The Role of Agglomeration and Technology in Shaping Firm Strategy and Organization

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Summary

Over the last few years a growing number of contributions have shown that the presence of business groups, i.e. sets of firms legally distinct but belonging to the same owner(s), is significant. From a theoretical point of view, this presence poses the question of whether the group or the single legal unit should be considered as the elementary unit in economic analysis: i.e., what is generally meant in microeconomic theory by 'firm'. In this paper we consider the group as the appropriate unit to delimit the firm's boundary, i.e. as the 'observed' organizational form adopted by firms when they grow in size. Starting from this hypothesis, the main aim of this paper is to analyse the role of structural variables, such as spatial agglomeration and technology, in determining some features of business groups' strategy and organization. Specifically, the analysis concerns the presence and organizational specificity of business groups based on their membership of industrial districts (as a proxy for spatial agglomeration) and to the role of spatial agglomeration and technology in vertical integration strategies. To conduct the analysis, we take advantage of a new and large data-set at firm and business group level, recently developed by ISTAT (the Italian National Statistical Institute). The data-set, referring to 2001, covers all manufacturing firms organized as joint-stock companies.

Keywords: Business Groups, Agglomeration, Technology, Organisation and Strategy

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1. Introduction

Over the last few years a growing number of contributions have shown that the presence of business groups, i.e. sets of firms legally distinct but belonging to the same owner(s), is significant. This phenomenon is not specific to large firms and to the Italian economy, but is widespread among small and medium-sized firms (SME) and in other industrialised countries (Barca *et al.*, 1994; Balloni and Iacobucci, 1997; Rosa and Scott, 1999; Loiseau, 2001; Brioschi *et al.*, 2002).

From a theoretical point of view, the presence of business groups poses the question of whether the group or the single legal unit should be considered as the elementary unit in economic analysis: i.e., what is generally meant in microeconomic theory by 'firm'. Recent contributions have shown that this question cannot be answered in a completely general way (Iacobucci, 2004). However, in most cases, the business group can be assimilated to a multidivisional firm (M-form) where the central direction (the ultimate owner) is responsible for deciding the resources to be allocated to existing divisions (firms) and when they should be opened (set up or acquired) or closed (liquidated or sold).

In this paper we consider the group as the appropriate unit to delimit the firm's boundary, i.e. as the 'observed' organizational form adopted by firms when they grow in size. Indeed, the characteristics of the legal units belonging to a group can be used to analyse some aspects of the firm's growth strategies and organization, such as specialization, spatial concentration, vertical integration, etc. Starting from this hypothesis, the main aim of this paper is to analyse the role of structural variables, such as spatial agglomeration and technology, in determining some features of business groups' strategy and organization. Specifically, the analysis concerns the presence and organizational specificity of business groups based on their membership of industrial districts (as a proxy for spatial agglomeration) and to the role of spatial agglomeration and technology in vertical integration strategies.

To conduct the analysis, we take advantage of a new and large data-set at firm and business group level, recently developed by ISTAT (the Italian National Statistical Institute). The data-set, referring to 2001, covers all manufacturing firms organized as joint-stock companies.

The paper is organized as follows. In section two we briefly discuss our decision to take the business group as the observed firms' organizational form; we then examine the relationships between agglomeration, technology and firm strategy and organization and develop the hypotheses to be empirically tested. Section three describes the characteristics of the data-set and discusses the empirical evidence of the presence and organizational specificity of business groups in industrial districts, by industries and Pavitt sectors. The econometric analysis aimed at detecting the joint impact of agglomeration and technology on vertical integration strategy is presented. Finally, section four presents the main conclusions.

2. Related literature

2.1 Business groups as an organizational form

The phenomenon of business groups is not limited to particular firm sizes, industries or countries. Indeed, recent empirical literature has shown that it is the organizational form normally adopted by firms when growing in size; i.e. when entrepreneurs or managers expand their control over business activities (Barca *et al.*, 1994; Rosa and Scott, 1999; Loiseau, 2001). As a result, almost all the larger firms and a significant share of SMEs in the Italian economy are organized as business groups (Brioschi *et al.*, 2002; Iacobucci, 2002).

Given the definition of business groups as a set of legally distinct units controlled by the same owner, several classifications have been proposed, the most common one being pyramidal and joint groups. The first is similar to a multidivisional firm in which there is a firm at the top and several layers of controlled companies while joint groups occur when several firms share minority crossholdings (and often some members of the boards of directors), which allows them to coordinate their strategies. The latter organization is particularly widespread among Japan's largest firms. However, because in this type of group it is not possible to identify a unitary control, they do not fit our definition of a business group. Thus, we focus here on pyramidal groups.

Most of the literature on business groups is devoted to justifying why pyramidal groups exist and comparing the behaviour and performance of business groups with

those of independent firms. This literature has mainly focused on financial aspects (Brioschi *et al.*, 1990; Gerlach, 1997; Almeida and Wolfenzon, 2004). The pyramidal group is regarded as a financial mechanism to minimize the amount of capital needed by the ultimate owner to control business activities; i.e. as a mechanism to separate control rights, concentrated in the hand of the vertex, from cash flow rights, dispersed among the minority shareholders of the companies belonging to the group.

There is an important strand of literature focussed on organizational issues in pyramidal groups (Goto, 1982; Kester, 1982). Following the transaction cost perspective this literature considers the group as an organizational intermediary between the internal hierarchy and the market. The main aim of these authors is to explain why the relationships between companies belonging to business groups can be more efficient than those observed in integrated firms or than market transactions between independent firms. Within this approach, business groups are assimilated to a multidivisional firm where the controlling owner's role is to allocate resources to existing firms and to decide whether they should be started up or closed down (Chandler, 1982).

While the financial perspective is more appropriate in the case of the largest groups, the organizational perspective appears to be more useful for explaining the existence and the characteristics of small and medium sized groups. Thus, in this paper we consider the group as being the appropriate unit to delimit the firm's boundary; i.e. we take business groups as the 'observed' organizational form adopted by firms when they grow in size.

Because business groups are complex structures, to identify the geographic location and the industry to which they belong we take the largest firm of the group as our reference. In some cases it might appear more appropriate to identify these characteristics by referring perhaps to the original firm;however, evidence shows that both reference points produce approximately the same results.

2.2 Spatial agglomeration and business groups

Only recently have the relationships between spatial agglomeration and firm's organization attracted the attention of the economics literature. For example, Rosenthal and Strange (2003) examine how corporate organizations affect the benefits that arise from clustering within a given industry. Moreover, as Duranton and Puga (2003)

argue, up to now little theoretical work has been done on the relationships between agglomerations forces and firms' heterogeneity. This paper is a first attempt to make an empirical contribution to this literature, extending an earlier study by Cainelli *et al.* (2006).

We characterize agglomeration as membership of groups in industrial districts. In these production structures, which are particularly widespread within the Italian economy, agglomeration forces such as labour market pooling, local knowledge spillovers, face to face contacts, etc. play an important role in enhancing firms' innovative activity and economic performance (Cainelli and Zoboli, 2004). Despite the importance of business groups and industrial districts in the Italian economy, until recently only a few studies had analysed the relationships between these two phenomena (Bianchi and Gualtieri, 1990; Brusco *et al.*, 1996; Dei Ottati, 1996; Brioschi *et al.*, 2002). From the point of view of our analysis, these contributions present two main drawbacks. First from an empirical point of view, they refer to specific industrial districts, making it difficult to assess to what extent their results can be generalized. Second from a theoretical point of view, they do not analyse the relationship between the nature of agglomeration forces and the presence and features of business groups.

Some more recent studies have tried to systematically analyse the relationship between industrial districts and business groups, taking account of the characteristics of the latter (Balloni and Iacobucci, 2001; Brioschi *et al.*, 2002; Brioschi *et al.*, 2004), but they do not develop a general framework for the possible relationship between a firm's organization and its belonging to an industrial district. To construct hypotheses about the empirical relationships between these phenomena we need further remarks.

Information sharing about production technology and market needs, transmission of ideas, and speed of the imitative process are some of the characteristic features of industrial districts and, more generally, of spatial agglomeration of production activities. They help firms to increase efficiency and to foster product innovation and growth. Moreover, knowledge spillovers and information sharing enhanced by spatial proximity allow firms to seize business opportunities along the production chain or in related sectors (Cainelli and Leoncini, 1999). At the same time economic geography models have shown that specialization can have a negative impact on diversification of production activity (Duranton and Puga, 2001). For these reasons the growth processes of district firms normally take the form either of product differentiation within the same sector, or vertical integration. Both forms concern activities along the district

production chain. Moreover, the familiarity of firms within the same district favours acquisitions among them (Brioschi *et al.*, 2002). As a result, it is likely that the setting up of new firms or the acquisition of established ones will involve firms belonging to the same sector of specialization and located within the same district.

From the previous discussion it emerges that spatial agglomeration forces play a role in shaping firms' growth strategies. Specifically, we can derive the following hypotheses: i) business groups, as a result of a firm's growth process, are more widespread within industrial districts than outside them; ii) business groups belonging to industrial districts show a higher degree of specialization than groups outside them; iii) business groups belonging to industrial districts show a higher degree of spatial concentration of their activities.

2.3 Technology and business groups

The second aspect investigated in this paper concerns the influence of technology on firms' strategies and organization. Specifically, we focus on vertical integration choices.

There are two main theories explaining the degree of vertical integration: transaction cost economics (TCE) and property rights theory (PRT). According to TCE (Williamson, 1985) vertical integration occurs as a result of the need to prevent ex-post hold-up problems resulting from transaction specific investments. The advantages of vertical integration in reducing or avoiding the costs of market transactions must be compared with the cost of producing within the firm (cost of integration). The latter depends on the ability to monitor employees and convey information within the organization.

In contrast to the TCE approach, which emphasises ex-post transaction problems, PRT focuses on distortions in ex-ante investment. The residual rights of control, guaranteed by the ownership of assets, are particularly valuable in situations of ex ante incomplete contracting and ex post opportunist behaviour. Some of the assumptions and conclusions of the two theories are very similar. Nevertheless it has been shown that this is not always the case (Whinston, 2001). PRT predictions are more difficult to empirically test than TCE theory. This is probably the reason why much of the empirical literature on vertical integration is based on TCE, relying on single industry case studies. Only a few studies have used a cross industry approach to explore the

intensity and the determinants of vertical integration (Fan and Lang, 2000; Acemoglu et al., 2004).

The approach followed by Acemoglu et al. (2004) is particularly interesting in our case as they aimed to assess the role of technology in the vertical integration choice. Following the property rights approach, their model predicts that: i) backward integration (i.e. the control of input suppliers) is positively related to the technological intensity of the acquirer and negatively related to the technological intensity of the supplier; ii) forward integration (i.e. the control of output acquirer) is positively related to the technological intensity of the acquirer and negatively related to the technological intensity of the supplier.

Using TCE theory we should obtain the opposite results as the technology intensity of the supplier is positively related to the degree of transaction specificity, thus increasing the probability of backward integration. Moreover, TCE also suggests a role for spatial agglomeration in vertical integration. Indeed spatial proximity and face to face contact, together with social and cultural homogeneity of industrial districts, should attenuate opportunistic behaviours thus reducing transaction costs (Dei Ottati, 1994). This means that, other things being equal, we can expect that groups in industrial districts will show a lower degree of vertical integration as they can more easily rely on market exchanges with supplier firms.

However, this negative effect of agglomeration on vertical integration could be counterbalanced by the action of local knowledge spillovers and information sharing, which facilitate the acquisition of resources and competences along the district production chain (Brioschi *et al.*, 2002).

3. Data and results

3.1 The data set

For our empirical analysis we use two different versions – a firm level and a business group level – of a new and original data-set on business groups recently

developed by ISTAT. The data refer to the year 2001. Merging the information about joint stock companies drawn from the Italian industrial census and the first version of the firm level data set, we are able to assess the presence of firms belonging to business groups by industry and industrial districts. The latter are identified according to the Sforzi-ISTAT procedure (ISTAT, 1997). This procedure considers the local labour systems (LLS) as the unit of analysis and identifies 199 industrial districts within the 784 LLS into which the Italian territory is divided.

The business group version of the data-set was used to study the organizational specificity and strategic choices of business groups. To compare district and non-district groups we isolated the manufacturing groups defined according to the following two criteria: i) group composed of at least two production companies (we excluded financial and property companies or non-active companies) one of which is a manufacturing firm; ii) largest company in the group is a manufacturing firm. The industry that a group belongs to is determined by the sector of its largest company. A manufacturing group is classified as belonging to a particular industrial district when its largest company is located in it, and it operates in the same sector of the district.

Given these criteria we identified 8,861 manufacturing groups, of which 4,125 belong to an industrial district. There are 25,739 manufacturing and service firms belonging to these business groups, with an average of about 3 firms per group. The distribution of business groups by class of employees and number of firms is shown in Table 1.

Table 1 – Manufacturing business groups by class of employees and number of firms

Class of employees	Class of firms in the group							**Total**
	2	3	4-5	6-9	10-49	50-99	>99	
1-9	732	138	24	2				**896**
10-19	893	234	60	8				**1,195**
20-49	1,604	546	196	34	9			**2,389**
50-99	815	461	270	63	18			**1,627**
100-249	542	395	337	118	42			**1,434**
250-499	117	123	156	110	58			**564**
500-999	49	45	67	77	63	3		**304**
> 999	20	26	40	51	100	12	3	**252**
Total	**4,772**	**1,968**	**1,150**	**463**	**290**	**15**	**3**	**8,661**

It should be noted that according to other statistical sources the number of manufacturing business groups is higher than that identified using the ISTAT data-set. Referring to the same year, Unioncamere (2004, p. 96) estimates about 16,000 groups as belonging to the manufacturing sector. Both data-sets are built taking into consideration joint stock companies and adopting the same definition of control: i.e. the ownership of at least 50% of the shares. The discrepancy is due to the way in which the 'raw' data have been elaborated. For our analysis we exclude what we call 'pseudo-groups' – i.e. groups with one production company and one or more financial companies - and groups composed of mostly foreign companies and only one Italian company because the ISTAT data-set lacks information (employees, activity, etc.) about foreign companies. We also only consider business groups with at least two 'active' companies.

3.2 The presence and organizational specificity of business groups in industrial districts

The first result of our analysis concerns the presence of business groups within Italian industrial districts. The empirical evidence shows that business groups are more widespread within industrial districts than outside them, thus confirming the findings of previous contributions on this issue (Brioschi *et al.*, 2002). In particular, columns 1 and 2 of Table 2 suggest that, passing from non-district to district LLSs, the share of firms belonging to business groups tends to increase. In the first case, the share of total firms is equal to 21.31%, whereas in the second it increases to 23.88%. This finding appears to be reinforced when we take into account only those firms specialized in the district sector. In fact, in this case the share of firms belonging to a business group is higher than in the two previous cases.

Table 2 - Firms belonging to a business group (2001), % of firms

	Firms		Employees	
	(c)/(a)	(c)/(b)	(c)/(a)	(c)/(b)
Non-district LLSs (585)	4.63	21.31	44.94	63.47
District LLS (199)	5.87	23.88	35.39	53.05
Industrial district (199)	5.86	24.11	35.67	53.28

(a) All firms
(b) Joint stock companies
(c) Firms belonging to a business group

Table 3 - Firms belonging to a business group by sector of activity (2001), % of firms

	District firms		Non-district firms	
	(c)/(a)	(c)/(b)	(c)/(a)	(c)/(b)
Food (17)	5.67	20.61	2.69	17.75
Textile and clothing (68)	5.01	21.82	3.09	17.43
Leather and footwear (28)	4.06	15.92	2.83	14.73
Furniture (39)	4.91	25.33	2.39	18.66
Mechanics (33)	7.46	25.77	5.43	22.31
Other sectors (14)	7.23	20.99	9.27	26.27

(a) All firms
(b) Joint stock companies
(c) Firms belonging to a business group

The greater incidence of business groups within Italian industrial districts is further confirmed by Table 4, where the analysis takes into account industrial districts by sector of activity. From this evidence we find that, with the exception only of districts operating in 'other sectors', the presence of business groups is always greater in district rather than non-district firms. For example, in the food industry the share of firms belonging to a business group increases, passing from non-district to district firms. In the latter case the share is equal to 5.67%, when measured as the ratio of all firms, and to 20.61% when measured with respect to joint stock companies. Similar evidence was found for the other manufacturing sectors. In the textile and clothing sector the share goes from 3.09% for non-district firms to 5.01% for district firms, while in the leather and footwear sector the share rises from 2.83% to 4.06%. The result is the same when the presence of business groups is measured as the ratio between firms belonging to a business group and joint stock companies.

For the purposes of this paper the higher presence of groups is more significant when measured in terms of firms than in terms of employees. This means that in industrial districts the group form is more widespread among smaller firms, while

outside industrial districts the presence of the groups is more dependent on firm size. Indeed, industrial districts are characterized, by definition, by the presence of small and medium-sized firms, while in non-district areas large firms can be localized.

Table 4 - Firms belonging to business groups (2001), % of employees

	District firms		Non-district firms	
	(c)/(a)	(c)/(b)	(c)/(a)	(c)/(b)
Food (17)	51.73	64.69	32.34	57.57
Textiles and clothing (68)	29.80	49.89	28.65	50.15
Leather and footwear (28)	17.29	31.47	20.66	38.36
Furniture (39)	41.54	61.14	25.30	49.00
Mechanics (33)	42.19	57.36	40.77	57.46
Other sectors (14)	36.36	50.43	51.60	64.72

(a) All firms
(b) Joint stock companies
(c) Firms belonging to a business group

So far we have shown that the presence of business groups is higher in district than in non-district areas. Now we empirically assess the existence of a link between spatial agglomeration and firms' organization. In other words, we intend to verify whether district groups show an organizational specificity with respect to business groups operating in non-district areas. To perform this analysis we calculate two different indicators: (i) a specialization index and (ii) a spatial concentration index. The index of the degree of specialization of groups is computed as the ratio of overall employees of the group that belongs to the same sector of the largest firm (which in the case of the district group is the same as the district sector). Although this is not a proper index of diversification, it is appropriate for the hypothesis being investigated: i.e., that groups in industrial districts tend to expand their activities in the sector characterizing the district.

The index of spatial concentration is calculated as the ratio of overall employees of the group belonging to firms located in the same LLS.

To test the hypothesis of organizational specificity of district groups we calculate, for both indicators, *t*-tests of mean differences between district and non-district groups. The findings are shown in Table 5 and Table 6. InTable 5 we find in particular that the degree of diversification of groups is very low, both for district and non-district groups. Nevertheless, the degree of specialization of business groups located in

industrial districts is significantly higher than that of groups located outside industrial districts, thus confirming Brioschi *et al.'s* (2002, 2004) hypothesis that there is a prevalence in industrial districts of a specific organizational form of business group which they define as a 'district group'.

Table 5 - Degree of specialization of business groups

	District group		Non-district group		Test of diff. of means	
	(1)	(2)	(1)	(2)	*t*	Sig. (1 tail)
Food (17)	46	.89	685	.87	.48	.316
Textiles and clothing (68)	477	.92	545	.89	3.08***	.001
Leather and footwear (28)	141	.93	178	.89	2.82***	.003
Furniture (39)	39	.89	82	.83	1.76**	.040
Mechanics (33)	826	.92	3329	.90	3.43***	0.001
Other sectors (14)	197	.91	2516	.88	2.59***	0.005

(1) Number of business groups
(2) Degree of specialization of business group
*** significant at 1%, ** significant at 5%, * significant at 10%

Table 6 - Degree of spatial concentration of activities of business groups

	District group		Non-district group		Test of diff. of means	
	(1)	(2)	(1)	(2)	*t*	Sig. (1 tail)
Food (17)	46	.87	685	.90	-1.51	.066
Textiles and clothing (68)	477	.94	545	.91	2.88***	.002
Leather and footwear (28)	141	.94	178	.93	.71	.241
Furniture (39)	39	.96	82	.92	1.52*	.065
Mechanics (33)	826	.92	3329	.91	1.05	.148
Other sectors (14)	197	.92	2516	.92	.19	.424

(1) Number of business groups
(2) Degree of specialization of business group
*** significant at 1%, ** significant at 5%, * significant at 10%

Table 6 shows that the degree of spatial concentration is very high for both types of groups. Also in this case it is due to the large number of small groups, whose firms are mainly located around the largest one. With the exception of the food groups the share of employees within the same LLS is higher in district groups than in non-district ones. Nevertheless, the difference between the mean values is statistically significant only for business groups belonging to textile and clothing districts (Table 6).

3.3 The presence of business groups by industry and Pavitt's sectors

We now examine the presence of business groups by industry and Pavitt sectors. This is a preliminary for the next analysis, where we use industries as proxies for technology. Our hypothesis is that the technological regimes that characterize industries influence the organization of firms and therefore the relative presence of business groups. In order to identify those industries where this presence is higher, in Table 7 and Table 8 we report the distribution of this phenomenon by industries and by class of employees. More specifically, Table 7 shows the incidence of business groups in terms of firms, while Table 8 presents the latter in terms of employees. The presence of business groups is particularly relevant in some industries such as (i) Chemicals and Allied Products (24,5% in terms of firms and 66,3% in terms of employees), (ii) Petroleum Refining and Related Industries (28,4% in terms of firms and 74,9% in terms of employees) and (iii) Transportation Equipment (26,5%7 in terms of firms and 71,4% in terms of employees). In other industries, such as (i) Lumber and Wood Products, (ii) Leather and footwear, and (iii) Miscellaneous Manufacturing Industries the presence of groups is low. It should be clear that the prevalence of business groups within an industry is generally associated with the presence of specific technological features. In other words, this evidence suggests that in high and medium tech sectors business groups often represent a more efficient solution for firms' organizational problems.

Table 7 – Firms belonging to groups by industry and class of employees (% on total firms)

Industry	Class of employees				Total
	1-49	50-249	250-999	1000-	
Food, Beverages and Tobacco	15,1	47,9	71,9	93,8	18,3
Textile and clothing	13,7	38,7	73,0	90,0	16,8
Leather and footwear	10,9	30,6	71,0	100,0	13,1
Lumber and Wood Products (Ex. Furniture)	10,4	34,9	100,0		12,3
Paper, printing and publishing	18,6	49,7	80,6	83,3	20,9
Petroleum Refining and Related Industries	23,9	54,8	60,0	80,0	28,4
Chemicals and Allied Products	24,5	47,4	80,0	82,8	29,5
Rubber and Plastic Products	17,8	47,2	80,4	50,0	21,7
Stone, Clay, Glass and Concrete Products	16,3	44,9	80,0	91,7	19,7
Metal products	14,7	38,9	66,3	92,9	17,2
Industrial Machinery	19,0	45,5	76,1	82,4	22,6
Computer and electronics	17,2	45,9	70,6	82,9	20,4
Transportation Equipment	20,2	48,6	54,3	82,1	26,5
Miscellaneous Manufacturing Industries	13,2	34,2	66,7	100,0	15,2
Total	16,1	42,6	72,3	84,0	19,2

These considerations are confirmed when we analyse the distribution of groups by class of employees. Table 8 illustrates the role of firm size in explaining differences in the presence of business groups. In all the industries considered the presence of groups is modest among small firms, and tends to increase with size. It is not by pure chance that all large industries (units with more than 1,000 employees) show a presence of groups equal to 84% in terms of firms and equal to 90.2% in terms of employees.

We now turn to the analysis of business groups by Pavitt sectors. Also in this case, the role of technology is clear. As can be seen from the analysis of Tables 6 and 7, the presence of business groups is particularly relevant in the 'science-based' (24,2% in terms of firms and 68,7% in terms of employees) and 'scale-intensive' sectors (21,4% in terms of firms and 53,3% in terms of employees), and, to a minor extent, in 'specialized suppliers' industries (21,4% in terms of firms and 49,4% in terms of employees). However, the presence of this organizational form in 'dominated supplier' sectors (16% in terms of firms and 39,3% in terms of employees) does not reach the values of the other Pavitt sectors.

Table 8 – Firms belonging to groups by industry and class of employees (% on total employees)

Industry	Class of employees				Total
	1-49	50-249	250-999	1000-	
Food, Beverages and Tobacco	19,7	51,8	78,8	90,9	53,1
Textile and clothing	17,4	43,6	73,9	94,8	41,4
Leather and footwear	12,7	35,7	71,7	100,0	30,1
Lumber and Wood Products (Ex. Furniture)	11,9	37,3	100,0		25,3
Paper, printing and publishing	22,7	53,8	84,2	99,9	50,2
Petroleum Refining and Related Industries	28,8	59,2	56,0	98,7	74,9
Chemicals and Allied Products	31,6	49,6	83,2	88,3	66,3
Rubber and Plastic Products	21,1	51,2	83,9	40,6	42,6
Stone, Clay, Glass and Concrete Products	21,0	49,5	79,9	89,1	48,9
Metal products	17,4	43,4	68,7	99,1	39,3
Industrial Machinery	22,3	49,1	76,6	84,5	50,7
Computer and electronics	22,5	50,8	73,3	92,7	56,9
Transportation Equipment	22,9	49,6	54,9	92,1	71,4
Miscellaneous Manufacturing Industries	16,0	38,9	69,8	100,0	32,5
Total	19,5	46,9	74,5	90,2	48,8

Table 9 - Firms belonging to business groups by Pavitt sectors (2001) (% on firms)

	Class of employees				Total
	1-49	50-249	250-999	1000-	
Dominated supplier	13,3	38,3	71,7	94,9	16,0
Scale intensive	18,1	45,6	72,6	79,6	21,4
Science based	20,2	49,1	65,9	89,1	24,2
Specialized suppliers	18,1	44,7	76,3	78,0	21,4
Total	16,1	42,6	72,3	84,0	19,2

Table 10 - Firms belonging to business groups by Pavitt sectors (2001) (% on total employees)

	Class of employees				Total
	1-49	50-249	250-999	1000-	
Dominated supplier	16,3	43,0	73,4	94,8	39,3
Scale intensive	21,5	49,7	75,6	87,2	53,3
Science based	27,7	53,6	70,4	94,9	68,7
Specialized suppliers	21,7	48,1	76,3	88,5	49,4
Total	24,0	58,6	93,1	107,1	60,1

3.4 Agglomeration, technology and vertical integration

The aim of this section is to analyse, from an econometric point of view, the relationship existing at business group level between vertical integration on the one

hand, and technology and spatial agglomeration, on the other. Thus, we complete our analysis by investigating the joint role of agglomeration and technology in shaping firms' organization.

To assess whether a diversified activity in a group can be considered to be a backward or a forward integration we use the Italian input-output tables for 2000 to determine when a pair of activities can be considered as part of the same production chain. The table contains the value of intermediate exchanges between 58 branches of economic activity, 23 of which are manufacturing activities. Indicated by *j=1,2,….,58* the branches of economic activity, for each manufacturing industry *i = 1,2,…, 23* we calculate the index b_{ij} as the share of intermediate consumption of industry *i* supplied by the industry *j*, so that for each *i* $\sum_j b_{ij} = 1$.

Excluding intra-industry exchanges the combination of the 23 manufacturing industries and the 58 potential supplier industries results in 1,311 pairs of activities. The larger b_{ij}, the larger the share of input requirement controlled by the producer in industry *i* in case of integration with industry *j*; i.e. b_{ij} is an index of the quantitative relevance of backward integration. Of the 1,311 potential backward relationships 284 are null while the others show a positive value. Of these latter, 287 show a value over 1% and 85 a value over 5%. We chose the 3% value as a reasonable cut-off value for discriminating significant backward vertical relationships among manufacturing industries.

In the case of forward integration, we use a similar procedure. Given *j=1,2,….,58* the branches of potential acquirers, for each manufacturing industry *i = 1,2,…, 23* we have calculated the index f_{ij} as the share of intermediate sales of industry *i* supplied to industry *j* , so that for each *i* $\sum_j f_{ij} = 1$. Of the 1311 potential pairs of activities, there are 945 with the index $f_{ij}>0$, 255 with $f_{ij}>0.01$ and 97 with $f_{ij}>0.03$. As in the case of backward integration we chose the 3% value as a reasonable cut-off for discriminating significant forward vertical integration between pairs of industries.

On the basis of this analysis we constructed a dummy variable for each group according to the presence within the group of the pair of industries with values of b_{ij} and v_{ij} exceeding the threshold level indicated above. The dummy has the following values: 0 = the group is not vertically integrated; 1 = the group is forward integrated: 2 = the group is backward integrated.

Table 8 shows the distribution of manufacturing groups according to the type of vertical integration and number of production companies. Given the small number of cases we excluded from our analysis groups that were both forward and backward integrated.

Table 11 – Manufacturing groups by type of vertical integration within the manufacturing sector

Class of production companies	Vertical integration				Total
	Non vertically Integrated	Forward integrated	Backward integrated	Forward and Backward integrated	
2	5,008	287	368		5,663
3	1,270	123	188	4	1,585
4-5	591	89	139	10	829
6-9	228	53	60	16	357
10-49	103	31	52	17	203
50-	4	6	2	12	24
Total	7,204	589	809	59	8,661

The econometric analysis is carried out using as the dependent variable the dummy variable previously defined. It is clear that this dependent variable is unordered since the numerical values associated with each vertical integration strategy are arbitrary in the sense that $0 < 1 < 2$ does not imply that outcome 1 (no vertical integration at all) is less than outcome 2 backward integration, and so on. We assume that there are basically two explanatory variables that might explain these business groups' vertical integration strategies: i.e., technology, captured in the following analyses by Pavitt's and industry dummies, and spatial agglomeration, captured by the a business group belonging to any Italian industrial district and by an urbanization economy measure such as the natural log of population density in 1996 at the LLS level. In the case of industrial districts, we use the dummy (*Dis*) for all the Italian industrial districts and dummies for specific districts, such as food districts (*Dis_food*), textiles and clothing districts (*Dis_tex*), leather and footwear districts (*Dis_lea*) furniture districts (*Dis_furn*), mechanics districts (*Dis_mec*) and districts operating in other industries (*Dis_oth*). Finally, in order to eliminate (at least partially) business groups' unobservable fixed effects we introduce in our econometric specifications group size variables captured, ifirst by the natural log of the number of firms belonging to a group and then by the natural log of the number of groups' employees.

As micro-econometrics tells us, the best way to model these three groups' vertical integration choices is by multinomial logit. Following Greene (2003), in this model the estimated equations provide a set of probabilities for the J choices for a decision maker – in our case, Italian business groups – with characteristics $\mathbf{x}_i$. In particular, this econometric methodology assumes that the probabilities for these J choices can be modelled as follows:

$$\Pr ob\left(Y_i = j\right) = \frac{e^{\beta_j^{'}\mathbf{x}_i}}{\sum_{k=0}^{2} e^{\beta_j^{'}\mathbf{x}_i}}, \qquad \mathrm{j} = 0,1,2$$

where $Y_i = 0$ if the business group i is not vertically integrated, $Y_i = 1$ if it is forward integrated, and finally if $Y_i = 2$ it is backward integrated.

The results of this econometric investigation are reported in Table 12. As far as technology is concerned, all Pavitt's dummies are always statistically significant but with different signs. In the case of forward integration they are all negative, while in the case of backward integration they are positive in the case of specialized supplier and science based sectors and negative in the case of the dominated supplier sectors. This result shows the difficulty for firms belonging to dominated supplier sectors to control backward production phases, thus confirming the role of innovative regimes in influencing backward vertical integration choices. In the case of forward integration it emerges that all the estimated Pavitt dummy variables are negative against the scale intensive sector, thus suggesting an important role of firm size in determining this choice. This finding is confirmed by the positive and significant coefficients of variables capturing group size.

With regard to spatial agglomeration, the district dummy is positive and statistically significant in the case of both forward and backward integration. This means that agglomeration, captured in our analysis by membership of firms in industrial districts, positively affects the vertical integration strategies adopted by Italian business groups. This suggests the prevalence of local knowledge spillovers and information sharing effects with respect to the lowering of transaction costs.

However, the analysis referring to a specific typology of Italian districts shows that these agglomeration effects are industry-specific. Indeed, the dummy for mechanics

districts is positive and statistically significant in all the forms of vertical integration considered while, with the exception of other districts in the case of backward integration, the dummies for the other types of districts are never statistically significant.

In this sense district dummies seem to capture industry effects rather than agglomeration effects; the latter are better captured by the LLS population size which is a proxy for the intensity of urban agglomeration economies.

Table 12 - Vertical integration, agglomeration and technology: estimates

	Multinomial Logit[a]		Multinomial Logit[a]	
1 – forward integration	Coefficent	*t values*	Coefficent	*t values*
Specialized supplier	-0.889**	-6.17	-0.905**	-6.25
Science based	-0.750**	-3.63	-0.784**	-3.61
Scale intensive	Ref.	Ref.	Ref.	Ref.
Dominated supplier	-0.685**	-6.95	-0.647**	-6.45
Log (number of firms' group)	0.586**	6.68	0.593**	6.72
Log (number of group's employee)	0.275**	8.07	0.274**	8.03
Log (population density) in 1996	-0.073*	-1.72	-0.085**	1.99
Dis	0.218**	2.42	…	…
Dis_food	…	…	0.131	0.46
Dis_tex	…	…	0.069	0.48
Dis_lea	…	…	0.067	0.27
Dis_mech	…	…	0.501**	4.20
Dis_oth	…	…	0.069	0.48
2 – backward integration				
Specialized supplier	1.246**	13.12	1.245**	13.10
Science based	0.473**	3.08	0.473**	3.07
Scale intensive	Ref.	Ref.	Ref.	Ref.
Dominated supplier	-0.584**	-5.18	-0.562**	-4.97
Log (number of firms' group)	0.678**	8.68	0.683**	8.75
Log (number of group's employee)	0.268**	8.71	0.267**	8.67
Log (population density) in 1996	-0.038	-1.04	-0.047	-1.28
Dis	0.205**	2.55	…	…
Dis_food	…	…	-0.036	-0.14
Dis_tex	…	…	0.116	0.97
Dis_lea	…	…	-0.165	-0.67
Dis_mech	…	…	0.328**	3.07
Dis_oth	…	…	0.261**	2.09
N. Obs.	8594		8594	
Pseudo R^2	0.095		0.097	

(a) The regression also includes a constant term
Legend: ** significant at 5%; * significant at 10%
Note: t values are in parentheses

4. Conclusions

This paper set out to analyse the relationships between certain structural variables, such as spatial agglomeration and technology, and firms' strategy and organization. Despite the relevance of this research line for understanding the behaviour of firms, up

to now only a few contributions have attempted to provide theoretical explanations and empirical evidences on these topics.

Our work contributes to this literature in three ways. First, we show that spatial agglomeration influences the growth patterns of business groups and affects their presence in industrial districts. Second, we show that the organizational specificity of business groups partially depends on their belonging to industrial districts. Finally, we detect the joint influence of spatial agglomeration and technology on firms' vertical integration decisions.

More specifically, we have shown that the incidence of business groups in industrial districts is higher than in non-district areas and also thatwhat matters is not simply belonging to an industrial district, but the 'size' of the local system and the strength of agglomeration forces. We also were able to detect the role of spatial concentration of production in shaping some features of firms' organization; indeed, groups belonging to industrial districts are less diversified and show a higher degree of spatial concentration. This means that agglomeration affects the growth process of 'district groups' around the district's core business.

The greater incidence of business groups within the Italian industrial districts can be explained on the basis of the costs to district firms for acquiring information on the characteristics of competitors and/or suppliers. These costs are lower in industrial districts than in non-district areas, thus fostering acquisitions (Brioschi *et al.*, 2002; Brioschi *et al.*, 2004).

The result on organizational specificity of district groups is interesting. This finding suggests that agglomeration forces operating in industrial districts are sector-specific, thus confirming the idea that in these production structures knowledge spillovers are of intra-industry type, or '*a là* Porter', as suggested in some recent urban economics contributions (Glaeser *et al.*, 1992; Cainelli and Leoncini, 1999). For this reason, spatial agglomeration seems to affect the growth/specialization processes of district groups around the district core business rather than fostering their spatial concentration. Finally, we find that these results are not homogeneous across industrial districts, being strongly affected by the industry in which the district is specialized. Specifically, the influence of agglomeration forces is particularly significant for mechanics districts but not for districts specialized in the so called 'traditional industries'.

This latter result questions the role of technology in these processes. We analysed how technology and innovation regimes influence the presence and growth strategy of

business groups. Empirical evidence shows that there is a high heterogeneity in the presence of business groups by industry and Pavitt sectors. Specifically, we found that business groups are more widespread in high and medium-tech industries than in traditional industries. Because the group is the outcome of a growth process, the learning mechanisms and knowledge base characterizing firms belonging to the former industries can facilitate their ability to enter into new business activities.

Finally, some aspects of firms' strategy, such as the degree and direction (backward or forward) of vertical integration were analysed. The control of the different stages of the production chain is one of the main strategic choices made by firms and one that strongly affects their organizational structure. Our empirical evidence shows that vertical integration is conditioned by technology. Specifically the technology intensity of the supplying industry shows a positive role in influencing backward integration. This result is consistent with the TCE approach, as the technology intensity of suppliers can be considered a good proxy for the 'specificity' of firm transactions, as opposed to the property rights approach adopted by Acemoglu *et al.* (2004). In the case of the technology intensity of the acquiring sector the positive role of this variable in determining backward vertical integration is confirmed.

We also detected the joint role of spatial agglomeration and technology in affecting firm's vertical integration decisions. Contrary to common opinion that low transaction costs favour vertical production disintegration within industrial districts our findings show that this is not the case, especially with reference to mechanical districts. This suggests the important role of technology in influencing the internal organization of industrial districts.

Overall our findings can be considered as a first attempt to investigate the relationships between spatial agglomeration forces and technology in shaping firms' strategy and organization. We are aware that further refinements both at theoretical and empirical level are needed.

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