STRATEGIC HETEROGENEITY AND INDUSTRY PERFORMANCE: EVIDENCE FROM SPANISH MANUFACTURING

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Abstract

Competition in some industries focuses around a well-established set of competencies and environmental resources. Yet in other industries, competing firms experiment with different strategic orientations in their search for competitive advantages. The resource-based view of the firm has devoted enormous attention to the implications of firm heterogeneity for competitive advantage at the firm level. On the opposite hand, the study of the performance implications of strategic heterogeneity at the industry level has received scant attention. Past research has produced conflicting results about the exact relationship between strategic heterogeneity and industry performance. This paper examines the relationship between industry variety and performance adopting a wide range of theoretical perspectives. The hypotheses are tested using data from a survey of Spanish manufacturing industries, finding the existence of a robust quadratic U-shaped relationship between industry variety and performance. This finding suggests that industries benefit from both strategic homogeneity and strategic heterogeneity.

Key words: strategic heterogeneity, industry performance, strategic groups

1. INTRODUCTION

Understanding the performance implications of firm heterogeneity constitutes a primary research goal in strategic management. Throughout the last decade, the so-called resource-based view of the firm has stressed the importance of firm heterogeneity in generating rents. Within the industrial organisation tradition, the literature on strategic groups has also called attention to the importance of the asymmetrical location of firms along the industry's strategic domain. Both approaches have contributed to a richer understanding of the effects of firm heterogeneity on industry performance.

The literature on strategic groups suggests that the potential profitability of an industry is related to the degree of strategic heterogeneity within the industry: the more different the strategies of competitors—i.e., the higher the level of strategic heterogeneity—the lower the potential profitability of the industry (Caves and Porter, 1977; Newman, 1978; Porter, 1979). This assertion comes from analysing the likelihood with which tacit collusion could be sustained within an industry populated by dissimilar competitors. Heterogeneous competitors can hardly recognise their strategic interdependencies, which, in turn, prevents achieving and sustaining collusive agreements.

On the other hand, resource-based theorists advocate that performance differences across firms are due to heterogeneity in firms' resources and capabilities (Wernerfelt, 1984). Resources that are valuable, unique, imperfectly mobile, and difficult to imitate constitute the basis for firm's competitive advantages (Barney, 1991; Amit and Schoemaker, 1993; Peteraf, 1993). This point has also been largely recognised by organisational ecologists. Carroll's (1985) resource partitioning model explains how differentiation can contribute to reduce the degree of competitive interdependence within a population of firms. Furthermore, Miles and Snow (1986) have identified positive effects of increased intraindustry heterogeneity due to the achievement of synergies between different strategic types.

On the empirical ground, some studies have found a negative relationship between strategic heterogeneity and performance (Cool and Dierickx, 1993), while others have found a positive relationship (Miles, Snow, and Sharfman, 1993). In contrast, Dooley, Fowler, and Miller (1996) found a quadratic U-shaped relationship, suggesting that industries characterised by high homogeneity or high heterogeneity will perform better than industries that are *stuck in the middle*.

2. OBJECTIVES

This paper examines, using different theoretical approaches, the nature of the relationship between industry strategic heterogeneity and industry profitability. We provide empirical evidence from a sample of Spanish industries. Following Dooley, Fowler, and Miller (1996) we will try to prove the existence of a double effect of strategic heterogeneity on industrial profitability (see Figure 1). Strategic heterogeneity is a variable that, coming from firm conduct, exerts two separate effects on industry performance. First, heterogeneity exerts a direct effect on firm conduct by limiting the feasibility of collusive agreements in oligopolistic industries. Second, the degree of heterogeneity alters industry structure, in particular the degree of competitive interdependence between firms (González, 2000). In the following sections we further develop the precise nature of these two effects.

<<<<<<<<<<<<<<FIGURE 1 ABOUT HERE>>>>>>>>>>>>

3. THEORETICAL BACKGROUND

3.1. Strategic heterogeneity and oligopolistic coordination

The idea that strategic variety may impair oligopolistic coordination traces back to the early writings in the strategic groups literature (Caves and Porter, 1977; Newman, 1978). The maintained hypothesis states that intergroup rivalry is higher than intragroup rivalry, because strategic homogeneity makes it easy for competitors to recognise their strategic interdependence, which facilitates tacit coordination. This argument implicitly assumes that firm strategists actually perceive the structure of strategic groups within the industry. Cognitive theorists (Reger and Huff, 1993; Peteraf and Shanley, 1997) have characterised strategic groups as cognitive realities, capable of inducing reactions in the strategic behaviour of managers. By linking industry structure to managerial action, the cognitive approach to strategic groups provides an appropriate conceptual framework to understand the implications of strategic heterogeneity for competitive behaviour within an industry.

Managerial perceptions lead to partitions of the industry in groups of firms that share *similar* positions within the cognitive map (Fiol and Huff, 1992). There exists some evidence that managers only use a few strategic dimensions to classify competitors. They follow a constructionist approach that makes tractable the cognitive problem of understanding the competitive environment (Reger and Huff, 1993; Lant and Baum, 1995). But, how does the perceived structure of groups alter firm behaviour and results? Peteraf and Shanley (1997) suggest that firms identify themselves with one group. It is this identification what significantly affects firm behaviour. Fiegenbaum and Thomas (1995) indicate that managers observe the competitive behaviour of other firms as reference points. Learning occurs around the set of firms with which the firm interacts more frequently, giving rise to a group identity. As managers gain experience from interactions and from observing the behaviour of rival firms, they learn how to distinguish which firms are worth to be observed and which ones are not, which firms constitute the reference to imitate and which firms are more relevant for competitive or cooperative purposes. In particular, member firms will make decisions taking into account the behaviour of other members, e.g. likely reactions.

Peteraf and Shanley (1997) identified many positive influences of groups with a strong identity on the behaviour and performance of member firms. First, member firms are able to better recognise strategic interdependencies (Caves and Porter, 1977). The group is comprised by a set of firms that recognise being playing the same competitive game. This recognition enormously facilitates cooperation, including explicit and tacit collusion or any other kind of cooperative agreement, e.g. joint political influence activities. Strategic alliances to enjoy economies of scale, input provision or technological development are also examples of the efficiency advantages that member firms can yield from improving coordination. The exchange of information may also foster innovation. Furthermore, a group with a strong identity may be able to effectively signal information about hard to evaluate characteristics of member firms to external observers (clients, suppliers, regulators). In this sense, the group may be able to generate shared reputational capital. Member actions can reinforce this advantage, e.g. establishing joint promotional campaigns.

We can now extend the reasoning of cognitive groups to analyse the relationship between strategic heterogeneity and rivalry within an industry. Three variables related to strategic heterogeneity influence the degree of rivalry: the number of groups, the strategic distances between groups and the degree of internal heterogeneity within the groups. In an industry with many strategic groups, oligopolistic coordination will be hard to achieve, since firms in different groups may have completely different goals and beliefs. *Strategic distance* refers to the magnitude of the differences between the strategic groups in the industry. The larger the strategic distances the higher the degree of rivalry between groups. Finally, within group heterogeneity also impairs coordination between group members. Thus, whatever its source or form, a high degree of strategic heterogeneity within the industry should lead to poor industry results. But this is just one half of the story.

3.2. The benefits of strategic heterogeneity

The previous section highlighted the benefits of strategic homogeneity, benefits that arise from enhancing the feasibility of oligopolistic coordination within the industry. The literature has also identified a high number of benefits derived from strategic heterogeneity, which we briefly examine in the following sections.

3.2.1. Strategic interdependence and heterogeneity

Interfirm coordination is just but one driver of industry performance. Another fundamental determinant is the degree of strategic interdependence that exists between competitors. While strategic homogeneity exerts a positive effect on coordination, it also contributes to increase strategic interdependence and rivalry. The resource-based view of the firm suggests that rivalry will tend to be intense when the resources and capabilities of competitors are similar. Homogeneity is not compatible with mobility barriers or isolating mechanisms and, thus, inhibits the achievement of competitive advantage. As firms become more homogeneous, competition becomes potentially more aggressive and the firms' market positions more vulnerable. Strategic differentiation reduces interfirm interdependence and, thus, the need for oligopolistic coordination. Between-groups rivalry will be higher than within-group rivalry only if the strategic distance between groups is not enough to significantly reduce strategic interdependence (Porter, 1979; Porac and Rosa, 1996; Porac and Thomas, 1994)).

3.2.2. Organisational ecology and heterogeneity

Organisational ecologists study the processes of environmental selection (Hannan and Freeman, 1977). The fitted firms survive and the unfitted are expelled out from the market. Heterogeneity plays a central role in organisational ecology, as it constitutes the raw material required for environmental selection processes to operate. Environmental selection in industries characterised by a higher degree of strategic heterogeneity is likely to act in the benefit of the industry as a whole. Surviving firms will represent the most fitted firms out of a wide range of selection possibilities. Miles, Snow, and Sharfman have remarked that a "lack of variety means not only that more head-to-head competition will be present in the industry but also that there will be less opportunity for firms to learn (…) By maintaining variety, the industry as a whole is more likely to be aware of changing conditions and to have appropriate responses available" (1993: 174).

Organisational ecology also predicts a higher degree of rivalry between similar firms. According to Hannan and Freeman (1977), firms of different sizes develop different strategies and compete for different environmental resources. Each size has its own efficiency niche and requires a different strategy to successfully compete within the industry (Woo and Cooper, 1982). Every market niche is attractive for a certain kind of firms and unattractive for the rest. In the empirical arena, some research has found that stronger competition occurs between firms with similar characteristics (Wholey, Christianson, and Sanchez, 1992; Baum and Mezias, 1992).

Differentiation may create complementary functional differences that lead to mutualistic interdependence among the members of a population (Carroll, 1985; Astley, 1985; Fombrun, 1986). The argument traces back to Hawley (1950) who suggested that competition fosters a further division of labour characterised by functionally differentiated organisations that fulfil complementary roles. In response to competition, entrepreneurs try to differentiate and perform functions in which they may achieve a sustainable competitive advantage. As a result, the population as a whole benefits from the efficiency gain that is derived from the increased functional division of tasks (Baum and Singh, 1994).

3.2.3. Complementarities among strategic types

The idea that a firm may benefit from a certain degree of variety was inspired by the theory of cybernetics, which studies the processes of control in systems. Ashby's (1956) law of requisite variety establishes that every system requires a minimum level of variety to remain under control. In an uncertain environment—one that can present different states with positive probability—the system must possess a set of possible responses greater or equal to the possible states of the environment: "Only variety can destroy variety" (Ashby, 1956: 282).

By extension, "an industry must possess a level of variety requisite to its environment (e.g., the domestic or global economy) or it will experience decline" (Miles *et al.*, 1993: 165). In dynamic environments strategic variety permits a better adaptation of the industry as a whole. Swaminathan makes the same point: "At an abstract level, a system characterised by greater diversity can respond better to changing environmental conditions. In terms of industry structure, one that is composed of firms manufacturing a diverse set of products is more likely to satisfy the needs of a heterogeneous market " (1998: 402). The firms within the industry must generate the variety of resources and capabilities that provide greater possibilities of industry evolution.

Miles and Snow (1986) have suggested that in today's competitive landscapes there exist benefits associated to the existence of different strategic types within the industry, whose different distinctive competencies allow them to pursue different strategic orientations with greater efficiency. Any moment in the life cycle of the industry requires the existence of Prospectors, Defenders, and Analysers. Each strategic type contributes and benefits from the overall demand of the industry, focusing his contribution around its distinctive competence. Miles and Snow (1986) have named this phenomenon *implicit interdependence*, suggesting that the industry needs a certain level of variety to respond to the objectives of innovation and efficiency. Prospectors generate innovation contributing to industrial development; Analysers rationalise innovations improving their adaptability to conditions of demand; Defenders, in turn, increase the productive efficiency, an indispensable requirement for the mass market. Each strategic type requires the presence of the other types to fully exploit its source of distinctive competence.

Differentiation among competitors may also offer greater opportunities to establish strategic alliances or other cooperative arrangements that imply the sharing of complementary resources. One of the main reasons firms enter strategic alliances is the need to exchange resources, this is, to gain access to resources that are otherwise unattainable. Homophile arguments, on the opposite side, suggest that it is similarity what induces firms to enter cooperative alliances. Porter and Fuller (1986) denominate X-coalitions those which are motivated by the exchange of complementary resources and Y-coalitions those in which the partners work jointly in the same activities bringing similar resources to the coalition.

Wholey and Huonker clarify that "[...] exchange theory would better explain relations in the for-profit sector, where organisations do not rely on third-party funding and have less need to join together in political activity" (1993: 368). Exchange arguments are more plausible in free market private settings, where consumers directly pay for the product or service. Obviously, to be able to exchange resources complementary differences among *cooperators* are a previous requirement. According to a theory developed by Nohria and García-Pont (1991), industry members tend to form strategic alliances that cluster into *strategic blocks*. Each strategic block is composed by a set of firms that have established stable alliances between them. It is possible to distinguish two types of strategic blocks, depending on whether the members possess similar capabilities (pooling blocks) or complementary capabilities (complementary blocks). The correspondence with the homophile and exchange arguments is straightforward. Most of the strategic blocks identified in Nohria and García-Pont's analysis of the automobile industry were complementary blocks—there was not a single strategic block in which all members belonged to the same strategic group. It seems that the success of a coalition requires that the partner possess a desired source of competitive advantage (Porter and Fuller, 1986). Strategic variety is an obvious prerequisite.

4. HIPOTHESES

So far we have examined two opposite effects of strategic variety on industry performance. Dooley, Fowler, and Miller (1996) have proposed a solution to this apparent contradiction by arguing that the relationship between strategic variety and performance is not lineal but quadratic. This functional form arises from considering the two effects as independent forces that exert an influence in two intermediate factors that are related with industrial performance. First, heterogeneity exerts a negative effect on oligopolistic coordination, which, in turn, determines a lower profitability potential for the industry. Second, heterogeneity implies less competitive interdependence and opens new areas for cooperative agreements.

<<<<<<<<<<<<<<FIGURE 2 ABOUT HERE>>>>>>>>>>>>

Figure 2 illustrates the relationship between the two effects mentioned above and the resulting overall effect on industry performance. First, oligopolistic coordination is harder to sustain as the level of industry variety increases and, thus, the coordination effect has negative slope. On the other hand, as heterogeneity increases, the competitive interdependence among firms is reduced and the possibilities for cooperative interaction are enhanced. Thus, the interdependence effect has positive slope. The overall effect is not linear but U-shaped, indicating that each of the two conflicting partial effects dominates when heterogeneity is low or large, respectively. The worst industrial scenario is one with an intermediate level of strategic heterogeneity. Less than enough variety does not allow firms to fully exploit the advantages of reduced competitive interdependence and enhanced cooperative interdependence, while it may be enough to deteriorate the terms of oligopolistic coordination. The empirical finding of a U-shaped relationship between strategic variety and industry performance was first established by Dooley, *et al.* (1996). In the following section, we provide additional evidence on the existence of such relationship using a sample of Spanish manufacturing firms[1].

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[1] The opposite hypothesis—an inverted U-shaped relationship—has been recently suggested in the literature. Deephouse (1999) advocates that the best strategy for a firm is to maintain a

5. METHODOLOGY

Our empirical test of the U-shaped relationship between strategic heterogeneity and industry performance heavily draws on the model developed by Dooley, *et al.* (1996). The basic regression model has the following specification:

$$R_i = \alpha + V_i \beta + \mathbf{C'_i} \boldsymbol{\gamma} + u_i \qquad (1)$$

where R_i is the average profitability of industry *i*, V_i is a vector of variables that approach the degree of strategic variety within industry *i*, $\mathbf{C'_i}$ is a vector of control variables—concentration, life cycle—and u_i is white noise.

The most delicate issue concerning the estimation of model (1) is how to approach strategic variety. Although there are many variables that strategically differentiate firms, we can only use those that are directly comparable across industries. Some authors (Hunt, 1972; Newman, 1978; Schendel and Patton, 1978; Porter ,1979) have employed bivariate representations—based on size or geographic span, for instance. We believe that a multivariate description is more appropriate (Hatten and Hatten, 1987). Recent research has extensively used three variables that reasonably approach the different dimensions of firm strategy and are sufficiently general as to be comparable across industries: capital intensity (production), advertising expenditure (marketing), and R&D expenditure (innovation).

Strategic variety can be measured along each strategy dimension. To allow for interindustry comparisons, a reasonable approach is to use the coefficient of variation. However, the coefficient of variation is not appropriate for strategy variables that are not quantitative. In the case of (ordered) categorical variables or dummy variables, the standard deviation is preferable. Note that the mean value of a qualitative variable depends on the way numerical values are attached to categories and, thus, the value of the coefficient of variation is arbitrary.

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carefully "balanced" level of differentiation relative to its competitors, this is, being different enough to avoid direct competition but not too different, to avoid loosing institutional legitimacy. However, this theory of "strategic balance" has serious limitations that compromise its empirical validation. First of all, the existence of strategic groups (that could provide legitimacy to far-from-the-mean strategic orientations) is explicitly ruled out. Second, it is also assumed that collusion is not possible, which obviously penalises the option of being similar. Third, an excessive weight is placed on institutional legitimacy, which exaggeratedly favours isomorphism. However, the cases of isomorphism are scant in the private sector, but tend to be dominant in the public sector and non-profit activities, in which survival depends to a large extent on the degree of legitimacy achieved.

By computing the coefficients of variation or standard deviations of the strategy variables, we obtain a number of partial measures of variety. However, to estimate model (1) we need to construct an overall measure of strategic variety. Dooley *et al*. (1996) obtained an overall measure of variety by simply adding up their three partial measures of variety. That approach seems to be correct when all the variables are coefficients of variation and, thus, the partial measures are directly comparable. But the partial measures of variety obtained from qualitative strategy variables are measured in standard deviations and, thus, they are no longer comparable—i.e., an unweighted sum may attach a larger "weight" to a strategy dimension just because of a scaling problem. To correct this bias we propose using a weighted measure of overall strategic variety as:

$$VG_i = \sum_{j=1}^{J} V_{ij}\gamma_j \tag{2}$$

where V_{ij} is the partial measure of variety in the strategy variable *j* and industry *i*, and γ_j is a weighting parameter. The issue at this point is how to define appropriate weights. There are several possibilities. Dooley *et al*. (1996) is a particular case in which γ_j=1 for all *j*. However, when the averages of the variables are significantly different a bias is introduced towards the largest variables. To remove this bias we weight each variable by the inverse of its average:

$$\gamma_j = \frac{N}{\sum_{i=1}^{N} V_{ij}} \tag{3}$$

where *N* is the number of industries. This way all the variables will have the same impact on the aggregate measure of variety. Another nice property of this measure is that its average is exactly equal to the number of strategy variables used to construct it[2].

Model (1) could also be estimated using a panel data specification:

$$R_{it} = \alpha_i + \lambda_t + V'_{it}\beta + \mathbf{C'_{it}}\,\delta + u_{it} \tag{4}$$

[2] Another obvious possibility to choose the weighting parameters would involve using a multivariate method of variable reduction. In fact, the purpose of aggregating is to reduce dimensionality. Multivariate techniques, such as Principal Components Analysis, reduce the dimensionality constructing a new variable that retains as much of the original variability as possible, i.e., minimising the loss of information. The problem with this method is that the retained component can be negatively correlated with a subset of the original variables while positively correlated with the other subset. Thus, in general, it cannot be interpreted as an overall measure of strategic variety.

The advantage of a panel data specification is that by observing the same individuals *i* along time it is possible to estimate the individual effect α_i that accounts for time invariant unobserved heterogeneity and time effects λ_t that account for common shocks across industries in a given period. However, the panel data specification may not be appropriate in the context of our research. Strategic decisions are long run decisions that imply strong resource commitments. Thus, strategic variety should not change much from year to year and its effect would confound with the individual effects. Thus, we estimated model (1) using the time averages of the variables. We also estimated model (4) with a panel data specification to compare both approaches.

5.1. Data

The *Encuesta Sobre Estrategias Empresariales* (ESEE) is an annual survey undertaken by the *Fundación Empresa Pública* and the Spanish *Ministerio de Industria y Energía*, since 1990. It collects accounting and activity data from a sample of Spanish manufacturing firms in different industries. Sample selection has tried to achieve an exhaustive participation of the biggest firms in each industry. The rest of the firms are randomly sampled (see Fariñas and Jaumandreu, 1994, 1999). To estimate models (1) and (4) we use the 1990-1994 ESEE data.

In order to classify firms into industries, we used the three digit CNAE-93 code. CNAE stands for *Clasificación Nacional de Actividades Económicas* and is the Spanish equivalent to the SIC codes. ESEE only reports the CNAE-74 code[3]. The conversion to the CNAE-93 codes was carried out using the codes of the *Clasificación Nacional de Bienes y Servicios* associated to the CNAE-74 codes[4]. Official correspondence tables were used to recover the three digit CNAE-93 codes. In some cases, 3 digit codes were deemed inappropriate, because the resulting industry did not have any meaningful interpretation in competitive terms. Such is the case of code 159 (Beverages) which includes wine, beer, tapered water and carbonate drinks, or code 158 (Other feed products) which includes producers of goods as diverse as cookies and coffee—which would be better interpreted as complements. We excluded all such conflicting codes from the sample[5].

[3] In 1992 the CNAE-93 substituted the out-of-date CNAE-74. The reason ESEE uses the CNAE-74 codes is because the first year covered by the survey is 1990.
[4] This classification adds three digits to the four digit CNAE-74 codes.
[5] Unfortunately, the information provided by ESEE does not allow for a finer 4-digit code. Most of the industry codes included in the final sample correspond to 4-digit SIC codes (see Table 5).

Twelve strategy variables were considered for the construction of the overall measure of strategic variety. Three of these variables—advertising over sales (MKT), R&D over sales (R&D), and capital intensity, as measured by the ratio of fixed assets to the number of employees (CAPI)—represent Khandwalla's (1981) typology of competitive strategies, and have been frequently used in the study of strategic groups and industry variety (Miles, *et al.*, 1993; Dooley, *et al.*, 1996). Additionally, we included a geographic span variable (GS), because of its crucial importance to delimit the effective competitive area of the firm. The internationalisation of the firm was approached by the percentage of exports over sales (EXP), while the firm focus was measured by the percentage of sales in its main market (M1). Subcontracting activities were also accounted for by the SUB variable.

The ESEE survey also provides some qualitative information in the form of dummy variables. We selected 5 dummy variables that account for several activities that the firm does or does not. Figure 3 describes the twelve strategy variables. The table also includes a description of the type of variable (quantitative, dummy, categorical), how was the respective partial measure of variety computed (coefficient of variation or standard deviation) and the time period for which data on that variable were available. Note that the dummy variables were collected just in 1990 and 1994—ESEE calls them four-yearly variables.

<<<<<<<<<<<<<<FIGURE 3 ABOUT HERE>>>>>>>>>>>>

To assess the robustness of the results, four different overall measures of strategic variety were constructed. VAR3 includes the three variables used in previous studies (Dooley *et al.*, 1996; Miles *et al.*, 1993). Although we believe that this variable is incomplete, it allows comparing our results with those reported in previous studies. VAR4 includes also the geographic span variable. VAR10 and VAR12, incorporate the other 8 strategy variables (Figure 4).

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Return on assets (ROA) was computed to approximate firm performance. As accounting data were only available from 1991 to 1994, strategy data were taken from 1990 to 1993 to allow for a year lag between strategy and performance. To obtain a measure of industry level performance we computed a weighted average of firm level performance with the weights reflecting the firms' market shares. This is equivalent to compute industry ROA as the aggregate profit divided by the aggregate assets of all the firms within the industry. We also included two control variables in the model. Sales variation (SV) accounts for the impact on performance of the industry's life cycle. Additionally, the 4-firm concentration ratio (CR4) was included to control the shared effect of market power within each industry. The ESEE survey includes a variable that reflects the belief the firm managers hold about the degree of concentration in the industry. We used the average value of this variable to approach concentration within each sector.

Dooley *et al.* (1996) also noted that "because many 4-digit SIC codes contain non-competing products, industries may consist of firms which have high strategic variety across product segments, but low strategic variety within product segments". Thus, the "real" degree of industry variety may differ from the degree estimated using a 4-digit SIC classification. The same problem arises when using the 3-digit CNAE93 codes. Following Dooley *et al.* (1996) we included a control variable that accounts for the number of product categories within each 3-digit CNAE93 codes. This variable (5D) measures the number of 5-digit CNAE93 categories within each corresponding 3-digit CNAE93 code.

Not all the data available in the ESEE survey are suitable for the estimation of model (1). In order to maintain an acceptable standard of representativeness, we selected the subset of industries with data of at least 5 firms in every year of the panel. The joint sales of these firms should also account for at least 1% of national sales in that industry in 1994. Also, firms with a return on assets larger than 100% in absolute value were excluded from the sample[6]. The filtered final sample contains 1414 firms in 1990, 1297 in 1991, 1291 in 1992, 1110 in 1993, and 1175 in 1994, representing a total of 55 3-digit industries, with an average of 24 firms per industry[7]. All the variables listed in Table 1 were computed for each industry and each year. To estimate model (1) we took the average value of each variable in each industry.

6. RESULTS

Model (1) was estimated by OLS, applying Withe's (1980) estimator of the variance-covariance matrix to account for heteroscedasticity[8]. First of all we contrasted the existence of a linear relationship between variety and performance. The results are shown in Figure 5. It is apparent that a linear relationship does not exist between any of the four measures of industry

[6] The inspection of the ESEE data reveals that these firms clearly underreport the value of the assets.
[7] Note that sample size has reduced along the panel although the size of the ESEE survey has remained almost unchanged. The reduction in our sample is due to the trend observed in some firms not to reveal some of the information required for our study.
[8] The Breusch and Pagan (1979) test rejected the hypothesis of homoscedasticity in all the models.

variety and industry performance. The coefficients of variety are positive in models 1 and 2 and negative in models 3 and 4, but statistically insignificant. The effect of concentration on industry performance does not appear to be significantly different from zero. On the other hand, sales variation shows a powerful positive influence on industry performance. According to this result, growing industries tend to attain higher profits than declining industries. The coefficients of determination suggest a very poor adjustment of the models. The variable controlling the number of product categories within the industry (5D) exerts a negative influence on performance, which is insignificant except in Model 1. This result contrasts with Dooley *et al.* (1996) who found a positive and significant coefficient.

<<<<<<<<<<<<<<FIGURE 5 ABOUT HERE>>>>>>>>>>>>

After rejecting the hypothesis of a linear relationship, we estimated the existence of a quadratic relationship (Figure 6). At the bottom of Table 3 we include the joint significance test of the linear and quadratic variety coefficients H_0: $Var=Var^2=0$. This test contrasts the hypothesis that there is no relationship between variety and performance, against the alternative that a quadratic relationship exists. The test differs from the individual significance tests in that the covariance between the coefficients is accounted for and not only the variances. The null hypothesis is rejected in models 1 and 2, but not in models 3 and 4. The individual significance tests confirm the existence of a U-shaped relationship between variety and performance: the coefficient of the linear term is negative, the coefficient of the quadratic term is positive and both are statistically significant in all the four models at conventional levels.

<<<<<<<<<<<<<<FIGURE 6 ABOUT HERE>>>>>>>>>>>>

Note that the statistical significance of the coefficients of the control variables diminishes as the number of variables included in the overall measure of strategic variety increases. The CR4 has a positive coefficient that is significantly different from zero in models 1 and 2 but not in models 3 and 4. The life cycle proxy (SV) has a positive and significant coefficient in all the models. The coefficient of the variable controlling the number of product categories (5D) is negative in all models but statistically insignificant. The lack of statistical relationship between the 5D variable and performance supports the selection of 3-digit coded industries included in the final sample. The fit of the model, as reflected by the coefficient R^2 takes values around 25% in models 1 and 2, and just 15% in models 3 and 4. Thus, the results show that a better fit is obtained if only the key strategy variables are included in the computation of the overall measure of variety.

Figure 7 shows the actual performance-variety (VAR4) values of the 55 industries included in the final sample and the fitted regression curve. Although a large dispersion is evidenced, the U-shaped relationship clearly emerges from the data. On average the most profitable industries are characterised by a higher degree of homogeneity or heterogeneity. According to this result, the worst alternative is to be *stuck in the middle*. Industries with an intermediate level of variety can’t take advantage of the benefits derived from homogeneity (tacit collusion) and can’t fully exploit the benefits of a larger heterogeneity (requisite variety, differentiation, mutualistic interdependence)[9].

<<<<<<<<<<<<<<FIGURE 7 ABOUT HERE>>>>>>>>>>>>

We also estimated (4) with a panel data specification for VAR3 and VAR4 (Figure 8). VAR10 and VAR12 were excluded because their components do not change in time. For the same reason, the model does not introduce the variables CR4 and 5D. The results indicate the absence of a relationship between strategic variety and industry performance. However, much of the across industries variation has been captured in the individual effects. These variables account for unobserved heterogeneity across individuals that is time invariant. Strategic variety does not change much from one year to the other, because firm strategies do not change from year to year. Thus, our variables of strategic variety present a low degree of intertemporal idiosyncratic variation, and their coefficients are negligibly different from zero. The association between strategic variety and performance observed in Figure 3 was captured by the individual effects.

<<<<<<<<<<<<<<FIGURE 8 ABOUT HERE>>>>>>>>>>>>

Following Dooley, *et al.* (1996), Figure 9 classifies the 55 industries of the sample in six cells as a function of variety (VAR4) and performance (ROA)—this table allows for a rough identification of the data points in Figure 7. The cutoff points were arbitrarily chosen after a careful inspection of Figure 7. Industries were ranked by variety as: Low variety (VAR4<3.6), Intermediate variety (3.6<VAR4<4.4) and High variety (4.4< VAR4)—

[9] It is curious though that the most profitable industry in the sample (ROA=20,3%) had an extreme intermediate level of variety (VAR4=4,1). However, it is a concentrated industry (CR4=25%) with a high growth rate (SV=22%). Figure 2 is only included for descriptive purposes and nothing can be inferred from it, because other important variables (concentration and sales variation) vary across industries.

remember that 4 is the average level of variety when using VAR4. Industries were divided also in High performing (ROA>7%) and Low performing (ROA<7%).

<<<<<<<<<<<<<<FIGURE 9 ABOUT HERE>>>>>>>>>>>>

From the 55 industries that integrate the sample, 36 (64%) are located in cells A, C and E. These are the cells that are consistent with the prediction that a U-shaped relationship exists between industry variety and performance. From the 18 “Low variety” industries, 13 (72%) of them show a high profitability. A similar result is observed within the 19 “High variety” industries: 14 (73%) of them obtain high profit rates, while the remaining 5 (27%) have a small average profitability. The results are more ambiguous in the “Intermediate variety” segment, where industries split evenly between the high and low performance cells. However, average performance in cells B and E is smaller than in cells A and C, and D and F, respectively.

In cells A and D we would expect finding industries with well-established competition parameters and a low degree of product differentiation. Most of the industries that actually fall into these cells respond to those requirements: Dairy product manufacturing, Rubber products, Seafood product preparation, Cement, lime & gypsum, Carrying wiring devices, Farm machinery. Similarly, cells C and F are populated by industries with a large potential for product differentiation, as it is the case of industries related to the world of fashion: Clothes, Footwear, Fine leather goods, Fabric mills, Textile fibres, Jewelry, gold & silver work. Industries in cells B and E are characterised by having an intermediate level of strategic variety. This is the case of industries as Bricks, structural clay tiles & clay refractories, Cutlery, Fabricated plate work, Iron, steel & iron alloys, Precious metals (non-ferrous), Pulp, paper & paperboard mills. The modest degree of differentiation within these sectors is not enough to reduce competitive interdependence, but makes oligopolistic coordination harder to sustain.

7. CONCLUDING REMARKS

The study of the economic and managerial implications of intraindustry strategic heterogeneity has received scant attention within the industrial organisation tradition. Research on strategic groups and contributions from the resource-based view of the firm have attempted to fill this important gap in the literature. This paper has tried to offer an understanding of the relationship between strategic heterogeneity and industry performance from a wide range of perspectives. We propose a model that distinguishes two effects of strategic variety on industry performance. The first effect comes from considering the sustainability of collusion as a function of the level of strategic variety present in the industry. Homogeneity contributes to a better understanding of the conduct of competitors and a faster reaction to competitive movements. Thus it also contributes to sustain collusive agreements. The second effect arises from the impact of strategic variety on industry structure. We claim that variety reduces the competitive interdependence of firms within the industry and enhances mutualistic interdependence.

As these two effects occur simultaneously, we agree with Dooley, Fowler, and Miller (1996) that the relationship between strategic variety and performance should be U-shaped. Our data from Spanish manufacturing firms confirms the existence of a quadratic U-shaped relationship. Thus, high performing industries are (other things being equal) characterised by a high degree of strategic heterogeneity or a high degree of strategic homogeneity. The worst scenario occurs in industries with a moderate degree of variety. Firms in these industries do not enjoy the benefits of either strategic homogeneity or strategic heterogeneity. We believe that this evidence from Spain sheds relevant light to the issue of strategic variety and its relationship to performance.

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Figure 1. Effects of strategic heterogeneity on industrial profitability (González, 2000)

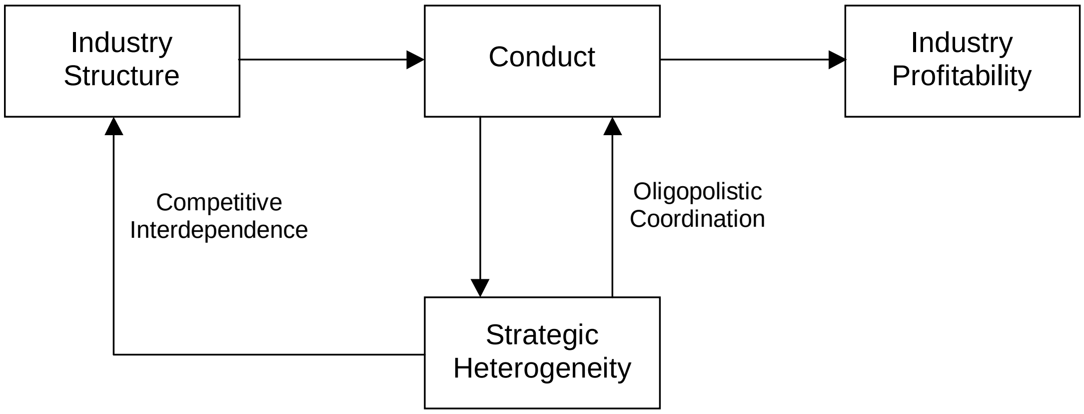

Figure 2. Relationship between strategic heterogeneity and performance

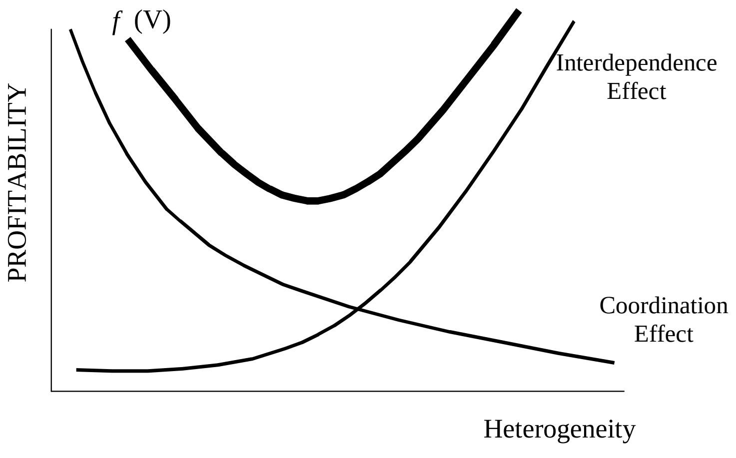

Figure 3. Description of the variables (industry level variables)

VARIABLE	Description	Measure	Type of data	Period
Performance				
ROA	Weighted Return to Assets	Weighted Average	QUANT	1991-1994
Strategy				
MKT	Advertising expenditure over sales	CV	QUANT	1990-1993
R&D	R&D expenditure over sales	CV	QUANT	1990-1993
CAPI	Fixed assets per employee	CV	QUANT	1991-1993
EXP	Exports over sales	CV	QUANT	1990-1993
SUB	Subcontracted production over sales	CV	QUANT	1990-1993
M1	Sales % in the main market	CV	QUANT	1990-1993
GS	Geographic span 1- Local 2- Provincial 3- Regional 4- National 5- Abroad 6- National and abroad	SD	CAT	1990-1993
SCI	Services of scientific information	SD	DUMMY	1990,1994
NOR	Normalisation activities	SD	DUMMY	1990,1994
ASI	Assimilation activities	SD	DUMMY	1990,1994
MA	Marketing activities	SD	DUMMY	1990,1994
DES	Design activities	SD	DUMMY	1990,1994
Control				
SV	Sales Variation	Average	QUANT	1990-1994
CR4	4 firms Concentration Ratio	Average	QUANT	1992-1994
5D	5-digit CNAE93 subcategories	Time invariant	QUANT	-

*CV= Coefficient of Variation; SD= Standard Deviation; QUANT= Quantitative; CAT= Categorical

Figure 4. Measures of strategic heterogeneity

Variety measure	Strategy variables included											
VAR3	MKT	R&D	CAPI									
VAR4	MKT	R&D	CAPI	GS								
VAR10	MKT	R&D	CAPI	GS	EXP	SC	NOR	ASI	MA	DES		
VAR12	MKT	R&D	CAPI	GS	EXP	SC	NOR	ASI	MA	DES	SUB	M1

Figure 5.- Linear model

Variable	Model1	t	Model2	t	Model3	t	Model4	t
Constant	0.47	1.14	0.06	1.37	0.08	1.03	0.13	1.64
CR4	0.0009	1.30	0.0007	1.05	0.0005	0.94	0.0005	0.82
SV	0.06	3.03***	0.06	3.03***	0.06	2.62***	0.05	2.59***
5D	-0.005	-1.72*	-0.004	-1.49	-0.004	-1.14	-0.003	-0.89
VAR3	0.01	0.99						
VAR4			0.41	0.46				
VAR10					-0.0003	-0.04		
VAR12							-0.005	-0.64
R^2	0.09		0.08		0.08		0.09	

* Significance level 0.1 ** Significance level 0.05 *** Significance level 0.01

Figure 6. Quadratic model

Variable	Model1	t	Model2	t	Model3	t	Model4	t
Constant	0.39*	4.15***	0.56	4.22***	1.17	2.76***	1.5	2.41**
CR4	0.001	1.69*	0.001	1.79*	0.0009	1.63	0.0007	1.27
SV	0.06	2.93***	0.07	3.51***	0.06	2.79***	0.05	2.56**
5D	-0.005	-1.64	-0.005	-1.67	-0.005	-1.37	-0.003	-0.86
VAR3	-0.22	-3.65***						
$VAR3^2$	0.04	3.91***						
VAR4			-0.25	-3.86***				
$VAR4^2$			0.03	4.01***				
VAR10					-0.22	-2.53**		
$VAR10^2$					0.01	2.49**		
VAR12							-0.23	-2.22**
$VAR12^2$							0.009	2.16**
R^2	0.24		0.25		0.14		0.15	
F-Test—H_0: $Var=Var^2=0$		5.06***		5.40***		1.67		1.95

* Significance level 0.1 ** Significance level 0.05 *** Significance level 0.01

Figure 7. Fit of Model 2 (VAR4)

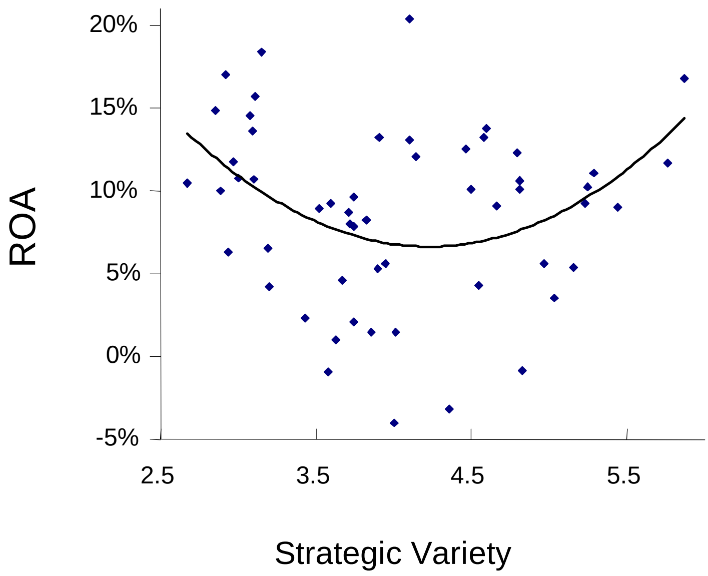

Figure 8. Quadratic model (panel specification)

Variable	Model1	t	Model2	t
Constant	0.048	0.92	0.17	0.89
SV	0.025	1.27	0.024	1.19
VAR3	0.015	0.72		
$VAR3^2$	-0.002	-0.74		
VAR4			-0.046	-0.52
$VAR4^2$			0.006	0.57
R^2	0.46		0.46	
F-Test—H_0: $Var=Var^2=0$	0.31		0.19	

* Significance level 0.1 ** Significance level 0.05 *** Significance level 0.01

Figure 9. Classification of industries

	Cell A	**Cell B**	**Cell C**
High ROA	152 Seafood product preparation 155 Dairy product manufacturing 191 Leather tanning and finishing 244 Pharmaceuticals 245 Soaps, detergents, perfumes, cosmetic & other toilet 251 Rubber products 263 Ceramic wall and floor tile 265 Cement, lime & gypsum 291 Industrial machinery & equipment 297 Household appliances 312 Distribution apparatus, relays & industrial controls 313 Carrying wiring devices 322 Radio & television broadcasting & communications equipment Averages: ROA=12.8% VAR4=3.1	173 Finishers of textiles 221 Publishing 243 Paints & allied products 261 Glass products 264 Bricks, structural clay tiles & clay refractories 315 Electric lighting fixtures 321 Electron valves & tubes 343 Motor vehicle parts & accessories 354 Motorcycles, bicycles & parts Averages: ROA=11.2% VAR4=3.9	151 Meat 156 Flour & other grain mill products 182 Clothes 192 Fine leather goods 193 Footwear 203 Wood structures, cabinetmaking 212 Paper & paperboard goods 222 Commercial printing 252 Plastics products 267 Cut stone & stone products 281 Fabricated structural metal 285 Coating, engraving & allied services 361 Wood household furniture 362 Jewelry, gold & silver work Averages: ROA=11.4% VAR4=5.0
	Cell D	**Cell E**	**Cell F**
Low ROA	241 Basic chemicals 293 Farm machinery 294 Machine tools 311 Motors, transformers & generators 323 Household audio & video equipment Averages: ROA=3.7% VAR4=3.27	211 Pulp, paper & paperboard mills 262 Pottery products 271 Iron, steel & iron alloys 272 Steel pipe and tubes 274 Precious metals (non-ferrous) 282 Fabricated plate work 286 Cutlery 342 Car, truck & bus bodies 351 Ship building & repairing Averages: ROA=1.6% VAR4=3.89	153 Fruits & vegetables 154 Fats & oils 171 Textile fibres 172 Fabric mills 266 Concrete, lime & gypsum products Averages: ROA=3.6% VAR4=4.9
	Low variety	Intermediate variety	High variety