EXPLAINING CORPORATE STRUCTURE: THE MD MATRIX, PRODUCT DIFFERENTIATION AND SIZE OF MARKET

by

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Abstract

Conventional explanations of diversification and multinationality both point to the existence of intangible assets as a driving force. Using a new database of leading EU firms in 100 NACE 3-digit industries, we devise a classificatory scheme which allows us to analyze multinationality and diversification jointly. We find that product differentiation and home market primary industry size constraints impact differently on different types of diversified firms. For instance, it appears that the causes of home country diversification are qualitatively different from those of diversification abroad.

JEL Classification: L1, L2

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1. Introduction

Conventional explanations of firm diversification and multinationality display striking similarities; for example, both point to the existence of intangible specific assets as often the driving force, and constraints on growth in the firm's primary/home market are often posited as an important push factor. Yet, in spite of this commonality, the empirical literatures on the two subjects have remained largely independent. The present paper attempts to redress this by examining the incidence of the two phenomena simultaneously for a sample of the leading firms in the European Union, in which 100 three-digit industries and eleven member states respectively define the product and geographic spaces1.

Part of the novelty derives from the data employed: as far as we know, this is the first ever attempt to explore the interface between these two elements of corporate structure at this level of disaggregation for the EU observed as a single entity. We develop a typology of different classes of firms which distinguishes multinationality in primary and secondary industries (or, equivalently, which distinguishes diversification at home and abroad). This enables us to explore a number of hypotheses which tend to be overlooked when multinationality and diversification are examined separately. For example, are diversification and multinationality substitutes or complementary strategies? Does the type of specific asset matter? Is there a "typical" pattern for corporate structure as firms grow?

Sections 2 and 3 provide the background by briefly summarising the existing literature and describing the main features of our database. Section 4 introduces the notion of an MD matrix which allows us to formalise the inter-relationship between multinationality and diversification and suggests a typology of classes of firm. Section 5 applies this typology to the database and distinguishes differences between the classes in terms of firm and industry characteristics. Section 6 uses multinomial logit analysis to examine whether specific assets and size constraints impact differently on the different classes of firm. Section 7 concludes.

1 This paper is an off-shoot of a recently completed project on the industrial organisation of the EU (Davies, Lyons et al, 1996).

2. Brief review of the literature

The conventional literatures on why firms choose to be multinational or diversified are sufficiently well known not to require lengthy rehearsal here. Two recent survey papers in the Journal of Economic Perspectives provide succinct summaries (Markusen (1995) on multinationality, and Montgomery (1994) on diversification). The multinational firm is often viewed as having some special advantage which it can only properly exploit in foreign markets by actually producing in them (e.g. Dunning, 1981). This might be some sort of managerial skills, but it is more commonly associated with product differentiation and/or technological know-how (e.g. Caves, 1982). According to this intangible asset story, massive R&D and advertising expenditures are often at the root of a firm-specific competitive advantage which is best exploited by local production because of high transaction and agency costs. Similarly, it is argued that growth-oriented firms diversify because they are able to exploit some technological or marketing asset in other industries than their original one, see Coase (1937) and Penrose (1959). Whenever critical organizational resources, e.g. know-how and brand name, display characteristics of public goods and can be used in different activities, economies of scope fuel diversification, provided transfer via markets is costly relative to internal allocation (Teece, 1980)2.

Of course, it is hardly surprising that the two literatures are parallel, after all, multinational operations may be seen merely as geographical diversification. What is more interesting is whether a joint analysis offers additional insights. Perhaps most obviously, if both diversification and multinationality are driven by the same intangible asset story, we might ask why are some firms multinational without being diversified and vice-versa? (Is the asset a 'public good' within the firm, or is it in finite supply?) Similarly, why do some firms diversify (go multinational) only in their

2 Undoubtedly, this is a narrow characterisation of both literatures; other important motives cited for multinationality include the strategic and anti-competitive, and, for diversification, the potential agency problem, in which growth-oriented managers may pursue diversification which has no strong industrial logic. We do not pursue oligopolistic motives in this paper due to lack of suitable data; but we do return later to the possibility that some diversification may be "illogical".

country of origin (core industry), while others are also diversified (multinational) in other countries (industries)? Does the type of specific asset matter, with some more suited to multinational expansion while others are more suitable to diversification? Moreover, if multinationality and diversification are both strategies for escaping constraints to growth in the firm's primary industry in its home country, are they typically pursued simultaneously or sequentially? Is there a "typical" sequence in the growing firm, with, say, home diversification followed by primary industry multinationality, and then diversification abroad?

We mentioned in the introduction that it is rare to find multinationality and diversification considered jointly, but there is a small and intermittent empirical literature which does this. As is often the case, Caves has been a major contributor (1975, 1982 and, with Hisey, 1985). Thus he argues (1975) that "in short-run the firm cannot expand freely in both directions. In the long term the successful and growing firm can diversify in both ways, but the adversary relation between them may still remain." Earlier, Bertin (1972) had found no evidence that multinationality and diversification were substitutes, but he suggested that firms might concentrate on one or the other at different points in time. Using Swedish data, Swedenborg (1979) found no statistical relationship between the two, whilst Horst (1974) found that multinationality and diversification tend to go hand in hand so far as the food industries are concerned. The most recent study known to us is by Pearce (1993), in which he concludes that "ID (diversification) and internationalisation occur together, in a manner that may often imply a direct causal relationship which is only effectively opposed by resource constraints at relatively high levels". He also reports that both multinationality and diversification are strongly related to firm size. However, we prefer to interpret his results as essentially descriptive, rather than behavioural or causal. Simple regressions of multinationality on diversification are not evidence of causality since, as we show below, the two are often jointly determined.

3. The database and the MD matrix

Against this backcloth, we use a new integrated database for a set of leading european firms. This was first assembled as part of a wide ranging study of the structure of European Union (EU) manufacturing and is fully discussed in Davies and Matraves (1996). The salient features for present purposes are that it comprises 313 firms, observed for 1987; it covers the firms' EU production in 100 3-digit manufacturing industries and in the 11 member states. The sample is not random; rather it was deliberately constructed so as to include the five leading producers (at the EU level) in each of the 100 industries. Since many of these firms are, in fact, leaders in more than one industry, they total 313 rather than 500. Although the criterion for including a firm is that it should occupy at least one leading position (as just defined), the data are not confined only to firms' outputs in those industries in which they are leaders - once any firm was found to satisfy the basic criterion, we endeavoured to identify its outputs in all industries in which it operated. Moreover, we disaggregated its aggregate EU production in each industry into separate figures for each member state in which it was produced3.

The sample includes nearly all firms with large aggregate size: according to our calculations, 97 of these firms are amongst the EU's largest 100 manufacturing firms. Finally, two special features of the sample should be borne in mind throughout: it takes no account of any operations the firms may have outside the EU, and it includes 36 firms who are subsidiaries of non-EU owned parents - for these firms too, no account is taken of their operations outside the EU.

3.1 Measures of Aggregate Diversification and Multinationality

Thus, for firm i (where the i subscript is suppressed throughout), we have a complete mapping of its EU production in both product and geographic spaces, defined respectively by N industries (j = 1,....,N) and S countries (k = 1,....,S); x_{jk} will denote i's output in industry j in country k. This is

3 The main source of information was company reports, supplemented by business directories and national production censuses. The 100 industries account for 99% of total EU manufacturing output, and the 313 firms account for about one third of this. The EU is defined here as the 12 member states in 1987, with Belgium and Luxembourg amalgamated.

shown conceptually in Figure 1, using a simple expositional device which we name the MD (Multinationality-Diversification) matrix.

From the data reported in such a matrix, a variety of indices of multinationality and diversification can be readily computed. For example, using the row totals, Berry's (1975) traditional index of diversification is estimated as:

$$D = 1 - \Sigma_j (x_{j.})^2/(x_{..})^2 \qquad (1)$$

and an analogous measure of multinationality can be derived from the column totals:

$$M = 1 - \Sigma_k (x_{.k})^2/(x_{..})^2 \qquad (2)$$

These indices have familiar properties4: a firm specialized in a single industry records D = 0, while one spreading its output equally across N industries records D= (N-1)/N, tending to unity as N becomes large; similarly, a firm which operates in a single country records M =0, while one having equal sized operations in all countries has M= (S-1)/S.

3.2 Evidence on Aggregate Multinationality and Diversification

These indices, as defined, are both aggregate: D in the sense that it refers to the EU as a single entity, and M in the sense that it refers to the aggregate manufacturing sector. While the thrust of our argument in this paper is that a much richer picture can be uncovered by disaggregating, a brief analysis of the aggregate indices for the sample firms, as in Table 1, serves as a useful scene-setter5.

4 Our preference for Herfindahl(H)-type indexes merely reflects the widespread acceptance of the H concentration index and Berry's D index in the existing literature. Many other indexes would be equally appropriate, for example, the Entropy family, so long as they have suitable decomposition properties.

5 This table covers the same ground as Davies, Rondi and Sembenelli (1996) but more briefly, and with a few minor definitional differences.

(i) Two-thirds of the firms are diversified while only one half are multinational[6]; and 130 firms are both multinational and diversified, while only 22 are specialist multinationals and 81 are diversified uni-nationals. In a crude sense then, diversification appears to be an easier route to follow than multinationality; but, more often than not, multinationality and product diversification are used as complementary strategies rather than substitutes.

(ii) Multinationality is more common in industries characterised by "product differentiation", and superficially the same is true for diversification. This is the message of part (ii) to Table 1, in which each firm has been allocated a core (or primary) industry, and where industries have been designated as associated with "differentiated" products if they exhibit typically high advertising and/or R&D expenditures. The table shows the proportion of firms in each cell originating from such industries; for instance, only 29% of the specialised uni-nationals come from differentiated product industries. Reading down the "total" column, a standard binomial test reveals that multinational firms are significantly more likely than uni-nationals to be associated with differentiated products; and reading across the "total" row, a similar difference emerges between diversified and specialised firms. However, an intriguing twist is revealed when comparing the constituent cells within the table. On the one hand, reading down each of the first two columns, the significant positive association between multinationality and differentiation is confirmed: multinationality is more likely when products are differentiated - within both sets of diversified and specialised firms. On the other hand, reading across the first two rows, the diversification-differentiation association collapses once multinationality is controlled for. In other words, within

6 Here, we define a firm as diversified (multinational) only if its D(M) value exceeds 0.095. This effectively ignores 'trivially small' amounts of diversification/multinationality which may be the result of measurement error. Our main datasources are company reports which are not always careful, when describing smaller subsidiaries, to define industry of production precisely, or to distinguish foreign production from merely selling operations. This critical value corresponds to a hypothetical firm operating in two industries (countries), of which the main industry (country) accounts for 95% of the total.

both sets of, multinational and uni-national, firms, there is no significant tendency for diversification to be associated with product differentiation.

(iii) Both diversification and multinationality tend to increase with aggregate firm size: as shown in Table 1(iii) the mean values of D and M increase monotonically through the aggregate size distribution. This is a familiar result from previous studies, but it is hardly surprising. Certainly, it does not establish causality since higher diversification (multinationality) may be the means for achieving larger size7. Rather more interesting is how the diversification-multinationality mix changes with firm size: amongst the smaller size classes, the ratio of mean D to mean M increases rapidly, but then declines noticeably amongst the middle classes, before stabilising between the two largest size classes8. This raises the intriguing possibility that we may be able to stylise the dynamics of corporate structure in terms of various stages. In a first stage, at small scales, firms are typically specialised uni-nationals, but as they encounter constraints on growth in their primary industry/home country, second stage expansion typically entails diversification into new industries at home. This is then followed by a third stage, in which foreign operations are added to home diversification. Finally, the firm becomes large enough, with a sufficiently broad specific-asset base, to enter into a fourth stage by moving to full multinationality in both primary and secondary industries, with diversification and multinationality then increasing more or less in tandem.

4. A Classificatory Scheme for Corporate Structure

7 Indeed, it can be argued that firm size is tautologically related to multinationality and diversification: Davies and Lyons (1996, chapters 9 and 11) derive two identities which reveal this quite clearly. The first shows that aggregate size can be decomposed in product space into three constituent parts: (i) diversification, (ii) typical market share and (iii) typical industry size. Analogously, the second shows how aggregate size can be decomposed in geographic space into: (i) multinationality, (ii) typical country share and (iii) typical country size.

8 This is also shown by a multiple regression of the D/M ratio against aggregate firm size, using the individual firm observations. A significant cubic relationship is found, and this is robust to the inclusion of other explanatory (dummy) variables representing the firm's country of origin and whether or not its home industry is differentiated. For reasons given above, such a regression does not, of course, establish causality.

To delve much further empirically - into both the puzzle concerning the diversification-differentiation relationship and the hypothesised stylised "growth" path - we will need to disaggregate, distinguishing diversification at home from diversification abroad. Our database is ideally suited for this purpose.

Returning to Figure 1, we can also calculate the firm's diversification within individual countries (columns) and its multinationality within individual industries (rows):

$$D_k = 1 - \Sigma_j (x_{jk})^2/(x_k)^2 \qquad (3)$$

$$M_j = 1 - \Sigma_k (x_{jk})^2/(x_j)^2 \qquad (4)$$

We can derive the relationship between the aggregate indices and these constituent indices by next defining "typical"[9] within-country diversification as:

$$d = \Sigma_k v_k D_k \text{ where } v_k = x_{.k}^2/\Sigma_k x_{.k}^2 \qquad (5)$$

and within-industry multinationality as:

$$m = \Sigma_j w_j M_j \text{ where } w_j = x_{j.}^2/\Sigma_j x_{j.}^2 \qquad (6)$$

It is then easily shown that:

$$M = m + \{(1-m).(D-d)/(1-d)\} \qquad (7)$$

9 Note that the unusual weighting structure in defining "typical" is dictated by the nature of H indices. The weights, so defined, sum to unity and attach relatively more importance to the larger industries (countries)

Thus overall multinationality may be more or less than the weighted average multinationality within individual industries, depending on the precise pattern of diversification. This serves to underline the important interdependence which will often exist between multinationality and diversification - the two phenomena are clearly jointly determined, and this should caution us against simple minded regression analysis which employs diversification as a 'determinant' of multinationality or vice versa.

In fact, for present purposes, we do not need to pursue disaggregation to the limit. Instead, we merely identify each firm's primary industry, P, and its home country, H, (the country in which it has the largest proportion of its output)10. Thus we use:

$$D_H = 1 - \Sigma_j (x_{jH})^2/(x_{.H})^2 \quad ; \quad M_P = 1 - \Sigma_k (x_{Pk})^2/(x_{P.})^2 \qquad (8)$$

We then summarise the rest of the firm's matrix with a single statistic, R, the proportion of its production outside the primary industry and home country. Thus R represents all the cells outside the primary industry row and the home country column, and can be interpreted as a crude measure both of diversification outside the home country and multinationality outside the primary industry.

Using these three summary statistics, we can identify eight natural classes of corporate structure, as shown in Figure 2, which makes simple home/abroad and primary/secondary distinctions for expositional clarity11. The first three classes are straightforward: **Class I** refers to specialist (non-diversified) uni-national firms (D_H=0, M_P=0 and R=0); **Class II** are specialised multinationals (D_H=0, M_P>0 and R=0); and **Class III** are diversified uni-nationals (D_H>0, M_P=0 and R=0). The other five classes all refer to different types of diversified multinationals. **Class IV** are firms which are specialised at home and uni-national in their primary industry, but

10 For most firms, there is little ambiguity concerning their primary industry: 230 produce more than half of their output in one industry. However, for 74 firms the primary industry accounts for 25-50% of total output, and for 9, it accounts for only 15-25%. There is even less ambiguity about home country of course: 282 firms produce more than 50% of their output in one country, but 31 (mainly US subsidiaries) produce less than 50% in their "main" country.

11 It has been pointed out to us that this simple 2*2 matrix is reminiscent of the Ansoff matrix (1965) which may be familiar to readers conversant with the corporate strategy literature. As far as we know, that matrix has never been used in empirical applications such as the one presented here.

nevertheless produce in a secondary industry abroad (D_H=0, M_P=0 but R>0). This might be the classical case of a vertical multinational (e.g. with an upstream plant in one country supplying a downstream subsidiary in another - say, extraction in a developing country to supply a manufacturing operation in an industrialised country. But we doubt that such structures will be common within the EU. **Class V** are multinational, but only in their primary industry and diversified, but only in their home country (D_H>0, M_P>0 but R=0). This might include firms at an intermediate stage in the growth process, with diversification abroad the next stage; but, equally, it might include firms which are essentially specialised multinationals with relatively minor home country diversification. The next two classes are more difficult to characterise ex-ante. **Class VI** firms are specialised at home, but produce abroad in both their primary and secondary industry (D_H=0, M_P>0 and R>0). Again, this might indicate a significant vertical dimension, with both the home and foreign core subsidiaries supplying downstream activities abroad. **Class VII** firms are diversified at home, but only multinational in secondary industries (D_H>0, M_P=0 and R>0). Perhaps this will include some firms that are genuinely conglomerate at home (i.e. with no dominant single core industry), but with an asset which is only internationally transferable in a "secondary" industry. Finally, **Class VIII** firms are diversified both at home and abroad, i.e. multinational in both primary and secondary industries (D_H>0, M_P>0 and R>0). This is the "ultimate" case described in our dynamic corporate structure story above.

5. Incidence and Characteristics of the Classes in the sample

We have estimated D_H, M_P and R for all 313 firms and each firm has been allocated to one of the eight classes12. Table 3 shows how they are distributed by aggregate firm size and country of origin, and Table 2 provides an easy-reference summary, citing some named firms from the top 50 as examples.

12 For the reason given in footnote 6, we have used critical values of 0.095 for M_P and D_H and, analogously, 5% for R.

The 80 specialised uni-national firms in Class I tend to populate the lower tail of the size distribution, and the relatively high frequencies of German, Italian and Spanish firms (compared to their proportions in the sample as a whole) mainly reflects the way the sample was constructed. These firms include many who are amongst the leaders in relatively small industries in which these countries have a comparative advantage (e.g. certain types of machinery for Germany and textiles for Italy). Significantly, only 2 of the top 50 firms comes from Class I, and one of these, Aerospatiale, is from an industry which was still structured on largely national lines due to public procurement bias in 1987. As noted earlier, there are relatively few completely specialised multinationals (Class II). Although they tend to be smaller than the overall sample average, there are 3 within the top 50. Whilst, for some firms, specialist multinationality may be an intermediate structure, prior to future diversification, this is clearly not the case for such world leaders as IBM, Michelin and Volkswagen. A disproportionately large number of Class II firms are North American owned subsidiaries, and we have more to say on them below. Class III firms, diversified at home without any multinational operations, account for over 20% of the sample. Nearly all these firms are from the "big 4" member states, with the UK and Italy having particularly high shares. They are relatively more common amongst the smaller to medium size classes, but there are also conspicuous examples from within the top 50.

Amongst the five other Classes - the diversified multinationals - only V and VIII are at all numerous. Both these Classes refer to firms that are multinational in their primary industry and diversified in their own country, but Class VIII are also diversified abroad. The higher frequency of VIII, compared to V indicates that, if a firm is diversified at home and multinational in its core activity, more often than not, it will also be diversified abroad (but the difference in proportions is only significant at the 10% level). Like Class III, Class V firms are nearly all from the big 4 member states, but they tend to be larger than Class III firms, and France has an unusually high share. Class VIII stands out as significantly different from all others in a number of respects. These are the firms which are multinational in both primary and secondary industries (i.e., diversified both home and abroad). Most strikingly, these firms tend to be larger than average,

nearly half of the EU's 50 largest manufacturers display this structure, and the Non-EU countries, Holland and the UK all account for disproportionately large numbers.

The remaining three Classes, IV, VI and VII, are relatively infrequent, as expected, and together they account for less than 7% of the total of firms. There are only three Class IV firms, each of small to middling size, and only eight Class VI firms. Crucially, all but two of these 11 firms are North American subsidiaries (the two exceptions are both Belgian). Closer inspection of the Class VI firms reveals that, for all but one, their main country of production accounts for less than 50% of their total EU production. As such, out use of the term "home" country is doubly misleading. An analogous problem occurs with Class VII. These are usually conglomerate firms for which there is, in reality, no single "core" industry. For example, six of the ten have home production in secondary industries which is either nearly as large, or in excess of, their home core production. Moreover, some have large non-manufacturing operations (e.g. Elf, the only Class VII firm in the top 50), and if these operations had been included, their structures might look quite different. In other words, the allocation of firms to these Classes is arbitrary, and we largely ignore them henceforward.

Putting aside these anomalous Classes, is there any evidence of the stylised growth path we hypothesised in section 3? The evidence is suggestive, rather than conclusive. Certainly, Class I is the most frequent amongst the smallest third of the sample firms, with Class III becoming most common amongst firms ranked 151-200. Class III is then joined by V as the most common form in 101-150, and Class VIII takes over as the most common structure amongst the top 100. However, there are many firms who 'buck the trend'. Most obviously, Class II is more or less evenly distributed across all size classes, and some Class I and III firms make it into the top 100. To get much further with this particular part of our analysis, both theoretically and empirically, we must await the emergence of time series data.

6. An Econometric Model

In this section we apply multinomial logit analysis13 to the classification scheme to test the following simple model. For firm i, with its core operations in industry j and home country k, suppose that the probability it belongs to Class c (c=1,...8) depends on:

(i) Whether or not industry j is characterised by significant product differentiation. This is represented initially by a dummy variable, TYPE 2, which takes the value unity if the industry is characterised by either high advertising and/or R&D. Subsequently, it is refined by distinguishing three sub-categories of Type 2 industry:

Type 2A if it typically engages in "high" advertising but not R&D

Type 2R if it typically engages in "high" R&D but not advertising, or

Type 2AR if it typically engages in "high" advertising and R&D14.

(ii) The size of industry j in country k, relative to the setup costs entailed by efficient scale. This is denoted by SIZE, and is measured as the (logarithm of) the size of the firm's primary industry in its home country relative to setup costs15.

(iii) The firm's country of origin, as represented by a dummy intercept for the country concerned. In fact, this is only really possible for firms from the "big 4" member states (due to the small numbers of firms from other countries in most of the Classes.)

These hypotheses are tested in Table 4. Class I is used as the default, thus all significance tests refer to the differences between class i and Class I. Equation 1 is estimated for all 8 Classes,

13 For this extension of the linear logit model to handle mutually exclusive alternatives see Theil (1969).

14 See the note to Table 1(ii). The default is Type 1 - an industry which does not engage in high advertising or R&D. This nomenclature is employed throughout Davies, Lyons et al (1996), in which it is found to yield significant explanatory power in a number of contexts, including multinationality, trade intensities and concentration. It derives from Schmalensee's (1992) terminology, as applied to the distinction drawn by Sutton (1991) between endogenous and exogenous sunk costs.

15 More precisely, it is the ratio of the industry's output to the minimum efficient scale of production times the capital output ratio. The data are taken from Davies, Lyons et al, Appendix 3.

including initially only the overall differentiation variable, Type 2, and the Size variable. As expected, the coefficient estimates and t values for the 3 anomalous Classes (IV, VI and VII) are largely uninformative, confirming our suspicion that these Classes are merely the result of measurement problems - at least as far as this particular sample is concerned. Equation 2 therefore re-estimates, excluding these three classes; the remaining results are almost completely unchanged16. Equation 3 distinguishes between the different Types of product differentiation, and equation 4 adds the country dummy variables.

The results concerning product differentiation and diversification go some way to clearing up the puzzle highlighted in Table 1(ii). There is obviously no tendency for uni-national diversified firms (Class III) to be more commonly located in Type 2 industries than are specialised uni-national firms; and this is true for differentiation in the aggregate and when distinguishing advertising and R&D. On the other hand, if diversification is coupled with multinationality (Classes V and VIII) there is a significant association with product differentiation, via R&D. This is strongest, and it widens to include the Type 2AR industries, in Class VIII. On the other hand, advertising plays no significant role, except, as just mentioned, when coupled with high R&D in Class VIII industries.

Results concerning the multinationality-differentiation relationship are much weaker than we had expected given the findings in Table 1(ii). Indeed, applying the 5% significance level, we find no tendency for specialised multinationals (Class II) to be associated with high advertising or R&D industries. It is only when coupled with diversification, especially abroad, that the stronger associations emerge - as just mentioned. However, lowering our sights to lower t values, there is a very weak tendency (at the 15% level) for Class II firms to be relatively more common in diversified industries (see equations 1 and 2), and this appears to be driven by Type 2AR industries (equations 3 and 4).

For the SIZE variable, results are much more consistent. With the notable exception of Class II, this variable is negatively significant for all Classes in all 4 equations17. This implies that

16 An important property of the multinomial logit is that the alternatives to be compared do not have to be exhaustive. See Uhler and Cragg (1971).

17 With the exception of Class VIII in equation 4 when the country dummies are added.

diversification is always driven, whether at home or abroad, by limits to growth imposed by the size of the firm's initial market. But, for Class II, there is no such effect, suggesting that specialised firms who choose the multinational option are not driven to do so because of constraints to growth in their home country market.

Turning to the country dummy variables, a comparison of equations 4 and 3, shows that their inclusion prejudices the significance level of only the SIZE variable for Class VIII. While the inclusion of these dummies is little more than a control device, their estimated coefficients may reveal important differences between the 4 big member states in their national endowments of specific assets, e.g. and scientific/human capital infrastructures. They may also reflect other cultural, political and institutional differences (e.g. in capital markets, the pattern of corporate ownership, the quality of management, etc.). In fact, the significant differences which emerge are that UK firms are relatively most common in Classes III, V and VIII; Italian firms are most likely to belong to Class III and least likely to belong to VIII, French firms are most likely to belong to V, and German firms least likely to belong to VIII.

7. Implications and Conclusions

We have derived a new classificatory scheme for firms' structures based on an integrated set of multinationality and diversification indices. This allows us to classify a set of leading EU firms into 8 Classes, distinguished by differences in their corporate structures in product and geographic space. In future work, we intend to add both a time dimension and measures of corporate performance to the database, in order to investigate the dynamics of corporate structure, and its effects on profitability, growth etc. Since our data relate to leading EU firms, such an agenda has obvious significance concerning the effects of the European integration process. But, for now, our analysis has been confined to structure alone, and for just a single year. Nevertheless, we have unearthed some novel facts on the role of specific assets, size of market and national characteristics in shaping firms' corporate structures.

On the evidence of this paper, there is little doubt that both multinationality and diversification tend to increase with firm size. However, this result has a strong flavour of tautology and is hardly surprising. A far more interesting question is whether the mix of diversification and multinationality varies systematically with size - are they substitutes or complementary dimensions of corporate structure? We find, for the sample as a whole, that only one quarter of firms are neither multinational nor diversified; diversification is more common than multinationality (67% and 49% respectively), but more firms are both multinational and diversified than are either only multinational or diversified. However, these aggregate figures conceal important differences between size classes. Using our classification scheme, we find that specialised uni-nationality prevails at small scales of firm, giving way to home diversification or, less often, specialised multinationality as constraints to growth are encountered: only about 10% of firms are both multinational and diversified outside the top 200 firms. At intermediate firm sizes, the coincidence of multinationality and diversification becomes more common, but this usually only entails multinational operations in a core industry and diversification in a home country. It is only within the largest 100 firms that we find most firms are diversified both at home and abroad, that is, multinational in core and secondary industries. On the basis of this static evidence, we have speculated that there may be an underlying stylised growth path which can be applied to many firms. However, pending the collection of more data for a later year, this must remain speculation. In any event, there are many large firms in our sample who do not appear to have followed such a route - for example, some have achieved very large scale purely on the basis of specialised multinationality, and others have diversified at home without venturing abroad.

Some of our most striking results concern the nature of diversified firms. On the positive side, our evidence is consistent with the conventional view that diversification is used as a strategy for escaping constraints to growth. On the other hand, it appears that diversification is unrelated to the existence of a specific asset unless it is also accompanied by multinational activity. This may imply that much (home country) diversification has no clear industrial logic except to avoid growth constraints - perhaps it is pursued largely in the managerial interest. Things are different, however, when considering diversification by multinational firms: here, there is clear tendency for

diversification to arise more often where differentiation is present. This may indicate that those intangible assets which drive multinational operations can also often be used to support product diversification - especially where that diversification takes place abroad.

Rather surprisingly, we find only weak evidence that specialised multinational firms are more likely to originate from industries characterised by either product differentiation or of limited scale; but, in this case, the result may be conditioned by a problem of degrees of freedom: only a few of the sample firms are multinational in just a single industry.

Turning to the nature of intangible assets, we should acknowledge an important limitation to our work. For data reasons, we have narrowly equated these assets with the existence of product differentiation as revealed by actual industry spends on advertising and R&D. Obviously, this fails to capture other intangible assets associated with managerial expertise; moreover, advertising and R&D are only imprecise proxies for differentiation. Subject to this qualification, one objective of the paper was to investigate whether there were differences between industries depending on whether differentiation is effected via advertising or R&D. On this, our results are inconclusive. Certainly, R&D seems to be the more dominant influence, although advertising and marketing also appear to be important if allied with high R&D (as is true for most consumer durable industries).

Finally, there appear to be some differences between firms which depend on their countries of origin, even after controlling for differentiation and size. Explanation of these differences is on the agenda for future research.

Table 1 - The Incidence and Characteristics of Multinational and Diversified Firms

(i) Firm numbers (percentages in brackets)

	Not Diversified	*Diversified*	*Total*
Not Multinational	80 (26)	81 (26)	161 (51)
Multinational	22 (7)	130 (42)	152 (49)
Total	102 (33)	211 (67)	313 (100)

(ii) Proportions from differentiated industries[1]

	Not Diversified	*Diversified*	*Total*
Not Multinational	29	32	30
Multinational	55	59	58
Total	34	49	44

Note: these are the proportions of firms in each group whose primary industry is characterised by "high" advertising and/or R&D, where "high" refers to an ADS/Sales or R&D/Sales ratio not less than 1% (using UK data, source: Davies, Lyons et al. (1996)).

(iii) Mean values of D and M by Firm Size

Firms ranked by size:	*D*	*M*	*D/M*
1- 50	.559	.353	1.58
51-100	.520	.330	1.58
101-150	.475	.255	1.86
151-200	.405	.155	2.61
201-250	.241	.106	2.28
251-313	.084	.060	1.40

Table 2 - A summary of the 8 Classes

	No.	Typical Size	Main Countries	Examples
Class I				
Specialised uni-national	80	small	Germany	BMW(17)
DH<0.05,MP<0.05,R<0.05			Italy	Aerospatiale (40)
			Spain	
Class II				
Specialised multinational	21	small/	N.America	Volkswagen (3)
DH<0.05,MP>0.05,R<0.05		medium		IBM (13)
				Michelin (31)
Class III				
Diversified at home	80	medium/	UK	Daimler (2)
uni-national		small	Italy	IRI(11)
DH>0.05,MP<0.05,R<0.05				Thyssen (19)
				B.Aerospace(24)
				Hanson (34)
Class IV				
Multinational, but	3	-	-	-
specialised in each country				
DH<0.05,MP<0.05,R>0.05				
Class V				
Multinational but only	49	medium	France	Fiat (1)
in core industry, Diversified,				Renault (5)
but only at home				PSA (7)
DH>0.05,MP>0.05,R<0.05				Usinor (18)
				Bosch (21)
Class VI				
Multinational, Diversified	8	medium/	N.America	Solvay (39)
but only "abroad"		large		P.Morris (44)
DH<0.05,MP>0.05,R>0.05				
Class VII				
Diversified, Multinational	10	medium	UK	Elf (33)
but not in core industry			France	
DH>0.05,MP<0.05,R>0.05				
Class VIII				
Diversified at home and	62	large	EFTA	Siemens (4)
abroad			N.America	Ford (6)
DH>0.05,MP>0.05,R>0.05			Holland	Philips (8)
			UK	Bayer (9)
				BASF (10)

Notes: "Main country" indicates a class in which the country has a disproportionately large share of firms compared to its share in the overall sample. "Examples" lists firms from each class in the 50 largest firms.

Table 3 - Frequencies of Classes

(i) by Country of Origin[1]

Class	*Total*	*GER*	*FRA*	*UK*	*IT*	*NL*	*BL*	*SP*	*EFTA*	*AMER*
I	80	29	15	4	19	2	4	7	-	-
II	21[2]	5	3	2	3	1	-	-	-	6
III	80	19	13	24	18	1	4	-	-	1
IV	3	-	-	-	-	-	1	-	-	2
V	49	12	14	12	6	2	2	-	1	-
VI	8	-	-	-	-	-	1	-	-	7
VII	10	2	3	4	-	-	-	-	-	1
VIII	62	8	10	19	3	5	-	-	6	11
Total	313	75	58	65	49	11	12	7	7	28

Notes:

1. GER=Germany, FRA=France, UK=United Kingdom, IT=Italy, NL=Netherlands, SP=Spain (7) and Portugal (2), BL=Belgium/Luxembourg, EFTA=Switzerland and Sweden, AMER=USA and Canada.
2. The single Japanese firm in the sample is also in this Class.

(ii) by Aggregate Size of Firm

Firm Rank	I	II	III	IV	V	VI	VII	VIII
1- 50	2	3	10	-	9	2	1	23
51-100	5	-	12	-	7	2	3	21
101-150	4	3	14	1	14	3	2	9
151-200	5	4	20	2	10	-	2	7
201-250	21	4	13	-	8	1	1	2
251-313	43	7	11	-	1	-	1	-
Total	80	21	80	3	49	8	10	62
Average size (geometric means mn. ecus)	175	561	796	721	1274	1652	1130	2807

Firms are ranked in descending order by aggregate size. The overall geometric sample mean is 751 mn. ecus.

Table 4 - Multinomial Logit analysis of corporate structure

	Class II	Class III	Class IV	Class V	Class VI	Class VII	Class VIII	n.	LL	χ^2	PCP
Equation 1											
Constant	-0.973	1.840*	-1.375	0.419	0.072	-1.978(*)	0.488	313	-511	65.2	39%
	(1.19)	(3.76)	(0.89)	(0.72)	(0.07)	(1.80)	(0.82)				
Type 2	0.801	-0.254	-0.229	0.556	0.385	0.027	1.554*				
	(1.50)	(0.70)	(0.18)	(1.39)	(0.51)	(0.03)	(3.86)				
SIZE	-0.125	-0.341*	-0.359	-0.210*	-0.541*	-0.019	-0.312*				
	(1.00)	(4.23)	(1.22)	(2.29)	(2.52)	(0.12)	(3.19)				
Equation 2											
Constant	-0.973	1.802*		0.406			0.463	292	-416	59.1	42%
	(1.20)	(3.70)		(0.71)			(0.82)				
Type 2	0.804	-0.240		0.564			1.567*				
	(1.51)	(0.66)		(1.41)			(3.92)				
SIZE	-0.125	-0.334*		-0.208*			-0.308*				
	(1.00)	(4.18)		(2.29)			(3.18)				
Equation 3											
Constant	-1.097	1.882*		0.427			0.373	292	-407	76.9	45%
	(1.30)	(3.82)		(0.73)			(0.61)				
Type 2A	0.735	-0.151		0.093			0.716				
	(1.13)	(0.33)		(0.17)			(1.33)				
Type 2R	0.485	0.166		1.386*			2.343*				
	(0.54)	(0.29)		(2.49)			(4.27)				
Type 2AR	1.237	-1.221		0.077			1.480*				
	(1.51)	(1.56)		(0.10)			(2.31)				
SIZE	-0.104	-0.351*		-0.212*			-0.289*				
	(0.81)	(4.30)		(2.28)			(2.89)				
Equation 4											
Constant	-0.729	0.784		-0.262			0.336	292	-377	137	48%
	(0.83)	(1.21)		(0.36)			(0.48)				
Type 2A	0.627	-0.086		-0.182			0.530				
	(0.94)	(0.18)		(0.31)			(0.94)				
Type 2R	0.757	0.441		1.670*			2.913*				
	(0.82)	(0.75)		(2.87)			(4.80)				
Type 2AR	1.310	-0.986		0.208			1.751*				
	(1.55)	(1.23)		(0.27)			(2.53)				
SIZE	-0.042	-0.366*		-0.199*			-0.169				
	(0.32)	(4.28)		(2.05)			(1.55)				
ITALY	-0.979	1.273*		0.126			-1.877*				
	(1.20)	(1.99)		(0.17)			(2.39)				
FRANCE	-1.029	0.954		1.033			-0.809				
	(1.30)	(1.47)		(1.55)			(1.36)				
GERMANY	-1.178(*)	0.712		0.028			-2.052*				
	(1.68)	(1.17)		(0.042)			(3.28)				
UK	-0.000	2.854*		2.250*			1.370*				
	(0.0)	(3.78)		(2.82)			(1.96)				

Figure 1- The MD Matrix

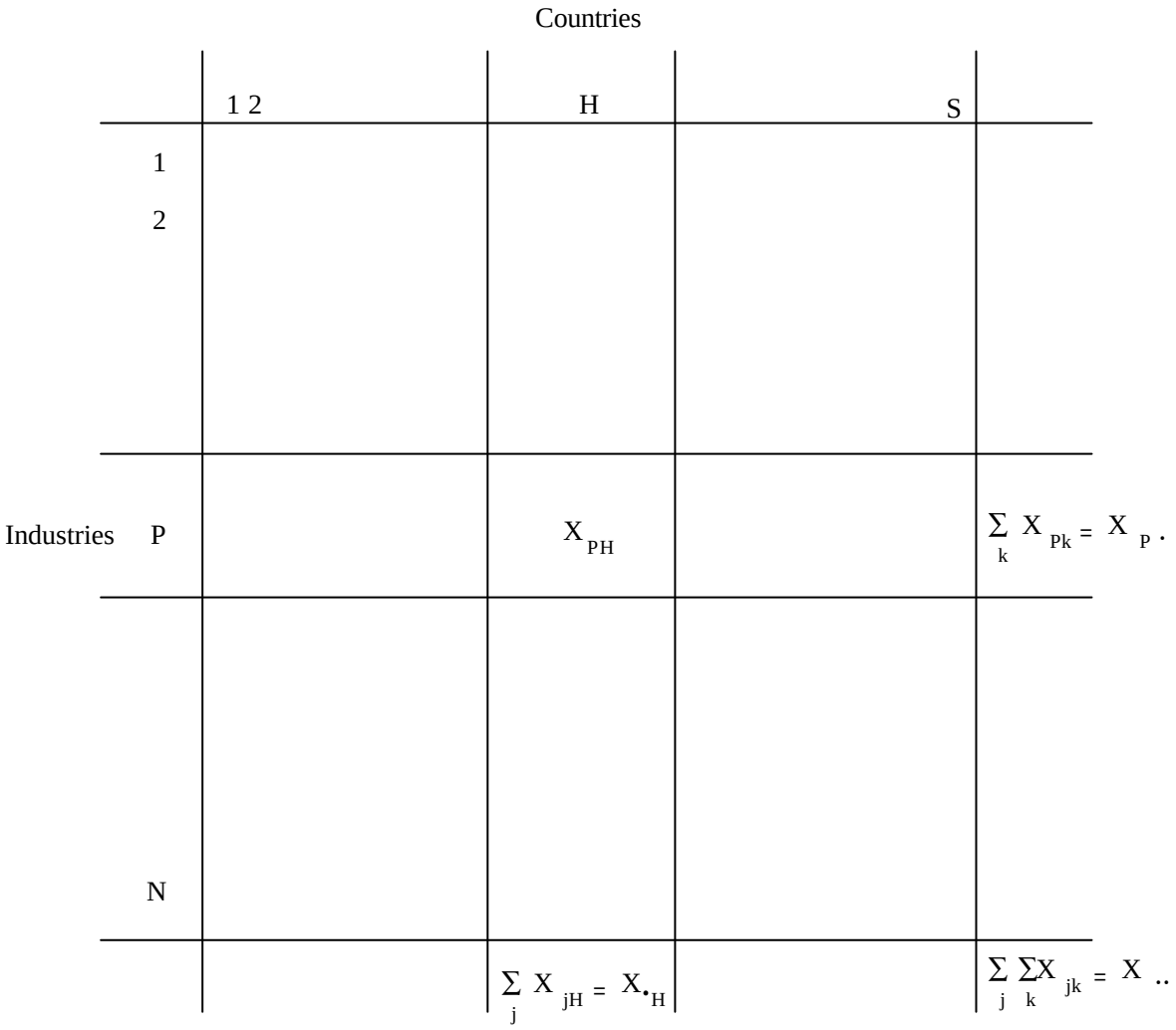
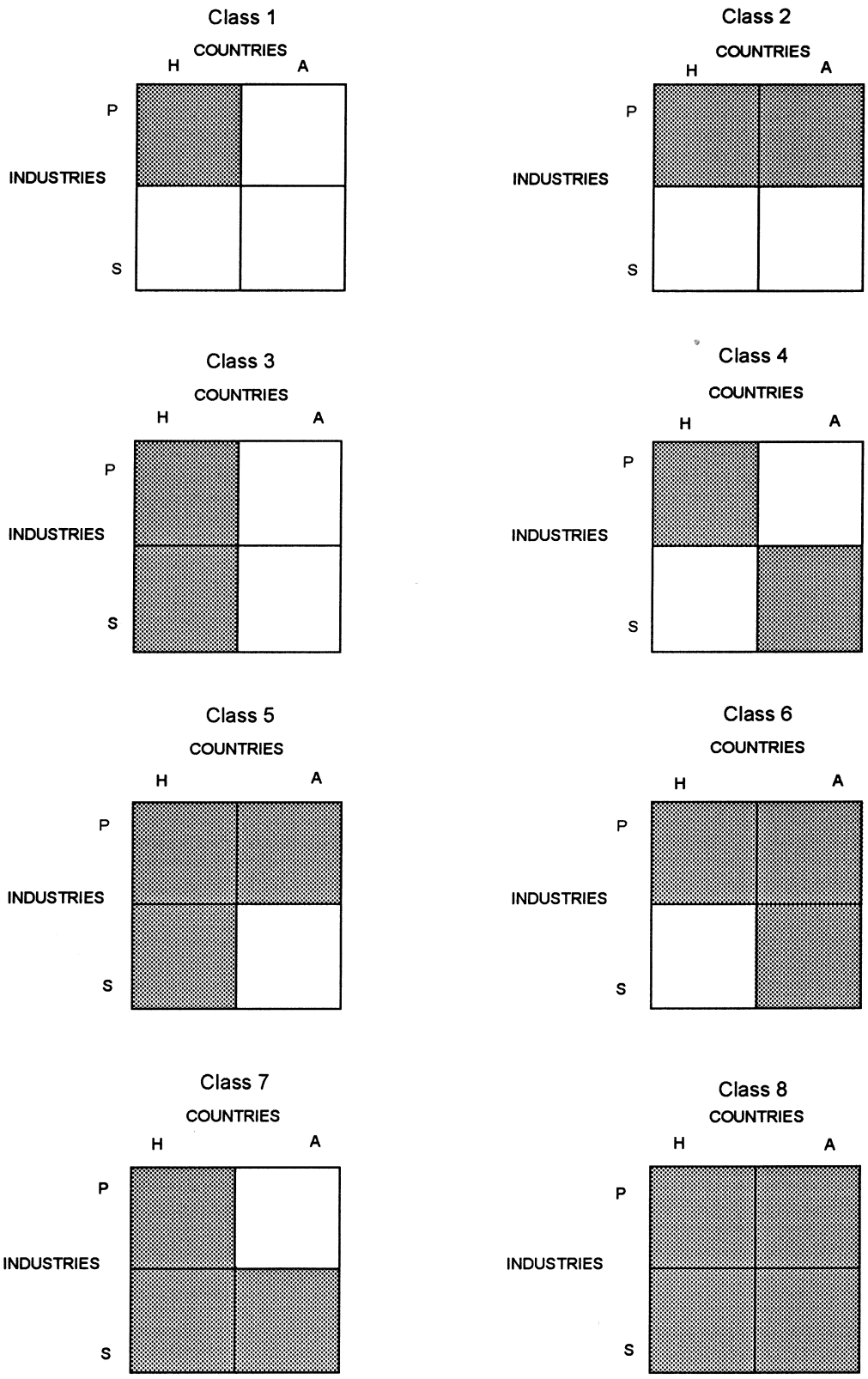


Figure 2 - A visual depiction of the 8 classes of firms



P = Primary industry; S = Secondary industries; H = Home country; A = Other countries

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