for, the 'dualistic' argument that innovative firms do not outsource in order to avoid the impoverishment of their capabilities is not guaranteed. On the contrary, according to a 'developmental' argument, being innovative in Reggio Emilia requires a certain degree of tapping-into an external provider, in order to benefit from its own competences.

Keywords: outsourcing, firm organization, transaction costs, competences, innovation, local production systems; JEL codes: L22, D23, J53

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†Department of Economics, Institutions and Territory, University of Ferrara (Italy). E-mail: mazzanti@economia.unife.it

‡Department of Economics, University of Bologna (Italy). E-mail: montreso@spbo.unibo.it

§Department of Economics, Institutions and Territory, University of Ferrara (Italy). E-mail: paolo.pini@economia.unife.it

1 Introduction

The relationship between vertical integration/disintegration, on the one side, and firm's innovativness, on the other side, has emerged to be a truly 'complex' one, whose direction and sign is hard to establish *a priori*.

At the outset, the causality of this relationship is ambiguous. On the one hand, firms can be claimed to innovate more or less depending on the vertical integration degree of their organization: the now popular "core competences" business argument, according to which the firm's innovation capabilities increase by focusing on the "area of specialized expertise" and by externalizing non-core activities (Hamel and Prahalad, 1990, p.164), is an example. On the other hand, it is also claimed that firms integrate and disintegrate (i.e. outsource) to different extents depending on their innovative profile. The idea that the firm's distance from the technological frontier makes vertically integrated and disintegrated structures more and less suitable in solving the trade-off between the managerial overload of the owners and their rent loss due to the suppliers' hold-up (Acemoglu, Aghion, and Zilibotti, 2002), exemplifies the latter causality relationship.

Out of the two interpretations, the paper focuses on the latter, that is on how the complexity of the outsourcing strategies of the firm, in terms of number and kind of outsourced activities, can be explained by firm's innovativness. Accordingly, outsourcing is our dependent variable, while different variables related to the firm's innovation process are our independent ones. However, establishing a definitive causality sign between outsourcing and innovation is not the aim of the paper. The empirical application will rather try to identify significant correlations between the two kinds of strategies, without excluding the possibility of reverse-causality interpretations.

Also the sign of the relationship between outsourcing and innovation is far from unambiguous. The 'standard' view, which retains vertically integrated structures generally superior to disintegrated ones in dealing with innovation — either for the advantages in managing complementary assets (Teece, 1986) or in coordinating new and unrelated information bits (Silver, 1984) — has been recently questioned. Langlois and Robertson, for example, in a series of studies (e.g. Langlois and Robertson, 1996; Robertson and Langlois, 1995) have shown that the sign of the relationship between vertical scope and innovation crucially depends on both the kind of technological change the firm faces and the institutional and economic context it is based in (for example, an industrial district).

On the basis of this argument, how outsourcing relates to innovation should be established pragmatically, by looking at which mechanisms, out of those identified by both standard and non-standard theoretical perspectives, are at work when the firm is '*embedded*' in the context it operates (Mazzanti, Montresor, and Pini, 2006).

In the paper, this will be done by drawing 'outsourcing arguments' on both the theoretical and the empirical literature on innovation (Section 2), and translating them into 'expected' correlations. These correlations will then be tested with respect to the firms of the local production system of Reggio Emilia (in Emilia Romagna), using a large dataset and a simple econometric model described in Section 3. Section 4 will present the main results of the application and Section 5 will conclude.

2 Outsourcing and innovation: an ambiguous relationship?

The relevance of outsourcing for the firm's innovativeness is manifold. This emerges clearly when a broad approach to the issue is adopted, which combines the two main theoretical perspectives emerged in the relevant literature: on the one hand, transaction cost economics (TCE) and the related research lines, which focus on such issues as contract incompleteness (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 incentive conflicts entailed by contractual relationships (Foss, 2000); on the other hand, the 'resource-based-view' approaches and the evolutionary perspectives, which address the implications of outsourcing for the firms' capabilities and competences (e.g. Mahnke, 2001) and set the contractual analysis in 'real time' (e.g. Langlois, 1992; Argyres and Liebeskind, 1999) by pointing to path-dependency and inertia.[1]

The insights about the innovation/outsourcing relationship which emerge from this broad perspective are more than numerous. For the sake of clarity, we propose to organize them around four sub-issues, which relate outsourcing to, respectively: (i) technological uncertainty, (ii) technological innovations, (iii) innovation radicalness, (iv) organizational innovations and flexibility. In all these four respects the innovative firm finds in outsourcing an extremely sensitive variable, and for different reasons which we will try to summarize in expected correlations in the following sections (Table 1).

[Insert Table 1 around here]

2.1 Technological uncertainty and technological regimes

Let us start by considering the turmoil technological change introduces in the firm's sector (Table 1: i, ii). At the outset, outsourcing can be retained a way firms deal with and transfer such a special kind of uncertainty on external suppliers. Apparently, this might sound inconsistent with the basic insights of TCE, according to which uncertainty, in general, renders vertically integrated hierarchies — in which residual decision rights only are agreed ex-ante — more flexible and preferable (Williamson, 1975).[2] However, an opposite and positive relationship between technological uncertainty and outsourcing can actually be established by introducing 'history' in TCE, and recognizing the role of *'governance inseparability'* (Argyres and Liebeskind, 1999) for it: in brief, the linkage between new contractual arrangements (such as a prospective outsourcing) and the existing contractual nexus of the firm, as it has emerged along its history. Indeed, 'technological uncertainty', when it unfolds, might require to the firm an important governance switch and/or a governance differentiation, for example between its constitutional commitments and its non-constitutional contracts. These prospective changes might be so costly to make the firm reluctant to augment present inseparability through vertical integration, and rather willing to outsource more activities, at least until new technological standards are established.[3]

Of course, the idea of an exogenous 'technological disturbance' is not entirely satisfactory. In searching for an endogenous account, evolutionary economists have introduced the idea of 'technological regime' (e.g. Winter, 1984), particularly useful in the present respect as it also refers to the extent to which, in a certain sector, the firm's knowledge becomes obsolete through imitation and learning-by-competition: two processes which are very often associated to outsourcing. Indeed, while it helps firms to access external capabilities not available 'in-house', on the other hand, outsourcing also provides the external provider with an important opportunity to imitate and learn from the outsourcee. In brief, through outsourcing some valuable knowledge of the outsourcing firm may leak and lead the outsourcer to innovative substitution.

However, the actual risk of knowledge leakage depends on the way knowledge evolves, that is on the relevant 'technological regime' (Mahnke, 2001): 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 'Schumpeter Mark I' technological regime, where knowledge evolves through the famous Schumpeterian idea of 'creative destruction', knowledge and capabilities up-grading, also through outsourcing, becomes crucial, even at the risk of a certain leakage, which is therefore less relevant. In a Schumpeter Mark II regime, instead, where knowledge evolves through a 'cumulative pattern', knowledge and capabilities upgrading are less relevant, while avoiding that knowledge leakage which is associated to outsourcing becomes more crucial than in the previous technological regime.

2.2 Technological innovations

The relationship between technological innovation and organizational arrangements has been debating for long time. Pros and cons for both vertical integration and disintegration[4] seem to make the investigated correlation undetermined and very much dependent on the kind of technological change and of the sector it takes place in (Table 1: iii). As we will argue, innovation-specific and sector-specific factors do matter in this respect. However, some general correlations can be stated by drawing on different theoretical insights.

First of all, a positive correlation between innovativeness and outsourcing can be put forward once more by incorporating 'governance inseparability' into TCE. From this perspective, an innovative firm appears a firm which, by carrying out a certain amount of R&D, is able and willing to extend its present activities, along with the relative contractual agreements, to different future prospects. Accordingly, such a firm would be more cautious than a non-innovative, or less innovative, one about entering into early commitments through vertical integration. In so doing it could in fact internalize a relatively low-value added activity and model its governance structure around it, while finding costly, later on, to break governance inseparability in order to internalize other high-value added activities (Argyres and Liebeskind, 1999, p.32).

A positive correlation can also be reached by looking at the firm in terms of resources and capabilities. From this perspective, the innovative firm might resort to outsourcing in order to overcome those 'learning-traps' in which the non-innovative one usually gets stuck in trying to adapt its present capabilities over time (Mahnke, 2001). Indeed, firms have to find a proper balance between the 'exploration' of new capabilities and the 'exploitation' of their present ones (Leonard-Barton, 1992). But such a balance turns out extremely difficult to reach as the positive feed-backs coming from past experience render exploiting current capabilities easier than exploring new ones riskily. Outsourcing,

however, can break these 'competence traps' (Levinthal and March, 1993) by allowing the firm to experiment an increase in its external knowledge interfaces and in its sources of learning-by-interacting.

A positive correlation between innovativeness and outsourcing is however not unconditional, but rather holds true when the outsourced activities are actually learned and then re-integrated by the outsourcing firms (the outsourcee) at affordable costs.[5] Unfortunately, as also shown by the literature on post-merger integration (Haspeslagh and Jemison, 1991; Jemison and Sitkin, 1986), these costs might be so high to turn the innovativeness-outsourcing correlation into negative. First of all, the innovative firm might find outsourcing to make it more dependent on suppliers in accessing external knowledge (Benson and Ieronimo, 1996), if not even inter-locked with competitors, via learning-by-interacting (e.g. Dyer and Nobeoka, 2000), and with external workers, via 'market-mediated' work arrangements (Abraham and Taylor, 1996). Second, the firm might see outsourcing to compromise its innovativeness by diminishing its 'absorptive capacity' (Cohen and Levinthal, 1989). Indeed, by focusing on the activities retained in-house, the firm might suffer from higher 'search costs' in looking for new external knowledge sources and higher 'cognitive costs' - both direct and indirect - and in articulating and codifying them internally (Foray, 2004).

2.3 Innovation radicalness

The relationship between firm's innovativeness and outsourcing does find different specifications depending on the innovation being 'radical' rather than 'incremental', or being a 'product' rather than a 'process' kind of innovation. The first question, in particular, has attracted a great attention and different answers depending on the meaning of 'radical' (Table 1: iv).

In introducing a fundamentally new product, for example, vertical integration has been claimed to be superior, because of the external suppliers' incapacity to understand the viability of an innovation too distant from their current competences (Silver, 1984). Vertical disintegration (that is, outsourcing) has been questioned also in front of an innovation whose radicalness is due to a 'systemic' character (Teece, 1986): outsourcing would in fact entail a special kind of transaction costs, which hamper the strict coordination and the numerous information flows necessary to undertake interdependent development efforts and to exchange and absorb related research findings. Finally, to the superiority of vertically integrated structures also leads the analysis of the effects that radical-

ness has on the 'technological dialog' (Monteverde, 1995) occurring between the supplier and the customer of a certain innovation (e.g. Christensen, Verlinden, and Westerman, 2002). By taking a radical innovation as 'disruptive', that is bringing in a product or a service whose functionality is not (at least at the beginning) suitable for the customers' needs, an interdependent (i.e. integrated) organizational architecture turns out preferable in dealing with diffuse unstructured dialogs. As the latter occur through interfaces which *are not* specifiable, measurable and predictable, it is in fact inconvenient to move these interfaces from within to outside the firm.

A positive sign in the present correlation is however not unquestioned either. If, for example, we follow Robertson and Langlois (1995) and maintain that radicalness could be due to an innovation which requires rearranging existing variables in drastic ways, and to fit them within an unknown framework (the personal computer, for example)[6], vertically integrated firms may loose their advantage over market mechanisms, such as those realized through outsourcing. A decentralization process which is able to create an appreciable diversity in information signals and possibly stimulate innovating networking effects might turn more suitable than vertical integration in dealing with the 'structural uncertainty' generated by this kind of radicalness (Robertson and Langlois, 1995, p.55).

2.4 Organizational innovations and flexibility

In closing the analysis of the outsourcing implications of innovation, a note deserves the relationship one can envisage between outsourcing and the organizational innovations of the firm (Table 1: v, vi). To be sure, from this point of view, outsourcing itself could be thought of as a special kind of organizational change. Accordingly, one might expect to find it accompanied by other similar changes in the firm's organization, possibly directed to re-enforce its contribution in terms of efficacy and efficiency. In other words, a positive correlation could be envisaged. Alternatively, outsourcing could be seen as a kind of organizational change which acts on the 'external governance' of the firm, and thus as substitute for those which instead concern its internal one (such as job rotation practices, quality circles and the like): in brief, a negative relationship.

An indeterminate sign emerges also when a special kind of organizational arrangement, devoted to the search for higher and/or better flexibility, is considered. Indeed, a relationship between the development of a more flexible workforce and outsourcing has been put forward with respect to all the differ-

ent meanings in which work flexibility can be understood (e.g. Clarke, 1992; Harrison and Kelley, 1993): functional flexibility, that is the firm's capacity to re-address labor toward new tasks or production methods in front of changes in the business environment; wage flexibility, meant as the attempt at linking wages to labor productivity and labor involvement in the innovative activities of the firm; numerical flexibility, understood as the firm's capacity to adjust the use of labor to shifts in market demand. As Benson and Ieronimo (1996) have argued, "outsourcing contributes to all three forms of flexibility. 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" (p.60). However, internal flexibility may also be thought to be hampered by an excessive dependence on unfamiliar external providers, so that the correlation turns out once more ambiguous.

2.5 Summing up

An important result emerges from the literature overview we have carried out above. When outsourcing is analyzed following a broad perspective, how the innovative firm deals with it is mainly ambiguous.

Most of the theoretical correlations identified in the previous section have an undetermined sign, depending on the specific aspect and mechanism which is considered. Accordingly, their actual specification depends on which of the identified arguments turns out to be more relevant in the context of analysis. In other words, 'embedding the outsourcing firm' (Mazzanti, Montresor, and Pini, 2006) becomes inescapable to make the innovation-outsourcing relationship more determined. For this reason, in the following we will 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' (LPS) of the Italian North-East (Seravalli, 2001).

3 The empirical application: dataset and methodology

According to a recent survey, carried out in 2002 on a population of 257 firms with at least 50 employees (Pini, 2004), the LPS of RE presents the following main distinguishing features: (i) a high density of firms whose size is no more than 'medium';(ii) a considerable number of 'district' firms, characterized by few but strong production specializations (Brusco, 1982); (iii) an idiosyncratic

industrial climate, characterized by the pervasive role of unions in industrial relations.[7]

Outsourcing is a quite pervasive phenomenon in this LPS: although with important differences in the number and the nature of the activities which are externalized (Table 2). As in other contexts, the outsourcing patterns of the RE firms are strategic, as they show a propensity to outsource material, routine-based activities with a low-value added, and to retain internally intangible activities with a higher value-added.[8] What is more, outsourcing appears closely related to the intrinsic characteristics of the same LPS. In particular, unions and industrial relations, with a long tradition in the area, have an important role in the management's implementation of outsourcing strategies (Mazzanti, Montresor, and Pini, 2006; Antonioli and Tortia, 2004).

[Insert Table 2 around here]

On this basis, it appears particularly interesting to apply the outsourcing arguments of Section 2 to a large sample of firms of this LPS. The dataset and the methodology of this application are illustrated in the following sections.

3.1 The dataset

The outsourcing-innovation correlations of Section 2 are estimated econometrically with respect to a sample of 166 RE firms, which represents as much as the 64.59% of the entire population: 257 companies listed in both national and local databases.[9]

The distribution of the sampled firms by sector and size is characterized by a limited bias when comparing the 166 firms with all the surveyed firms: the textile sector and 'small-size' firms (50 to 99 employees) are slightly under-represented. However, a significant distortion in all other sectors and dimensional employees' classes has been tested and rejected (Cochran, 1977), with the number of interviewed firms approaching or reaching 100% of the total in many of them (Table 3).

[Insert Table 3 around here]

An important point must be stressed clearly at the outset. The 257 firms in the population, as well as the 166 of the sample, 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 LPS 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.

3.2 The model

The econometric model of the paper is a reduced-form of a larger one developed to investigate the general profile of the RE outsourcing firm (Mazzanti, Montresor, and Pini, 2006). Of this latter model, the present paper applies a specific 'module', by introducing new and original interpretative insights. More precisely, we estimate a reduced-form such as the following:

$$y_{OUT_{i,t}} = \beta_0 + \beta_{1,t} \cdot x_{INNO_{i,t}} + \beta_{2,t} \cdot x_{STRU_{i,t}} + e_i \tag{1}$$

In Equation (1) $y_{OUT_{i,t}}$ represents the outsourcing 'output' of firm i at time t. $x_{INNO_{i,t}}$ is the set of innovation variables related to outsourcing identified in Section 2. $x_{STRU_{i,t}}$ is the set of control variables of structural nature, β_{1-2} the correspondent sets of coefficients, β_0 the constant term and e_i the error term with usual properties.

As in the previous broader application, a model such as that of Equation (1) requires us to control for heteroskedasticity, as it is often found when cross sectional data are used. Accordingly, a 'robust' estimator, which addresses such a source of distortion, will be used in all the estimates. In principle, attention should also be paid to a potential endogeneity problem, as the causal relationship between outsourcing and innovation might be bi-univocal. However, rather than testing endogeneity by proper two stages procedures, in the following, as in other studies based on purely cross sectional data (Michie and Sheehan, 2005, e.g.), we will focus on an extensive analysis of correlations rather than on causal processes . Finally, in order to be run, the model of Equation (1) requires us to search for suitable proxies for both the dependent and independent variables it contains, to which we will dedicate in the following.

3.3 The variables

Dependent variable. Following Mazzanti, Montresor, and Pini (2006), as a dependent variable we use an index of *outsourcing complexity*, $OUTCOM_i$, defined as:

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

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 ($s_3 = 3$). Although somehow arbitrary, the choice of these weights has been inspired by both theoretical reasons — related to the different degree to which the core competences of the firm are actually 'embodied' in these activities (Hamel and Prahalad, 1990) — and empirical evidences — related to the actual outsourcing propensity of the RE firms (Mazzanti, Montresor, and Pini, 2006). Furthermore, in order to 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}).[10]

Independent variables. Given the complexity of the correlations developed in Section 2, translating them into accurate variables is highly difficult. However, our dataset is detailed enough to allow us to refer to some kind of proxy for each of them. Some of these proxies require a bit of illustration (for the details, see the positions-column of Table 1).

The technological uncertainty faced by a certain firm i, for example, has been approximated by the average degree of innovativeness of the firms operating in its reference branch j ($TECUNC_j$), as is expressed by the number of their technological innovations.[11] Schumpeterian technological regimes, instead, have been empirically characterized (Malerba and Orsenigo, 1993) by working out: (i) the concentration degree of the innovative activities of a certain sector j ($HERFINNO_j$); (ii) the average degree of reshuffling in the innovation ranking of its firms across different periods of time ($SPEARINNO_j$). As usual, a Schumpeter Mark II (Mark I) regime associates to a high (low) innovative concentration and to a low (high) innovative turmoil.[12]

With a certain degree of arbitrariness, the radical innovations of a certain firm i ($RADINNO_i$) have been associated to their product and/or process innovations, retaining incremental the quality ones. Introducing a new product and/or a new production process is thus maintained to 'shake' the firm technological base more pervasively than ameliorating the existing ones (Pini and Santangelo, 2005).

Finally, a set of synthetic indicators, built up on the basis of the same dataset of our (Antonioli, Mazzanti, Pini, and Tortia, 2004), have been inserted in order to proxy the organizational innovations and the flexibility of the sampled firms ($ORGINNO_i$, $FLEXINNO_i$, $INWORK_i$, $FLEXFUN_i$,

$FLEXWAGE_i$ and $INNOREWARD_i$).

Once illustrated the variables, let us now turn to the main results of the application.[13]

4 Outsourcing and innovation in Reggio Emilia

What links innovation to outsourcing in RE does not seem to be the need or the opportunity of transferring on the external providers the uncertainty entailed by technological change. $TECUNC$, our proxy of the degree of technological uncertainty, is not significant, and non significant has emerged in another related work (Mazzanti, Montresor, and Pini, 2006) also the proxy designed to catch 'market uncertainty', related to trends in the firms' sales (Table 4).

[Insert Table 4 around here]

On the other hand, however, the resort to a complex kind of outsourcing correlates with the reshuffling, rather than with the persistence, of the relative innovative performances of the firms of a certain sector ($SPEARINNO$). In spite of the non significance of $HERFINNO$, the outsourcing decisions of the RE firms thus would seem to emerge from Schumpeter-Mark-I technological regimes, where the risk of knowledge leakage in externalizing parts of the production process is worthwhile paying to access the superior competences of the provider.

The core result of the paper is represented by the significant and positive relationship we have found between the firm's technological innovativeness, $TECINNO$, and the complexity of its outsourcing processes, $OUTCOM$.[14] Those firms which innovate less, at least in technological terms, also do outsource less, while the more innovative the firm, the more it contracts out production activities as such. The picture we get for RE is thus one in which, by intensifying its technological outcomes the firm's need to extend the tapping-into the resources and competences of the external providers, which possibly helps them breaking competence traps due to consolidated specialization models. The special kind of relationships (often cooperative besides competitive) which characterizes the district atmosphere of the province, instead, might be of some help in attenuating the risk of a vicious and passive dependency from external suppliers, which impoverishes the capabilities of the outsourcing firm. This is an important result, which places among those empirical works which confute the comparative disadvantage of vertically disintegrated structures in facing technological change claimed by standard TCE approaches (e.g. Mol,

2005). Conversely, it would provide support to the 'real-time' interpretation of TCE, according to which the innovating firms might find convenient to outsource in order to avoid the costs of switching integrated organizational structures once the technological change has been implemented.

In spite of the low significance, also $RADINNO$ (thus not shown in Table 4) correlates positively with $OUTCOM$, thus suggesting that even relatively more radical innovations would require the knowledge kind of specialization allowed for by outsourcing. However, being the significance of $TECINNO$ mainly driven by that of $INNO_{PROD}$, and given the rough way we have proxied radical innovations, it appears safer to conclude that it is the introduction of a new product, with its possible technical modularity, which reflects into a modular organization across the boundaries of the outsourcing firm.[15]

An interesting result is also represented by the negative sign of the significant relationship occurring between the extent of the firms' organizational innovations ($ORGINNO$) and that of their outsourcing practices ($OUTCOM$). As we argued above, outsourcing can be seen as a special kind of organizational innovation, which acts on the firm's 'external governance', while other organizational innovations look for a greater flexibility by acting on the 'internal' one. In this last respect, let us 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.[16] On the basis of their different rational, the result that the firm plays with them substitutively was thus to a certain extent expected.

In concluding, let us observe that, among the controls ($x_{STRU_{i,t}}$), $SIZE1$, $SKILL$ and $FIRMAGE$ are highly significant and, respectively, negative, negative and positive, providing the results with some important specifications. First of all, being $SIZE1$ a dummy which refers to firms whose employees are in-between 100 and 249, it seems that larger firms are less involved in complex outsourcing activities than our "small" ones (in-between 50 and 99 employees).[17] Although the relative size of the two parties involved in the outsourcing relationship should be evaluated to conclude it, in RE outsourcing does not appear a simple 'dual' relationship, where the largest firms simply exploit and subordinate smaller, 'satellite' firms to them. A 'developmental' approach, where also small firms can benefit from larger ones, for example in terms of superior competences, appear instead more relevant (Taymaz and Kilicaslan, 2005).

To the same conclusion also leads the sign of $SKILL$, proxing the competence degree of the firm's workforce. Firms with higher skills seem less willing to outsource in order not to lose them and thus impoverishing the organizational competences which are built up on them.

Finally, the complexity of the outsourcing strategies seems to be higher for older firms than for the younger ones ($FIRMAGE$). Given that what we called 'governance inseparability' is typically the more relevant, the older the firm is, as the 'ticker' is the nexus of contracts which constitute its model of governance, this is somehow unexpected (e.g. Mahnke, 2001). A deeper 'embeddedness' in the LPS seems instead to allow the older firms to be more prompt in benefiting from the opportunities of outsourcing (Mazzanti, Montresor, and Pini, 2006).

5 Conclusions

A broad review of the literature about the relationship between innovation and outsourcing, which takes into account both standard and non standard approaches emerged on the issue, does not convey unambiguous results. Rather, the sign one can attach to a set of innovation related variables with an outsourcing explanatory role depends on the relevant interpretation, on the specific aspect it focuses on and, accordingly, on the specific context the different aspects are embedded in.

In order to make the innovation-outsourcing relationship more determined, the paper investigates it in a specific context, such as that of a Emilia Romagna (North-East Italy) local production system (LSP): Reggio Emilia (RE). And what emerges is indeed quite idiosyncratic. The RE firms seem to conceive outsourcing as an instrumental strategy to their innovative one, possibly helping them in breaking competence traps by tapping-into the suppliers' competences. The risk of some kind of knowledge leakage in doing that does not appear very crucial, as outsourcing mainly occurs in Scumpether Mark I technological regimes, where knowledge cumulation is less important than knowledge acquisition. Furthermore, getting locked-in dependency relations from the suppliers is possibly attenuated by the particular set of network relationships which make up the social capital of this LSP.

This is another important result of the paper. A relational, 'developmental' approach to outsourcing, rather than a 'dualistic' one, seems to characterize the way RE firms conceive outsourcing (Taymaz and Kilicaslan, 2005). Smaller firms resort to them apparently more than larger ones, a deep embeddeddness in the territory seems to provide an advanatge in catching its opportunities,

while the skill profile of the workforce act as a sort of deterrent.

In concluding, the main limitations of the paper should be frankly recognized, along with some future research lines to address them. First of all, the econometric model is, because of data availability, purely cross-sectional, entailing well-known interpretation difficulties. While grounding on a survey carried out in 2005 on the same industrial area of RE we will be able to deal with this problem, by now, an extensive analysis of correlations is at least instructive. Second, the reference dataset does not cover SMEs as such, of which Emilia Romagna and the whole Italy are extremely dense. Once more, the resort to the 2005 survey will allow us 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. However, given the dimension and the representativeness of the paper's sample, the role of firm's size in the investigated relationship has been already addressed to a certain extent.

Notes

[1]The idea that understanding vertical integration and disintegration could benefit from a combined research effort has been recommended from both of the parties (e.g. Jacobides and Winter, 2005; Nooteboom, 2004; Williamson, 1999).

[2]To be sure, as is well known, such a relationship should be qualified by making uncertainty interact with asset specificity.

[3]The idea that 'technological uncertainty' might have a different relationship with outsourcing than the simple TCE 'volume uncertainty' has been recently echoed also by Williamson (1996) himself.

[4]On the one hand, vertically integrated structures are recognized, among the others, the ability to access economies of scale in R&D (e.g. Lazonick, 1990), of co-ordinating it with other firm's activities (e.g. Florida and Kenney, 1990) and of solving relevant problems of power distribution and appropriability (e.g. Teece, 1986). On the other hand, market-based structures, such as those implemented through outsourcing, are instead attributed, still among the others, the capacity of guaranteeing higher specialization, greater flexibility and a superior adaptability to innovations (e.g. Sabel, Herrigel, Kazis, and Deeg, 1987; Sabel, 1989).

[5]Namely, as has been clarified by the literature on international partnerships, with significant economies of scale and of scope in combining them with the old ones, with no substantial integration investments (e.g. in re-arranging knowledge and material flows) and no worsening in industrial relations (Hamel, 1991; Lyles and Stalk, 1996).

[6]This point of view is quite similar to that put forward by Henderson and Clark (1990), who distinguish 'architectural' from 'radical' innovations, making the latter requiring simultaneously also a change in the modular knowledge which is instead absent in the former.

[7]To be sure, the investigated firms are typically 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). As for their specialization patterns, they mainly refer to: 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.

[8]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.

[9]These firms have been surveyed on a remarkable number of issues in 2002 (Pini, 2004). 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).

[10]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. Let us note that $OUTCOM_i$, although continuous, ranges from 0 to 1, and that we are prevented from transforming it 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. As is well known, this fact poses some econometric problems in dealing with a dependent variable which is fractional (Pindyck and Rubinfeld, 1991). However, its use, instead of 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. What is more, 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.

[11]Three categories of innovations have been identified in the interviews and translated into consistent dummy variables: product innovations ($INNO_{PROD}$), process innovations ($INNO_{PROC}$) and quality innovations ($INNO_{QUAL}$), meant as ameliorations of *existing* products and/or production processes.

[12]The expected signs in Table 1 refer to these two variables. In particular, 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.

[13]To be sure, the covariates of the analysis are just a subset of a full set of proxies deriving from the information sources related to the survey questionnaire (Antonioli, Mazzanti, Pini, and Tortia, 2004; Pini, 2004). Indeed, a preliminary selection has been carried out in order to reduce collinearity, assure independent factors exogeneity and mitigate biases.

[14]A similar result was also found by Antonioli, Mazzanti, Pini, and Tortia (2004), by relating the outsourcing of production functions and some main indexes of technical innovation and also innovation in an extensive meaning, including organizational, labor management and human resources practices.

[15]The selected specification of Table 4 has been chosen accordingly.

[16]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).

[17]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.

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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	$\sum_{i=0}^{1}(HL_i + TW_i + QC_i +$ $+JR_i + JIN_i + TQM_i +$ $+ES_i + EI_i)/8$	HL_i: Hierarchical Ladders, TW_i: Team Work QC_i: Quality Circles, JR_i: Job Rotation JIN_i: Just-In-Time TQM_i: Total Quality Management ES_i: Employee Suggestions EI_i: Employee Involvement	+/-
vi	$FLEXINNO_i$	firm's production flexibility	$\sum_{i=0}^{1}(INWORK_i + FLEXFUN_i +$ $+FLEXWAGE_i + INNOREWARD_i)/4$	$INWORK_i$ = index of workers' participation to production decisions $FLEXFUN_i$ = index of plants and labor flexibility $FLEXWAGE_i$ = index of wage related flexibility $INNOREWARD_i$= index of compensations linked to performances	+/-

Table 1: Outsourcing and innovation: expected correlations

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 2: Reggio Emilia: outsourcing firms of the sample by kind of activity (1998-2001)

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 3: Reggio Emilia: results of the Marbach test for the sample

Dep. variable: OUTCOM		
Covariates:	Version 1	Version 2
constant	2.833	3.185***
SIZE1	-2.284**	-2.261**
SKILL	-2.155**	-2.161**
FIRMAGE	2.006**	2.210**
TECINNO	2.403**	
SPEARINNO	-1.946*	-2.164**
ORGINNO	-2.435**	-2.163**
INNOPROD		2.674***
F test (prob)	3.02 (0.0002)	3.19 (0.0001)
adj-R-squared	0.099	0.106
N	166	166

Table 4: Regression results

Illustrative notes for Table 4

1. Since we are not interested in emphasizing elasticities, t ratios only are shown; *: 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 size-related dummies ($SIZE1$, $SIZE2$ and $SIZE3$), only $SKILL_i = \frac{QUALEMP_i}{EMP_i}$ — where EMP_i = number of firm i's employees and $QUALEMP_i$ = number of firm i's qualified employees — and $FIRMAGE_i = \lg(2002 - SETYEAR_i)$ — where $SETYEAR_i$ = firm i'i set-up year — are shown. 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.