Firm Diversification in the European Union
New Insights on Return to Core Business and Relatedness

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May 2002

Abstract

According to ex-ante expectations, one effect of the increased competitive pressure within the Single Market was to drive firms to reduce diversification and refocus on their core business. This paper addresses two main questions: the extent and the purpose of multi-product strategies. Using a large database of 223 leading manufacturing firms in the EU, we document whether EU leaders reduced diversification over the decade 1987-1997. We then investigate if firms have de-diversified by re-focussing around a core of related activities, testing for alternative measures of "core" and "relatedness". Our results confirm that firms readjusted corporate structures around one (or more) core(s) of related activities.

Keywords: Firm diversification, European integration, Return to Core

Jel Classification: L11, L22, F15

WORKING PAPER CERIS-CNR
Anno 4, N° 8 – 2002
Autorizzazione del tribunale di Torino
N. 2681 del 28 marzo 1977

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Segreteria di redazione
Maria Zittino

Distribuzione
Spedizione gratuita

Fotocomposizione e impaginazione
In proprio

Stampa
In proprio

Finito di stampare nel mese di maggio 2002

Private edition

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1. Introduction

Most studies in the empirical literature find a negative relationship between diversification and performance, either measured by profitability, productivity or stock market returns[1]. Product and capital markets discipline is often invoked to correct or even eradicate the source of this allocative inefficiency.

Empirical evidence from the US in the late 80s and early 90s is consistent with the hypothesis that, as competition gets tougher and capital markets become more efficient, firms reduce diversification and abandon marginal and less profitable activities[2].

According to ex-ante expectations of the benefits of the Single European Market, one of the effects of the increased competitive pressure within an integrated economy is to drive firms to reduce the extent of their product diversification and to refocus on their core business[3].

To date, the evidence of de-diversification in the European Union is uncertain. Based on summary results of a research project on the changing structure of EU manufacturing over the decade 1987-1997, we observe quite an undecided behaviour amongst the largest EU leaders[4]. A heterogeneous pattern of diversification trends emerges, in which some large firms first increase and then reduce diversification, some decrease it monotonically and others even increase the number of their operations. In particular, comparing data between 1987 and 1993, firms appeared to be somewhat in disequilibrium at the onset of the Single Market, uncertain as to whether expand or reduce the range of their activities[5]. Evidence for a later year, albeit revealing that diversification has diminished on average, seems to suggest that the adjustment process was not concluded in 1997 and that many firms (especially large ones) were still on the path to converge to a new equilibrium. Clearly, further analysis is required to understand the ultimate direction of corporate restructuring. Our analysis of the changing pattern of diversification of EU leaders in manufacturing is relevant for understanding whether European producers are moving toward a more efficient use of their resources (intangible and proprietary assets, domestic competitive advantages).

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1 Lang and Stulz (1994), Lichtenberg (1992), Berger and Ofek (1995), Lamont and Polk (2001).
2 Bhagat, Shleifer and Vishny (1990), Markides (1995), Comment and Jarrel (1995).
3 Cecchini, Catinat and Jacquemin (1988), European Commission (1990, 1996).
4 KUL, UEA, CERIS, WIFO (2001), "Determinants of industrial concentration, market integration and efficiency in the European Union", Study for the DG Economic and Financial Affairs, April, unpublished.
5 Davies, Rondi and Sembenelli (2001a).

This paper addresses two main questions that are related with the motivations and the effects of multi-product strategies, namely the extent and the purpose of diversification. Our study departs from previous empirical research that documents whether EU leaders have reduced diversification equating this to an unqualified "return to core strategy", in that it investigates if firms have de-diversified by increasing the relatedness of their activities. Insofar as firms pursue strategies of "related constrained diversification", diversification builds around a core organisational capability. As a consequence, firms may increase relatedness without reducing diversification. What the economic and finance theories predict is that it is not just important that firms reduce diversification, but that they re-adjust around one core business to draw the benefits from narrow business strategies or objectives[6]. Empirical research in this field has mainly focussed on the level and change of diversification, thus failing to account, jointly, for the relatedness content of changing diversification strategies.

The mixed evidence for the EU to date may simply depend on the fact that looking at reductions in diversification indexes alone might conceal that firms are actually increasing relatedness and refocussing not around one core business, but around more core businesses. As the notions of "core business" as well as of "relatedness" are not clearly defined and different definitions may lead to different conclusions, our main hypothesis – that EU largest firms have re-focussed around related industries – is tested using alternative measures of "core" and "relatedness".

We conduct our analysis with a large dataset comprised of more than 200 leading manufacturing firms operating in the European Union. The data we use is the most suitable in providing the answers to the questions above. The Market Share Matrix for EU manufacturing leading firms in 1987, 1993 and 1997 is explicitly and purposively designed to analyse and track the evolution of the industrial and corporate organisation of the European Union, based upon firm-level data[7]. The database includes the estimates of the turnovers of the top 5 EU leading producers in each three digit EU manufacturing industry disaggregated across all the industries and member states in which they operate. It provides a time-consistent comparison at a comprehensive and analytical level for the decade alongside the ongoing integration process (1987-1997).

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6 See Rotemberg and Saloner (1994), Montgomery and Wernerfelt (1988), Jensen (1986), Rumelt (1982).

7 The database is the by-product of an ongoing collaborative international project financed by the European Commission, which started in the early Nineties. The main results are summarised in Davies, Lyons et al. (1996), Davies, Rondi and Sembenelli (2001), KUL, UEA, CERIS, WIFO, (2001).

Our results suggest that, in spite of limited evidence of reduction in the levels of conventional indexes of diversification, firms appear to have pursued strategies of related constrained diversification.

The remainder of the paper is organised as follows. Section 2 briefly reviews the theoretical and empirical literature. Section 3 describes the measures of diversification and relatedness we use in the empirical analysis and presents our research strategy. Section 4 describes the data and presents the summary statistics. Section 5 presents the empirical methods that we employ to test our hypotheses and the econometric results. Section 6 concludes.

2. Literature

Mainstream economics argues in favour of diversification when it prescribes that profit maximising firms should not forgo profitable opportunities, and even unprofitable ones, if financial markets are not perfect and bankruptcy is costly. In the field of strategic management, narrow strategies and "clearly defined" goals are instead praised. Plausible motivations to pursue focussed strategies are that there are increasing returns to specialisation and that narrow objectives facilitate coordination.

In between these two extremes, many arguments have been made about why firms diversify: scale and scope economies, intangible and proprietary assets, managerial hubris, risk diversification, multimarket contacts[8]. In the early literature, the interest of economists in diversification stemmed from its potential anti-competitive effects (Edwards, 1955). According to the *market-power view*, diversified firms may behave anticompetitively in various ways: cross-subsidisation (when profits in one industry can be used to sustain predatory pricing in another market where competition is tougher); mutual forbearance (where firms meeting each others in several industries have a greater incentive to devise and sustain collusive agreements. See Bernheim and Whinston, 1990), reciprocal buying (whenever the multiple interrelationships among large conglomerates foreclose markets to smaller competitors).

The *resource view* of diversification argues that, in the growth process, firms accumulate resources that can be profitably employed to enter new related markets if transaction costs make it costly to sell the services of such resources through the market mechanism (Penrose, 1959, Rubin, 1973, Teece, 1982). Noticeably, both the market-power and the resource views are consistent with profit maximisation, but only the latter is consistent with the efficient use of resources. Conversely, according to the *agency*

[8] For recent surveys of the theories of diversification, see Montgomery (1994) and Vannoni (2000).

(managerial) view of diversification, managers pursue their own objectives (private benefits deriving from empire-building and risk diversification) in conflict with shareholders' interests for profit maximisation (Marris, 1964), and over-invest in growth projects that reduce the firm's value (Jensen, 1986). A side effect of the positive relationship between size and product diversification is that large corporations are most likely to exhibit a considerable amount of unrelated and industrially illogic diversification. However, this "golf-course" diversification is bound to be eliminated as soon as competition in the core industry toughens.

From a different perspective, Teece, Rumelt, Dosi and Winter (1994) propose a theory which encompasses elements of the resource view of diversification and of evolutionary economics (Nelson and Winter, 1982). The firm's choice of an optimal strategy (i.e coherent diversification versus specialisation or unrelated diversification) depends on a set of firm-specific factors – e.g. the firm's technological and organisational capabilities – as well as on a set of characteristics of the "selection environment". The theory predicts that if the competitive pressure in the selection environment becomes tougher, the firm ought to re-focus to ensure survival.

Both the managerial view and the approach by Teece et al (1994) converge in predicting that important changes in the competitiveness of markets, such as those driven by globalisation at the world level or by European integration at a more regional level, push firms towards related diversification strategies. In the empirical literature, descriptive and anecdotal evidence is consistent with such interpretation of the changes in diversification patterns. Markides (1995), for example, finds that, in contrast with the diversification waves of the 60's and the 70's, his large sample of Fortune firms turned towards more focused strategies in the 80's. Firms were exiting marginal and unrelated activities, probably as a result of increased stock markets' efficiency in assessing and rewarding firms' strategies, or because of improved managerial ability to rule organisations. Davies, Rondi and Sembenelli (2001) examine the impact of the Single European Market on diversification strategies of EU leaders in the period 1987-1993. They show that 'return to the core' had been marginal on average (but stronger for firms active in industries judged as more 'sensitive' to European Integration) and that de-diversification was confined to non-leading activities (see also Sembenelli, 1999).

However, this evidence is based on changes in diversification levels, and does not take into account the changes in the type of diversification (i.e. from unrelated to related). A step in this direction is the study by Fan and Lang (2000), who constructed measures of vertical relatedness and complementarity of diversification strategies. Their main results for a large panel of US firms in the period 1979-1997 show that, while the level of diversification was decreasing, relatedness was increasing over time on both dimensions. In their analysis vertical relatedness and complementarity are calculated with respect to the firm's primary activity, which is assumed to be the 'core business' of the firm. Similar to Fan and Lang (2000), we analyse the changing pattern of diversification strategies of EU leaders in the 1987-1997 period by considering, jointly with indexes of the degree of diversification, alternative measures of relatedness. We depart from this approach, however, in that we investigate the return to the core business of EU leaders by using a number of different definitions of "core business", including the principal 3-digit industry, the principal 2-digit industry and the set of most related industries.

3. Empirical measures of diversification and relatedness

3.1 Definitions and drawbacks of diversification indexes

There are several commonly used indices to measure firms' product (and geographical) diversification, each requiring different degrees of disaggregation and analytical detail in the data. These range from the number of industries in which the firm operates or the output share in the primary industry, which are relatively easier to construct, to the Entropy index, which instead requires detailed information on the breakdown of the firm's output into the various industries. A related issue, with obvious implications for the resulting levels of diversification, is the definition of the industries, although the choice of the degree of disaggregation is often dictated by reasons of practicality.

The analytical detail in our dataset enables us to use the most information-intensive index, the Entropy (E) and to compare their results with a less refined, albeit telling, measure of the share of output in non-primary industries to total output.

More precisely, for firm i, diversification is defined as:

$$E_i = - \Sigma\, s_j \ln s_j \qquad (1)$$

where s_j is the firm's output (defined by sales) share in industry j and the summation is across industries (j), and

$$R_i = \Sigma\, s_{-p} \qquad (2)$$

where s_{-p} is the firm's output share outside the primary (i.e largest) industry. Thus a firm is specialised in a single industry (non-diversified) if it records E_i = 1*0 = 0 and R_i = 1 –1 = 0. In contrast, a firm spreading its output equally across k industries records:

$E_i = -\Sigma (1/k)*\ln(1/k) = \ln k$ and $R_i = 1 - (1/k)$. To facilitate the interpretation of the Entropy index, we use its number equivalent form, which re-defines diversification as if the firm is operating equally across industries[9]. The number equivalent form is:

$$NE_i = \text{antilog}(E_i) \qquad (3)$$

The main difference between the Entropy index and alternative measures, such as the Berry index ($B_i = 1-\Sigma s_j^2$) is that it does attach less weight to those operations which account for a larger proportion of the firm's activities. Consequently, for a firm distributing its operations unequally across industries, the actual number of industries is greater than the number equivalent of its entropy index (NE), and this, in turn, is greater than the number equivalent of the Berry index ($NB_i = 1/(1-B_i)$).

One major drawback of diversification indexes is that they only account for the quantitative and distributive dimensions of diversification (the number of industries, the distribution of the output shares). They do not capture the qualitative dimension of multi-product strategies, i.e. the extent to which the different activities are related to each other and to the core business. As a consequence, the reduction in diversification is not easily interpreted. For example, what is the underlying strategy of a firm that appears to be de-diversifying? Which industries is it abandoning, and why? One plausible strategy, consistent with the ex-ante expectations of the effects of the Single Market, is that firms reduce diversification by abandoning marginal industries and by focussing around a "core business", i.e. expanding the output of industries related to the "core". Although the conventional notion of a multi-product firm is that there exists one primary activity, anecdotal evidence shows that large corporations often have more than one core business. In so far as diversification indexes fail to reflect this important feature of the corporate structure, comparing indexes through time may not reveal the most relevant changes.

3.2 Research strategy

As the definitions of "relatedness" and of "core business" appear themselves disputable, our research strategy consists in testing for alternative measures of relatedness and core. We start with a notion of relatedness that defines *related* all three digit industries within one single two digit industry. The core is therefore a two digit industry where the firm has several three digit operations. One novelty of this approach

[9] Conceptually, the number equivalent form identifies the number of hypothetical equal-sized output shares that would be required to generate the original diversification index, see also Davies & Lyons, 1996, Appendix 1.

is that the firm is in principle allowed to have more than one core business. However, it is implicitly assumed that only activities classified in the same 2-digit industry are related. Statistical offices cluster industries according to both technological characteristics of the production process and broad marketing similarities (e.g. vehicles and parts, chemical and pharmaceuticals, foods and beverages). Vertical integration is an obvious dimension of relatedness that this definition fails to capture, in spite of the fact that vertical links can explain why firms keep operating in different 2 digit industries[10]. Complementarity between industries sharing similar input and/or output markets is another unaccounted dimension[11]. For example, tin cans and glass and plastic containers share common output markets, i.e. the food and beverage industry. Pharmaceuticals and soap and detergents both use basic chemicals as intermediate products.

To account for the potential disadvantages of measures of relatedness and cores based on two digit industries, we adopt an alternative approach, that builds on the methodology introduced by Fan and Lang (2000). Exploiting the information available in the Italian Input-Output Tables for 1992, we construct two measures of relatedness between pairs of sectors, one for vertical relatedness and one for complementarity. The tables record for each sector j (92 sectors in total, of which 54 are manufacturing) the amount of inputs transferred to industry s (x_{js}). The input and output coefficients are respectively $a_{js}=x_{js}/X_s$ and $b_{js}=x_{js}/X_j$, where X_s (X_j) is the total output produced by industry s (j). High values of a_{js} (b_{js}) reveal that industry s (j) has important backward (forward) integration relationships with industry j (s). A similar interpretation applies for a_{sj} and b_{sj}[12].

An index of average *vertical relatedness* between industry j and s can be constructed by looking at their respective average backward and forward relationships[13]:

$V_{js} = (a_{js}+a_{sj}+b_{js}+b_{sj})/4$[14].

[10] See for example the following vertical productive chains: metal products-rubber-electrical goods-motor vehicles; electrical and electronic products-office equipment.

[11] As highlighted by Fan and Lang (2000), the definition of complementarity is broader than “horizontal integration” in that the former may cover different industries, whereas the latter is confined within the same industry.

[12] Note that even if industry j is an important input supplier for industry s, not necessarily s is an important destination industry for industry j. For example plastic products are very important inputs for the beverages industry, but the latter is not a very important destination industry for plastic manufacturers. To take another example, car manufacturing is the most important forward industry for manufacturers of tyres, but the tyres industry is not a very important backward industry for car manufacturers.

[13] For another example of how input-output tables can be used to infer measures of vertical integration, see Davies and Morris (1995).

[14] In this we depart from Fan and Lang (2000). By using the index $VB=(a_{js}+a_{sj})/2$ they are *de facto* exploring only the backward relationship between industries j and s.

An index of average *complementarity* between industries j and s can be constructed by looking at the similarity in their relationships with other industries as input providers or as output buyers. Starting from the inputs coefficient matrix (a_{js} as elements of the matrix) and the output coefficients matrix (b_{js} as elements of the matrix), we compute:

$C_{js} = ½ \cdot[\text{corr}(a_{kj},a_{ks})+\text{corr}(b_{jk},b_{sk})]$, for all k different from j and s.

In practice, $\text{corr}(a_{kj},a_{ks})$ is the correlation between the column j and the column s of the inputs coefficient matrix, measuring if the two industries have similar inputs flows; analogously, $\text{corr}(b_{jk},b_{sk})$ is the correlation between rows j and s of the output coefficients matrix, measuring if the two industries are similar in their output flows to the other k industries.

After having calculated V_{js} and C_{js} for each pair of industries, we check if firms in our sample operate into a set of vertically related and/or complementary sectors. This is done in different ways. First, we compute the relatedness between each industry in which the firm operates and its principal three digit industry ($C3_{jp}$ and $V3_{jp}$), under the assumption that the core business is the firm's main 3-digit activity. Second, we compute the average relatedness between industry j and all the other industries classified in the firm's largest 2 digit industry ($C2_{jp}$ and $V2_{jp}$), assuming that the core business of the firm corresponds to its main 2 digit industry. In section 4 we present descriptive statistics of the changing diversification patterns of EU leaders based on vertical relatedness and complementarity.

In section 5 we use our two definitions of relatedness, one based on the three-digit activities in the same two digit cluster, the other based on vertical relatedness and complementarity to investigate for EU leaders if the increase in the output share between 1987 and 1997 in industry j is positively related to a) the firm's sales in 1987 in the set of related sectors and b) the growth of sales in the set of related sectors.

4. Data and descriptive statistics

In this section we present summary statistics on firm diversification for 1987 and 1997 based on the Matrix of Market Shares database. The basic idea of the database is to identify a group of leading firms and disaggregate their turnover figures across the NACE 3-digit manufacturing industries in which it operates. A firm qualifies as a *leader* if it is one the five largest EU producers in at least one manufacturing industry. For each firm the matrix reports the full extent of its diversification across industries (not only includes those where it is a leader) as well as the full extent of intra EU multinational production. The database does not include the firm's output produced outside the EU, but non-EU multinationals that qualify as a top 5 leader in any industry are included[15].

A comparison of the basic dimensions of the matrices for 1987 and 1997 provides a quick guide to the major changes in firm diversification over this period (Table 1a).

By construction the number and identities of industries remain unchanged, but the number and identities of firms may well differ. In what follows, however, we abstract from firms' identities and present two highly stylised facts:

I. The number of firms, 223, remained substantially unchanged. However, the number of multi-product firms decreased by five units from 1987 to 1997.

II. The number of entries (the non-zero cells in the matrices, denoting the breakdown of firm output across industries) has remarkably decreased (from 1079 to 810, 25 percentage points), providing the first evidence of decline in diversification. As the number of *leading* entries is constant by construction (67 industries x 5 leading positions = 335), this fall is exclusively accounted for by *non-leading* entries - from 744 in 1987 to 475 in 1997. This pattern is confirmed by the drop in the average number of entries (from 4.84 to 3.63), that again is due exclusively to the reduction in *non-leading* diversification (from 3.34 to 2.13). Altogether, the evidence suggests that EU firms have reduced their diversification at the expense of industries in which they are not leaders.

In table 1b we separate firms that have survived in the matrix as leaders in at least one industry, from firms that either exited from or entered into the matrix between 1987 and 1997. Of the 223 initial leaders, 123 maintained a leadership position in 1997. In that we expect that the increasing competitive pressure favoured less diversified firms more than high diversifiers, we should find that entrants (i.e. new leaders) are less diversified than exitors, and survivors exhibit lower, or decreasing, diversification over the period. Overall, the empirical findings are consistent with the return to the core hypothesis. On the one hand, exitors (100 firms) were, on average, highly diversified and more diversified than the new leaders (100 entrants). On the other hand, surviving leaders (123 firms) exhibit relatively high diversification, which they reduced by the end of the period, albeit marginally. Not surprisingly, however, surviving leaders appear

[15] The original 1987 Matrix used the NACE classification Rev-0, but the 1997 Matrix had to be constructed using the new NACE Rev-1 classification, to ensure comparability with EUROSTAT industry data. Comparable firm data became available thanks to a major reclassification of the industry set (from 96 NACE-Rev 0 industries to 67 "sectors", in an effort to match the old and the new classifications), and of the country set (from 12 EC member states to 15 EU countries). See Davies and Lyons (1996) and KUL, UEA, CERIS and WIFO (2001).

to be the largest in the sample. As the positive correlation between diversification and firm size is a stylised fact in the empirical literature, a relatively higher degree of diversification is therefore to be expected.

4.1 Distribution of diversification across firms

In Tables 2a and 2b we report summary statistics on 2-digit and 3-digit diversification indices[16].

The two tables present the distributions of diversification indices across firms, by comparing the quartiles and extreme deciles of the distributions of NE (the Number equivalent of Entropy) and R (the output share in secondary industries), when firms are ranked by diversification. The changes in means calculated for 2-digit industries (Table 2a) appear to be consistent with a de-diversification process. EU leaders appear to have, on average, operations in 1.88 2-digit sectors in 1997, as opposed to 1.72 in 1987. Firms in the top decile of the distribution were operating in 3.16 2-digit industries in 1987, and in 2.80 ten years later. Looking through the indices in Table 2a, we find that highly diversified firms decreased diversification more substantially. At this level of aggregation, these preliminary findings are suggestive of rationalisations that eliminated operations in unrelated or marginal industries.

Turning to Table 2b we find that the evidence of de-diversification is only particularly pronounced when the Entropy index is used, thus suggesting that firms prevailingly retreated from marginal industries. Inspection of the R index reveals that the output share in secondary industries, on average, increased by 1 percentage point over the decade. Looking at the distributions of 3-digit indices we find that, throughout the period, the mean values of the index are overall remarkably stable. The only exception is that firms in the top decile (i.e. the most diversified firms) have increased their output shares in non-primary industries by 5 percentage points. Coupled with a decrease of the Entropy index, this suggests a reshuffling of output shares aimed at retreating from marginal activities (or at increasing in other, non-primary industries).

The finding that, in spite of a decrease in the Entropy, output shares in secondary three digit industries increased by 1%, leads us to inspecting the dynamics of output shares. Table 2c shows summary statistics of the output shares (OS) ranked by size for the sub-sample of surviving firms that are diversified in one or both years (108 out of 123 firms). OS I (II, III) industry is therefore the output share in the primary (secondary, third) 2- or 3-digit industry. The table reveals that, on average, the firms' turnovers are

[16] The original 67 industries, roughly corresponding to a 3 digit classification, have been grouped into 19 macro aggregates, roughly corresponding to a 2 digit classification.

highly concentrated in their primary industry, at both levels of disaggregation. The largest three-digit industry accounts for more than two thirds of the output, whereas the third industry ranked by size has an average output share of less than 10%. Comparing 2- and 3- digit results across time, however, we find a pattern consistent with the idea of refocussing and rebalancing of output shares. On the one hand, the primary 3-digit industry loses ground in favour of the industries that rank second (+1.8 percentage points) and third (+0.6), whereas the remaining marginal sectors reduce their shares by nearly 2 percentage points. On the other hand, the output share in the primary 2-digit industry increases by 1.5 points and, added up to the slightly increasing share in the secondary industry, amounts to 94.7% of the total output at the end of the period.

In general, the overall impression of a remarkable return to the core is somewhat weakened by these findings. Firms appear to have readjusted their corporate structure around a lower number of industries, but have not re-focussed the output share in their primary industry in any remarkable way. In other words, instead of a *return to core business*, we are documenting either a *return to core businesses* or a re-focussing on interrelated 3-digit industries. Looking at the results of table 2c, we note that the primary 2-digit industry can be a plausible proxy for a cluster of "core" of related industries.

4.2 *The new indexes, $C3_i$, $V3_i$, $C2_i$, $V2_i$*

Following our research strategy, we now turn to investigate if firms operate in a set of sectors related to their main 3 digit or 2 digit activity. $C3_i=\Sigma_j C3_{jp}\cdot x_j$ ($V3_i=\Sigma_j V3_{jp}\cdot x_j$) is a weighted average (with weights $x_j=S_{ij}/(S_i-S_{p3})$ being the output shares of industries j, excluding the primary 3 digit industry S_{p3}) for firm i of the complementarity (vertical relatedness) between each sector j and the firm's primary 3 digit industry. Analogously, $C2_i=\Sigma_j C2_{jp}\cdot s_j$ ($V2_i=\Sigma_j V2_{jp}\cdot s_j$) is a weighted average for firm i of the complementarity (vertical relatedness) between each sector j and all the activities classified in the firm's primary 2 digit industry[17].

Table 3a shows that complementarity with respect to both the primary 3-digit industry and the primary 2-digit industry has increased in the period, while the values of vertical relatedness have remained fairly stable. Compared to the average values of C_{js} and V_{js} in the Italian input output matrix, respectively 0.215 (maximum value = 1) and 0.0087 (maximum value = 0.2842), Table 3a reports much higher values for our data.

[17] $C2_{jp}$ and $V2_{jp}$ are in turn weighted averages of the relatedness between industry j and all the other industries belonging to the firm's main two digit activity: $C2_{jp}=\Sigma_j C_{jp}\cdot y_j$ ($V2_{jp}=\Sigma_j V_{jp}\cdot y_j$), for all j's included in the primary two digit industry, where weights are $y_j=S_{ij}/S_{p2}$.

This suggests that the EU leaders in our sample are diversified into industries which have remarkable links with the main 3 digit industry and with the largest 2 digit cluster. Moreover, by looking at the leading positions only (i.e. at all the j's in which the firm is a top 5 leader) we notice higher values for both complementarity and vertical relatedness. This suggests that relatedness with respect to the firm's main 3 digit or 2 digit industry is important for firms to reach or maintain leadership positions.

Table 3b, which reports average values of $C3_{jp}$, $V3_{jp}$, $C2_{jp}$ and $V2_{jp}$ for 676 firm/industry observations (i.e. excluding each firm's primary industry), records for all the indices lower values as compared to $C3_i$, $V3_i$, $C2_i$, $V2_i$ reported in Table 3a. Since the latter are simple averages (across all firms) of firm-level weighted averages, this implies that the industries with the highest output share are more related to the firm's primary 3-digit (2-digit) industry than the industries accounting for a small portion of the firm's output.

The second and third columns of Table 3b refer to the behaviour of entries and exits. The higher values in the third column of $C3_{jp}$ and $C2_{jp}$ suggest that, on average, firms entered industries which were complementary with respect to the primary 3-digit or 2-digit industry, and exited industries which were less related. The evidence for vertical relatedness is much weaker.

To summarise, the descriptive statistics show that complementarity between a firm's set of industries and its main 3 digit or 2 digit industry is high and increasing through time for our sample of firms. Conversely, the pattern for vertical relatedness is less clearly discernible (see also section 5).

In the next section we include $C3_{jp}$, $V3_{jp}$, $C2_{jp}$, and $V2_{jp}$ as explanatory variables in our econometric analysis. In addition we use the C_{js} and V_{js} variables obtained from the Input-Output tables to investigate if aggregating forces other than the primary 3 digit (2-digit) industry drive the restructuring/reorganization of diversification towards more related patterns.

5. Econometric evidence

5.1 An Empirical Model of Output Share Growth

To perform our analysis of "return to core business" amongst EU leaders in a period of market integration, we investigate the determinants of changes in firm output shares over the decade 1987-1997. The motivation of our choice of change in output share as the dependent variable is twofold. First, the joint analysis of diversification indices (Entropy and R index) has shown that the readjustment within the firm is mainly reflected in a reshuffling of its output shares. If the firm is refocussing around a set of related industries, marginal activities (small output shares) are abandoned (the output share decreases or goes to zero), and vice-versa. We study what drives this reshuffling. Second, the use of output share changes allows us to adopt a simple, but flexible empirical model of the growth of the firm (see Davies and Geroski, 1997). The starting point is the Gibrat's model of the dynamics of firm size, which postulates that firm growth rates are random and, therefore, that firm size follows a random walk. We adjust this conceptual framework to describe the growth of each industry (as measured by output shares) within the firms instead of the growth of firm size (as measured by market shares) within the industry. As output shares are bounded between zero and one, the simplest stochastic description of output shares growth is that they follow a random walk with regression to the mean. Therefore we write $\Delta OS_{ij} = \alpha + \lambda\ OS_{ij} + \mu_{ij}$, where $OS_{ij} = S_{ij} / S_i$ is firm's *i* output share in industry *j* at time t-1 (1987), S_{ij} is the firm's output in industry j and S_i is the firm's total output. If there is regression to the mean, λ is less than zero. This model can be easily extended to include a vector of firm and industry explanatory variables, X_{ij}. We then interact the firm's initial output shares at time t with the set of explanatory variables, thus allowing the parameters α and λ to vary across firms and industries (the industries in which the firm is operating in either one or both years). By interacting the initial output share with firm/industry specific variables, we investigate which variable is either making the regression to the mean less pronounced, or even driving the output share away from the regression to the mean. The final specification for the econometric investigation is therefore:

$$\Delta OS_{ij} = a + b\ OS_{ij} + c\ X_{ij} + d\ X_{ij}{*}OS_{ij} + \mu_{ij}$$

The original dataset is therefore rearranged to form an unbalanced panel where the two dimensions are N firms and I industries. By using the whole set of output shares for each surviving firm in 1987 and 1997, we fully exploit the informational content of the database. We present the econometric results of pooled regressions where the standard errors are robust to heteroscedasticity.

The empirical tests in this paper focus principally on the hypothesis that de-diversification among EU leaders has mainly occurred by re-focussing production around a core of related activities. We therefore include a specifically constructed variable designed to measure the extent to which each individual industry is related to a core of "related industries" in each firm. The remaining firm- or industry-specific variables are included mainly for control purposes, although they also contribute explaining what drives output shares' changes. Here follows the list of control variables and their definition.

As firm specific variables we include LFIRMSIZE87, the firm's size, measured by the log of total sales in 1987, and DIV87, firm *i*'s diversification index measured by the Number Equivalent of Entropy in 1987.

We then add three firm/industry specific variables. LEADER87 is a dummy variable that identifies if firm *i* was amongst the five 1987 EU leaders in industry *j*. ENTRY is a dummy variable that takes value 1 if firm *i* became an EU leader in 1997, in industry *j*. EXIT is a dummy variable, 1 if firm *i* was no longer a leader in 1997, in industry *j*.

Finally, we include an industry specific variable, designed to identify the set of industries that were supposed to be most affected by the implementation of the Single Market Programme, i.e. the so-called *sensitive* industries (Buigues, Ilzkovitz and Lebrun, 1990). We define SENSITIVE a dummy variable that is 1 if *j* is a SMP sensitive industry.

Our primary interest is for the variables designed either to capture relatedness or to measure the core. To account for the multifaceted notion of "relatedness" and of "core business", our research strategy consists in testing for alternative measures and alternative specifications. Insofar as industries that are related to a "core", however measured, grow faster than industries that are not related to the "core", the firm is pursuing a strategy of *related constrained diversification*. In Section 3 we described three alternative measures of relatedness, one simply based on the two-digit industry that includes the three-digit industry *j*, the other two based on average vertical relatedness and complementarity between industry *j* and the other industries in the product mix of the diversified firm *i.* $C3_{jp}$ measures the complementarity between industry j and firm *i*'s primary industry. $V3_{jp}$ measures the vertical relatedness between industry j and firm *i*'s primary industry. Similarly, $C2_{jp}$ and $V2_{jp}$ measure the weighted average vertical relatedness and complementarity between industry j and the remaining industries in the same 2-digit aggregate. A positive relationship between the output share change and $C3_{jp}$ and $V3_{jp}$ ($C2_{jp}$ and $V2_{jp}$) suggests that relatedness matters in driving the reshuffling of output shares and that the primary three-digit (two-digit) industry can be a plausible measure of the "core".

To operationalize other measures of relatedness, we construct two firm specific variables, i.e. one level (size) and one growth variable for the "core". The former adds up, for each firm, either the individual output shares in each two-digit industry or the output shares of all industries with vertical relatedness (V_{js}) and complementarity (C_{js}) above the sample medians[18]. The latter is the relative growth of either the firm's 2-digit

[18] The sample medians are 0.001 for $V3_{js}$ and 0.13 for $C3_{js}$.

industry or the firm's cluster of vertically related or complementary industries with respect to total firm growth, excluding industry *j*. In order to reduce reverse causality problems, both level and growth variables are computed excluding industry *j*.

To summarise, SHA2D87-j is firm *i*'s output share in *j*'s 2-digit industry, excluding OS_{ij}; and GROWTH2D-j is the relative growth rate of *j*'s 2-digit industry with respect to total firm growth, excluding industry *j*. Likewise, $SHACOM_{js}$ (and, analogously, $SHAVERT_{js}$) is firm *i*'s output share in the set of highly complementary (most vertically related) industries, and $GROWCOM_{js}$ ($GROWVERT_{js}$) is the relative growth rate of *j*'s most related industries with respect to total firm growth (excluding industry j). By including these variables we investigate the impact of clusters of related industries on industry *j*'s growth.

5.2 Econometric Results

We start with a simple specification that tests for the impact of the "Input-Output" relatedness variables, $C3_{jp}$ and $V3_{jp}$, on the changes of industry j's output shares, ΔOS_{ij} between 1987 and 1997. The data sample is comprised of the sample of surviving diversified firms in one or both years, i.e. 108 firms, but drops the primary industry's observation since $C3_{jp}$ and $V3_{jp}$ capture the relatedness of industry j with the firm's primary activity. This leaves us with 676 firm/industry observations. Table 4 summarises the results. We first note that both the firm's size and the initial output share in industry j, OS87, enter with a negative coefficient, the latter confirming regression to the mean. The extent of firm diversification in 1987 appears to display a negative effect on relative industry growth, thus suggesting that highly diversified firms may face some problems in allocating resources for growth, but the point estimate of the coefficient is not significant. The firm/industry controls all enter significantly in the equation, and their coefficients are signed quite consistently with common sense explanations. Being a LEADER in 1987 has a positive impact on the output share change, as might be expected if the firm intends to maintain the leadership. Similarly, becoming a leader (ENTRY) or losing a top position (EXIT) display, respectively, a positive and a negative effect on the relative growth of the industry. Indeed, we add these controls to avoid that the inclusion of turnover in leadership positions might unduly bias (emphasize) the effect of our relatedness variables. SENSITIVE enters the equation with a positive and significant coefficient, suggesting that, for EU leaders, operating in industries that were expected to be more affected by the Single Market leads to higher growth rates. Turning to the relatedness variables, we find that when we include both $V3_{jp}$ and $C3_{jp}$ (column (i)) only complementarity exhibits a positive and significant coefficient. This suggests that the higher the similarity in the input factors and output markets relationships between the industry and the firm's primary activity, the higher the change in industry j's output shares. The result in column (ii), where $C3_{jp}$ appears alone confirms the positive, growth-enhancing role of complementarity. Vertical relatedness is still not significant in column (iii), but investigating non-linearities we find an inverted-U quadratic relationship between $V3_{jp}$ and industry growth (column (iv)). Vertical links have a positive impact on the industry's growth, but only up to a certain threshold, beyond which it is plausible to presume that some firms may decide to de-verticalize[19]. This result bears some empirical relevance as to the long-standing issue in industrial organization that concerns the determinants of the boundaries of the firms, and certainly deserves further research[20]. In a set of unreported regressions we tested for the impact of $C2_{jp}$ and $V2_{jp}$, obtaining results very similar to those shown in Table 4.

Tables 5, 6, and 7 report the results of models where the output shares of the cluster of related industries, and their relative growth rates, are included as explanatory variables. These variables are further interacted with the initial (1987) output share in each industry to explore their impact on regression to mean.

We start with the results from the model reported in Table 5, that adds SHA2D87-j, the total output share in the 2-digit industry, to the control variables discussed above. The data sample includes all firm/industry observations for the sub-sample of surviving firms that were diversified in either 1987 or 1997 (108 firms, 784 observations). Column (i) reports the results of a specification excluding firm/industries controls and interacted variables. The initial output share, OS87, exhibits the usual negative and significant coefficient that denotes regression to the mean. The coefficients for the control variables have the same signs as those in Table 4, but are somewhat less significant. Our primary interest is for the output share of 2-digit industries, i.e. the core's size, and its relative growth rate. Both enter with positive and significant coefficients (although the coefficient for the level variable SHA2D87-j is only significant at the 10% level), indicating that the larger the initial output share of the subset of related industries, and the higher its growth rate, the higher the industry growth. This highlights the role of clusters of related activities in driving the refocussing of our sample of EU leaders. When we include the variables controlling for the leadership turnover, LEADER87, ENTRY, and EXIT, all highly significant and with the expected sign, we find that the coefficient on the 2-digit share loses

[19] The threshold is for $V3_{jp}$ equal to 0.19, a fairly high value if compared with the maximum value recorded for V_{js} in the Input-Output Matrix, i.e. 0.284.

[20] Interestingly, the inverse-U relationship does not hold for complementarity.

significance, but not the coefficient on the growth rate, GROWTH2D-j (see column (ii)). Column (iii) reports the result for the full specification, with all interactions, to investigate what variables make the regression to the mean of the 1987 output share less pronounced. Of the control variables that appear interactively with OS87, all enter the equation significantly and keep their signs, except LEADER87. This suggests, not surprisingly, that regression to the mean is less acute for industries in which firms become a leader over the period and more pronounced in those industries where they lost the leading position during the decade. Analogously, regression to the mean is less acute in sensitive industries. Of the variables accounting for the size and the growth of the "core", neither the level of output share nor its interaction is significant, whereas the growth variable is positive and significant in either form. This indicates that the larger the initial output shares in industry j, the stronger the growth-enhancing effect of the "core" as defined by the set of industries in the same 2-digit industry.

Table 6 expands the scope of our analysis by using two alternative definitions of "core business", one comprising only industries with vertical relatedness (V_{js}) greater than the sample median, the other comprising only industries with complementarity (C_{js}) greater than the sample median (see section 4).

Columns (i) and (ii) report the results of the specification that does not include the interactions with the initial output share in industry j. Again the coefficient on OS87 denotes regression to the mean and the control variables exhibit coefficients similar to those obtained in table 5. Turning to the variables that proxy for relatedness, however, we find that the size of the "core", as measured by the vertically related or complementary industries ($SHACOM_{js}$ and $SHAVERT_{js}$) both exhibit a negative sign (although only $SHACOM_{js}$ is significant at the 7% level). But when we look at the impact of the growth variables, $GROWCOM_{js}$ and $GROWVERT_{js}$ we find, consistently with the results in Table 5, that both exhibit positive and highly significant coefficients, suggesting a strong growth-enhancing effect of the "core". When we include the interacted variables in column (iii) and (iv), none of the interactions are significant. If any, the evidence suggests a negative effect of the initial size of the "core", and a positive effect of the growth of the core defined by complementarity ($GROWCOM_{js}$). In contrast, both $GROWCOM_{js}$ and $GROWVERT_{js}$, included separately, remain significant, displaying their strong positive effect on the industry growth.

In tables 4, 5 and 6 we considered separately three different definitions of "core", namely: i) the firm's primary 3 digit (2 digit) industry; ii) the 2-digit industries in which the firm operates; and iii) the clusters of vertically related or complementary industries. While the results so far suggest that firms are growing in industries linked to a 'core business', we have not yet performed a joint analysis of the three core measures.

Table 7 refines our results by including $V3_{jp}$ and $C3_{jp}$ along with the sizes and the growth rates of cores based on vertically relatedness and complementarity. This is the most restrictive specification, since we add, as a separate variable, the index of relatedness with the firm's primary industry that the common sense would describe as the activity most likely to aggregate (be related with) the other industries in the firm's product mix. Consistently with our empirical strategy in Table 4, we drop the firm/industry observations in the primary industry and remain with 676 observations. We find here many suggestive indications. First, column (i) reports the results for the 'complementarity' core and shows, quite surprisingly, that the coefficient for the complementarity with the primary industry, $C3_{jp}$, is positive but not significant. The size of the core, both separately and interactively is also not significant. Most importantly, however, both the separate and the interacted coefficients for the core's growth are positive and highly significant. This clearly indicates that, even controlling for relatedness with the primary industry, the growth of "cores" of complementary industries, via input and output markets, positively influences industry growth, actually contrasting regression to the mean. Second, the same effect does not appear to be at work when vertical relatedness is examined. In column (ii) the aggregating force appears to be the primary industry – $V3_{jp}$ enters with a positive and significant (the p-value is 0.07) sign. The growth of the vertically related core influences the industry growth directly, as in Table 6, but not interactively (the coefficient is negative, but not statistically significant). Third, when we include $C3_{jp}$ and $V3_{jp}$ in the specification with the '2-digit core', only the former enters positively and significantly, but then both the size and the growth of the 2-digit "core" lose their effect (columns (iii) and (iv)). Only the positive coefficient on the separate growth variable (GROW2D-j) remains (weakly) significant after the inclusion of $C3_{jp}$ and $V3_{jp}$ (p-values are 0.12 and 0.13 respectively). In a set of unreported regressions we included $C2_{jp}$ and $V2_{jp}$, industry j's relatedness with the primary 2-digit industry. The results show that neither $C2_{jp}$ nor $V2_{jp}$ enter significantly in the equation, but the coefficients on both the growth "core" variable and its interaction with OS_{ij} are positive and significant, consistently with our results in Table 5. It should be noted, however, that the data sample for the regressions with $C2_{jp}$ and $V2_{jp}$ included the firms' observations for the primary three-digit industry (784 firm/industry observations). We interpret these findings as evidence of the aggregating force of the 2-digit "core" that includes the primary 3-digit[21].

[21] For all estimated models, we tested the robustness of our results by estimating panel regressions with one-way effects and robust standard errors. Overall our findings were found to be robust to this change in estimating techniques.

6. Conclusions

According to ex-ante expectations of the benefits of the Single European Market, one of the effects of the increased competitive pressure within the EU on corporate structure was to drive firms to reduce the extent of their product diversification and refocus on their core business. Evidence of the return to the core business for European firms based on the most commonly used diversification indices is unclear. One drawback of diversification indexes is that they do not capture the qualitative dimension of multi-product strategies, i.e. the extent to which different activities are related to each other and to the core business. Empirical research in this field usually equates the reduction in diversification to an unqualified "return to core strategy", thus neglecting the relatedness content of changing diversification patterns.

This paper departs from previous studies by investigating if firms have de-diversified by increasing the relatedness of their activities. As relatedness and core business are not uniquely defined, our research strategy consists in testing for the impact of different measures of relatedness and core. One is simply based on the two-digit industry that includes a given three-digit industry j. To construct the other two measures, one for vertical relatedness, one for complementarity (similarity between the input and output markets), we exploit the information available in Input-Output Tables (see Fan and Lang, 2000). We define accordingly the core of industry j as the set of industries recording vertical relatedness or complementarity indexes above the sample medians. We apply these definitions to firm level data included in the Market Shares Matrix for EU manufacturing leaders in 1987 and in 1997. This unique database reports for each EU leader the breakdown of its output across 3-digit manufacturing industries. We then use the firm's output shares (the share of the firm's total output accounted for by each industry) to construct alternative measures of "core" sizes by adding up, for each firm, the output shares in industries that: i) belong to a given 2-digit industry, ii) record vertical relatedness indexes, or iii) complementarity indexes above the sample medians. Similarly, we construct three additional measures of the relative growth of the cores (with respect to the firm's growth). We finally use the size and the relative growth rates of the "cores" as well as indexes of the vertical relatedness or complementarity between industry j and the firm's primary industry as explanatory variables in a model of output share growth (see Davies and Geroski, 1997). The choice of output share change as dependent variable is motivated by our descriptive analysis that shows that the readjustment within the firm is mainly reflected in a reshuffling of output shares.

We estimate a set of specifications including, alternatively or jointly, our measures of cores and relatedness. We use different data samples, either including or excluding the observations for the primary three-digit industry.

Our main results may be summarised as follows.

i. The 3-digit industry where the firm produces the largest share of its output (the primary 3-digit industry) represents an aggregating "inner core" that drives the relative growth of related industries. In fact we find that the higher the complementarity with the primary 3-digit industry the higher the industry's output share change.

ii. Our results from the specification with the industry's 2-digit "core" refines the above findings indicating that the 2-digit industry represents itself a "broader core" with an aggregating force, but only if it includes the primary 3-digit industry. Diversified activities build around a core that is bounded by the 2-digit definition.

iii. When we drop the firm's primary 3-digit industry and control for the driving force of the "inner 3-digit core", we find that also non-primary industries tend to build around cores of complementary industries.

Our results have interesting implications for the understanding of the readjustment of European leaders' corporate structures in the years of EU market integration. They suggest that, in spite of limited evidence of de-diversification (as measured by conventional indices) firms pursued strategies of related constrained diversification. On the one hand we find evidence that refocussing has occurred and that the reshuffling of output shares mainly reflects the growth of industries related to the firm's primary (3-digit) industry. On the other hand, we find that also remaining industries – i.e. those unrelated to the primary 3-digit -, appear to be clustering based upon the similarity between input and output markets (complementarity). In this respect our findings support the view that European producers are moving toward a more efficient use of their resources.

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Table 1a
Changes in the matrix between 1987, 1993 and 1997 aggregate EU figures

	1987	**1997**
Number of Industries	67	67
Number of Firms	223	223
Number of Diversified Firms	175	170
Number of entries (*non-zero cells)*	**1079**	**810**
of which:		
Leading	*335*	*335*
Non-leading	*744*	*475*
Number of entries per firm	**4.84**	**3.63**
of which:		
Leading	*1.50*	*1.50*
Non-leading	*3.34*	*2.13*

Table 1b
Diversification of survivors, entrants and exitors
Arithmetic mean values of NE, R

	N. Firms	*Size*	**Number equivalent of Entropy**		**Output share in secondary industries**	
			1987	*1997*	*1987*	*1997*
Survivors	123	6147	2.67	2.45	0.28	0.29
Exitors	100	1502	2.57	-	0.27	-
Entrants	100	1859	-	2.03	-	0.22
Full Matrix Sample	223	-	2.62	2.25	0.27	0.25

Table 2a
Distribution of diversification across surviving firms
(19 2-digit industries)

	Number equivalent of Entropy			Output share in secondary industries		
	1987	*1997*	*Change 1997-87*	*1987*	*1997*	*Change 1997-87*
Arithmetic mean values of D						
Surviving Matrix Firms	1.88	1.72	-0.16	0.19	0.17	-0.01
Std. Dev.	0.95	0.89	-0.06	0.18	0.19	0.02
Distribution of D across firms						
Decile 9	3.16	2.80	-0.36	0.46	0.50	0.04
Quartile 3	2.32	2.02	-0.30	0.34	0.30	-0.04
Median	1.60	1.38	-0.21	0.14	0.10	-0.04
Quartile 1	1.13	1.00	-0.13	0.02	0.00	-0.02
Decile 1	1.00	1.00	0.00	0.00	0.00	0.00

Table 2b
Distribution of diversification across surviving firms
(67 3-digit industries)

	Number equivalent of Entropy			Output share in secondary industries		
	1987	*1997*	*Change 1997-87*	*1987*	*1997*	*Change 1997-87*
Arithmetic mean values of D						
Surviving Matrix Firms	2.67	2.45	-0.22	0.28	0.29	0.01
Std. Dev.	1.79	1.55	-0.24	0.22	0.24	0.02
Distribution of D across firms						
Decile 9	4.79	4.56	-0.23	0.56	0.61	0.05
Quartile 3	3.42	3.07	-0.35	0.46	0.47	0.01
Median	2.15	1.97	-0.18	0.28	0.29	0.01
Quartile 1	1.36	1.17	-0.19	0.07	0.04	-0.03
Decile 1	1.00	1.00	0.00	0.00	0.00	0.00

Table 2c
Distribution of Output Shares, Ranked by Size. 108 Surviving Diversified Firms
(percentages, mean values). $OS_{ij} = S_{ij} / S_i$

	2-digit		3-digit	
	1987	*1997*	*1987*	*1997*
OS I Industry	79.6	81.1	68.0	67.4
OS II Industry	13.5	13.6	17.0	18.8
OS III Industry	4.2	3.4	6.7	7.3
OS in remaining industries	2.7	1.9	8.3	6.5
Total	100.0	100.0	100.0	100.0

Table 3a
Summary statistics of Vertical Relatedness and Complementarity
Firm averages (1)

		1987	*1997*	*Leading positions in 1987*	*Leading positions in 1997*
No. Firms		*101*	*96*	*101*	*96*
Complementarity with Primary 3-digit ($C3_i$)	Mean	0.485	0.509	0.539	0.532
	Std Dev	*0.254*	*0.261*	*0.309*	*0.278*
Vertical relatedness with Primary 3-digit ($V3_i$)	Mean	0.046	0.044	0.059	0.053
	Std Dev	*0.049*	*0.047*	*0.060*	*0.060*
Complementarity with Primary 2-digit ($C2_i$)	Mean	0.521	0.544	0.588	0.580
	Std Dev	*0.244*	*0.256*	*0.291*	*0.275*
Vertical relatedness with Primary 2-digit ($V2_i$)	Mean	0.047	0.047	0.058	0.054
	Std Dev	*0.046*	*0.043*	*0.055*	*0.053*

Note 1: Primary industry excluded.

Table 3b
Summary statistics of Vertical Relatedness and Complementarity
Firm/industries averages (1). Relatedness of Exits and Entries

		Total	*Exit from Top 5*	*Entry in Top 5*
No. Firms / Industries		*676*	*307*	*122*
Complementarity with Primary 3-digit ($C3_{jp}$)	Mean	0.392	0.320	0.416
	Std Dev	*0.278*	*0.248*	*0.279*
Vertical relatedness with Primary 3-digit ($V3_{jp}$)	Mean	0.027	0.019	0.021
	Std Dev	*0.044*	*0.035*	*0.035*
Complementarity with Primary 2-digit ($C2_{jp}$)	Mean	0.413	0.335	0.413
	Std Dev	*0.277*	*0.251*	*0.274*
Vertical relatedness with Primary 2-digit ($V2_{jp}$)	Mean	0.029	0.020	0.021
	Std Dev	*0.042*	*0.036*	*0.032*

Note 1: Primary industry excluded.

Table 4
Determinants of Output-Share Change (1987-1997)
Pooled Regressions
108 Firms, 676 Firm/Industry observations
Dependent Variable: ΔOS_{ij}

	(i)	*(ii)*	*(iii)*	*(iv)*
OS87	-0.272 *(-3.135)*	-0.273 *(-3.169)*	-0.269 *(-3.064)*	-0.275 *(-3.157)*
$C3_{jp}$	0.024 (1.881)	0.024 *(2.241)*	-- --	-- --
$V3_{jp}$	-0.003 *(-0.030)*	-- --	0.076 *(0.978)*	0.406 *(2.251)*
$V3_{jp}$ Squared	-- --	-- --	-- --	-2.111 *(-1.973)*
LEADER87	0.100 *(5.251)*	0.100 *(5.267)*	0.102 *(5.296)*	0.100 *(5.254)*
ENTRY	0.126 *(8.116)*	0.126 *(8.103)*	0.128 *(8.312)*	0.130 *(8.407)*
EXIT	-0.145 *(-7.521)*	-0.145 *(-7.475)*	-0.145 *(-7.514)*	-0.140 *(-7.457)*
SENSITIVE	0.013 *(2.043)*	0.013 *(2.052)*	0.013 *(2.140)*	0.013 *(2.065)*
DIV87	-0.001 *(-1.113)*	-0.001 *(-1.110)*	-0.001 *(-1.330)*	-0.001 *(-1.247)*
LFIRMSIZE87	-0.013 *(-3.755)*	-0.013 *(-3.744)*	-0.013 *(-3.826)*	-0.014 *(-4.191)*
Constant	0.100 *(3.579)*	0.100 *(3.568)*	0.112 *(3.892)*	0.119 *(4.163)*
Adjusted R-squared	0.250	0.251	0.248	0.251

Notes: Results corrected for heteroskedasticity. t-statistics in parentheses.

Table 5
Determinants of Output-Share Change (1987-1997)
Pooled Regressions
108 Firms, 784 Firm/Industry observations
Dependent Variable: ΔOS_{ij}

	(i)	*(ii)*	*(iii)*
OS87	- 0.112	-0.203	-0.294
	(-4.842)	*(-6.323)*	*(-4.268)*
SHA2D87-j	0.020	0.007	0.015
	(1.860)	*(0.727)*	*(1.389)*
GROWTH2D-j	0.016	0.011	0.005
	(3.984)	*(3.186)*	*(1.668)*
LEADER87	--	0.090	0.083
	--	*(4.745)*	*(4.228)*
ENTRY	--	0.129	0.096
	--	*(7.906)*	*(5.626)*
EXIT	--	-0.168	-0.097
	--	*(-6.967)*	*(-3.827)*
SENSITIVE	0.013	0.019	0.003
	(1.601)	*(2.533)*	*(0.479)*
DIV87	-0.001	-0.002	--
	(-0.914)	*(-1.590)*	--
LFIRMSIZE87	-0.004	-0.007	-0.012
	(-1.173)	*(-1.989)*	*(-3.494)*
SHA2D87-j * OS87	--	--	-0.087
	--	--	*(-0.562)*
GROWTH2D-j * OS87	--	--	0.047
	--	--	*(2.900)*
LEADER87 * OS87	--	--	0.073
	--	--	*(1.080)*
ENTRY * OS87	--	--	0.463
	--	--	*(2.318)*
EXIT * OS87	--	--	-0.387
	--	--	*(-2.395)*
SENSITIVE * OS87	--	--	0.116
	--	--	*(2.739)*
Constant	0.049	0.066	0.102
	(1.734)	*(2.284)*	*(3.517)*
Adjusted R-squared	0.072	0.242	0.321

Notes: Results corrected for heteroskedasticity. t-statistics in parentheses.

Table 6
Determinants of Output-Share Change (1987-1997)
Pooled Regressions
108 Firms, 784 Firm/Industry observations, Dependent Variable: ΔOS_{ij}

	(i)	*(ii)*	*(iii)*	*(iv)*
OS87	-0.192	-0.208	-0.266	-0.269
	(-6.320)	*(-6.441)*	*(-3.767)*	*(-4.079)*
$SHACOM_{js}$	-0.038	--	-0.005	--
	(-1.782)	--	*(-0.335)*	--
$SHAVERT_{js}$	--	-0.036	--	-0.010
	--	*(-1.427)*	--	*(-0.633)*
$GROWCOM_{js}$	0.032	--	0.026	--
	(8.238)	--	*(8.319)*	--
$GROWVERT_{js}$	--	0.009	--	0.010
	--	*(2.644)*	--	*(2.920)*
LEADER87	0.082	0.094	0.078	0.098
	(4.698)	*(5.039)*	*(4.499)*	*(5.039)*
ENTRY	0.111	0.133	0.081	0.095
	(7.528)	*(7.861)*	*(5.124)*	*(5.366)*
EXIT	-0.162	-0.173	-0.100	-0.117
	(-7.364)	*(-7.287)*	*(-4.608)*	*(-4.582)*
SENSITIVE	0.018	0.018	0.003	0.002
	(2.566)	*(2.392)*	*(0.639)*	*(0.335)*
DIV87	0.001	-0.0003	--	--
	(0.664)	*(-0.186)*	--	--
LFIRMSIZE87	-0.007	-0.008	-0.009	-0.011
	(-2.013)	*(-2.134)*	*(-3.054)*	*(-3.250)*
SHACOM * OS87	--	--	-0.184	--
	--	--	*(-1.117)*	--
SHAVERT * OS87	--	--	--	-0.230
	--	--	--	*(-1.500)*
$GROWCOM_{js}$ * OS87	--	--	0.043	--
	--	--	*(1.226)*	--
$GROWVERT_{js}$ * OS87	--	--	--	-0.008
	--	--	--	*(-0.196)*
LEADER87 * OS87	--	--	0.072	0.041
	--	--	*(1.158)*	*(0.685)*
ENTRY * OS87	--	--	0.430	0.514
	--	--	*(2.503)*	*(2.402)*
EXIT * OS87	--	--	-0.322	-0.314
	--	--	*(-2.356)*	*(-1.896)*
SENSITIVE * OS87	--	--	0.099	0.115
	--	--	*(2.237)*	*(2.625)*
Constant	0.063	0.071	0.089	0.101
	(2.430)	*(2.530)*	*(3.451)*	*(3.557)*
Adjusted R-squared	0.296	0.238	0.351	0.299

Notes: Results corrected for heteroskedasticity. t-statistics in parentheses.

Table 7
Determinants of Output-Share Change (1987-1997)
Pooled Regressions, 108 Firms, 676 Firm/Industry observations, Dependent Variable: ΔOS_{ij}

	(i)		*(ii)*		*(iii)*		*(iv)*	
OS87	-0.534	*(-3.727)*	-0.722	*(-4.305)*	-0.713	*(-5.476)*	-0.711	*(-5.497)*
$SHACOM_{js}$	-0.021	*(-1.297)*	--	--	--	--	--	--
$SHAVERT_{js}$	--	--	-0.013	*(-0.778)*	--	--	--	--
SHA2D87-j	--	--	--	--	0.005	*(0.480)*	0.007	*(0.667)*
$GROWCOM_{js}$	0.011	*(3.318)*	--	--	--	--	--	--
$GROWVERT_{js}$	--	--	0.012	*(3.543)*	--	--	--	--
GROWTH2D-j	--	--	--	--	0.006	*(1.573)*	0.006	*(1.515)*
LEADER87	0.056	*(2.831)*	0.057	*(2.324)*	0.047	*(1.993)*	0.048	*(2.040)*
ENTRY	0.087	*(5.364)*	0.088	*(5.240)*	0.083	*(4.930)*	0.085	*(5.097)*
EXIT	-0.082	*(-4.092)*	-0.061	*(-2.569)*	-0.058	*(-2.358)*	-0.056	*(-2.263)*
SENSITIVE	-0.002	*(-0.357)*	-0.006	*(-1.001)*	-0.007	*(-1.103)*	-0.007	*(-1.075)*
$C3_{jp}$	0.010	*(1.070)*	--	--	0.021	*(1.953)*	--	--
$V3_{jp}$	--	--	0.117	*(1.802)*	--	--	0.095	*(1.256)*
LFIRMSIZE87	-0.014	*(-5.101)*	-0.016	*(-4.894)*	-0.015	*(-4.826)*	-0.016	*(-4.897)*
SHACOM * OS87	0.029	*(0.084)*	--	--	--	--	--	--
SHAVERT * OS87	--	--	-0.142	*(-0.373)*	--	--	--	--
SHA2D87-j * OS87	--	--	--	--	-0.108	*(-0.653)*	-0.124	*(-0.744)*
$GROWCOM_{js}$ * OS87	0.419	*(4.735)*	--	--	--	--	--	--
$GROWVERT_{js}$ * OS87	--	--	-0.071	*(-1.390)*	--	--	--	--
GROWTH2D-j * OS87	--	--	--	--	0.045	*(0.547)*	0.042	*(0.515)*
LEADER87 * OS87	0.275	*(1.503)*	0.563	*(2.515)*	0.606	*(3.004)*	0.605	*(3.004)*
ENTRY * OS87	0.300	*(1.666)*	0.781	*(5.001)*	0.850	*(5.815)*	0.840	*(5.699)*
EXIT * OS87	-0.148	*(-0.867)*	-0.707	*(-3.224)*	-0.664	*(-3.074)*	-0.685	*(-3.102)*
SENSITIVE * OS87	0.210	*(1.408)*	0.408	*(2.352)*	0.422	*(2.471)*	0.435	*(2.524)*
Constant	0.132	*(5.532)*	0.147	*(5.221)*	0.138	*(4.898)*	0.147	*(5.109)*
Adjusted R-squared	0.481		0.359		0.356		0.354	

Notes: Results corrected for heteroskedasticity. t-statistics in parentheses.

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