Outsourcing and structural change: shifting firm and sectoral boundaries

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Abstract

The paper aims at disentangling the role of outsourcing, of business services in particular, in explaining the structure and restructuring of economic systems. Its inspiring rational is that, while changing the boundaries of an organization, outsourcing also changes the economic contribution that an organization makes to its industrial sector and, in turn, that of this sector to the whole economy. Accordingly, the externalisation of business services undertaken by manufacturing firms, while (or rather than) decreasing the industrialization degree of one economy, determines a reshaping of the sectoral boundaries between manufacturing and (business) services.

Although nearly common sense, this idea has been only limitedly explored in empirical applications, also and above all due to constraints in the availability of input-output tables and consistent national accounts data, which were sufficiently comparable over time and across countries. Relying on the new input-output dataset recently made available by OECD, the present paper intends to provide some empirical evidence on the structural implications of outsourcing processes. Different indicators are used by discussing their different reliability in measuring outsourcing and sectoral vertical disintegration, both at the subsystem and the sectoral level of analysis. With respect to the former level, we refer to sectoral labour shares in manufacturing subsystems as indicators of vertical disintegration and of business services integration in vertically integrated sectors. As for the sectoral level of analysis, instead, we discuss the reliability of the gross-production/value added ratio as a measure of vertical disintegration, and we examine sectoral indicators of service outsourcing derived from input-output analysis. Evidences are provided both about sectoral regularities across countries and country-specific effects with respect to the '80s and the middle '90s.

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1   Introduction

Outsourcing has recently become a 'hot-topic' of several economic disciplines dealing with the firm, such as organization economics – both transaction-cost based (e.g. Grossman and Helpman, 2002; González, Arrunada, and Fernández, 2000), resource - capabilities based (e.g. Jacobides and Sidney, 2005; Argyres and Liebeskind, 1999) and game-theory based (e.g. Shy and Stenbacka, 2003; Van Mieghem, 1999) – labour microeconomics and labour relations (e.g. Abraham and Taylor, 1996; Benson and Ieronimo, 1996) and operation management (e.g. Kim, 2003; De Kok, 2000). Accordingly, cases for and against outsourcing are numerous and heterogeneous, depending on the specific approach to the firm which is adopted.

This renewed interest for outsourcing processes at the firm level has had an important cross-disciplinary fertilization. A 'new' strand of trade theories has developed on the basis of it (e.g. Baldone, Sdogati, and Tajoli, 2002; Kohler, 2004; Jones and Kierzkowski, 2001),[1] while regional economics has founded on it a new theoretical approach to the internationalisation of local production systems and industrial districts (e.g. Gereffi, 2003; Humphrey and Schmitz, 2002). Quite surprisingly, instead, the new wave of outsourcing studies has not been accompanied by an as enthusiastic revival of one of the economic fields which for first recognised its relevance: that is, structural change analysis. More than 20 years ago already, Momigliano and Siniscalco (1982b), among others at that time (e.g. Stanback, 1979; Ginzberg and Vojta, 1981; McFetridge and Smith, 1988), recognised that the externalisation of production activities from manufacturing firms to specialised producers of business services represented, also and above all, a change in the relative weight of the sectors of an economic system, in terms of both production output and employment. In other words, while changing the boundaries of an organization, outsourcing also changes the economic contribution that an organization makes to its industrial sector and, in turn, that of this sector to the whole economy.

The structural change implications of outsourcing, namely of the outsourcing of business services, have remained since then relatively neglected. The increasing availability of firm micro-data, on the one hand, and the extraordinary development of firm surveying techniques, on the other hand, have made the analysis of its impact on the firm boundaries dominant with respect to that on the boundaries of manufacturing sectors. However, quite recently, the increasing pervasiveness of outsourcing has spurred some researchers to reconsider the role that, along with technological change and changes in demand, the kind of organizational change entailed by outsourcing has had on the economic restructuring of developed countries (Dietrich, 1999; McCarthy and Anagnostou, 2004). More precisely, these studied have tried to 'decompose' the changes occurred over time in input-output tables data, with the aim of disentangling the relative weight of demand-side and supply-side factors in driving economic restructuring and of telling more accurate 'stories' of structural change. In fact, they generally conclude that the 'de-industrialization' arguments that have been used, for example, in accounting for the economic restructuring of Europe from

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[1]Empirical evidences on international outsourcing have concentrated on different aspects, depending on the theoretical framework through which they have been interpreted. Fragmentation and global production networks are just two of them. For a recent and extended survey on international outsourcing see Spencer (2005).

the '70s to the '90s, have largely overlooked the extent of outsourcing processes. In so doing, they add, conventional economic views would have underestimated the actual importance and contribution of manufacturing to GDP. Accordingly, the recognition of the actual extent of sectoral outsourcing processes would help in getting rid of such a bias.

The present paper places in this latter strand of analysis. Its aim is to present and discuss some indicators which could be useful in detecting the role that externalisation processes, of business services in particular, have had in explaining the structural change of some OECD economies. As in the studies mentioned above, we will still refer to input-output tables and national accounts to carry out both cross-sectional and longitudinal analyses. In order to get a deeper understanding of the role of outsourcing in economic restructuring, however, we will accomplish the analysis at both a subsystem and a sectoral level of analysis, crossing the two in a fruitful way. Indeed, these two levels are somehow complementary: while the former is able to capture the overall changes occurred in intersectoral production linkages due to externalizations practices, the latter is suitable in catching firm-based outsourcing decisions using sectoral data.

The empirical application of this methodology is largely constrained by the availability of reliable input-output tables and, at the end, the set of countries and sectors with respect to which we are able to carry out this analysis is not that large. However, the results we are able to obtain are at least more illustrative than those empirical evidences which relate the outsourcing processes of one country to one or more of its representative firms or sectors.

The structure of the paper is the following. In Section 2 we elaborate more on the relationship between outsourcing and structural change and, in so doing, we qualify the idea of outsourcing to which we refer. Section 3 presents our approach at detecting the role of outsourcing in explaining structural change, both at the subsystem (3.1) and the sectoral (3.2-3.4) level. Section 4 contains some empirical applications of our approach to a number of OECD countries. Section 5 concludes the paper by summing up the main results and envisaging possible future research lines.

2   Outsourcing and structural change: firm boundaries vs. sectoral boundaries

In organization economics outsourcing is usually dealt with under the 'firm-boundaries' agenda. Usually, it is considered as a process symmetric to the integration one,[2] through which the 'vertical scope' of the firm shrinks rather than enlarging. Either because some transactions are 'moved' from the firm to the market governance mechanism – following transaction cost economics – or because monitoring costs are such to make external principal-agent relationships more effective – following incomplete contract theories – or because some

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[2]For this reason, it is often referred to simply as 'disintegration' or 'externalization'. To be sure, in some economic disciplines, namely in business economics, outsourcing is distinguished from other externalization processes of the firm by looking at, for example, the nature and the characteristics of the underlying obligations, the strategic value of the assets involved, etc... In the present paper however, at the risk of being somehow inaccurate, we will treat externalization, disintegration and outsourcing as synonymous.

activities are better carried out through external rather than internal resources and competences – following the resource-based view. Coupling this analysis with that of newly emerged trade patterns, in particular between differently developed countries, 'international outsourcing' has established as a new and attractive body of economic literature (Spencer, 2005).

Associating outsourcing to a shrink of the firm boundaries could however be contrasted by looking at the firm as an 'open system', whose boundaries integration and outsourcing would rather make, respectively, less and more 'permeable' to other organizations and, more in general, to market mechanisms (Jacobides and Billinger, 2005). Indeed, some have argued that outsourcing, through the partnerships, collaborations and agreements which it often entails, would have stimulated the firms to become 'extended enterprises' (McCarthy and Anagnostou, 2004) or, similarly, 'network firms' (Antonelli, 1988).

Sticking to one or the other interpretation has important implications on the nature of the shifts that outsourcing determines in the boundaries of those sectors in which the relevant firms operate. Using a more accurate jargon, outsourcing turns out to have in the two cases different structural change implications. The fact that, for example, a textile firm outsources its machinery maintenance to a specialised service firm, according to the first interpretation, just alters, namely diminishes, its economic contribution to manufacturing and, in turn, the economic contribution of manufacturing to the economic system: putting it simply, outsourcing would induce nothing but a 'tertiarization' effect. Following the second interpretation, however, the same outsourcing operation would rather entail a restructuring of the textile sector, and of manufacturing in general, following which its contribution to the economic system is actually changed in nature rather than simply diminished. As Momigliano and Siniscalco (1982b) put it as long as 20 years ago, much of what is called tertiarization should be better called integration of services in manufacturing or, possibly, of some manufacturing activities in other manufacturing activities.

In the light of the increasing resort that firms make to outsourcing strategies, capturing this particular kind of structural change, often amounting to an extension of manufacturing sectors into non-manufacturing sectors, has become extremely urgent. And as urgent has become the need of disentangling the role of outsourcing in explaining the deep structural changes that most of the developed economies have undergone over the last twenty years. The next sections of the paper aim to move in this direction, by debating on some methodological tools (Section 3) and by presenting some empirical evidences (Section 4).

3 Outsourcing and sectoral input-output relations

Given that outsourcing shifts both firm and sectoral boundaries, its occurrence and extent can be inferred by identifying and mapping those changes it determines in the sectoral input-output relations of a certain economic system.

The reference to input-output tables, which of such relations represent an increasingly more accurate measurement, can be extremely helpful in this respect: indeed, their use in investigating sectoral integration and disintegration patterns is not new (e.g. Tucker and Wilder, 1977; McFetridge and Smith, 1988; Diet-

rich, 1999). However, the same use should also be accompanied by important caveats, due to the nature of their typical unit of analysis, on which intersectoral studies of outsourcing are instead, in general, quite cavalier.

As is well known, input-output tables are built up by measuring and adding, sector by sector, the deliveries of goods and services which occur between different 'establishments', rather than between different firms, or enterprises, as such. In other words, the so-called 'inter-establishment deliveries' – that is, deliveries of goods and services between establishments belonging to the same enterprise – are also accounted as total output of the production unit and thus recorded as either intermediate consumption or gross fixed capital formation by the receiving unit. Apparently, this would represent a serious obstacle in detecting outsourcing starting from input-output tables. Indeed, 'data aggregation methods which assign various plants of a single company to different industries in effect ignore multi plant ownership and therefore result in data which are insensitive to major forms of vertical integration' (Woodrow Eckard Jr., 1979, p.105): the comment, raised in an old but effective note on the empirical measurement of vertical integration, actually also applies to vertical disintegration.

The insensitivity of input-output tables to outsourcing is however not total and rather depends on the specific case. At the outset, the sensitivity is quite high in front of those outsourcing processes which occur when a certain establishment substitutes services and/or intermediate inputs provided by a new establishment, of a different firm, for those previously produced within the establishment itself.

The sensitivity is definitively lower when services and intermediate inputs were previously provided to a certain establishment by another establishment of the same firm: indeed, the substitution, for the latter, of an establishment belonging to a different firm, could virtually leave the correspondent input-output deliveries unchanged but, it should be stressed, just in quantitative terms. Indeed, in terms of value, the substitution would certainly find an input-output manifestation because of the substitution of market prices for internal prices in evaluating the outsourced transaction. Such a transaction actually becomes more permeable to market mechanisms.

A last case could instead generate a sort of 'over-sensitivity', rather than insensitivity, of input-output tables to outsourcing. Such as when a certain firm creates, *ex-novo*, a new establishment for the provision of certain services and/or intermediate inputs to another existing establishment of its own. Although, strictly speaking, this does not represent a case of outsourcing as such, changes in input-output relationships could assimilate it to other more proper cases of it, such as the previous two. However, also in the light of its limited extent, accounting it as a special (and indeed 'odd') case of inter-firm outsourcing does not appear to us totally misleading with respect to the inner rational of the process.

With these caveats in mind, in the following we discuss a 'battery' of input-output indicators of outsourcing, at different levels of analysis (e.g. subsystem and sectoral) and with different interpretative power (e.g. direct and indirect). In particular, we aim at showing how outsourcing would make them change under a global *ceteris paribus* condition. In other words, in order to make the sectoral implications of outsourcing more apparent, we rule out that the economic system in which it occurs is affected by significant efficiency gains due to technological change or other kinds of change in production.

3.1 The weight of sectors in subsystems

In the early 80s, in a series of studies on the Italian economy, Momigliano and Siniscalco (1982b; 1982a) utilized the concept of vertically integrated sector (sometimes also termed 'subsystem') to analyze the so called 'tertiarization' process and to show to which extent it could be caused by the growing integration of services into manufacturing.[3]

For this aim, they referred to a matrix $\mathbf{C}$ in which each cell c_{ij} measures the share accounted by sector i in the total labour required by subsystem j to produce the output needed to satisfy the final demand. Indeed, $\mathbf{C}$ is defined as:

$$\mathbf{C} = \hat{\mathbf{l}}\mathbf{B}(\widehat{\mathbf{i}'\hat{\mathbf{l}}\mathbf{B}})^{-1} \tag{1}$$

where $\hat{\mathbf{l}}$ is the diagonalized vector of labour inputs, $\mathbf{i}'$ is a row unit vector and $\mathbf{B}$ is defined as:

$$\mathbf{B} = \hat{\mathbf{q}}^{-1}(\mathbf{I} - \mathbf{A})^{-1}\hat{\mathbf{y}}. \tag{2}$$

In (2) $\hat{\mathbf{q}}$ is the diagonalized vector of gross production, $\mathbf{A}$ is the matrix of technical coefficients calculated on the basis of domestic flows and $\hat{\mathbf{y}}$ is the diagonalized vector of total final demand. Each row of $\mathbf{B}$ adds up to 1 and shows 'the shares of output of each branch which contribute to the different subsystems'(Momigliano and Siniscalco, 1982b, p.156). A useful property of $\mathbf{B}$, demonstrated by Rampa (1982), is its invariance to changes in relative prices. An interesting property of $\mathbf{C}$, noted by us, is that it turns out to be invariant to changes in final demand as well as to changes in relative prices, like $\mathbf{B}$.

Each cell c_{jj} of the main diagonal of $\mathbf{C}$ tells us which is the weight of sector j on the correspondent subsystem in terms of labour, that is: the proportion of total labour, directly and indirectly needed to produce the output of a certain sector j, accounted by sector j itself. If this sector were fully vertically integrated, i.e. if the production process turning non produced inputs into final goods took place entirely within the sector itself, this value would be equal to 1. Accordingly, the closer the value of the main diagonal cell is to 1, the more the correspondent sector will be vertically integrated. In a similar way, summing up, for each column j, the rows of the $\mathbf{C}$ matrix which refer to business services, we obtain a measure of the integration degree of the same services in the correspondent manufacturing subsystem j: the higher this sum, the more business services are integrated into the relevant manufacturing subsystem.

At this point we should remark that the cells of the $\mathbf{C}$ matrix can be taken as indicators of what should be called 'system' integration, i.e. the integration that arises from the whole set of input-output relations occurring in the economic system. As it is determined by both technological and organizational factors, and not only specific to the sector under consideration, this system integration is different from that integration which is usually contrasted with outsourcing. Indeed, the values of $\mathbf{C}$ are affected by the different labour productivities and production techniques of the different sectors of an economy, as well as by the

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[3]The genesis of vertical integration can be traced back to Adam Smith. However, starting from the seminal notion of *subsystem* put forward by Sraffa (1960), it was only in the late 60s that the concept of vertically integrated sector was analytically studied by, among the others, Zaghini (1967) and Pasinetti (1973). Until the work of Momigliano and Siniscalco (1982b) the concept was mainly utilized in empirical studies on productivity, as those by Gossling (1972) and Gupta and Steedman (1971) and, more recently, by Milberg (1991).

organization of their production processes.[4] Thus, changes over time in the values of **C** cells actually reflect all of these changes.

However, it is also true that this temporal analysis also brings out the impact of the reorganization of the production processes on the division of labour across the sectors of the different *filières*: to the extent at which it reduces the relative weight of a certain sector in the relative subsystem, outsourcing is thus one of the production reorganizations signaled by **C**. Accordingly, firm's integration and system integration are strictly linked, though not coincident.

Of course, the analysis of the temporal changes in **C** cells cannot point out organizational changes that occur entirely inside the sector itself, without involving across sectors reorganizations: e.g., if firms classified in textiles externalize some activities to firms belonging to the same sector, this change cannot be detected by changes in the values of **C**, at least keeping the level of aggregation unaltered.

With this caveat in mind, in the paper we are going to use **C** matrix based indicators as a first, possibly rough, signals of outsourcing processes. However, departing from other previous works on the issue (Momigliano and Siniscalco, 1982b), we compute all the indexes related to subsystems using not only domestic flows, but also total flows (domestic plus imported). Indeed, in a world that is more and more integrated, it seems hard to defend the choice of leaving out foreign intermediate inputs in order to avoid the technical problems they entail. When total input coefficient matrices are utilized in computing subsystem values, the theoretical meaning of the operation through which labour input coefficients are multiplied by the Leontief inverse becomes in fact less clear. However, in trying to solve this problem, we can move from the interpretation given by Rampa and Rampa (1982) and see the deflation of the import input coefficient matrix (**M**) as follows:

> If m_{ij} is an imported inputs *technical* coefficient and $\bar{m}_{ij}^0 = (p_{mi}^0) \, m_{ij} (p_j^0)^{-1}$ is the associated *expenditure* coefficient at constant prices, the latter can be written as $(p_{mi}^0/p_i^0) \, p_i^0 \, m_{ij} (p_j^0)^{-1}$. Thus $\bar{m}_{ij}^0$ can be seen as the quantity of domestic input i needed to obtain the amount of imported input i necessary to produce a unit of j at the terms of trade which prevail in the base year (p_{mi}^0/p_i^0) (1982, p.318, our translation).

Accordingly, by using the deflated **M** matrix in working out **B** as in Equation (2), and by pre-multypling it by $\hat{\mathbf{l}}$, we obtain a matrix whose generic element can be seen, with respect to the imported part, as the labour needed for a special kind of international exchange, that is, the labour to produce the domestic commodities necessary to obtain the foreign ones used in producing the relative (subsystem) final good. Foreign commodities which are in turn obtained through an international exchange carried out at the import-export relative prices of the base year.

Unfortunately, when the total flows transaction matrix is used, instead of the domestic one, the invariance of **B** and **C** to relative price changes does not hold anymore, so that matrices at constant prices have to be used necessarily.

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[4]Keeping labour input coefficients constant, if the technical coefficient matrix is not decomposable, that is, if it cannot be reduced through elementary operations to a block triangular matrix, an increase in service expenditure in whatever sector causes an increase in the weight of services in each subsystem.

3.2 The ratio between sectoral value added and gross production

As we said, outsourcing can be seen as a change in the firm boundaries, indeed a point on which organizational economics is currently debating (Jacobides and Billinger, 2005). It is instead indubitable that, through outsourcing, intra-firm transactions, or better to say, 'intra-establishment deliveries', which cannot be caught by national accounts and input-output data, actually shift outside and thus become measurable by them. In other words, by shifting the boundaries of a certain establishment, outsourcing brings about an increase in the intermediate consumptions of the sector to which it belongs, which comes from organizational changes, and not from technological ones. More precisely, through this mechanism outsourcing affects the intermediate consumption, the total production and the value added of the sectors in which it occurs.

Of course, these effects are different depending on the sectoral classification of the firms and establishments themselves. We can distinguish two cases. In the first case, that might be called 'intrasectoral disintegration', the 'outsourcee' and the 'outsourcer' belong to the same sector: *ceteris paribus*, we can view outsourcing as increasing the intermediate consumption and the gross output of the same sector, while leaving its value added hardly affected. In the second case, on the contrary, outsourcing involves units of production belonging to different sectors ('intersectoral disintegration'), such as in the case of production services: *ceteris paribus*, in the 'outsourcee' sector, because of outsourcing, gross production can be viewed as unchanged, while its value added diminishes.

On the basis of this argument, an increasing vertical disintegration at the sector level is usually associated with lower sectoral value added-gross production ratios.

As is well known, the value added-sales ratio is quite often taken for a measure of vertical integration of both firms and sectors in industrial economics.[5] However, the seminal contributions on the topic recommend not to use such a ratio in cross-sectional comparisons of vertical integration, but only in intertemporal analysis. The former, it is argued, will be biased by the fact that the index 'will be higher the closer the firm in question is to the raw materials source of the production chain' (Tucker and Wilder, 1977, p.83).

Although true, this fact does not invalidate the use of the relevant indicator in cross-sectional analysis as it holds true only if the vertical linkages between different production processes are more prominent than horizontal ones. While this could be the case when a manufacturing sector is compared with an agricultural one, it is not necessary so when the comparison is between two manufacturing sectors. Indeed, in the latter case horizontal linkages are far more important than vertical ones. Accordingly, no process can be viewed to be 'closer' to the raw materials than another one and the value added-gross production ratio can be retained as a rather consistent indicator of vertical integration also in comparisons across sectors.

More relevant seems to us the fact that, the value added-gross production

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[5]The value added-sales ratio as a measure of vertical integration was proposed in a seminal article by Adelman (1955). It was then utilized in a number of empirical studies for testing the shifts over time of vertical integration in manufacturing (e.g. Laffer, 1969; Tucker and Wilder, 1977).

ratio is affected by cyclical effects as well as sectoral crises.[6]

In order to discount, at least to a certain extent, these last factors, it is however possible to use average values of the same sectoral ratios over a sufficiently long period.[7] Although with some arbitrariness, due to the identification of this temporal extent, average VA/Q sectoral ratios can be retained as indicators of sectoral vertical integration/disintegration, with important elements of complementarity with respect to those analyzed in the previous section. On the one hand, while the vertical integration degree, calculated as the sectoral labour share of a sector in the relative subsystem, is unable to capture phenomenona of disintegration that occur entirely within the sector, the same does not hold true with respect to the sectoral VA/Q ratio, which instead tends to decrease for 'intrasectoral disintegration'. On the other hand, the vertical integration degree of the sector is less influenced than the sectoral VA/Q ratio by those 'market power' factors which affect the translation of the different labour costs into prices. Indeed, if a sector is quite far from a perfectly competitive model, firms might impose a mark-up relatively high, and the sectoral VA/Q ratio tends to rise. For this reasons, the two indicators should be used as complementary rather than substitute.

3.3 The input-output technical coefficients

As we said in the previous section, outsourcing affects sectoral intermediate consumptions, gross output and value added, and these effects are different depending on the sectoral classification of the firms involved in it. We distinguished two cases: 'intrasectoral' and 'intersectoral' disintegration. Indeed, *ceteris paribus*, that is, assuming irrelevant efficiency gains stemming from outsourcing, the gross production of the 'outsourcee' sector remains stable only in the latter case, while in the former it tends to increase. Again, this last effect comes from the increase of duplication in intermediate consumptions and it is not related to any possible technological factor.

The different sectoral implications of these two kinds of outsourcing become particularly apparent in terms of input-output technical coefficients. When in a certain sector j there is what we called an 'intrasectoral disintegration' process, its gross output (Q_j) increases, because the correspondent intrasectoral inflows (w_{jj}) increase for accounting reasons. On the other hand, the inflows out of

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[6]Being $Q_i \equiv VA_i + M_i$, where Q_i, VA_i and M_i stand for, respectively, the gross production, the value added and the intermediate consumptions of a certain sector i, the derivative of VA_i/Q_i with respect to VA_i is:

$$\frac{\partial}{\partial VA_i} \frac{VA_i}{Q_i} = \frac{M_i}{Q_i^2} \ (> 0).$$

Therefore, whenever there is a reduction in VA_i, with a constant M_i, VA_i/Q_i diminishes. And the same ratio decreases also when the rate of decrease of VA_i is greater than the rate of decrease of M_i, as it usually happens in sectoral crises, due to demand slowdowns. Indeed, whenever $g_{Mi} > g_{VAi}$, where g_x stands for the rate of change of x, we have that:

$$g_{VAi/Qi} = g_{VAi} - g_{Qi} = g_{VAi} - \left(\frac{M_i}{Q_i} g_{Mi} + \frac{VA_i}{Q_i} g_{VAi} \right) = \frac{M_i}{Q_i}(g_{VAi} - g_{Mi}) < 0.$$

[7]To get rid of trends in profitability, Tucker and Wilder (1977) construct instead an alternative index, defined as $(VA - Net\ income - Income\ taxes)/(Q - Net\ income - Income\ taxes)$. However, due to data availability, using this index usually shrinks the coverage of the set a lot.

the main diagonal (w_{ij} with $i \neq j$) do not change. Accordingly, outsourcing determines, first of all, a reduction in the extra-diagonal technical coefficients for sector j, that is, a_{ij} (with $i \neq j$). As the sectoral value added, which is not affected by duplication, remains unchanged. The increase of w_{jj} turns out to be greater than that of Q_j, because Q_j is the sum of all the intermediate inflows plus the value added of the sector. Accordingly, outsourcing makes also increase the technical autocoefficients a_{jj}. Summing up, 'intrasectoral disintegration' determines a reduction in the technical coefficients a_{ij} (with $i \neq j$) and an increase in the technical coefficients a_{jj}. Let us note that this is due just to 'accounting' reasons, not related to the production side.

These effects do not occur in the case of 'intersectoral disintegration', because the gross output of the 'outsourcee' sector remains relatively stable. Therefore, disentangling organizational changes from technological ones becomes in this case nearly impossible.

The analysis of input-output technical coefficients thus turns out to be useful in detecting the relevance of some kinds of outsourcing processes with respect to which the subsystem analysis is instead ineffective.

3.4 The sectoral indicators of service outsourcing

As we said in Section 3.1, the **C** matrix makes it possible to analyze the integration of business services in the manufacturing subsystem. However, this level of analysis could be once more somehow too wide, referring to what we called 'system' integration, determined by a large set of technological and organizational factors in the economy.

If we are interested in capturing the amount of service outsourcing made by the firms belonging to a certain manufacturing sector, leaving out the other indirect effects, we could simply look at the intersectoral flows from service firms to manufacturing ones. For instance, we could analyze the changes occurring over time in the intermediate business service transactions at constant prices ($SERV$) made by manufacturing firms per unit of production (Q): that is, for sector i, $SERV_i/Q_i$. However, in using this measure as an indicator of sectoral outsourcing we have to implicitly assume two hypotheses. First of all, returns of scale should be held constant, referring to a common assumption in input-output analysis. Second, we have to assume once more a *ceteris paribus* assumption, in particular, that technological progress does not significantly affect service technical coefficients in manufacturing sectors, or, at least, that in cross-sectional comparisons this effect is more or less the same across countries. Moreover, given the effect 'intrasectoral disaggregation' has on input-output coefficients, in interpreting the changes in $SERV_i/Q_i$ we have to take into account the possibility that a large intrasectoral disaggregation might have occurred in some countries, but not in others, thus blurring the relative conclusions.

To get rid of these problems, McFetridge and Smith (1988) propose an alternative indicator given by the ratio between the intermediate business service transactions of a certain sector i ($SERV_i$) and the value of wages and salaries of the same sector ($LABR_i$): that is, $SERV_i/LABR_i$. Indeed, as we have already seen in Section 3.2, outsourcing implies a substitution of primary inputs, mainly labour, for intermediate inputs, thus increasing the previous ratio. However, to use this measure as an indicator of outsourcing we have to implicitly assume the relative stability of the price of business services in wage-units. Hence, in making

Event	Level	Indicators	Expected variation
Intersectoral disintegration	Subsystem	Vertical integration degree[a]	$-\Delta$
		Business services integration[b] (service outsourcing)	$+\Delta$
	Sector	VA_i/Q_i[c]	$-\Delta$
		a_{ii}[d]	$= / - \Delta$
		$SERV_i/Q_i$[e] (service outsourcing)	$+\Delta$
		$SERV_i/LABR_i$[f] (service outsourcing)	$+\Delta$
Intrasectoral disintegration	Sector	VA_i/Q_i	$-\Delta$
		a_{ii}	$+\Delta$
		$SERV_i/Q_i$	$-\Delta$
		$SERV_i/LABR_i$	$= \Delta$

[a]Weight of sector i on the relative subsystem in terms of hours worked
[b]Weight of business services on subsystem i in terms of hours worked
[c]Value added-gross production ratio of sector i
[d]Autocoefficient of sector i
[e]Intermediate business services expenditure per production unit in sector i
[f]Intermediate business services expenditure on labour compensation in sector i

Table 1: *Changes in the sector/subsystem indicators of manufacturing sector i in the presence of outsourcing*

cross-section comparisons we have to assume a constant relative cost of labour across countries, an assumption which hardly holds true for economic systems with different levels of development. Moreover, the same indicator tends to vary, and thus become less reliable, whenever a change in the labour productivity of a certain sector is not properly reflected in the correspondent monetary wages.

Thus, also the present indicator, as the previous one, is just an imperfect indicator of service outsourcing at sectoral level. Both of them are affected by different phenomena, not all related to outsourcing. However, the 'noise' by which they are affected can be deemed as negligible when and if they all signal traces of outsourcing, while contrasting signals coming from different indicators would recommend caution.

A similar argument holds true with respect to the whole battery of outsourcing indicators we presented in this section. Using the indicators in such a complementary way, in the next Section we will try to investigate the outsourcing patterns that input-output relations suggest for a set of OECD countries (see Table 1 for a summary of all the relevant changes in the indicators presented in this section).

4 Some empirical applications to the OECD area

In the present section we illustrate some of the several empirical analyses of outsourcing processes that can be carried out by applying the indicators described in Section 3.

Data are obtained from different dataset: input-output tables from both the new input-output dataset, recently built up by the OECD (OECD, 2005) and the 'old' STAN input-output database for the '80s (OECD, 1995); sectoral data on total hours worked from the *60-Industry Database of the Groningen Growth and Development Centre* (GGDC, 2005); sectoral gross production and value added over the '90s from the OECD STAN database (OECD, 2004).

All along the paper data availability constraints allow us to refer to two different country sets: the OECD6, made up of Canada, Denmark, France, Japan, UK and US, over the '80s; the OECD18, that includes Australia, Canada, Check Republic, Denmark, Spain, Finland, France, Germany, Greece, Hungary, Italy, Japan, Korea, Netherlands, Norway, Poland, UK and US, with respect to the middle '90s (see Appendix A).

Data availability also allows us to retain a sectoral disaggregation for manufacturing (including construction) of 14 sectors for the OECD6 over the '80s, and of 17 sectors for the OECD18 in the middle '90s (see Appendix C).

Following OECD conventions we have included in business sector services such service sectors as: Wholesale and retail trade, Repairs; Hotels and restaurants; Transport and storage; Post and telecommunications; Financial intermediation; Real estate, renting and business activities (50–74 ISIC Rev.3) (see Appendix B).[8]

4.1 The subsystem level: vertical disintegration and business services integration in manufacturing subsystems

As we said, working with total production flows matrices in dealing with subsystem changes requires us to use input-output tables at constant prices. This requirement, together with the time coverage of the tables, inevitably shrinks the set of OECD countries to which we can refer. Thus, in disentangling sectoral patterns of vertical integration and disintegration over the '80s, we refer to the OECD6.

Cross-country comparisons on the same basis can instead be carried out also by using input-output tables at current prices, for which data are much more available. Indeed, by referring to the middle '90s, we are able to identify cross-country sectoral patterns of vertical integration/disintegration with respect to the OECD18.

Given the novelty of these data, and their geographical coverage, such a cross-sectional application represents one of the major value added of the paper. Interesting results, however, emerge also by starting from a temporal kind of analysis.

4.1.1 Vertical integration/disintegration over the '80s in the OECD6

Although with respect to a quite limited number of OECD countries, Figure 1 and 2 show some interesting results in analysing levels and patterns of change in the average degree of vertical integration of manufacturing sectors.

First of all, vertical disintegration at subsystem level appears a quite recent result in OECD manufacturing, of the middle '80s, and indeed a switch with

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[8]In order to avoid, as much as possible, distortions coming from sectoral aggregation, calculations have been carried out at the maximum level of disaggregation, and then the results have been reaggregated as required.
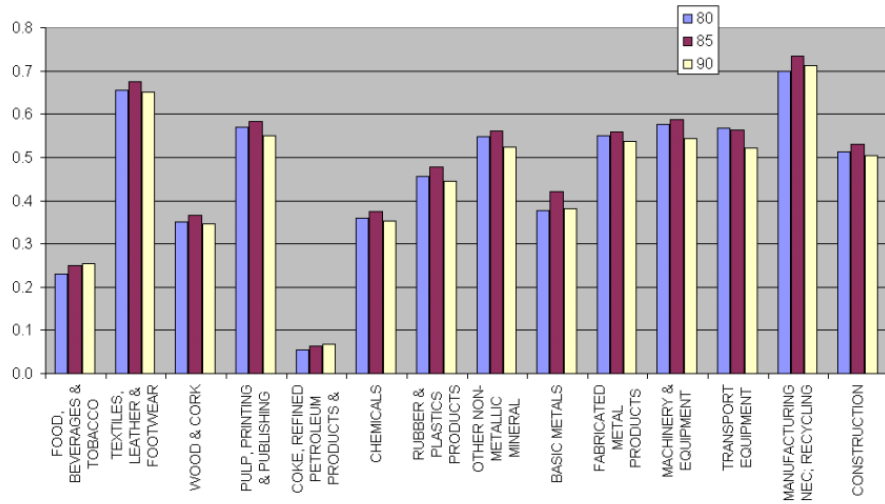
Figure 1: *Vertical integration degree of OECD6 manufacturing – cross-country average values: 1980-1990* – Weight of sectors on the relative subsystems (hours worked) – total flows input-output tables at constant prices
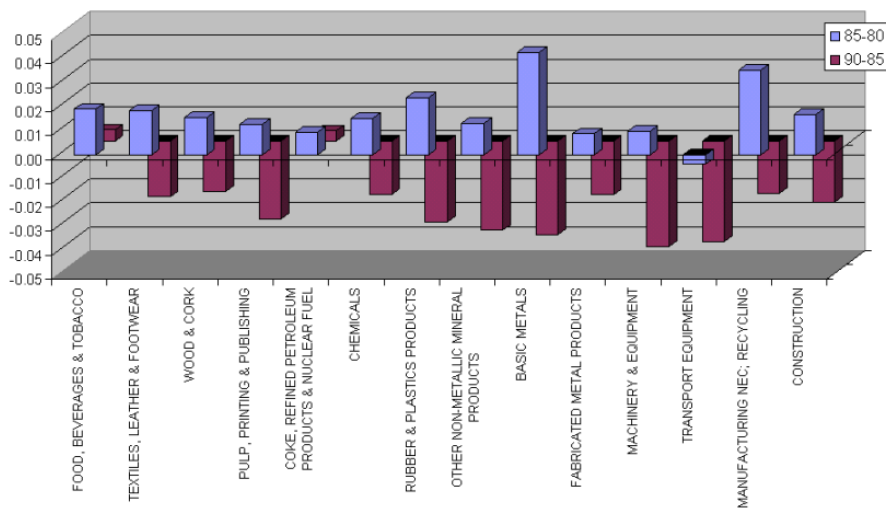

Figure 2: *Vertical integration degree of OECD6 manufacturing – changes in cross-country average values: 1980-1990* – Weight of sectors on the relative subsystems (hours worked) – total flows input-output tables at constant prices

respect to the early '80s. Apart from transport equipment, all the 14 retained manufacturing sectors increased, rather than decreased, their average vertical integration at the beginning of the '80s: sometimes quite substantially, such as for basic metals and the residual of manufacturing including recycling. At that stage, therefore, only motor vehicles and other transport sectors in OECD6 seemed to have started undergoing a process of vertical reorganization of labour, being it due to technological change or other causes, such as outsourcing. All the remaining sectors, instead, followed such a pattern in the last part of the decade, and to a different extent. Indeed, in the middle '80s, machinery & equipment overcame the disintegration increase of transports and stood, on average, as one of the most disintegrating sectors along with others of a small group: other non metallic mineral products, rubber and plastics, paper and printing, construction and basic metals, for which the level of vertical integration in 1990 is higher than in 1980. Fabricated metal products and chemicals, along with textiles and wood products, instead, identify a second set of sectors in which disintegration has been relatively less intense, but still more than in coke and petroleum, and food, beverage and tobacco, where it has remained, on average, substantially unchanged.[9]

In order to get further insights on the extent at which the vertical disintegration processes detected above actually translated into service outsourcing it could be helpful to analyze temporal changes in the weight of business sector services on manufacturing subsystems, namely in terms of hours worked.[10] Figure 3 and 4 show that, unlike vertical disintegration, 'tertiarisation' - that is the increase of the labour weight of services on manufacturing subsystems - was already occurring in the early '80s (with the only exception of residual manufacturing).[11] Combining the two results, we can argue that, although increasingly more important for manufacturing, in the early '80s business services did not enter in it as substitute yet. This has possibly occurred instead in the middle '80s, as the vertical integration of business services in manufacturing further increased on average and was accompanied, as we saw, by the vertical disintegration of the latter. Indeed, in the middle '80s, with the only exception of the energy sector, the average relative weight of business services increased more than in the early '80s in all the manufacturing subsystems of the disaggregation. Although the matching between the retained subsystems in terms of changes in vertical disintegration and integration of business services is only limited, the correlation between the correspondent rankings is positive (+0.115) thus hinting at the relationship we are investigating.

Although the previous analysis is suitable for identifying common trends, it clearly hides country specificities. These appear evident, for example, when we

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[9]Although the previous sectoral grouping is not completely replicated, the basic insights we have obtained get confirmed when vertical integration is worked out on the basis of domestic, rather than total, production flows, thus ruling out huge differences due to international offshoring.

[10]The weight of business sector services in each subsystem j is measured by $\sum_{i=n}^{m} c_{ij}$, where c_{ij} is the generic element of the matrix $\mathbf{C}$, and the rows from n to m correspond to the business services sectors of the same matrix.

[11]It should be noted that, keeping technical coefficients and production organization constant, the weight of business sector services on manufacturing subsystems tends to growth over time when, as it is generally assumed, the rate of growth of labour productivity in manufacturing is greater than in services. Accordingly, outsourcing accelerates the pace of this 'natural' tendency.
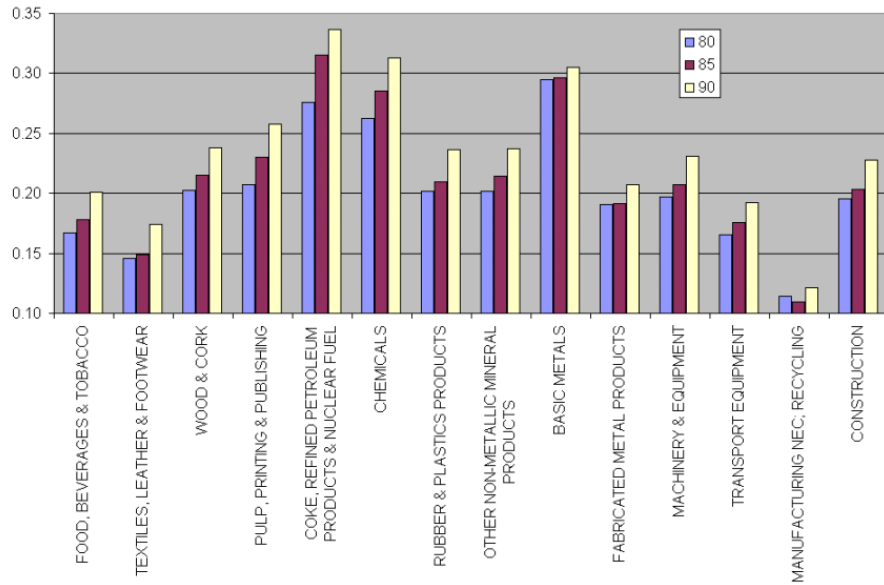
Figure 3: *Business services integration in manufacturing subsystems – cross-country average values: 1980-1990* – Weight of business services in manufacturing subsystems (hours worked) – total flows input-output tables at constant prices
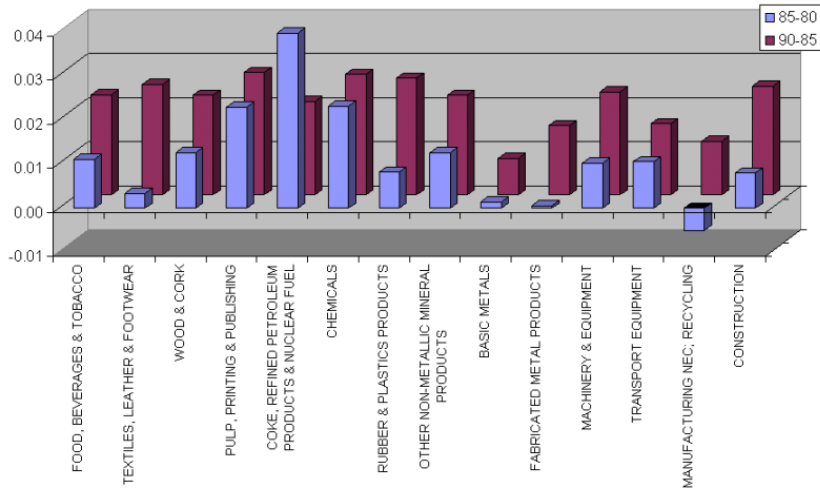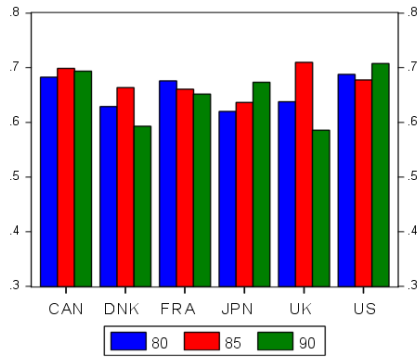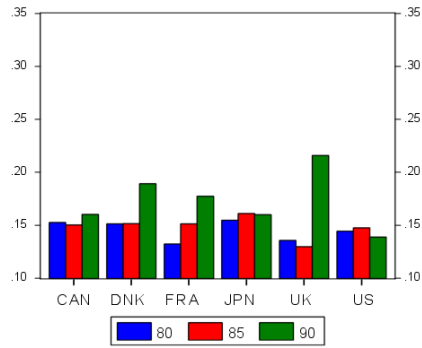

Figure 4: *Business services integration in manufacturing subsystems – changes in cross-country average values: 1980-1990* – Weight of business services in manufacturing subsystems (hours worked) – total flows input-output tables at constant prices
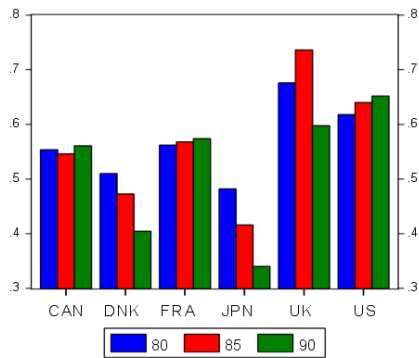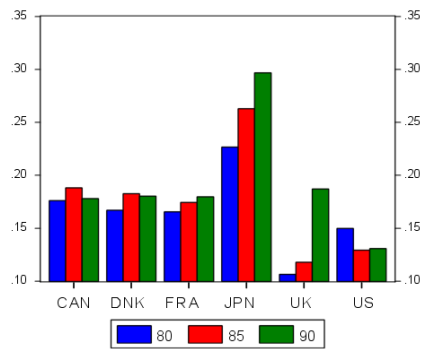
(a) Vertical integration degree   (b) Weight of business services in subsystems

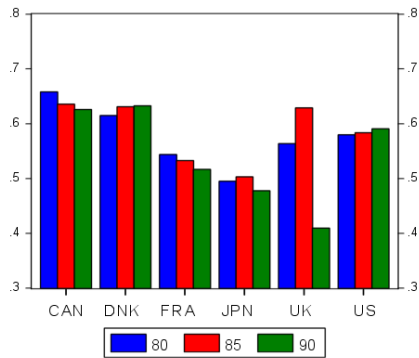Figure 5: *Textiles, textile products, leather and footwear: 1980-1990*

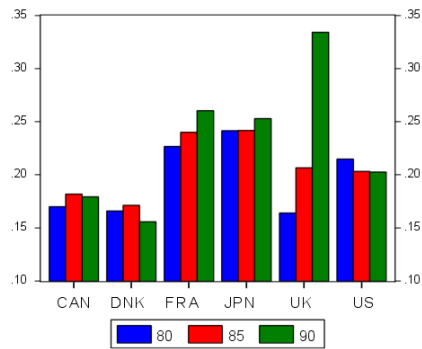(a) Vertical integration degree   (b) Weight of business services in subsystems

Figure 6: *Transport equipment: 1980-1990*

(a) Vertical integration degree   (b) Weight of business services in subsystems

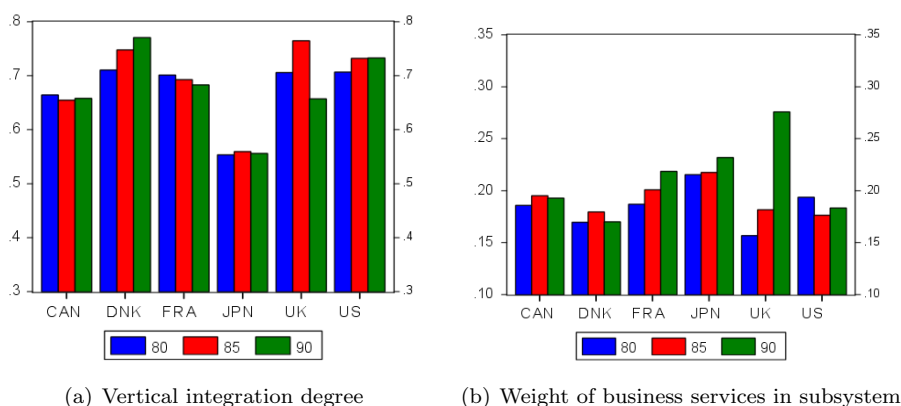Figure 7: *Machinery & equipment: 1980-1990*

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(a) Vertical integration degree   (b) Weight of business services in subsystem

Figure 8: *Total manufacturing: 1980-1990*

refer to three sectors of our disaggregation which are usually deemed 'vulnerable' to outsourcing, that is: textiles, leather and footwear; transport equipment and machinery & equipment.

As Figure 5 shows, in textiles and leather we can clearly distinguish the European countries (Denmark, France and UK) from the others of the OECD6 set (Canada, Japan and US). Indeed, during the '80s, the vertical integration degree of the sector has progressively decreased and the weight of business services in the subsystem considerably increased mainly in the first group, while for the non-European countries they did not change significantly from the early to the late '80s. Moreover, within the group of the European countries, the case of the United Kingdom emerges as idiosyncratic: the data show in fact a remarkable increase of the business services integration in the textile subsystem. Indeed, the weight of business services increased more than 66% between the middle and the late '80s, and this increase was accompanied by a corresponding reduction in the vertical integration degree of the sector itself during the same period (-21.1%). Accordingly, the UK textile sector moves from the first to the last position in the cross-country ranking in terms of vertical integration degree. What seems to emerge as the 'UK case' gets confirmed also in other sectors, and in particular in the other two we are considering (Figure 6 and 7).[12] Accordingly, the large increase of business services integration in the UK manufacturing subsystems, shown by the data, seems to support the hypothesis of an overestimation of the tertiarization of the UK economy over the '80s due to an inaccurate resort to sectoral data.[13]

The analysis of transport equipment (Figure 6), apart from the usual restructuring in the UK, shows a notable disintegration of the Japanese sector, indeed the most disintegrated one over the whole period, far beyond the others, and with a recent increase in the disintegration ranking. In 1990 the vertical integration degree of the Japanese transport equipment sector was just 0.34,

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[12]Just to make an example, during the same period the business services integration in machinery & equipment increased more than 61%, making the sector the most disintegrated one of the countries analyzed.

[13]Although with some apparent methodological problems this is suggested, among the others, by McCarthy and Anagnostou (2004, pp.64-66).

while in the United States it was nearly twice as much (0.65). Moreover, from the early to the late '80s the rate of change of the vertical integration degree of this sector was -29.4%, while in the US it was positive and equal to 5.5%.[14] These data seem thus to confirm the outcomes of the studies, mainly at firm level, on the Japanese transport equipment sector and they show how the economic restructuring in this sector changed the contribution of the sector itself to the subsystem in terms of labour. Notably, what happened in Japan, did not occur in the US, where, on the contrary, no such tendency can be seen in the '80s.

Finally, in the machinery & equipment subsystem a tendency towards outsourcing can be found neither in the US nor in Japan, where instead in the UK there was a radical increase of business sector weight also in this last subsystem.

Some final remarks can be drawn by referring to manufacturing as a whole and by making a country-by-country comparison (Figure 8). First of all, the case of the UK gets definitely confirmed by aggregate data: the UK business services were the most integrated in the manufacturing subsystem in 1990, while in 1980 they were the least integrated ones, increasing more than 75.8%. Second, another European country, namely France, shows a significant increase in service integration (+17%). Third, in Japan the level of integration of services in manufacturing increased consistently only during the late '80s (6.6%) and, what is more relevant, it was not accompanied by an appreciable vertical disintegration of manufacturing. Anyway, in the early '90s the Japanese manufacturing sector was still the most disintegrated one. Together with the high absolute level of service integration in manufactruing, these results seems to suggest that Japanese manufacturing firms might have resorted to outsourcing consistently just before the '80s and that they did not continue at the same pace during the '80s. Finally, it is interesting to note that the US was the only country in which the weight of services in manufacturing during the '80s, rather than increasing, decreased to an appreciable extent (-5.3%), thus hinting at a possible different strategy of US manufacturing firms, which got more vertically integrated.[15]

4.1.2 Vertical integration/disintegration in the middle '90s in the OECD18

The input-output tables recently made available by the OECD allow us to accomplish the previous integration/disintegration analysis in the middle '90s with respect to a broader set of countries and belonging to different geographical areas (Appendix A).

To start with, we worked out cross-country average values of the sectoral vertical integration degree and of the business services integration for all the manufacturing sectors. With respect to the former, Table 2 classifies the manufacturing sectors of our disaggregation into three groups, depending on the relative labour weight of the sector on the correspondent subsystem being lower than 40% - sectors with low vertical integration - in-between 40% and 50% - sectors with middle vertical integration - and higher than 50% - highly vertically

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[14]The main findings get confirmed when the vertical integration degree is calculated with respect to domestic, rather than total, production flows: during the '80s, the rate of change in the Japanese sector was -25.8%, falling from 0.23 to 0.17, while in the US it remained substantially unaltered, changing from 0.436 to 0.429 (-1.6%).

[15]In the cross-country ranking of services integration in manufacturing in 1980 the US ranked second, after Japan, while in 1990 it was the next to last, just before Denmark.

Industrial sectors		Avg % values			
Code		Tot.flows[a]	Rank	Dom.flows[b]	Rank
	Low Vertical Integration				
23	Coke, refined petroleum products and nuclear fuel	9.9	17	22.2	17
15-16	Food products, beverages and tobacco	26.3	16	31.0	16
34	Motor Vehicles, Trailers and Semitrailers	35.1	15	47.3	13
24	Chemicals (including Pharmaceuticals)	35.4	14	42.9	15
27	Basic Metals	37.4	13	46.8	14
	Middle vertical integration				
25	Rubber and Plastics Products	44.2	12	58.6	8
31	Electrical machinery and Apparatus, nec	45.4	11	57.1	11
30,32-33	Office and computing machinery - Communication equipment - Medical, precision and optical instruments	46.9	10	57.3	10
26	Other non-metallic mineral products	48.5	9	57.1	12
29	Machinery and equipment, nec	49.4	8	59.5	6
35	Other transport equipment	49.6	7	58.3	9
20	Wood and products of wood and cork	50.2	6	59.2	7
	High Vertical Integration				
36-37	Manufacturing, nec; Recycling	52.2	5	62.7	3
45	Construction	52.4	4	61.1	4
21-22	Pulp, paper, paper products, printing and Publishing	53.2	3	60.3	5
28	Fabricated metal products, except machinery and equipment	54.2	2	65.5	2
17-19	Textiles, textile products, leather and footwear	64.6	1	72.8	1

Source: our calculation on *OECD* and *GGDC* data

[a]Weight of sectors on the relative subsystems in terms of hours worked – Total flows input-output tables

[b]Weight of sectors on the relative subsystems in terms of hours worked – Domestic flows input-output tables

Table 2: *Vertical integration degree of OECD18 industrial sectors - middle '90s – cross-country average values*

integrated sectors.[16] Such a ranking, which remains substantially unchanged when the reference is to domestic production flows (the Spearman correlation index is as high as 0.941), shows that, across the 18 OECD countries considered, 5 are the sectors in which, on average, extra-sectoral labour contributions (direct and indirect) are particularly relevant, that is: coke, refined petroleum products and nuclear fuel; food products, beverages and tobacco; motor vehicles, trailers and semi-trailers; chemicals and chemical products; and basic metals. Among these sectors a special comment is due to for the 'resource intensive' ones, that is: coke, refined petroleum products and nuclear fuel; food products, beverages

[16]The boundaries of the three intervals are somehow arbitrary and just used to better underline differences among sectors.

and tobacco. For these two sectors vertical disintegration constitutes quite a structural feature on the production side, not only directly linked to outsourcing or organizational factors. Indeed, they rely heavily on, respectively, the mining and the agricultural sectors. The average labour share of 'mining and quarrying' in the 'coke, refined petroleum products and nuclear fuel' subsystem across the OECD18 is 28%. Similarly, the weight of 'agriculture, hunting, forestry and fishing' sector in the 'food products, beverages and tobacco' subsystem is, on average, 39%. A similar structural feature cannot be found instead in the other subsystems of the least integrated, such as basic metals, chemical and transport equipment subsystems, for which no manufacturing or agricultural sector out of the main diagonal seems to play a pivotal role. For instance, in the basic metals subsystem, the mining and quarrying sector accounts, on average, for just 6% of the total labour. With this distinction in mind, we can retain the low vertically integrated sectors of Table 2 as those on which outsourcing might have played, once controlled for other explanations, the major restructuring effect at subsystem level.

Crossing the previous results with the integration degree of business services in the correspondent manufacturing subsystems can help us in getting more insights on the five 'candidate' sectors (Table 3). Indeed, with the only exception of food, beverages and tobacco, the remaining four are also the sectors in which production services have the greatest average labour weight in the middle '90s. Let also observe that the two rankings are quite similar, supporting our tentative interpretation of a relationship between vertical disintegration and integration in business services: the Spearman correlation index is 0.684 and becomes 0.798 when the two 'resource intensive' sectors previously analyzed are not considered.

Except for these last two sectors, some remarks should be made about the other ones that exhibit, both, high vertical disintegration and high business services integration in the relative subsystem, that is, motor vehicles, chemicals and basic metals. With respect to the first, due to the long value chain characterizing its production processes, as well as the large resort to outsourcing pointed out in many studies, this result is not surprising. It holds true also for chemicals, in which service outsourcing practices are widespread. As for the last instead, namely basic metals, its ranking is somehow counterfactual. Indeed, having in mind the relative 'closeness' to raw materials of the sector compared to the other manufacturing ones, we might expect a relative high vertical integration degree. On the contrary, data show the sector is vertically disintegrated, thus supporting the hypothesis of a prominent role of horizontal linkages over the vertical ones for manufacturing, and, together with the high integration of services in basic metal subsystem, revealing a process of great restructuring occurred in the sector.

Another interesting exercise can be that of comparing the ranking of the considered manufacturing sectors in terms of average vertical integration in the early '80s, late '80s and middle '90s. Table 4 shows that, with respect to the restricted set of countries we analyzed in section 4.1.1 (OECD6), apart from some notable exceptions, the ranking of the retained sectors in terms of vertical integration represent quite a structural feature. In spite of all the relevant technological, organizational and demand changes which have occurred in the retained period, the 'club' of the most disintegrated sectors remains substantially unaltered: coke, refined petroleum products and nuclear fuel; food products, beverages and tobacco; chemicals and chemical products; and basic metals are

Industrial subsystems		Avg % values			
Code		Vertical disinte- gration[a]	Rank	Business services integra- tion[b]	Rank
23	Coke, refined petroleum products and nuclear fuel	9.9	1	35.8	1
15-16	Food products, beverages and tobacco	26.3	2	20.6	14
34	Motor Vehicles, Trailers and Semitrailers	35.1	3	28.4	4
24	Chemicals (including Pharmaceuticals)	35.4	4	35.3	2
27	Basic Metals	37.4	5	30.2	3
25	Rubber and Plastics Products	44.2	6	25.7	7
31	Electrical machinery and Apparatus, nec	45.4	7	24.9	8
30,32-33	Office and computing machinery - Communication equipment - Medical, precision and optical instruments	46.9	8	27.6	5
26	Other non-metallic mineral products	48.5	9	26.3	6
29	Machinery and equipment, nec	49.4	10	23.4	10
35	Other transport equipment	49.6	11	21.2	13
20	Wood and products of wood and cork	50.2	12	18.2	16
36-37	Manufacturing, nec; Recycling	52.2	13	19.4	15
45	Construction	52.4	14	21.4	11
21-22	Pulp, paper, paper products, printing and Publishing	53.2	15	24.9	9
28	Fabricated metal products, except machinery and equipment	54.2	16	21.3	12
17-19	Textiles, textile products, leather and footwear	64.6	17	17.8	17

Source: our calculation on *OECD* and *GGDC* data

[a]Weight of sectors on the relative subsystems in terms of hours worked – Total flows input-output tables

[b]Weight of business services (50-74 ISIC Rev.3) on industrial subsystems in terms of hours worked – Total flows input-output tables

Table 3: *Vertical disintegration and business services integration per industrial subsystems - middle '90s* – cross-country average values

the subsystems on which the correspondent sector weights relatively less in all the three periods. However, two important structural changes can be noticed, although still on average. First of all, the disintegration process of the transport equipment sector, already detected above, has brought it progressively from, on average, one of the most integrated - in the early '80s - to one of the least integrated ones - in the middle '90s, and the change seems to have occurred at an increasing rate - losing two positions from the first to the second period, and three, from the second to the third period.

Second, in approaching the middle '90s the construction sector seems to have been affected by an opposite phenomenon, turning it from the seventh least integrated to the fourth most integrated one, always on average. More gradual changes over the period can be observed in non-metallic mineral products, fabricated metal products and in machinery equipment. Quite interestingly, while

Industrial sectors		early '80s		early '90s		mid-'90s	
Code		Avg	Rank	Avg	Rank	Avg	Rank
23	Coke, refined petroleum products and nuclear fuel	5.3	1	6.8	1	10.4	1
15-16	Food products, beverages and tobacco	23.0	2	25.4	2	29.1	2
20	Wood and products of wood and cork	35.0	3	34.5	3	49.7	6
24	Chemicals (including Pharmaceuticals)	35.9	4	35.2	4	35.6	3
27	Basic Metals	37.5	5	38.0	5	42.7	4
25	Rubber and Plastics Products	45.4	6	44.4	6	49.9	7
45	Construction	51.2	7	50.4	7	53.2	11
26	Other non-metallic mineral products	54.6	8	52.2	9	52.9	10
28	Fabricated metal products, except machinery and equipment	54.8	9	52.2	10	57.8	13
34-35	Transport Equipment	56.7	10	52.2	8	44.2	5
21-22	Pulp, paper, paper products, printing and publishing	56.8	11	54.8	12	57.6	12
29 -33	Machinery and Equipment	57.6	12	54.2	11	52.8	9
17-19	Textiles, textile products, leather and footwear	65.6	13	65.1	13	66.9	14
36-37	Manufacturing, nec; Recycling	69.8	14	71.2	14	51.6	8

Source: our calculation on *OECD* and *GGDC* data

Table 4: *Vertical integration degree of OECD6 manufacturing sectors: 1980-1995* – Average percentage weight of manufacturing sectors in the relative subsystems (hours worked) – total flows input-output tables

the former two, typically specialised-supplier sectors, have scaled positions in terms of vertical integration, the latter, encompassing also computing machinery, have scaled the integration ladder down, pointing to a possible evidence of the outsourcing processes occurred in it.[17]

As in the previous subsection, also the present 'average' analysis has to be refined by shifting from a sector to a country perspective and by analyzing, with respect to the broader set of OECD countries of the middle '90s (OECD18), the degree of business services integration in the manufacturing subsystems.

To start with, it is interesting to examine how the 18 OECD countries of the present set rank when the analysis is carried out with respect to the manufacturing subsystem as a whole (Table 5).[18] Business services have a relatively lower integration in manufacturing in all the transition economies considered, namely Czech Republic, Poland and Hungary. This fact appears quite interesting considering that these countries underwent a tertiarisation process by which their employment reached, in the middle '90s, a structure quite similar to that of the EU countries (e.g. Landesmann, 2000). Among them, Hungary deserves

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[17]As for the wood and cork sector, the observed shift in the integration degree between the '80s and the middle '90s might have been affected by a change in the classification. Indeed, while according to ISIC Rev.2 furniture is included in the wood, products of wood & cork sector (33 ISIC Rev.2), for the ISIC Rev.3 it is instead included in manufacturing n.e.c. (36 ISIC Rev.3).

[18]The analysis is accomplished both with respect to total and domestic flows input-output tables. The relative country ranking is quite similar (the Spearman correlation index is 0.83).

Country	Business services integration			
	Total flows	Rank	Domestic flows	Rank
United Kingdom	29.1	1	26.6	2
Netherlands	29.0	2	25.9	4
France	28.9	3	26.4	3
Australia	26.9	4	24.2	6
United States	25.7	5	27.2	1
Canada	25.4	6	24.9	5
Norway	25.1	7	21.4	8
Spain	24.9	8	21.0	11
Korea	24.2	9	21.1	10
Finland	23.5	10	19.0	14
Italy	23.3	11	18.6	15
Japan	22.9	12	21.4	9
Germany	22.5	13	19.7	12
Czech Republic	21.8	14	19.4	13
Poland	21.4	15	17.4	16
Denmark	20.3	16	22.1	7
Greece	19.1	17	14.9	18
Hungary	15.2	18	16.1	17

Source: our calculation on *OECD* and *GGDC* data

Table 5: *Business services integration in the manufacturing subsystem - middle '90s* – Weight of business services (50-74 ISIC Rev.3) on the manufacturing subsystem (15-37,45 ISIC Rev.3) in terms of hours worked

a particular attention. Indeed, as Landesmann's (2000) survey on the European post-socialist countries clearly shows, this is the country in which in the '90s there was the largest increase in the service share, both in terms of value added and labour, and where manufacturing labour productivity grew faster. Notwithstanding, in this country business services are the least integrated ones in manufacturing, thus suggesting that the increase in the service sector was mainly due to final services, whereas the production services still lag behind.

As far as the other countries are concerned, in the middle '90s some trends highlighted with respect to the '80s are confirmed and reinforced, while others are not. On the one hand, in the mid-'90s the UK has got the most integrated business sector services, followed by other two European countries of the set (Netherlands and France). On the other hand, Japan, which ranked first in the '80s, just ranks in an intermediate position, thus hinting at a possible change of the overall strategy of Japanese firms in the early '90s. At the same time, the United States, that in the '80s displayed a tendency towards a decrease of service integration in manufacturing, clearly show a reversing trend, also pointing to a possible change in the strategies of US firms, that might have largely resorted to outsourcing in the early '90s.

In passing, let us also observe that the country ranking we got in terms of business services subsystem integration is substantially different from that obtained working with value added and employment shares of business services in total manufacturing (Figure 9 and 10). In particular, relying on these data leads to a significant underestimation for some countries, that is, France, Netherlands,
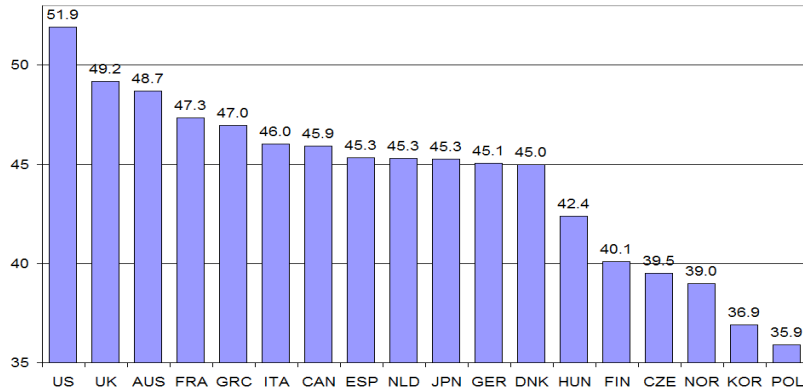
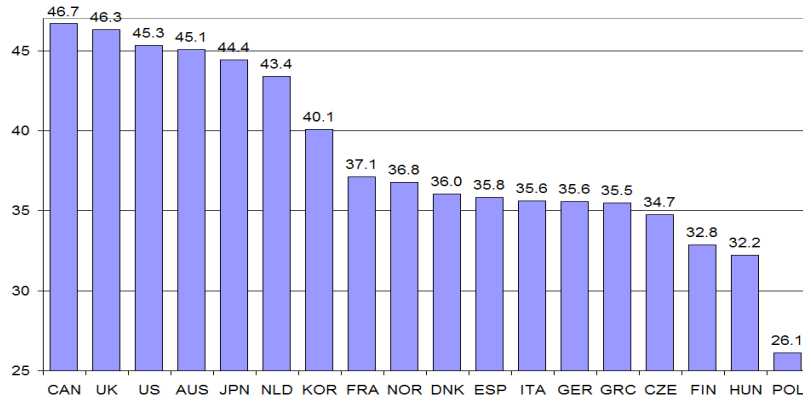Figure 9: *Business services shares of the total economy value added - middle '90s*


Figure 10: *Business services shares of the total economy hours worked - middle '90s*

Finland and Poland, in which producer services are thus apparently more important than final. On the contrary, with respect to Greece and Hungary, the data on value added and employment shares leads to overestimate the integration of services in manufacturing, possibly because of the prominent role of final services in producer services.

As in the previous subsection, it could be interesting to analyze the most recent integration/disintegration patterns occurred in so many countries in the 'usual suspect' manufacturing sectors, that is, textiles, leather and footwear; transport equipment and machinery & equipment (Figure 11). First of all, the low integration of business services in manufacturing for the former socialist European countries, and for Hungary in particular, get confirmed in all the three sectors. Confirmed is also their relatively high integration in France, UK and Netherlands, as well as the reversing trend of the US, which show an increase in the relative integration of business services for all the considered subsystems from the early to the middle '90s (see Figures 5-7). As for the other coun-

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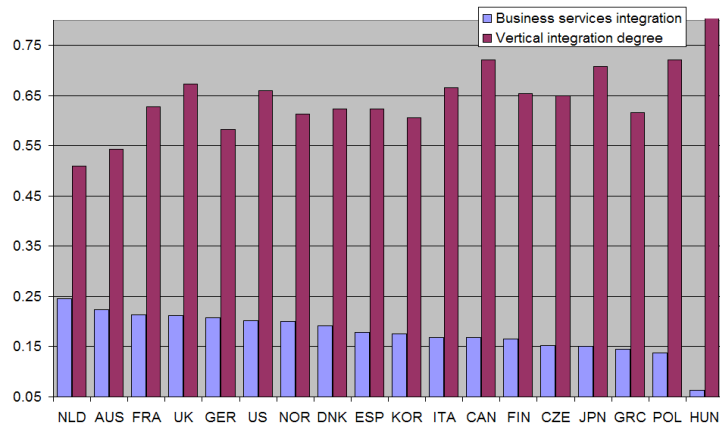
(a) Textiles, textile products, leather and footwear
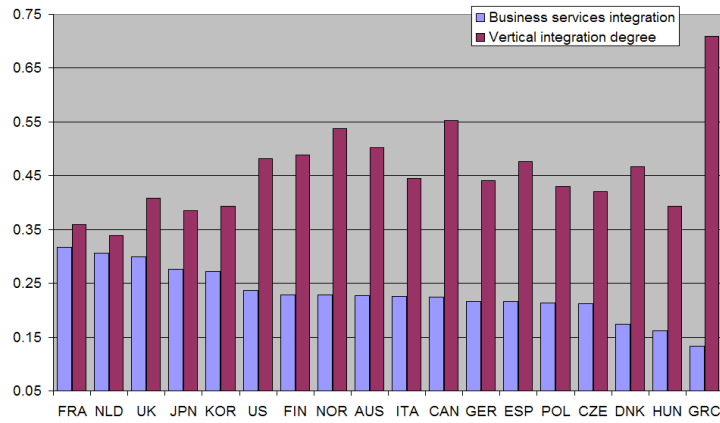
(b) Transport equipment
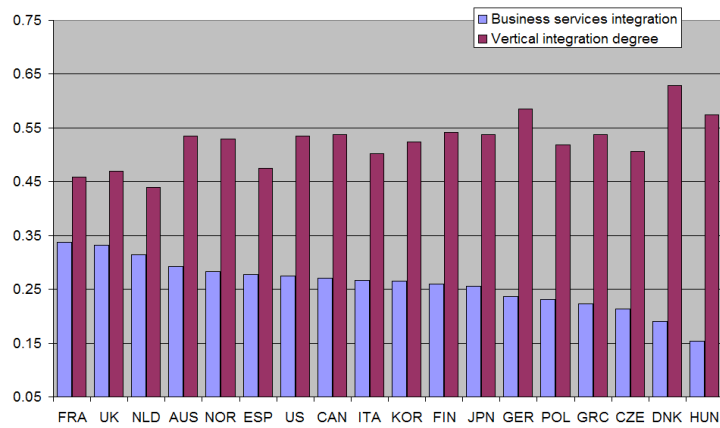
(c) Machinery & Equipment

Figure 11: *Business services integration and vertical integration degree - middle '90s*

tries, it is interesting to note the close ranking of Japan and Korea, both in terms of vertical integration and of business services integration, especially in transport equipment and machinery & equipment, thus pointing to a possible similar production and organizational structure. With respect to Greece the low integration of business services clearly emerges, especially in the transport equipment sector. As for Australia instead, the integration degree of business services is quite large, thus signaling widespread outsourcing practices, in particular with respect to the textile and machinery & equipment sectors.

Having a closer look at each sector, it is worth stressing the low integration of business services in Italian textiles,[19] while, for the transport equipment sector, what emerges is the marked distance of Germany, Italy, Spain from the disintegrated model characterizing France, UK, Japan and US. Finally, in the machinery & equipment sector, the relative country ranking seems to show a positive correlation between productive specialization and vertical integration degree, thus pointing to a possible better performing of the integrated model compared with the disintegrated one.

4.2 The sectoral level: vertical integration and service outsourcing by manufacturing sectors

4.2.1 Sectoral value added-gross production ratios over the '90s in the OECD18

In the previous section we worked out the weight of sectors on the relative subsystems in terms of hours worked to measure their vertical integration degree. As we said in Section 3.2, an alternative and more standard measure of vertical integration, which relies just on sectoral data, is the value added-gross production ratio. Given that they refer to an apparently similar process, it is interesting to analyze whether the results we have obtained in terms of subsystems are actually replicated at the sectoral level or wether differences emerge which can be related to their different rational.

In order to deal with this issue, we calculated the average sectoral value added-gross production ratios over the '90s across the same sectors and countries (OECD18) of the previous section. We then worked out the relative cross-country averages and ranked the sectors accordingly (Table 6).[20]

Before turning to the ranking analysis, it is worthwhile observing that no strict positive relation emerges between the 'sectoral proximity' to raw materials

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[19]Its high integration degree, instead, is not significant because this indicator is not affected by 'intrasectoral disintegration'. Thus, it is not capable to bring out the delocalization actually occurred in this sector in Italy.

[20]Because of missing data, we have excluded Australia from the average ratio of the construction sector. Furthermore, when for some country some of the needed disaggregated data were missing, we used the least aggregated data available assuming that, for that country, the proportion between the disaggregated data and the more aggregated ones is the same as that between the correspondent average values. This procedure has been applied to the following missing values: Chemicals and chemical products (Cod. 24) and Rubber and plastics products (Cod. 25) for Norway, using the data of Chemical, rubber, plastics and fuel products (Cod. 23-25); Basic Metals (27) and Fabricated metal products (28) for Australia and Czech Republic, using the data of Basic metals and fabricated metal products (27-28); Motor vehicles, trailers and semi-trailers (34) and Other transport equipment (35) for Czech Republic, using the data on Transport equipment (34-35). The ensuing results are quite robust and do not change significantly if some other method is adopted, such as, for instance, simply calculating the sectoral averages without the sectors of the countries for which the data are missing.

Code	Industrial sectors	Avg VA/Q [a]	Vertical integration[b]
23	Coke, refined petroleum products and nuclear fuel	0.202	9.9
27	Basic Metals	0.261	37.4
15-16	Food products, beverages and tobacco	0.264	26.3
34	Motor Vehicles, Trailers and Semitrailers	0.268	35.1
24	Chemicals (including Pharmaceuticals)	0.332	35.4
20	Wood and products of wood and cork	0.349	50.2
30-33	Electrical and Optical instruments	0.353	46.4
17-19	Textiles, textile products, leather and footwear	0.361	64.6
35	Other transport equipment	0.363	49.6
25	Rubber and Plastics Products	0.368	44.2
29	Machinery and equipment, nec	0.376	49.4
21-22	Pulp, paper, paper products, printing and Publishing	0.380	53.2
36-37	Manufacturing, nec; Recycling	0.400	52.2
28	Fabricated metal products, except machinery and equipment	0.401	54.2
26	Other non-metallic mineral products	0.405	48.5
45	Construction	0.421	52.4

Source: our calculation on *OECD* and *GGDC* data

[a]Average sectoral value added-gross production ratios 1990-2000

[b]Weight of sectors in the relative subsystems in terms of hours worked – Total flows

Table 6: *Average sectoral VA/Q ratios of OECD18 manufacturing sectors over the '90s* – cross-country average values

and the average VA/Q ratios, so that the hypothesis of a prominent role of vertical linkages over the horizontal ones in manufacturing sectors cannot be supported.[21]

This result enables us to use the same ratio in cross-sector comparisons and, for example, to analyze the relation between the average sectoral VA/Q ratios and the percentage labour share of the sectors in the relative subsystems. Indeed, their correlation turns out to be as high as 0.862 and the two rankings are quite similar, except for some sectors, in particular: textiles, leather and footwear; other non-metallic mineral products; and construction (Figure 12).

These and other outliers deserve a special attention, as they actually reveal the different 'disintegration' rational the two measures are able to capture. First of all, as we said in Section 3, while the vertical integration degree is not affected by phenomena of disintegration that occur entirely within the sector, the same does not hold true with respect to the sectoral VA/Q ratio, which tends to decrease when firms belonging to a certain sector outsource to firms classified in the same sector. Apparently, this is what happened during the '90s in the

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[21]E.g., basic metals has got a ratio equal to 0.261, while the ratios of fabricated metals product and electrical & optical instruments sectors are equal to, respectively, 0.401 and 0.353. The coke, refined petroleum products and nuclear fuel sector has the lowest VA/Q ratio (0.202), though it is certainly one of the most structurally 'closer' to raw materials among the manufacturing sectors.
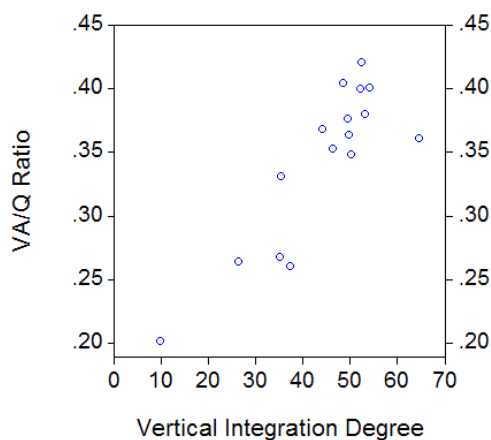
Figure 12: *Sectoral VA/Q ratios vs vertical integration degrees*

textile sector, where phenomena of 'intra-sectoral disintegration' are highly frequent. Indeed, following the data on the average labour share of the sectors in the relative subsystems, the textile and footwear sector turns out to be the most vertically integrated one, while, looking at the sectoral VA/Q ratios, it comes out as having a VA/Q ratio that is relatively small. Although to a lesser extent, the same holds true also for wood, wood products and cork; basic metals; and paper products, printing and publishing. All turn out to be more disintegrated in terms of VA/Q ratios than in terms of the labour share of the sector in the relative subsystem and again this could be related to intrasectoral disintegrations. Quite interestingly, the 'intrasectoral disintegration' revealed by the data can be related to the recent technical changes occurred in these sector, especially in the last two, involving a reduction in their minimum efficient scale. We refer in particular to the emergence of mini-mills in the steel production (e.g. Audretsch and Feldman, 1996) and to the massive computerization occurred in printing and publishing in the last years (e.g. Domberger, 1998).

A different argument holds with respect to constructions, other non metallic mineral products and rubber and plastics products, which appear less disintegrated in terms of VA/Q than what would be in terms of the relative sector-subsystem ratio. As we pointed out in Section 3.2, this could be due to the peculiar market structure of these sectors, of the first in particular, in which monopolistic rents are quite diffuse and hinder the outsourcing revealing power of the VA/Q ratio.

Although both the kinds of interpretations need to be confirmed with other data, suffice here to notice how the two indicators of disintegration/integration should be used in a complementary way to have a better understanding of the investigated phenomenon.

4.2.2 Sectoral indicators of service outsourcing and input-output technical coefficients over the '80s in the OECD6

The final point to address is of course how consistent the previous 'indirect' indicators of outsourcing are with the more 'direct' ones we have presented in

(a) Textiles

(b) Transport Equipment

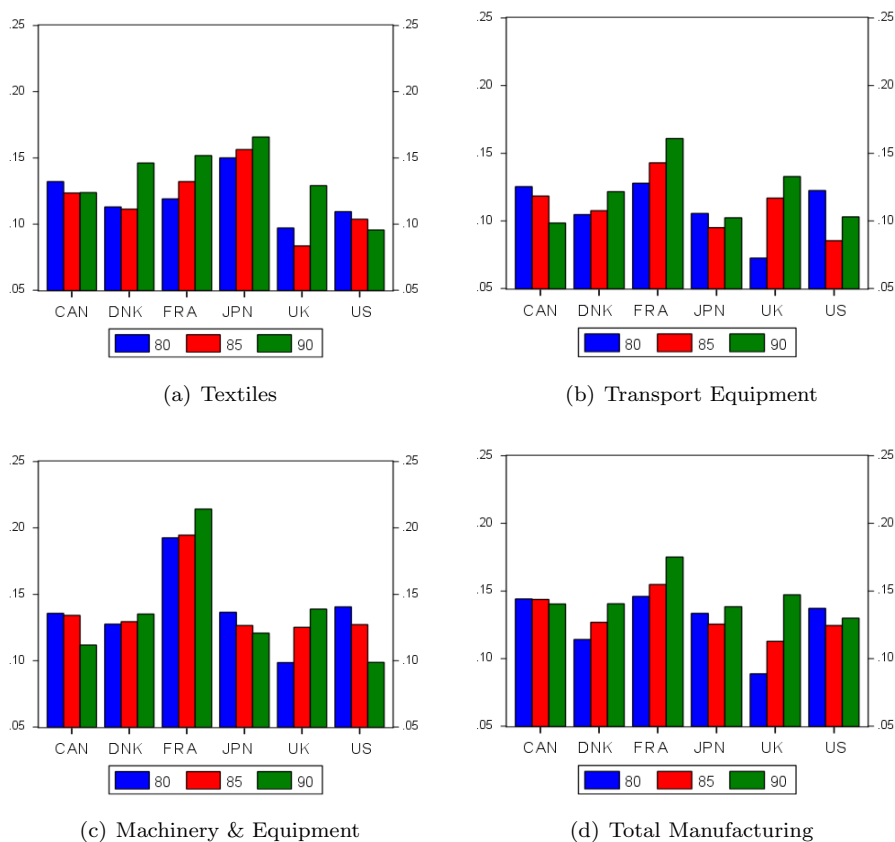(c) Machinery & Equipment

(d) Total Manufacturing

Figure 13: *Intermediate business services expenditure per production unit in manufacturing (constant prices): 1980-1990*

Section 3.4, that is $SERV/Q$ and $SERV/LABR$, along with the changes in input-output coefficients. In order to make this analysis more straightforward we have calculated them for the same countries of Section 4.1.1, that is, Canada, Denmark, France, Japan, UK and US, and with respect to the usual 'candidate' sectors, namely textiles, leather & footwear, transport equipment and machinery & equipment, besides the whole manufacturing. Figures 13 and 14 show the results of this analysis with respect to the '80s.

As far as the European countries are concerned, the two data series are quite consistent between them and decisively supportive of the outsourcing hypothesis for all the sectors considered. Indeed, these countries show significant increases in both the variables over the whole period. Moreover, while France is the country in which there were the highest average levels, the UK is that in which the growth rates were prominent: for manufacturing as a whole, for example, $SERV/Q$ increased more than 66%, while $SERV/LABR$ of 60.6%. The data thus provide further evidence on the economic restructuring of the UK manufacturing during the '80s, and especially in the last five years. At the same time, they seem to point to a possible 'European model of externalization'. Furthermore, crossing these data with those on the labour share of business ser-

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(a) Textiles

(b) Transport Equipment

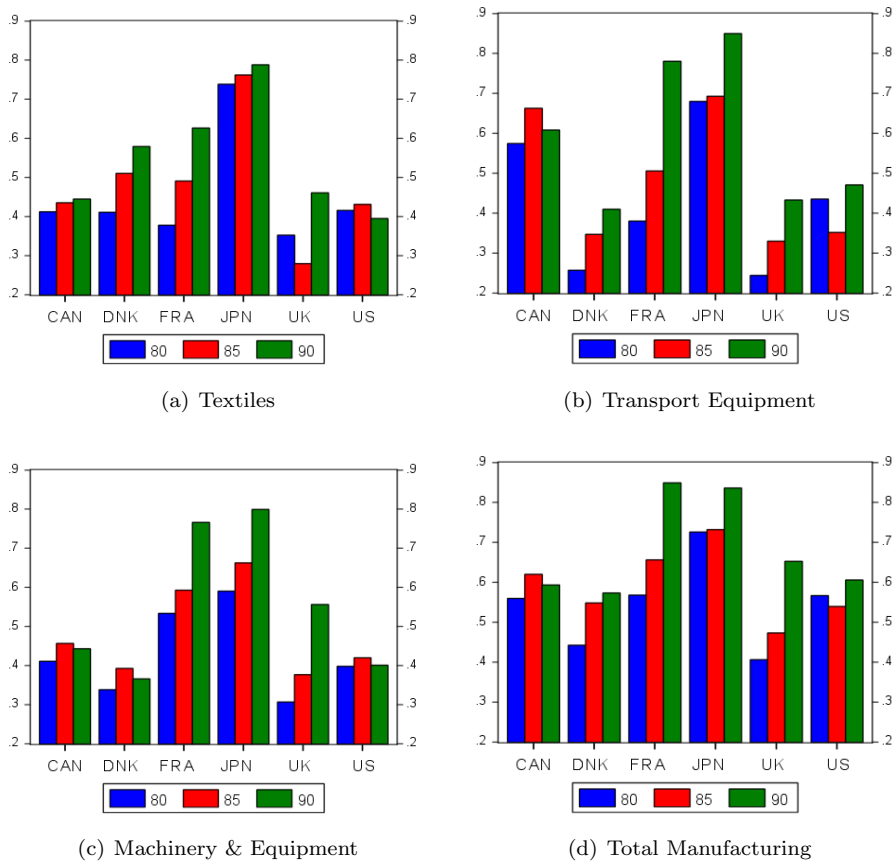(c) Machinery & Equipment

(d) Total Manufacturing

Figure 14: *Intermediate business services expenditure on labour compensation (current prices): 1980-1990*

vices in manufacturing subsystems (Section 4.1.1), two interesting facts should be noticed. First of all, the integration of business services in UK manufacturing is largely underestimated by the two indicators of the present section, both in terms of levels and of rates of changes, as it clearly emerges comparing Figures 5-8 with Figures 13-14. This suggests how considering both direct and indirect intersectoral relationships matters in dealing with outsourcing as much as with other processes of economic restructuring. Second, although Denmark shows a significant increase in both $SERV/Q$ and $SERV/LABR$, signalling a remarkable resort to service outsourcing by the Danish manufacturing firms,[22] this did not entail a change in the integration of business services in the manufacturing subsystem in terms of labour, as shown by Figure 8.

As far as Canada and US are concerned, the data do not show significant tendencies towards service outsourcing in any of the sectors considered.[23] The

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[22]The growth rates of $SERV/Q$ and $SERV/LABR$ are, respectively, of 23.2% and 29.6%.

[23]In particular, in the United States during the '80s the overall rate of change of $SERV/Q$ for the whole manufacturing is negative and equal to -5.2%, whereas the rate of change of $SERV/LABR$, though positive, is relatively small (6.9%).

only exception is represented by the US transport equipment sector in the late '80s, with respect to which $SERV/Q$ and $SERV/LABR$ possibly hint at a certain rethinking of the in-sourcing strategies followed in the early '80s by the US firms. Indeed, after a marked decrease of $SERV/Q$ and $SERV/LABR$ for the sector between 1980 and 1985 – respectively of -30.3% and -19.2% – both the indicators increased considerably in the late '80s (+20.7% and +33.9%). Interestingly enough, this fact involved neither an increase of business service integration in the transport equipment subsystem, nor a vertical disintegration of the subsystem itself for the US, as it was clearly shown by Figure 6. That was probably due to the opposite strategies pursued by the supplier sectors of the US transport equipment. The result of these counterbalancing effects might actually be the relative stability of the business services labour share in the relative subsystem.

Finally, a special attention should be paid to the case of Japan, and of the Japanese transport equipment sector in particular, for which the data seem to be somehow inconsistent. Indeed, as we saw in Section 4.1.1, during the '80s the growth rate of business services integration in the transport equipment subsystem was of 30.8%, and accompanied by a related process of sectoral disintegration (-29.4%), thus clearly signalling an intense process of economic restructuring within the subsystem. This fact gets somehow confirmed by the data on $SERV/LABR$: for transport equipments, the overall growth rate of the indicator for the '80s was nearly 25%, although this increase mainly occurred in the last five years. At the same time, the indicator increased a lot also for machinery & equipment (+35.4%), the main supplier sector of transport equipment.[24] Furthermore, looking at the average levels of the indicators in the two sectors, Japan shows the highest values. However, the same outsourcing pattern is not confirmed by the data on $SERV/Q$. Indeed, unlike for the other countries, in the Japanese sector there was no significant increase in business services expenditure per production unit during the '80s (see Figure 13(b)), and the same does hold true also for its traditional supplier sectors, that is, machinery & equipment, basic metals, rubber and plastics products and other fabricated metal products. [25] In addition, examining the average level of $SERV/Q$ over the '80s, rather than its change rates, it turns out that it is particularly small for transport equipment in Japan.

The picture that emerges with respect to Japan is therefore somehow mixed-up. On the one hand, we have a small and decreasing $SERV/Q$, that seems to exclude service outsourcing in the sector. On the other hand, a large and increasing $SERV/LABR$ as well as an increasing business service integration in the relative subsystem, that leads to an opposite conclusion. In other words it seems that the Japanese economic restructuring, while reflected in the changes occurred in the employment structure, does not result from the data on inter-

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[24]As for basic metals and fabricated metals products, the other two manufacturing sectors with relevant labour share in the transport equipment subsystem, the rates of change of $SERV/LABR$ were, respectively, 24.1% and -2.9%.

[25]Although sectoral input flows at constant prices from business services increased more than 89.8%, the overall increase in sectoral gross production was 95.6%, thus determining a reduction in the coefficients of -2.94%. Looking at the Japanese data on $SERV/Q$ for machinery & equipment; basic metals; rubber and plastics products; and other fabricated metal products, the overall rates of change for the '80s were, respectively, -11.5%, 9.9%, -16.6%, -2.6%. (With respect to the same period, in the UK the rates of change in the corresponding sectors were 40.9%, -23.1%, 70.9% and 43.6%.)

mediate service consumptions per production unit.

A tentative explanation of this apparent inconsistency can be found by recalling the relationship between 'intrasectoral disintegration' and sectoral input-output coefficients we have pointed out in Section 3.3. In the case of intrasectoral externalization, as we said, $SERV/Q$ would tend to decrease in the outsourcing sector i, whereas its $SERV/LABR$ would be, *ceteris paribus*, hardly affected. What is more, all the technical coefficients of the same sector (a_{ij}) tends to decrease, with the exception of the autocoefficients (a_{ii}), which, on the contrary, increase. In order to ascertain that is the case for the Japanese transport equipment sector, in Figure 15 we have compared its technical coefficients with those of the UK and the US.

The results seem to support our interpretation. Indeed, over the '80s the autocoefficients of the transport equipment sector in Japan increased of 70.9%, while, among the remaining five countries of the OECD6 set, the largest increase occurred in the UK and it was of just 32.9%.[26] At the same time, in Japan all the remaining technical coefficients decreased. Among these, we have to notice the changes occurred in the coefficients referred to basic metals, machinery & equipment and fabricated metal products, three of the most important and complementary inputs in the production of transport equipment. Over the '80s, in all the countries but Japan the reduction in the coefficients of basic metals was accompanied by an increase for machinery & equipment and fabricated metal products. On the contrary, in Japan they all decreased: -31.4% for basic metals, -37.3% for machinery & equipment and -22.7% for fabricated metal products. One might argue that these results, rather than by disintegration, are mainly due to technical progress. However, if it was so, how to explain the marked increase of the autocoefficients?

Evidences of a certain intrasectoral disintegration of the Japanese transport equipment sector are therefore apparent. However, other factors might have played a role in explaining the inconsistency we have detected. First of all, the particular features of the Japanese manufacturing, and of transport equipment in particular, sometimes pointed out in empirical studies (e.g. Domberger, 1998), might have led to underestimate the service inputs of manufacturing sectors. Indeed, given the particular relationships ('keiretsu') between the 'outsourcee' firms and the 'outsourcer' ones, input prices are more similar to intra-firm 'transfer prices' rather than normally negotiated 'market prices' (see, for instance, Jarillo, 1993). Second, the large labour productivity gains reached in the transport equipment during the '80s in Japan, not accompanied by an equal increase of labour productivity in the service sectors, might have caused an increase in the service labour share of the transport equipment subsystem. Thus, the observed changes in the sectoral labour shares might have been also due to the different growth rates of sectoral productivity. However, although more than plausible, all these interpretations turn out to be complementary, rather than primary, with respect to the particular disintegration hypothesis we have put forward.
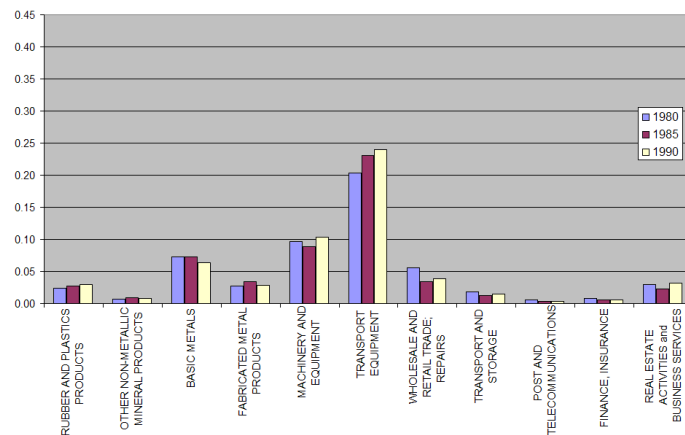
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[26]It is worth noting that the increase of a_{ii} we have registered in Japan is not due to changes in the composition of the sector. Also by increasing the level of disaggregation, the basic insights get confirmed. Indeed, the growth rate of motorvehicles, trailers and semitrailer in Japan was of 52.7%, whereas in the UK it was of just 12.9%.
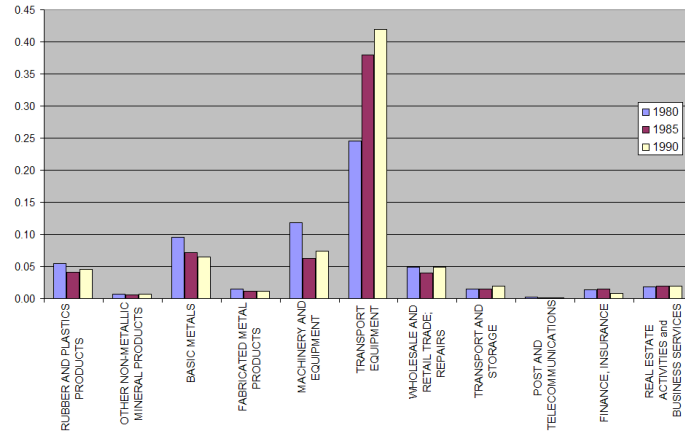
(a) Japan
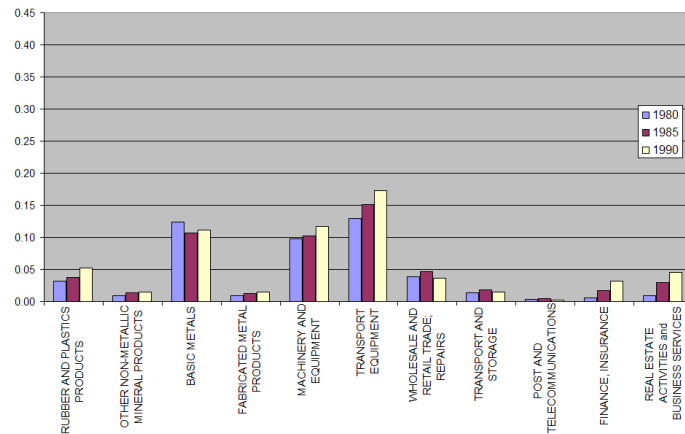
(b) United Kingdom

(c) United States

Figure 15: *Input-output technical coefficients in transport equipment (constant prices): 1980-1990*

5   Conclusive remarks

Although mainly investigated as a process of organizational change, in particular of the firm boundaries, outsourcing has important implications also for the structure of the economic system in which the 'outsourcee' and the 'outsourcer' firms operate. Among these, the economic literature has focused on: the employment and wage effects it entails (e.g. Feenstra and Hanson, 1999), the ensuing patterns of international trade (e.g. Kohler, 2004), the opportunities and constraints it poses in terms of development, especially at the local level (e.g. Humphrey and Schmitz, 2002). Relatively less attention has instead be paid to the implications outsourcing has on the structure of the input-output relations of one economy. This is somehow 'odd' given that, while shifting firm boundaries, outsourcing inevitably shifts also the sectoral boundaries of the firms involved in it. The organizational and structural changes it determines are thus nothing but two coins of the same medal.

In bridging the micro and the macro-analysis of outsourcing - an effort so far successful only in international trade studies (for a survey see Spencer, 2005) - this paper illustrates, compares and applies a 'battery' of an input-output kind of outsourcing indicators. That is, indicators which help in disentangling to which extent and in which way the different externalisation decisions of the firms turn into changes of the inter-sectoral and intra-sectoral relationships of the economic system in which they operate. In other words, a set of indicators through which outsourcing, especially of production services, can be accounted for in explaining structural change along with other more 'popular' determinants of it, such as technical, production and demand-led changes. Some of these indicators apply to a sub-system level of analysis and consider the changes that outsourcing determines in the relative weight of the sectors which are vertically integrated in it. Some others, instead, operate at the sectoral level, and examine the combined effects that externalisation exerts, on the one hand, on the relevant intra-sectoral and inter-sectoral acquisitions, on the other hand, on the correspondent value added. Some are devised to measure the general extent of the externalisation activities of a certain sector. Some others are instead specifically designed to capture the outsourcing of service activities by manufacturing firms.

Given that the different structural change determinants of one economy are at work simultaneously, an accurate analysis and interpretation of the indicators we discuss should be accompanied by a suitable decomposition of their relative weight. Indeed, some decomposition techniques have been recently put forward for this scope (e.g. Dietrich, 1999; McCarthy and Anagnostou, 2004). However, their construction and interpretation appears to us still problematic and requires further research effort (see Montresor, 2005). Accordingly, although not entirely satisfactory, we decided to place this issue on our future research agenda. In this paper we have instead opted to: on the one hand, discuss the rational of the same indicators under a general *ceteris paribus* condition, on the other hand, to carry out their empirical application just by alerting about the need of controlling for extra-outsourcing determinants when necessary.

The discussion of the rational of the outsourcing indicators we present leads us to a first important result. Although they are all affected by the externalisation decisions of the correspondent firms, and thus inform about it, their interpretative power differs: either because they retain total (at the sub-system level) rather than direct (at the sectoral level) outsourcing effects, or because

they are able rather than unable to distinguish inter-sectoral from intra-sectoral outsourcing, or because they are affected rather than unaffected by the market structure of the relevant sector, just to mention a few differentiating mechanisms. Accordingly, the indicators of outsourcing of the paper should be used as complementary rather than as substitute among them, while looking for the 'best', or the 'most revealing' one could be misleading.

The empirical application we carried out with respect to a set of OECD countries over the '80s and the early '90s corroborates this suggestion. Some results confirm, on a comparable and systematic basis, what previous work had already suggested on the basis of case-studies and/or nation specific analyses, such as, for example: the evidence of two different temporal patterns of outsourcing, one European and the other non-European, both for manufacturing as a whole and for some key outsourcing sectors (i.e. textiles, transport equipment and machinery and equipment); the idiosyncratic resort to outsourcing, both in terms of levels and of growth rates, of the UK manufacturing sectors; the recent outsourcing switch of the US manufacturing sectors from the high levels of vertical integration of the '80s.

Some of these results had already been detected both in qualitative and quantitative terms. As for the US, for instance, Byrne (1996) roughly estimated the overall growth rate of service contracting between 1992 and 1996 to be of 28%. With respect to the UK and Australia, Domberger (1998), in one of the most cited studies on outsourcing concludes that 'all indications are that both manufacturing and service industries are contracting for support services', though he admits that 'fewer figures are available in the private sector' (Domberger, 1998, p.22).[27] In the same study no systematic evidence is provided instead with respect to France, which, according to our results, exhibits widespread service outsourcing, though Domberger points to some qualitative confirmative data for it (1998, p.23).

Apart from these confirmations, some of the results we got are instead quite original, as they have been obtained by working on a new OECD dataset, covering updated input-output tables for a larger set of countries than the 'old' one, and by crossing it with other newly available sources of sectoral data (e.g., the 60-Industry Database of the Groningen Growth and Development Centre). The evidence we obtained for the former-socialist countries, usually retained to have been invested by a massive 'tertiarisation' process over the '90s, but here characterized by the lowest degree of integration of business services in manufacturing sub-systems, is one of the most relevant of these results.

Finally, some of the outcomes that we got turn out to be inconsistent or mixed-up, as different indicators point to, at least apparently, different predictions in terms of outsourcing: the case of the Japanese transport equipment sector, detected as 'problematic' also by other studies on the basis of different data, is for sure the most representative of them. On the other hand, an accurate complementary use of the different outsourcing indicators we have discussed turns out to be helpful in solving these apparent contradictions and in eliminating the inherent biases by which some of them are affected. In the Japanese case, for example, a closer look at the technical input-output coefficients of transport equipment sheds some light on the hypothesis of an intra-sectoral, rather than

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[27]The evidences provided troughout the book for the private sector are mainly case-studies. The only empirical evidences at sectoral level are given in Chapter 10, especially for the UK, the US and Australia (Domberger, 1998, pp.181-198), and they fit quite well our results.

inter-sectoral, disintegration process over the '80s and the early '90s.

In closing the paper, it seems to us that, although in the need of controlling for other factors, the indicators we have presented could be used as complementary (and possibly rough) proxies of a structural change determinant which should be extrapolated from the 'black-box' of other important economic processes.

Appendix A   Country coverage

Country	I-O Tables			
	early '80s*	mid-'80s*	early '90s*	mid-'90s
Australia				1995
Canada	1981	1986	1990	1997
Czech Republic				1995
Denmark	1980	1985	1990	1997
Finland				1995
France	1980	1985	1990	1995
Germany				1995
Greece				1994
Hungary				1998
Italy				1992
Japan	1980	1985	1990	1995
Korea				1995
Netherlands				1995
Norway				1997
Poland				1995
Spain				1995
United Kingdom	1979	1984	1990	1998
United States	1982	1985	1990	1997

*Input-output tables at constant prices

Appendix B   Business sector services

Sector	ISIC Rev.3 Codes
Wholesale and retail trade; repairs	50-52
Hotels and restaurants	55
Transport and storage	60-63
Post and telecommunications	64
Financial intermediation	65-67
Real estate, renting and business activities	70-74

Appendix C   Sector classification

Sector	ISIC Rev.3 Codes
Food products, beverages and tobacco	15-16
Textiles, textile products, leather and footwear	17-19
Wood and products of wood and cork	20
Pulp, paper, paper products, printing and publishing	21-22
Coke, refined petroleum products and nuclear fuel	23
Chemicals (including pharmaceuticals)	24
Rubber and plastics Products	25
Other non-metallic mineral products	26
Basic metals	27
Fabricated metal products (except machinery and equipment)	28
Machinery & equipment	
...Machinery and equipment, nec	29
...Office and computing machinery - communication equipment - medical, precision and optical instruments	30,32-33
...Electrical machinery and apparatus, nec	31
Transport equipment	
...Motor vehicles, trailers and semitrailers	34
...Other transport equipment	35
Manufacturing, nec; recycling	36-37
Construction	45

References

ABRAHAM, K. G., AND S. K. TAYLOR (1996): "Firms Use of Outside Contractors: Theory and Evidence," *Journal of Labor Economics*, 14(3), 394–424.

ADELMAN, M. A. (1955): "Concept and Statistical Measurement of Vertical Integration," in *Business Concentration and Price Policy*, ed. by G. J. Stigler, pp. 281–322. NBER-Priceton University Press.

ANTONELLI, C. (1988): "The emergence of the network-firm," in *New Information Technology and Industrial Change: the Industrial Case*, ed. by C. Antonelli, pp. 13–22. Kluwer Academic Pubblishers, Dortrecht.

ARGYRES, N., AND J. LIEBESKIND (1999): "Contractual commitments, bargaining power, and governance inseparability: incorporating history into the transaction cost theory of the firm," *Academic of Management Review*, pp. 49–63.

AUDRETSCH, D. B., AND M. P. FELDMAN (1996): "Innovative Clusters and the Industry Life Cycle," *Review of Industrial Organization*, 11, 253–273.

BALDONE, S., F. SDOGATI, AND L. TAJOLI (2002): *EU enlargement to the CEECs: Trade competition, delocalisation of production, and effects on the economies of the union.* Franco Angeli, Milan.

BENSON, J., AND N. IERONIMO (1996): "Outsourcing decisions: evidence from Australia-based enterprises," *International Labour Review*, 135(1), 59–73.

BYRNE, J. A. (1996): "Has Outsourcing Gone Too Far?," *Business Week*, 1 Apr., 28–30.

DE KOK, T. G. (2000): "Capacity allocation and outsourcing in a process industry," *International Journal of Production Economics*, 68, 229–239.

DIETRICH, M. (1999): "Explaining Economic Restructuring: an input-output analysis of organisational change in the European Union," *International Review of Applied Economics*, 13(2), 219–240.

DOMBERGER, S. (1998): *The Contracting Organization. A Strategic Guide to Outsourcing*. Oxford University Press, Oxford.

FEENSTRA, R. C., AND G. H. HANSON (1999): "The impact of outsourcing and high-technology capital on wages: estimates for the United States, 1979-1990," *Quarterly Journal of Economics*, August, 907–940.

GEREFFI, G. (2003): "The governance of global value chains," *Review of International Political Economy*, forthcoming.

GGDC (2005): "Data Sources and Methodology of the 60-Industry Database of the Groningen Growth and Development Centre," http://www.ggdc.net.

GINZBERG, E., AND G. VOJTA (1981): "The service sector of the U.S. economy," *Scientific American*, 3.

GONZÁLEZ, D. M., B. ARRUNADA, AND A. FERNÁNDEZ (2000): "Causes of subcontracting: evidence from panel data on construction firms," *Journal of Economic Behavior & Organization*, 42, 167–187.

GOSSLING, W. (1972): *Productivity Trends in a Sectoral Macro-Economic Model*. Input-Output Publishing, London.

GROSSMAN, G., AND E. HELPMAN (2002): "Integration versus outsourcing in industry equilibrium," *The Quarterly Journal of Economics*, 117, 85–120.

GUPTA, S., AND I. STEEDMAN (1971): "An Input-Output Study of Labour Productivity in UK," *Oxford Bulletin of Economics and Statistics*, 33, 21–34.

HUMPHREY, J., AND H. SCHMITZ (2002): "How does insertion in global value chains affect upgrading in industrial clusters," *Regional Studies*, 36, 1017–1027.

JACOBIDES, M. G., AND S. BILLINGER (2005): "Designing the Boundaries of the Firm: from 'Make, Buy or Ally' to the Dynamic Benefits of Vertical Architecture," London Business School - Strategic and International Management Working Paper Series, Working Paper.

JACOBIDES, M. G., AND G. W. SIDNEY (2005): "The co-evolution of capabilites and transaction costs: Explaining the institutional structure of production," *Strategic Management Journal*, forthcoming.

JARILLO, J. (1993): *Strategic Networks: Creating the Borderless Organization*. Butterworth-Heinemann, Oxford.

Jones, R. W., and H. Kierzkowski (2001): "A Framework for Fragmentation," in *Fragmentation: New production patterns in the world economy*, ed. by S. W. Arndt, and H. Kierzkowski, pp. 17–34. Oxford University Press, Oxford and New York.

Kim, B. (2003): "Dynamic outsourcing to contract manufacturers with different capabilities of reducing the supply cost," *International Journal of Production Economics*, 86, 63–80.

Kohler, W. (2004): "Aspects of International Fragmentation," *Review of International Economics*, 12(5), 793–816.

Laffer, A. B. (1969): "Vertical Integration by Corporations, 1929-1965," *Review of Economics and Statistics*, February, 1969, 91–93.

Landesmann, M. (2000): "Structural Change in the Transition Economies, 1989-1999," *Economic Survey of Europe*, 2/3, 95–123.

McCarthy, I., and A. Anagnostou (2004): "The impact of outsourcing on the transaction costs and boundaries of manufacturing," *International Journal of Production Economics*, 88, 61–71.

McFetridge, D. G., and D. A. Smith (1988): *The Economics of Vertical Disintegration*. Fraser Institute, Vancouver.

Milberg, W. S. (1991): "Structural Change and international competitiveness in Canada: an alternative approach," *International Review of Applied Economics*, 5, 77–93.

Momigliano, F., and D. Siniscalco (1982a): "The growth of service employment: a reappraisal," *BNL Quarterly Review*, 142, 269–306.

——— (1982b): "Note in tema di terziarizzazione e deindustrializzazione," *Moneta e Credito*, 138, 143–181.

Montresor, S. (2005): "Mapping the resource-capabilities-competence of the firm on its outsourcing decisions," MIMEO, University of Bologna.

OECD (1995): "The OECD Input-Output Database. Sources and Methods," http://www.oecd.org/sti/stan.

——— (2004): "STAN Database," http://www.oecd.org/sti/stan.

——— (2005): "Input-Output Tables (2002 Edition)," http://www.oecd.org/sti/stan.

Pasinetti, L. L. (1973): "The notion of vertical integration in economic analysis," *Metroeconomica*, 1.

Rampa, G. (1982): "Commento a Momigliano e Siniscalco," *Moneta e Credito*, 139, 475–479.

Rampa, G., and L. Rampa (1982): "Sul mutamento tecnologico nell'economia italiana, 1959-1975: Un'analisi input-output," *Ricerche economiche*, XXXVI(4), 303–341.

SHY, O., AND R. STENBACKA (2003): "Strategic outsourcing," *Journal of Economic Behaviour and Organization*, 50, 203–224.

SPENCER, B. J. (2005): "International Outsourcing and Incomplete Contracts," Working Paper 11418, National Bureau of Economic Research, http://www.nber.org/papers/w11418.

SRAFFA, P. (1960): *Production of commodities by means of commodities*. Cambridge University Press, Cambridge.

STANBACK, T. M. (1979): *Understanding the service economy*. Johns Hopkins University Press, Baltimora.

TUCKER, I. B., AND R. P. WILDER (1977): "Trends in Vertical Integration in the U.S. Manufacturing Sector," *Journal of Industrial Economics*, 26(1), 81–94.

VAN MIEGHEM, J. A. (1999): "Coordinating Investment, Production and Subcontracting," *Management Science*, 45(7), 954–971.

WOODROW ECKARD JR., E. (1979): "A Note on the Empirical Measurement of Vertical Integration," *Journal of Industrial Economics*, 28(1), 105–107.

ZAGHINI, E. (1967): "Una nota sui subsistemi di Sraffa," *Studi Economici*, 22, 290–305.