Empirical Studies of Vertical Integration: the Transaction Cost Orthodoxy

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Abstract

In this paper the empirical literature on transaction cost motivations of vertical integration strategies is critically reviewed. From the large number of empirical studies on this particular area, it emerges that, notwithstanding a) serious data and measurement limitations; b) the different attention given to the specific asset hypothesis with respect to the other hypotheses advanced by the theory; c) the unbalance between single industry and cross section studies; transaction cost theory is successful in explaining why firms may decide to internalise some stages of the manufacturing process. However, the growing body of empirical papers has not solved all problems, and more work is warranted. There are still some under researched topics which deserve a deeper investigation as well as a number of methodological problems which should be addressed.

1. Introduction

Vertical integration occurs when a firm internalises one or more stages of production. Several motivations have been advanced in order to explain why firms may extend their range of operations across the vertical chain[1]. First, they may exploit *technological economies*. A classical example is the energy savings in the steel production, when downstream firms use still-hot inputs instead of buying steel (which has to be re-heated) from external contractors. Second, there may be *market power advantages*, with firms transferring their power across upstream and downstream stages. Some examples are cross subsidisation practises, the erection of barriers to entry, or predatory strategies. Third, there may be *transactional economies*, that is savings in the process of exchange of intermediate inputs, with firms emerging as organisations that challenge the market as an alternative mechanism for managing transactions.

In what follows I will concentrate mostly on the third approach, which is based on the well-known *transaction cost theory*. I do not believe that the latter is the only theory able to account for vertical integration strategies, but it is certainly the most widely used, and nowadays can be considered as the orthodoxy in this area of studies. In reviewing the large amount of empirical works on vertical integration the methodology and the econometric techniques used in each single paper will not be discussed in depth. The attention will rather be focused on drawing some general conclusions, so as to underscore the relative successes and failures reached so far.

Section 2 reviews the main hypotheses advanced by transaction cost theory, while section 3 describes the methodology used to classify the empirical works. The latter are discussed in sections 4 to 6. Section 7 discusses a number of critical issues, which might limit the strength of some empirical studies, while section 8 includes some final comments.

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[1]   See the excellent surveys by Perry (1989) and Joskow (1988).

2. The transaction cost approach

Goods and services are obtained by transforming a set of inputs. The latter can enter the manufacturing process in different combinations and proportions, depending on the technologies which have been adopted. A different perspective focuses on the alternative ways available for a firm to ensure the supply of inputs on the one hand and to reach successfully the final consumer on the other hand: following this approach, firms, rather than *production functions*, are seen as *organisations* governing a series of relationships.

Transaction cost theory concentrates on the relative efficiency of different *exchange processes*. If for the firm-as-a-production-function view the internalisation of one or more stages of production might generate technological economies (that is savings on the costs of *physical inputs*), for the firm-as-organisation view it could lead also to transactional economies (that is savings on the costs of *exchange inputs*, due to the reduced amount of resources required to get the intermediate inputs). An intermediate step between pure market exchange and vertical integration is the use of short term and long term contracts for transforming inputs. To some extent the decision to enter durable contractual relationships by signing long term contracts and the alternative vertical integration strategy share the same motivation: the choice among these options is then a matter of degree[2].

Following the transaction cost theory (Coase, 1937), firms evaluate the relative costs of alternative governance structures (spot market transactions, short term contracts, long-term contracts, vertical integration) for managing transactions. Transaction costs could be defined as the costs of acquiring and handling the information about the quality of inputs, the relevant prices, the supplier's reputation, and so on. Contractual agreements are costly: costs have to be borne in order to negotiate and write the terms of the arrangements, to monitor the performance of the contracting party, to enforce the contracts. Firms emerge as a way of economising on transaction costs in a world of uncertainty, where

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[2]   Unfortunately, this implies that it is difficult to distinguish between them empirically (Tirole, 1988).

contractual arrangements are too expensive. The basic framework was enriched by Williamson (1971) with the introduction of two concepts: *bounded rationality* (Simon, 1961) and *opportunism*. The former underlines that human beings have limited cognitive competencies; as a consequence, it is not possible to foresee each future possible contingency, so that all contracts turn out to be in some way incomplete. The latter is defined as 'self interest with guile' and is particularly important in small number bargaining situations. Where it is possible to choose among many firms, opportunism is not an important problem. If, on the other side, one contracting party has undertaken some specific investments in view of the future trade with a downstream or upstream firm, it is locked into that particular relationship: the ex-ante competitive situation shifts towards an ex-post bilateral monopoly. The firm which is not owning the specific asset may extract the so called quasi-rents (Klein, Crawford and Alchian, 1978)[3]. Following Williamson, transaction costs are relevant when relationships are a) *frequent*, b) *uncertain* and c) if *specific assets* are involved[4].

a) The exchange relationship may be one-time, occasional or recurrent; a frequent transaction (especially in the presence of specific assets) is more likely to be internalised (Williamson, 1979), since expected damages from opportunistic behaviour are higher;

b) As far as there is uncertainty, complete contracts cannot be foreseen and the firm making the specific investment[5] could be disadvantaged if future contingencies require the renegotiation of the contract terms. This is known as the hold-up problem. Transaction cost theory individualises two kinds of uncertainty: environmental uncertainty, that is unpredictability of future contingencies, and behavioural uncertainty, that is the possibility of monitoring the behaviour of the contracting party;

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[3] They are measured by the difference between the value of the asset when employed in the relationship and the value in its best alternative use.

[4] The first two factors are very important if associated to asset specificity.

[5] Klein and Shelanski (1997) underline that uncertainty is important only when associated with specific assets. They argue that some confusion has been made in the empirical literature, with works including proxies for uncertainty without checking for the relevance of specific investments.

c) Different types of asset specificity have been detected: *physical capital specificity* (when some particular machinery, used to produce components specific to the buyer, cannot be converted without costs to manufacture inputs for alternative buyers), *human capital specificity* (when some workers of the upstream firms obtain a specific knowledge of the technology and of the productive process of the buyer), *site specificity* (when downstream plants are located close to upstream plants for lowering transportation costs or improving technical efficiency), *dedicated assets* (when some non-specific investments, made in view of the relationship, lead to excess capacity after the latter has been broken), *brand name capital* (when expensive investments are made in order to promote a brand characterised by vertical relationships with other firms), *design specificity* (when inputs are specifically designed for the particular manufactures of the downstream firm).

While it is generally recognised that transaction costs are very important in determining the decision between make or buy or between sell or use, one weakness is the underdeveloped treatment of the disadvantages of vertical integration. The proponents of the theory point out the presence of managerial diseconomies, or the emergence of mistakes in allocating factors when firm's size and the number of inputs become large[6], but the boundaries of the firm remain in some way undetermined. It is not clear why a firm, by using selective interventions, cannot continue to integrate forward and backward and perform better than decentralised competitors[7]. Grossman and Hart (1986) solved this puzzle by noticing that ownership confers residual rights of control over physical assets, so that "a firm that purchases its supplier, thereby removing residual rights of control from the manager of the supplying company, can distort the manager's incentive sufficiently to make common ownership harmful" (p. 692). Hart (1989) argues that vertical integration between independent firms which have complementary assets is beneficial, since it reduces the number of parties with

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[6] Kole and Lehn (1997) analyse the merger between USAir and Piedmont Aviation in 1987. They found that the operation did destroy value, with two profitable firms that were transformed into the least profitable carrier in the industry. The reasons of this unsuccess have been individualised by the authors in the failure to integrate the workforces of the merging firms.

[7] This is known as the selective intervention puzzle (Holmstrom and Tirole, 1989).

hold-up power. Following this line of reasoning, which takes into account the incentives for managers and workers, forward integration strategies have different effects from backward integration ones. The firm which integrates backward or forward is also the one which acquires the ownership and the residual rights of control over the integrated assets. This in turn inevitably distorts the incentives of those employees who were previously working in a independent entity and now are constrained to use assets over which they have a restricted, if any, freedom of disposal.

Another serious criticism is that Williamson's theory, while making use of concepts such as bounded rationality, opportunism and uncertainty, remains however embedded in the static and optimising neoclassical framework. As Medema (1992) points out: "for Williamson, there exists a single most economical governance structure. In some cases markets are optimal while in other cases hierarchies are optimal". However, "if bounded rationality, in the sense of Simon, leads to vertical integration, this result is due to the limited capacity of the human mind, not to economising on the use of the human mind". After having put in the arena concepts which require a heterodox treatment, it is somewhat limiting to force them into a orthodox framework.

3. The empirical methodology

Since the purpose of the paper is to review the empirical literature based on transaction cost theory, the other motivations for vertical integration strategies (technological savings, market power) will be considered only if related or compared to transaction cost arguments.

The available empirical models have been seen as crude (Williamson, 1989) in two respects: on the one side the hypotheses which have been tested are very simple and lead to gross predictions. There are in fact many potential motivations that could explain the vertical structure of a firm. Models generally refer to one or two kinds of asset specificity, while technological, historical or environmental factors are rarely included (Lyons, 1995). On the other side the dataset required for the empirical investigation are hardly recoverable from

official statistical sources. Available information is generally of little help and researchers have been forced to construct their own sets of data or to rely on proxies which are sometimes only indirectly linked to the phenomenon under study.

The main hypotheses of transaction cost theory are that small number bargaining problems, highly specific assets, frequent relationships, and uncertainty could induce firms to internalize some stages of the production process. Different empirical investigations could be in principle, and have been in practice, conducted. In order to put some systematicity I extend the categorisation introduced by Lyons (1996) to analyse the empirical literature on contract theory. Studies have been classified in four typologies, as illustrated in table 1 below:

Type 1) studies look at the different contractual arrangements (basically, the use of the market mechanism versus internal sourcing) devised to obtain different inputs by one or a small number of firms;

Type 2) studies focus on the different ways to manage transactions in a sample of firms active in a particular industry (type 2a) or in different industries (type 2b);

Type 3) works are case studies which make no extensive use of econometrics or statistical analysis;

Type 4) studies examine the causes and the effects of the degrees of vertical integration in different industries.

The choice between single industry (1, 2a) and cross section studies (2b, 4) implies the usual trade-off between the precision of the results and the possibility for them to be employed in more general interpretations. The nature of the predictions, together with some data and measurement problems, makes the transaction cost theory particularly apt to be tested in single industries or by limiting the analysis to some particular stages of the vertical chain. However, this does not preclude the possibility to draw some general conclusions. As Bresnahan (1989) correctly points out: 'A single industry case study cannot paint a broad picture....The integration of different case studies to give a unified picture of the whole map is an obviously attractive prospect' (p.1051). As it will be shown, more than 30 studies will be put into the arena for attempting such a broad picture.

Table 1. Empirical studies of vertical integration

Typology	Empirical studies
Type 1 **One firm or a few number of firms**	Monteverde and Teece (1982a) Monteverde and Teece (1982b) Masten (1984) Walker and Weber (1984)* Masten, Meehan, and Snyder (1989) Weiss (1994)
Type 2a **Single industry studies**	Anderson and Schmittlein (1984) Joskow (1987) Anderson (1988) Lieberman (1991) Ohanian (1994) Jensen and Rothwell (1998) Coles and Hesterly (1998)
Type 2b **Cross section studies**	Spiller (1985)* Helfat and Teece (1987) John and Weitz (1988) Weiss (1992) Majumdar and Ramaswamy (1994) Minkler and Park (1994) Lyons (1995)*
Type 3 **Case studies**	Stuckey (1983)* Joskow (1985) Hennart (1988)* Tapon (1989) Muris, Scheffman, and Spiller(1992) Krickx (1995) Cook (1997)*
Type 4 **Studies of the degree of vertical integration**	Levy (1985) Mac Donald (1985) Martin (1986) Caves and Bradburd (1988) Davies and Morris (1995)

*Indicates comparative studies.

From a different point of view, empirical investigations might test the relative importance of alternative theories of vertical integration or they might be limited to check the relevance of the hypotheses advanced by one single theory. In particular, one type of uncertainty, demand variability, has been developed as a separate theory (Carlton, 1979). This could explain why Lieberman (1991) in his investigation on the empirical determinants of vertical integration considered the

demand variability motivation as an alternative theory to transaction cost theory. The same 'vagueness' led Spiller (1985) to consider the available empirical investigations of transaction cost theory mainly as tests of the 'specific asset hypothesis'. In what follows we should keep in mind this distinction between the full set of hypotheses stemming from transaction cost theory and the more restricted set which investigates the role of specific assets.

Section 4 addresses empirical works based only on the transaction cost theory, while section 5 deals with comparative studies and section 6 focuses on type 4 studies.

4. Transaction cost motivations in the empirical literature

Single theory studies are overwhelming in this field of studies. Moreover, empirical works are mainly addressed to test the role of *specific assets* for vertical integration, while the other variables have been given less attention. However, it could be argued that *uncertainty* is very hard to measure and is pervasive, so that it does not distinguish many relationships. On the other hand, frequency is not so obviously important and is more diffusely treated in the empirical literature on contract theory (Lyons, 1996), which has many points of contact with the works reviewed here.

4.1. Physical assets

Lieberman (1991) studied the determinants of backward integration strategies in the US chemical industry (type 2a). Some chemical inputs are liquid at room temperature and may be transported via tank cars. Other inputs are gasses at room temperature and are shipped through pipelines, which represent expensive specific assets. The author found that chemical firms were more often integrated backward when they were using gaseous inputs, that is in correspondence of specific investments. Coles and Hesterly (1998) analysed the make or buy decision relative to 15 services (ranging from therapy, laboratory, to housekeeping and foodservice) provided by hospitals. The findings suggested that the higher the

degree of asset specificity (notable, if the service requires equipment which cannot be used to provide similar services in other hospitals and which has a low salvage value) the higher the probability that the service is made in house[8]. An *indirect test* of the importance of physical asset specificity was undertaken by Weiss (1992 and 1994). The author was particularly interested in vertical mergers and argued that specific investments between the merging firms should have been reflected in positively correlated residual stock returns[9]. In fact, with specific investments firms will probably arrange some profit sharing agreements: as a consequence, a demand or supply shock will hurt both firms and its effects are likely to be shared between them. By examining 29 cases of mergers, Weiss (1992) found that the residual stock returns of a merging firm were correlated to the returns of the other merging partner. Moreover, the above correlation was higher than the correlation with all the other firms in the partner's industry. The above results were associated to transaction cost arguments without checking for the actual presence of specific investments but on the ground that 'firm specific capital theory is unique in predicting a positive correlation between these returns' (Weiss, 1994, p.395). In a later paper (Weiss, 1994), however, the same analysis was applied to three cases (type 1) in which firm specific investments had been actually made, with similar results.

4.2. Human assets

Human asset specificity has been examined by Anderson and Schmittlein (1984) relative to the decision of using a direct sales force instead of contracting with independent agents in the electronic components industry (type 2a). The use of direct salespeople was found to be positively correlated to an index of human asset specificity, built on the basis of the time needed for a new salesman to become familiar with firm's product lines. A similar study has been conducted by John and Weitz (1988), with two main differences: first they investigate forward

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[8] The authors examined also the role of human asset specificity and uncertainty on the make or buy decision. When uncertainty was interacted with physical and human asset specificity, it was found to have a stronger impact on vertical integration.

[9] The residual stock return is the return after having removed market and industry effects.

integration into distribution by a set of firms operating in different industries (type 2b), second they use a proxy for the 'degree' of forward vertical integration, that is a measure of the percentage of sales made through direct channels. Again, the higher the level of skill required from salespersons, the higher the degree of vertical integration.

Monteverde and Teece (1982b) have been concerned with the effects of the engineering effort required to develop components in the automotive industry (type 1), showing that the probability of manufacturing the component internally was increasing with the amount of the engineering effort.

Anderson (1988) addressed the issue of human specificity from a different perspective. He investigated the determinants of opportunism in the production of electronic components (type 2a), with the hypothesis that integrated systems of sale would leave less room for opportunistic behaviour by salespeople. Opportunism was measured on a scale variable through a questionnaire given to superiors, and the coefficient of a variable checking for vertical integration was found to be negatively affecting it.

Masten et al. (1989) tried to assess the relative importance of human specificity as opposed to other specific investments. Their work was motivated by the evidence provided by Monteverde and Teece (1982a), who found that to circumvent the problem of physical asset specificity it was sufficient to undertake quasi-vertical integration strategies[10]. In a study of three automobile manufacturers (type 1), Masten et al. (1989) found that specific know-how (which implies human asset specificity) had a positive influence on vertical integration (measured as a percentage of components produced inside the firm) while proxies for physical and site specificity were found not to be important. They interpreted these results as evidence supporting the idea that human assets specificity was more important than physical asset specificity as an incentive for vertical integration.

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[10]   These are situations in which a downstream firm owns the specific capital, but leaves the firm using it as an independent entity.

4.3. Site specificity

Site specificity was analysed, among others, by Joskow (1985). By studying backward integration strategies of electricity firms into the upstream coal industry, he found that mine-mouth coal generating plants were more likely to be vertically integrated or, to a lesser degree, were induced to sign long term contracts with the independent coal suppliers (type 3). Levy's and Spiller's studies, which will be discussed in section 5, are two other pieces of evidence consistent with the view that site specificity stimulates the internalisation of activities.

4.4. Design specificity

Design specificity has been addressed by Masten (1984) for the aerospace industry. He associated the need to dispose of specifically designed components with the probability of activating internal production (type 1). In this industry the government generally contracts with the aerospace firm for a complex product to be provided. The contractor may decide to develop all the components of the product internally or, alternatively, to rely on external sub-contractors. Each component in the sample was judged as specific and as complex, two qualities which proxy respectively for design specificity and uncertainty. The results highlighted that both characteristics were leading to vertical integration in most cases. Design specificity was found to stimulate backward integration strategies also in the study by Monteverde and Teece (1982b) discussed above.

4.5. Brand name capital

This type of asset specificity has been investigated by Minkler and Park (1994) for franchised firms in the restaurant industry, in the hotel industry and in the business and profession service industry (type 2b). The authors argued that the

proportion of company owned outlets should depend positively on a measure of brand name capital[11]. The results were consistent with the above hypothesis.

4.6. Dedicated assets

Joskow (1987) (type 2a) conducted a study on the duration of contracts between coal suppliers and electricity utilities, including a proxy for dedicated assets among the explanatory variables. It was argued that the amount of coal supply specified in the contract was a good indicator of the presence of dedicated assets because, in the case of contract breaching, the seller party could find himself with an excess capacity and the purchaser could hardly obtain alternative supplies. Consistently with the expectations, the above variable was positively correlated to the contract length. Tapon (1989) (type 3) examined vertical disintegration in the pharmaceutical industry. He started noticing that owned laboratories had become less productive and creative than independent laboratories through time. As a consequence, firms were increasingly using long term R&D joint ventures with academic laboratories. The authors argued that this was consistent with the transaction cost theory because, as compared to independent ones, academic scientists have less room for opportunism other than site specificity and human asset specificity problems, the transaction between a R&D laboratory and firms which will be using the R&D results involves dedicated assets too, because the investment undertaken in view of the specific project cannot be easily employed in alternative uses.

4.7. Frequency

The evidence available on the effect of the frequency of transactions is limited. Anderson and Schmittlein (1984) included in their analysis a proxy for frequency, broadly linked to the time agents spend for travelling, that is to the

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[11]   This was proxied by the difference between the market value and the book value of the franchisor's equity.

density of the served market[12]. The proxy was found not to be significant, even when interacted with asset specificity. Conversely, Majumdar and Ramaswamy (1994) (type 3) found that in industries manufacturing goods characterised by frequent purchases, the downstream distribution activities were more likely to be fully integrated. Jensen and Rothwell (1998) analysed the decision to rely on subcontractors or on in-house employees for undertaking some tasks in nuclear power plants. The empirical results suggested that frequent tasks (routine maintenance, reactor operations, waste processing) were done by workers, while infrequently performed tasks (refuelling, special maintenance) were positively associated with the presence of independent contractors.

4.8. Uncertainty

Unlike frequency, uncertainty has been addressed in a discrete number of empirical papers. Lieberman (1991) attempted to test Carlton's hypotheses about *demand variability*, following which a high demand variability in the downstream market as well as a high demand variability in the upstream market correlated with the former are obstacles for vertical integration strategies. Conversely, if variability in the input market is not correlated with that of the downstream market, backward vertical integration becomes more attractive. In his study only the latter variable (proxied with the variance of the upstream market output after having controlled for variations in the output of the downstream market) was found to be significant. Helfat and Teece (1987) addressed *environmental uncertainty* by examining the response of firms' returns to general economic uncertainty (undiversifiable risk). They showed in a sample of 14 vertical mergers that the merged firms had a lower response than the response of each single firm participating to the merger in the pre-merger period. Majumdar and Ramaswamy (1994) associated environmental uncertainty with the presence of major technological changes in the manufacturing of the product. They investigated also the role of *behavioural uncertainty*, proxied with a dummy variable inversely

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[12] The underlying hypothesis is that in areas characterised by high densities selling agents spend less time in travelling, so direct salespersons are more likely to be used.

linked to the number of end users, under the assumption that independent distributors would increase their power if consumers were limited in number (in which case the dummy was set equal to 1). Both variables were positively associated to forward integration into sale activities. These results are similar to the ones obtained by John and Weitz (1988). Their measure of environmental uncertainty was constructed by asking sales managers how turbulent and uncertain they considered their market, while the difficulty to asses the performance of salespeople was assumed to be correlated with the length of the selling cycle. Again, both variables had a positive influence on vertical integration.

The works examined so far may be considered as the core of the empirical literature on vertical integration. Most of them concentrate on a single industry, while the few cross section studies available are interested mainly in forward integration strategies towards selling activities. Moreover, asset specificity, and in particular physical and human assets, are the principal areas of interest. Having said this, it appears that the theoretical predictions are almost always successfully and convincingly confirmed. Klein and Shelanski (1995), in reviewing the empirical literature on transaction cost economics (TCE), maintain by similar arguments that the findings are 'remarkably consistent with the predictions of TCE - more so than is typically the case in economics'.

5. Competing theories

The success of a theory is judged also by putting it into comparison with alternative, and possibly mutually exclusive, explanations. As we will see, more work has to be done in this direction. Spiller's paper (Spiller, 1985) is one of the few studies available on the relative importance of alternative theories of vertical integration. Starting from the analysis of the gains resulting from a sample of vertical mergers (type 2b) as well as from their different distribution among the firms participating to the merger, he contrasted the 'specific asset' story with the market power theory (which basically considers vertical integration as mainly driven by the desire to obtain a higher market power). In particular, following the latter hypothesis, the overall gains from vertical mergers should be positively

related to the market power of the target firm or to the market power of the acquiring firm. However, gains should be lower in the event that both sides did enjoy already some degree of market power[13]. Conversely, transaction cost theory associates the gains to the fact that specific assets are at play, whereas the variables checking for market power effects have no predicted sign[14]. While the coefficients on concentration variables were not significant or had the wrong sign, a proxy for site specificity[15] was found to positively influence the gains from mergers.

Another comparative study has been conducted by Stuckey (1983) for the aluminium industry. She finds that backward vertical integration by aluminium refiners into bauxite and alumina was mainly driven by site specificity while forward integration into smelting and fabrication was due to market power considerations (notably, the possibility to engage in price discrimination in downstream markets). The aluminium industry has been investigated also by Hennart (1988) (type 3) together with the tin industry. He argues that the high level of backward vertical integration in aluminium is justified by transaction cost arguments while the lower level of upstream integration in the tin industry could be explained by lower economies of scale and lower transportation costs for the miners of alluvial ores as compared to lode ores.

Recently, Cook (1997) examined the vertical integration of the brewing and petrol industries in the UK (type 3) and showed that the former was consistent with market power considerations, while the latter was better explained by transaction cost arguments. Vertical integration in the beer industry declined between 1965 and 1990, while an opposite trend was interesting petrol firms. Since monopoly power decreased and competition increased in both industries, the author argues that the previous high levels of vertical integration were harmful for the beer industry, while the recent high levels of vertical integration are beneficial for the petrol industry.

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[13] When market power is enjoyed by only one firm vertical integration should reduce the previous inefficiency, while in the case of bilateral market power it is reasonable to assume that the firms were already agreeing on an efficient pricing scheme.

[14] Similar hypotheses are tested for the target firm's share in total gains.

[15] In this study site specificity was related to the distance between the firms resulting from the merger.

On the whole, notwithstanding the incidental presence of mixed results, the few studies comparing transaction cost predictions with alternative theories highlight that the former are dominating. Another empirical finding consistent with this view has been provided by Lyons (1995). Following the heuristic approach developed by Williamson, he investigates the relationship between transaction cost advantages of vertical integration and the technological disadvantages implied by the presence of economies of scale and scope[16]. The context is the decision between subcontracting or internal production of specialised inputs by a set of firms operating in different industries (type 2b). He finds that in the presence of both asset specificities and economies of scale and scope, vertical integration revealed to be the preferred strategy, while in the absence of asset specificity, economies of scale moved the balance towards external sourcing[17]. Walker and Weber (1984), stimulated by the heuristic approach in a similar way, tested the importance of transaction cost considerations as opposed to supplier production cost advantages. They examined a sample of 60 make or buy decisions relative to some simple components manufactured by a car manufacturer (type 1). The results gave strong support for external sourcing decisions in the case of cost disadvantages and limited support for the other variables testing for uncertainty and asset specificity (volume and technological uncertainty, small number bargaining problems).

6. The degree of vertical integration: type 4 studies

Most of the above cited empirical works refer to single industries (type 1 and type 2a). Moreover, when they are relative to a cross section of industries (type 2b) they concentrate mostly on one stage of the vertical chain. I turn now to studies which try to synthesise the determinants of vertical integration strategies through global measures. In order to examine the relevance of specific assets in

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[16] In this case, as independent producers can aggregate several productions, vertical integration could not be a good strategy, as far as specific assets are not important.

[17] Another interesting result is that in the absence of economies of scale, most of the inputs were produced internally. This could be due to the fact that the inputs under examination were specifically designed to comply with firms' requirements.

influencing vertical integration for a cross section of industries it is necessary to devise some reliable measures of the degree of vertical integration. Moreover, in this kind of studies it is only possible to rely on very crude proxies for specific assets. A proxy that has been used for physical capital is the capital labour ratio, while human specific investments have been linked to research and development expenditures (Martin, 1993). Small number bargaining problems have been investigated by introducing measures of downstream industry and upstream industry concentration levels[18].

Mac Donald (1985) used a measure at the industry level of the proportion of industry shipments that are directed toward plants owned by the seller. That measure was positively correlated with proxies at the industry level for capital intensity and for buyer and seller concentration. Levy (1985) calculated the widely used and widely criticised value added to sales ratio at the firm level. He tried to test the role of uncertainty and site specificity by including a proxy for unanticipated demand shift and by measuring the weighted average of the proportion of goods shipped less than 500 miles far from plants[19]. Martin (1986) examined separately industry average forward (FVI) and backward (BVI) vertical integration. The measures were computed by exploiting available information on the amount of inputs produced and consumed within each industry. He regressed FVI and BVI on proxies for average firm size, concentration, number of trading partners, transportation and distribution margins. Concentration was treated as an endogenous variable and was regressed, among other variables, on FVI and BVI. Similarly, price cost margins at the industry level were regressed on BVI and FVI. As to the findings, he obtained mixed results consistent both with transaction cost arguments and with the market power view. Forward integration was positively related to distribution margins, while the fewness of trading partners was

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[18]   A good proxy for the presence of small number bargaining problems is the product between the concentration level of one industry and the weighted average of the downstream (or upstream) industries with which it has links (Davies and Morris, 1995). Nevertheless, some empirical studies make direct reference to the transaction cost hypothesis by including two separate variables for the upstream industry and downstream industry. In this case it is not clear which theory (market power or transaction cost) is being tested.

[19]   The former was found to be positively related to the degree of vertical integration, while the latter was not significant.

stimulating both backward and forward vertical integration. On the other hand, concentration was found to be positively related to backward integration. The positive effect of concentration on price cost margins was sometimes reduced and sometimes increased by vertical integration. Martin interpreted this latter result by differentiating vertical integration within each industry from vertical integration out of the industry, that is backward and forward operations by plants with main activities in other industries. The latter may reflect the desire to expand operations in industries were it is possible to enjoy high price cost margins, while the former may reflect market power motivations such as the erection of barriers to entry. Caves and Bradburd (1986) used a measure at the industry level of the proportion of companies which were vertically integrated, which was found to be positively correlated to variables attempting to catch the presence of small number bargaining problems and the investment in specific assets. Davies and Morris (1995) used the information available in the input-output tables on the relationships between upstream and downstream industries to infer the extent of intra-firm flows of intermediate inputs. While the main interest of the paper was the introduction of a new measure to be used for analysing the outstanding pattern of vertical integration in the UK manufacturing, the authors conducted also an empirical investigation, with findings broadly consistent with the ones obtained by Mac Donald (1985) and by Caves and Bradburd (1986). Finally, Ohanian (1994) applied a similar methodology to study vertical integration strategies in the pulp and paper industry (type 2a). For each mill the ratio of pulp capacity to paper capacity was linked to measures of concentration and mill size. He found that both variables were positively correlated to vertical integration. The joint buyer and seller market concentration was the usual proxy for small number bargaining problems, while the size variable was, in the author's view, taking into account the fact that larger firms would have suffered more from a supply disruption[20].

The general results coming from these series of studies suggest that vertical integration is prominent in capital intensive industries, when economies of scale are important, and where upstream and downstream concentration levels

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[20] However, if there are economies of scale in the upstream stage, vertical integration might be due to cost advantages, independently from transaction cost motivations.

are high. Differently from the empirical works reviewed in the previous section, here low effort is put in order to discriminate between the market power explanation and the transaction cost approach. The continuous indices of vertical integration which have been introduced and used reflect a commendable effort in order to reach more precision in the measurement of this complex phenomenon. Apart from the use of particular and discontinuous information sets, which appear *una-tantum* in official statistics, the information included in input-output tables is indeed very useful for measuring vertical integration (Vannoni, 1996). In fact the tables contain information at the industry level on the amounts of inputs received from different industries and on the amounts of goods transferred to other industries, which can be easily exploited to make inferences on the transfer of inputs within each firm.

7. Measurement and data problems, cross country and time differences

As has already been pointed out, in empirical works concerning this area both dependent and explanatory variables are *difficult to measure*. We reviewed the different and sometimes ingenious ways that have been devised in order to obtain some proxies for specific assets, uncertainty, frequency. Vertical integration has mainly been proxied with a dichotomous variable, notwithstanding it is not a one-or-zero phenomenon. Moreover, this approach implies some selection bias because in the real world firms are using both direct and indirect channels to sell the same product, and they are using both internal production and external contractors for obtaining intermediate inputs. Publicly available information is generally of little help and data are frequently obtained directly through questionnaires. Finally, for type 4 studies, the proxies used for investigating the relevance of specific assets are sometimes questionable.

In spite of these serious drawbacks, which should constitute a warning against the possibility to use the outcomes of each particular study for more general interpretations, on the whole there is enough evidence consistent with the transaction cost theory. However, some improvements could be easily made. On the one hand, it could be possible to ameliorate single industry studies by using

some measures of the degree of vertical integration. On the other hand, the quality of cross section studies could be improved by limiting the wideness of the cross section, as well as by restricting the investigation to particular stages of the vertical chain.

Another important issue is the analysis of *differences between countries*. Most studies are relative to the US, and, to a lesser extent, to the UK. Caves (1989, p.1227) argues that "*if* competition worked the same way in every country and the transaction-costs efficiencies of firms and markets were independent of laws, cultural traits, and other distinguishing traits of nationhood, then we should expect the allocation between firms and markets to differ only inessentially from country to country". Similarly, Majumdar and Ramaswamy (1994, p.127) argue that "in other geographical market domains such as Asia or Africa incentives may differ. There is enough evidence to suggest that incentive facing Japanese firms are quite different from those facing US firms. Thus, our results are subject to cultural specificity as well". According to this view, Hennart (1988) found that vertical integration in the tin industry was low in Malaysia, Thailand and Australia, while it was very high in Bolivia and Indonesia and explained these differences with different historical paths and different State interventions. Similarly, Khanna and Palepu (1997) argue that in emerging markets, firms which operate directly in a range of industries may "imitate the functions of several institutions which are present only in advanced economies". Examples of such advantages are the possibility to train their own workers, the avoidance of contract enforcement problems, or the guarantee of receiving inputs with an acceptable level of quality.

Finally, vertical integration incentives are *not constant through time*. Krickx (1995) investigated the variations in the vertical integration strategies undertaken by the 10 biggest computer manufacturers between 1950 and 1970. He argued that in the early stages of the industry firms were mainly using receiving tubes as components and there was no compelling reason to produce in the same firm the components and the central processors. With the advent of integrated circuits in the sixties, on the other hand, transaction cost motivations (uncertainty and asset specificity) pushed firms to become more vertically integrated. Ohanian

(1994) found that recent entrants in the pulp industry were more affected by specific assets in their vertical integration decisions, while established firms were less prone to alter their integrated structure. Cook (1997) argues that the sources of transaction costs (physical assets, brand name capital) increased in the brewing and in the petrol industries in the 1965-1990 period, and firms had been forced to cope with this evolving pattern. The same issue is implicit in Tapon's analysis, following which the technological progress in pharmaceutical R&D rendered firm's internal laboratories inefficient as compared to independent laboratories. With similar arguments, Muris et al. (1992) individualised in the change of technology, and in the need for more coordination in the distribution of products, the increased stimulus for firms operating in the carbonated beverage industries to integrate towards the bottling activities over the last 20 years. Finally, Weiss (1994) was not only interested in the reasons for mergers but also in explaining the timing of mergers and divestitures. In particular, he argued that Pepsico acquired one of its independent bottlers because the specific investments were increasing in importance through time. Conversely, IBM reduced its share of interest in Intel (which was producing semiconductors) either because the contracts for the input supply were becoming more reliable or because technological advances rendered the specific investment less important.

8. Concluding comments

Referring to the transaction cost literature available at the time he was writing, Sheperd (1986, p.44) stated that "the theory is largely confined to special cases and is largely untested as a factual matter. It may yet attain general importance, but that seems to await a broader set of analyses and empirical test". In a similar vein, Simon (1991) argues that 'in general the new institutional economics has not drawn heavily from the empirical works in organisation and decision-making for its auxiliary assumptions. Nevertheless, it is appropriately subversive of neoclassical theory in that it suggests a whole agenda of microeconomic empirical work that must be performed to estimate the exogenous parameters and to test the theory empirically. Until that research has been carried

out (and the existing literature on organizations and decision making taken into account), the new institutional economics and related approaches are acts of faith, or perhaps of piety'. I am confident that this paper has demonstrated that empirical studies in vertical integration have to a great extent challenged Sheperd's and Simon's concerns. Of the 32 works reviewed here, 22 have been written after 1986 and 13 after 1991. On the whole the empirical work on the relevance of transaction cost motivations in determining vertical integration strategies is successfully confirming the hypotheses advanced by the theory. This is true for both single tests and comparative studies.

Of course, I am not saying that all forward and backward integration strategies are driven by efficiency reasons and should not be contrasted by the antitrust authorities. Certainly market power motivations may be well important in some circumstances and should not be ignored. Waterson (1993), in comparing the hostile and the benign views towards vertical arrangements, concludes that "the general lessons are that a concentrated vertical market structure is not necessarily undesirable, and that freely negotiated contractual relationships are not necessarily benign". A similar view can be found in Martin (1986): "The fact that the impacts of integration on structure and performance vary across clusters within the manufacturing sector and the fact that these impacts are complex and interactive, strongly suggests that policy decisions relating to vertical integration be approached in a 'case by case', 'rule of reason' way".

I believe that in future works researchers should look for some compromises between cross-section studies (that are forced to use measures which are only crude proxies for vertical integration and specific assets) and single industry studies (which leave less room for general applications). Cross country differences and the evolution of vertical integration incentives upon time should not be ruled out as well. Finally, a further development could be obtained by conducting some comparative studies of vertical integration strategies as opposed to the use of long-term and short-term contracts, since they share similar underlying motivations.

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