OWNERSHIP STRUCTURE, CONTROL TYPE CLASSIFICATIONS AND THE

PERFORMANCE OF LARGE BRITISH COMPANIES

by

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A large, mostly theoretical, literature emphasizes the structure of share ownership as a determinant of the behaviour of a company which has market power. In firms where ownership is so dispersed that no shareholder is in a position to dominate decision taking, managers might have the discretion to pursue goals other than those of the owners of the firm. Company performance is affected because of conflicts of interest between managers and owners due to differences in the presumed incentives they face, the former not necessarily seeking to maximize profits on behalf of the latter. This literature originated with the discussion by Berle and Means (1932) of the implications of the separation of ownership and control, nowadays treated as a special case of the general principal-agent problem, and has recently been surveyed by McEachern (1975), Hay and Morris (1979), Marris and Mueller (1980) and Lawriwsky (1984)[1]. Of the empirical work it contains, most of it is American and there are relatively few British studies. This paper reports an empirical analysis which was motivated partly by a desire to gain more information about British companies but mainly by a belief that recent methodological advances in the analysis of ownership structure require application in a systematic study. Moreover, the recent change of emphasis in the explanation of profitability away from the industry-level structure-conduct-performance paradigm to a firm-level approach suggests a greater need to focus on the role of company ownership variables.

Although our central concern is whether there is evidence that the principal-agent problem is important empirically, we are also interested in describing the patterns of ownership structure observed and examining factors affecting its determination as well as its effects. Besides being interested in patterns of ownership structure in the UK the question of finding a suitable basis of classification by control type is also of central

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[1]See also recent contributions by Mueller (1986), Demsetz and Lehn (1985).

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concern. The paper is organized as follows: Section 1 discusses the relationship between ownership structure and control and describes the sample; Section 2 presents cross-sectional econometric tests of the effects of ownership structure variables on a vector of firm performance indicators chosen to be relevant to both shareholder and manager utility functions; Section 3 contains an econometric analysis of the determination of variation in the ownership structure variables; and conclusions are drawn in Section 4.

1 OWNERSHIP STRUCTURE AND CONTROL AMONG BRITISH COMPANIES

1.1 OWNERSHIP STRUCTURE AND CONTROL TYPES

We describe a firm's ownership structure in two ways: (i) in terms of numerical measures of the <u>degree</u> to which share ownership is concentrated; and (ii) in terms of qualitative "control types" derived from concentration of shareholding. Precise definition of both sets of variables used in the econometric analysis are defined in Table 1: the first set of variables are conventional concentration indices, the Herfindahl index and the relative combined holding of some arbitrary group of large shareholders (a concentration ratio). The latter are four concentration ratios: C1, the largest shareholding, C5, C10 and C20 respectively the relative combined shareholding of the largest 5, 10 and 20 shareholders respectively. The second set of measures are dichotomous (0,1) control-type variables and involve interpreting the concentration of the data in terms of a voting model of control; two such sets of measures are used.

Whether a firm can be regarded as owner- or manager-controlled has been shown by Cubbin and Leech (1983) to depend not only on the size of the largest bloc of shares but also on the dispersion of the remainder as measured by the Herfindahl index. This gives rise to an approach to control-type classification which contrasts with the standard methodology which has been used in all previous studies back to Berle and Means (1932) whereby ownership-control is assumed if the largest shareholding exceeds some arbitrary fixed percentage. The variables OC1, OC2 and OC3 are

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conventional measures defined in this way, according to whether the largest holding C_1 exceeds, respectively, 5%, 10% and 20%.

The alternative approach of Cubbin and Leech is based on the use of a stylized probabilistic-voting model which allows us to calculate a measure of voting power for the largest shareholder, the degree of control. Since the question of owner- versus manager control is always cast in terms of whether there is a large shareholder with enough votes to act as a nucleus for attracting a majority, the degree of control is only defined for the largest shareholding (or combined shareholding where such a bloc has been identified). Specifically, the degree of control of the largest shareholding bloc is defined as the probability of its being large enough to attract majority support in a contested vote[2].

Consider the question of evaluating the degree of control for a bloc consisting of the leading k shareholders. The data consists of the percentage shareholdings in size order: $p_1, p_2, \ldots, p_N$, where $p_i \geq p_{i+1}$ for all i, and $\Sigma p_i = 100$, the total number of shareholdings being N. The combined shareholding of the bloc is $C_k = \sum_{i=1}^{k} p_i$.

Denote the degree of control by α_k and let $V_k = \sum_{i=k+1}^{N} p_i^2$. Then we can show[3] that:

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[2]This methodology assumes a hypothetical situation in which all shareholders were to exercise their votes. An alternative measure which has recently been used by the Monopolies and Mergers Commission in the report on BP, HMSO (1988), employs essentially the same notion but considers the actual turnout at company meetings, rather than the size distribution of shareholdings, as relevant to control. Thus a large shareholder has control if his holding exceeds the combined voting strength of all other shareholders normally represented at company meetings. A subsidiary definition which they also used was the size of holding required to call an extraordinary meeting to consider any resolution.

In many companies a three-quarters majority is required to change the articles but this is not required by our definition of control. Control is the power to exercise discretion including that of influencing the selection of the board of directors. Therefore the degree of control is defined in terms of the capacity to secure a simple majority vote.

[3]See Leech (1987b).

$$\alpha_k \cong \Phi\left(\frac{C_k}{\sqrt{V_k}}\right),\qquad\qquad (1)$$

where $\Phi(.)$ is the standard normal distribution function such that if $z \sim N(0,1)$, then $\Pr[z < x] = \Phi(x)$ for any x.

The degree of control of the bloc therefore depends on *both* the concentration ratio C_k *and* the Herfindahl concentration index H, since we can write $V_k = H - \sum_{i=1}^{k} p_i^2$, where $H = \sum_{i=1}^{N} p_i^2$. The accuracy of the approximation in (1) improves with the dispersion of the shareholding size distribution and we can assume it to be very good in many cases encountered in practice.

The degree of control for the largest individual shareholder is obviously:

$$\alpha_1 \cong \Phi\left(\frac{C_1}{\sqrt{V_1}}\right) = \Phi\left(\frac{p_1}{\sqrt{H - p_1^2}}\right).\qquad\qquad (2)$$

The degree of control has been shown by Leech (1988) to be closely related to a measure of a *priori* voting power (or "power index") defined for "simple games" (the most important class of which comprise weighted majority games such as shareholder voting). This approach to a definition of "power" or "control" is abstract in that voting behaviour is assumed to be independent of any particular issue which may be the subject of a vote. This appears to be a slightly strange aspect of the use of voting models in the present context where we assume there are fundamental conflicts of interest between shareholders and managers. However, it is not inappropriate to a methodology in which the control status of a company is inferred solely from its ownership structure, an approach originating with Berle and Means. Its advantage is that it allows us to deal systematically with the uncertainty faced by a minority shareholder given that (in most companies) few shareholders appear *actually* to exercise their voting rights in practice at regular company meetings.

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The degree of control gives a measure of voting power; in order to use it to define control type requires us to specify a minimum degree of control to correspond with "practical" or "working" control through a shareholding which, although large, has a minority of the votes. Three such alternative "critical" values which have been used in this study are 90%, 95% and 99%. These values of the degree of control have been used to describe the data in two ways: (i) deeming a firm as ownership-controlled if the degree of control of the largest individual shareholder exceeds the chosen critical value; (ii) examining the data to see whether a "potential controlling coalition" exists among the leading shareholders. The second approach involves successively forming groupings of increasing size and computing the degree of control of the group; ownership control is inferred if a small enough group with a high enough degree of control can be found. The latter approach has been used in a previous paper (Leech (1987b)); the results for the current sample are reported in section 1.4. The former approach has been used to define the variables OC90, OC95 and OC99, which are dichotomous, taking the value 1 if the degree of control of the largest shareholder exceeds 90%, 95% and 99% respectively; results of using them and OC1, OC2 and OC3 are reported in section 1.3 below.

TABLE 1. OWNERSHIP STRUCTURE VARIABLES

Concentration indices	
Name:	Definition:
H	Upper bound* Herfindahl index $(\%^2)$[4]
C1	Largest holding (%)
C5	Combined holding of largest 5 shareholders (%)
C10	Combined holding of largest 10 shareholders (%)
C20	Combined holding of largest 20 shareholders (%)

Dichotomous control-type variables (0,1)	
Name:	Equals 1 if:
OC1	Largest Shareholding exceeds 5%
OC2	Largest Shareholding exceeds 10%
OC3	Largest Shareholding exceeds 20%
OC90	Degree of control of largest holding exceeds 90%
OC95	Degree of control of largest holding exceeds 95%
OC99	Degree of control of largest holding exceeds 99%

*Allowing for the truncation of the observed size distribution.

1.2. THE SAMPLE

The sample consists of 470 UK-listed companies from a wide range of industries. The basis for inclusion was the availability of ownership data sufficiently detailed to enable Herfindahl indices to be calculated. The source of this was a commercial service, "Who Owns What on the London Stock Exchange", which supplies share register details of all voting shareholdings of 0.25 percent or more for the companies it covers. The observation point is some time during the period 1983-5 and differs somewhat between companies. The sample has been chosen to include the maximum number from "The Times 1000" largest industrial companies and to ensure reasonable representation of as many industries as possible. It includes 325 industrial companies from "The Times

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[4]Because of the nature of the data the Herfindahl index has had to be approximated: shareholdings smaller than 0.25 percent have not been observed. Ignoring them gives a lower bound to H; assuming them all to be slightly smaller than 0.25 gives an upper bound. The difference, however, is quite small for all the companies.

1000", smaller industrial companies and 51 financial companies. A detailed description of the sample in terms of industry groups is given in Table A1 in the Appendix which shows that it is broadly representative. When we collected the data the coverage in terms of companies was less than universal and therefore we have been unable to survey systematically ownership structure and control type for the whole population of large companies (as, for example, Nyman and Silberston (1978) were able to do for the largest 250 companies)[5] Our companies, therefore, strictly constitute neither a population nor a random sample and any statements we make about the relationship between ownership and control of UK companies must be qualified by this fact. We are, however, reasonably confident in assuming that the sample is representative of the population of large companies in the UK. Apart from in two industries which are not represented, the proportion of firms included varies, among industries other then finance, between 14 percent in Textiles and 60 percent in office equipment. The sample's overall representativeness of these industries (including finance) is 32 percent.

Basic ownership data consisted of share register details of holders of record including names and addresses and sizes of holding. We were able to convert this raw data into consolidated size distributions using a directory of nominee companies.[6] Although the coverage of this directory was inevitably incomplete in that not all nominee companies were included, it proved invaluable in enabling linkages among shareholders to be identified. The bases of consolidation were: common ownership by a single individual; a family having a common surname; ownership through nominees;

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[5]"Who Owns What on the London Stock Exchange" began in 1984 providing subscribers with regularly updated information about share ownership and changes in it for a list of companies. Although the list subsequently grew to over 1500, the criteria for initial inclusion derived from the main purpose of the service which was to create a marketability in certain shares. Our sample therefore might be seen as comprising companies which were seen by stockbrokers as not having attracted sufficient .market attention..

[6]Supplied with the share ownership details.

or some other obvious linkage especially a group of shareholders/nominees sharing the same address.[7]

1.3. ANALYSIS OF LEADING SHAREHOLDINGS

In this section we analyse the ownership structure data in terms of control implications by examining the largest shareholding of each company. The analysis focuses on: (i) the ability to construct a control classification; (ii) the comparative properties of classification rules which use a fixed percentage threshold for control versus variable rules based on the probabilistic voting model; (iii) ownership control and type of leading shareholder; (iv) ownership control by industry. Each firm is assigned for simplicity to one of two categories: "ownership controlled" or "management controlled". It is assumed to be management controlled in the absence of a dominant shareholding. The latter category is therefore a residual group consisting of firms which cannot be shown to be ownership controlled in some sense.

Table 2 provides a description of the data in terms of the size of the largest shareholding by type of shareholding. Four types are distinguished: (i) company interest group, CIG, consisting of a single individual, a family or a group of linked individuals and including a company pension fund or charity; (ii) a bank or nominee with unknown beneficiaries, BNBU; (iii) an insurance company, IC; and (iv) a non-financial company, NFC. In 215 cases (46 percent) the largest shareholder is a bank or nominee company with unknown beneficiaries[8]. In 104 companies (22 percent of the total) the leading shareholder was a company interest group.

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[7]Other studies have identified shareholder groupings using surnames, eg Burch (1972), Leech (1987b), but the use of addresses is new.

[8]To some extent this large figure is a reflection of the limitations of our information about the ownership and control of nominees, and perhaps should not be taken as a strong result about the extent to which banks are leading shareholders.

TABLE 2. LEADING SHAREHOLDINGS BY SIZE AND TYPE

Percentage of voting shares held by a single shareholder

Size	CIG	BNBU	IC	NFC	Total
>50%	7	5	0	13	25
20-50	55	32	2	46	135
10-20	27	60	15	23	125
5-10	14	97	25	8	144
<5%	1	21	17	2	41
Total	104	215	59	92	470

Key: CIG - Company interest group, eg an individual, family or group of individuals, company pension fund or charity; BNBU - Bank or nominees with beneficiaries unknown; IC - Insurance company; NFC - Non-financial company. Allowance has been made where possible for holdings held beneficially through nominees.

Looking at the distribution of leading shareholdings by size, it is notable that only a very few firms, 25 or 5 percent of the sample, were majority-controlled; the methodology employed to define minority ownership control is therefore of central importance. Taking a single holding of 20 percent as necessary and sufficient for control we find that ownership control is unusual with 310 companies, or 66 percent, failing to satisfy this criterion. On the other hand, ownership is not typically very highly dispersed since in only 41 cases (9 percent) is the largest holding smaller than 5 percent. It is interesting that in almost all these cases the shareholder is a financial institution. Table 2 generally suggests a tendency for the leading shareholder to be a financial institution in the most dispersed cases, a non-financial company in the more concentrated cases and a company interest group in the intermediate cases.

Table 3 reports an analysis of the leading shareholding in each firm in terms of its degree of control, α_1. Separate analyses using three values of α_1 are given, 99

percent, 95 percent and 90 percent, and the results classified by the size of the leading holding. A complete classification (ownership controlled versus management controlled) is given for a degree of control of 90 percent. An interesting result revealed by Table 3 is that none of the chosen values for the degree of control gives a controlling shareholding smaller than 10 percent, not even when $\alpha_1 = 90$ %. The classification based on a degree of control of 90 percent suggests that, for companies with leading holdings of 10 to 20 percent, 14 are owner controlled and 111 manager controlled while, for those with leading shareholdings of 20 to 50 percent, 97 are owner controlled and 38 manager controlled. This apparently loose criterion, in which control is assumed to rest with a shareholding such that its probability of winning a vote is only 90 percent, suggests fewer than a third (136 out of 470 or 29 %) of companies ownership controlled and a very small number controlled through a holding of less than 20 percent. A tighter criterion, based on a degree of control of 99 percent, classifies only 66 (14 percent) as owner controlled, 25 of which are majority controlled. Only one company is owner controlled through a holding smaller than 20 percent. The overall result is that a relatively small proportion of firms would be classified as ownership controlled using one of the three variable rules: OC90, OC95 and OC99.

TABLE 3. CONTROLLING HOLDINGS BY SIZE

Size:	Degree of Control:				
	>99%	>95%	>90%	<90%	Total
>50%	25	25	25	0	25
20-50	40	71	97	38	135
10-20	1	8	14	111	125
5-10	0	0	0	144	144
<5%	0	0	0	41	41
Total	66	104	136	334	470

By contrast, a classification based on a fixed rule would give a somewhat different picture, depending very much on the particular criterion chosen. A 5 percent

rule would put 429 companies, 91 percent, in the owner control category while a 20 percent rule would classify 160 or 34 percent as owner controlled. The results for all six control criteria are summarized in Table 4. The general conclusion is that, if a fixed rule of thumb is used, the control type classification is very sensitive to the precise value chosen as the threshold. On the other hand, if control is defined using the degree of control in a voting model, then the results are not too sensitive to the criterion chosen and the overall picture is that only a small minority of companies are classified as owner controlled.

TABLE 4. OWNERSHIP CONTROL ACCORDING TO DIFFERENT CRITERIA

	Fixed Rules			Variable Rules		
Definition:	OC1	OC2	OC3	OC90	OC95	OC99
Number of firms:	429	285	160	136	104	66
Percent of sample:	91.3	60.6	34.0	28.9	22.1	14.0

Table 5 provides nine cross-tabulations of control classifications comparing fixed and variable rules in which management control is assumed in the absence of a sufficiently large shareholding. The tendency of the fixed rules to infer ownership control more frequently than the variable rules is apparent since, for each tabulation, there is a high proportion of companies in the top right hand corner. There are only a very few instances when the fixed 20 percent rule gives manager control while the variable rule suggests ownership control : a degree of control of 90 percent puts only 14 (less than three percent of the sample) in the ownership control group which would be classified as management controlled on the fixed 20 percent rule.

These results contrast somewhat with those of the previous study which used the probabilistic voting model, that by Cubbin and Leech (1983). The general finding there was that using a variable rule based on a given degree of control rather than a

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fixed rule changed the classification of many firms from management controlled to ownership controlled. We suggest that this may be because the ownership data used in the present study is more concentrated because we have been able to make a serious attempt to consolidate holdings of record into voting blocs using detailed information about shareholders' identities and ownership by nominees.[9]

TABLE 5. COMPARISON OF CONTROL CLASSIFICATIONS

	OC1		OC2		OC3	
	Manager control	Ownership control	Manager control	Ownership control	Manager control	Ownership control
OC90:						
Manager control	41	293	185	149	296	38
Ownership control	0	136	0	136	14	122
OC95:						
Manager control	41	325	185	181	302	64
Ownership control	0	104	0	104	8	96
OC99:						
Manager control	41	363	185	219	309	95
Ownership control	0	66	0	66	1	65

Entries are numbers of firms.

Table 6 presents an analysis by *type* of leading shareholder according to the six criteria. The general tendency is for ownership control to be found where the leading shareholder is a company interest group or a non-financial company. The range of variation of the estimate of the percentage ownership controlled is broadly similar whether variable or fixed rules are used, although the fixed rules suggest ownership control is much more common than the variable rules. For example, for firms whose leading shareholder is a company interest group, estimates using fixed rules vary between 59.6 percent and 99 percent, while those using variable rules are between 24 percent and 49 percent. The results for firms whose leading shareholder is a non-financial company are roughly similar. Where the leading shareholder is a financial institution, however, the results are somewhat different. In this case there is a much

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[9]Cubbin and Leech used the data of Collett and Yarrow (1976) which consisted of the numerical sizes of shareholdings of record taken directly from share registers and did not include shareholders' identities.

greater range in the estimate over the fixed rules than the variable rules. Insurance companies have a controlling holding in 71.2 percent of cases where they are the leading shareholder on the 5% rule but this falls to only 3.4 percent on the 20% rule; the proportion is always very small according to a variable rule, between 1.7 percent and 3.4 percent.

TABLE 6. CONTROLLING SHAREHOLDINGS BY TYPE:

FIXED RULES:	OC1		OC2		OC3	
	no.	%	no.	%	no.	%
CIG	103	99.0	89	85.6	62	59.6
BNBU	194	90.2	97	45.1	37	17.2
IC	42	71.2	17	28.8	2	3.4
NFC	90	97.8	82	89.1	59	64.1
All Companies	429	91.3	285	60.6	160	34.0
VARIABLE RULES	OC90		OC95		OC99	
	no.	%	no.	%	no.	%
CIG	51	49.0	41	39.4	25	24.0
BNBU	31	14.4	19	8.8	12	5.6
IC	2	3.4	2	3.4	1	1.7
NFC	52	56.5	42	45.6	28	30.4
All Cos.	136	28.9	104	22.1	66	14.0

Percentages are relative to the total number of companies whose leading shareholder is the the respective type.

An industrial breakdown is given in Table 7 where ownership control in each industry is analysed according to all six rules. These figures do not allow an estimate of the proportion of firms owner-controlled to be made for each industry with any confidence. For Mechanical Engineering, the largest group, for example, the estimates are 14, 45 and 95 percent according to which fixed rule is used. However there is more consistency among the variable rules, the estimate being between 5 and 14 percent. A similar pattern occurs in most industries. The industries with the highest incidence of ownership control (more than 25 percent of companies so classified by all rules) are Electricals,.Brewers & Distillers, Leisure, Banks and Other Financial. According to the

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variable rules, the industries with the lowest incidence of ownership control (less than 20 percent of firms) are Building Materials, Mechanical Engineering, Health & Household Products, Packaging & Paper, Textiles and Insurance.

TABLE 7. OWNERSHIP CONTROL BY INDUSTRY.

Industry:	Firms	Fixed Rules OC1	OC2	OC3	Variable Rules OC90	OC95	OC99
1 Building Materials.	21	13(62)	6(29)	4(19)	3(14)	2(10)	1(5)
2 Contrg & Construction.	25	25(100)	16(64)	7(28)	5(20)	4(16)	3(12)
3 Electricals	15	14(93)	13(87)	9(60)	9(60)	6(40)	5(33)
4 Electronics	15	14(93)	7(47)	3(20)	3(20)	2(13)	2(13)
5 Mechanical Eng.	42	40(95)	19(45)	6(14)	6(14)	4(10)	2(5)
6 Metals & Metal Forming	15	14(93)	12(80)	4(27)	5(33)	3(20)	2(13)
7 Motors	18	18(100)	13(72)	9(50)	6(33)	5(28)	1(6)
8 Other Ind. Mats.	15	14(93)	9(60)	5(33)	3(20)	2(13)	0(0)
9 Brewers & Dist.	15	15(100)	10(67)	7(47)	5(33)	4(27)	4(27)
10 Food Manuf.	17	12(71)	7(41)	3(18)	5(29)	4(24)	2(12)
11 Food Retailing	10	10(100)	7(70)	4(40)	3(30)	2(20)	1(10)
12 Health& Ho. Prods.	3	1(33)	1(33)	0(0)	0(0)	0(0)	0(0)
13 Leisure	15	14(93)	10(67)	6(40)	6(40)	6(40)	5(33)
14 Publg & Printing	15	15(100)	10(67)	6(40)	6(40)	6(40)	4(27)
15 Packaging & Paper	15	13(87)	9(60)	2(13)	2(13)	1(7)	0(0)
16 Stores	33	31(94)	22(67)	13(39)	12(36)	9(27)	3(9)
17 Textiles	15	15(100)	10(67)	3(20)	2(13)	1(7)	1(7)
18 Chemicals	15	15(100)	8(53)	5(33)	5(33)	3(20)	1(7)
19 Office Equipment	9	7(78)	5(56)	4(44)	2(22)	1(11)	1(11)
20 Shipping & Trans.	15	15(100)	10(67)	5(33)	5(33)	5(33)	4(27)
21 Misc.	35	33(94)	21(60)	11(31)	9(26)	7(20)	6(17)
22 Oil & Gas	12	9(75)	6(50)	5(14)	4(33)	3(25)	1(8)
23 Property	15	15(100)	10(67)	6(40)	5(33)	3(20)	2(13)
24 Overseas Traders	14	12(86)	12(86)	10(71)	8(57)	7(50)	3(21)
25 Banks	3	3(100)	3(100)	2(67)	2(67)	2(67)	2(67)
26 Insurance	10	7(70)	3(30)	1(10)	1(10)	1(10)	1(10)
27 Ins. Brokers	5	4(80)	2(40)	2(40)	1(20)	1(20)	1(20)
28 Merchant Banks	10	10(100)	9(90)	6(60)	4(40)	3(30)	2(20)
29 Other Financial	23	21(91)	15(65)	12(52)	9(39)	7(30)	6(26)
Total	470	429(91)	285(61)	160(34)	136(29)	104(22)	66(14)

Table shows the number of firms in each industry and the number classified as ownership controlled by each of the six criteria. Numbers in brackets are percentages of firms in the industry.

1.4. ANALYSIS OF POTENTIAL CONTROLLING COALITIONS

In the previous section control through ownership was inferred if the largest shareholding could be shown to be large enough by itself, the variable rules making use

of its degree of control, α_1. An analysis based solely on the leading shareholding ignores the possibility that control could be exercised through a group of k, where k>1, large shareholdings, each individually too small, but big enough collectively, using the group's degree of control α_k. Defining ownership control in this way does not have to presuppose the existence of linkages among the members of the group; such linkages are ruled out in our approach both theoretically, in that shareholder voting is assumed independent, and empirically, in that, if there was evidence to suspect any such linkage, the holdings involved were combined at the data collection stage. On the contrary, the approach is to examine whether the ownership structure is such that there is the *potential* to form a controlling bloc at sufficiently small cost ; ownership control is assumed if such a potential controlling coalition can be found.

As in Section 1.3, ownership control here is a property solely of the ownership structure; the difference, however, is that in that approach, any controlling coalition is exogenous while in that of this section we allow for the possibility of controlling coalitions being formed endogenously. The justification for this is the theoretical model described in Leech (1987a) in which the formation of controlling coalitions from among leading shareholders depends on the costs and benefits of control; a potential controlling coalition exists if the former are small relative to the latter. The costs of organizing a group to take concerted action in the exercise of control are assumed to depend on the number of holdings represented in it and to increase rapidly beyond a small number. The group is termed a *potential* controlling coalition since it is not suggested that it can be identified as such in practice but that, for purposes of control, there is a strong incentive for it to be brought into existence; any tendency of management to pursue objectives which reduced shareholder welfare might be met by such a response.

Table 8 reports the results of an investigation of potential controlling coalitions. The ownership structure of each company has been analysed by successively amalgamating leading holdings into a bloc, computing its degree of control and

comparing it with the threshold level assumed necessary for control; if the former was lower than the latter, then the next-smallest shareholding was added to the bloc and the calculation repeated until its degree of control reached the critical value required. Such a bloc always exists but for it to be controlling it must contain a small number of holdings. How small this is is a matter of conjecture but certainly it would not be unreasonable if it were less than 10 shareholders, a number small enough for an effective committee[10]

The sizes of potential controlling coalitions obtained, k, are tabulated against their voting strengths, C_k, for the three critical levels of the degree of control, α_k. Two points emerge strongly from Table 8. First, the results contrast sharply with those of Section 1.3 in suggesting that British companies are overwhelmingly owner controlled. Indeed a control-type classification appears to have very little power to discriminate among companies. A degree of control of 90 percent, the weakest criterion of the three, gives potential controlling coalitions of 1, 2 or 3 holdings[11] in 449 companies out of 470, or 95.5 percent; in only 1 company does the controlling coalition contain more than 5 shareholders and allowing coalitions up to 10 members means every company would be owner controlled. The strongest criterion used, a degree of control of 99 percent, gives a greater spread of values of k and finds controlling coalitions of 1, 2 or 3 members in 252 firms (53.6 percent); in only 49 cases does the coalition contain more than 5 and all companies except one have potential controlling coalitions with 10 or fewer members.

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[10]See Leech (1987a).

[11]Including where the groups have majority control.

TABLE 8. POTENTIAL CONTROLLING COALITIONS
Size of coalition versus number of shareholdings it contains

Degree of control α_k=90%

Size C_k:	Number of holdings k:							Total
	1	2	3	4	5	6-10	>10	
>50%	25	8	0	0	0	0	0	33
20-50	97	98	42	0	0	0	0	237
10-20	14	61	96	16	1	0	0	188
5-10	0	2	6	3	0	1	0	12
<5%	0	0	0	0	0	0	0	0
Total	136	169	144	19	1	1	0	470

Mean k: 2.1; median k: 2. Mean C_k: 25.9; median C_k: 21.6.

Degree of control α_k=95%

Size C_k:	Number of holdings k:							Total
	1	2	3	4	5	6-10	>10	
>50%	25	15	0	0	0	0	0	40
20-50	71	99	92	20	0	0	0	282
10-20	8	17	48	55	13	2	0	143
5-10	0	0	1	1	1	2	0	5
<5%	0	0	0	0	0	0	0	0
Total	104	131	141	76	14	4	0	470

Mean k: 2.5; median = 2.5. Mean C_k: 28.4; median C_k: 24.0.

Degree of control α_k=99%

Size C_k:	Number of holdings:							Total
	1	2	3	4	5	6-10	>10	
>50%	25	20	1	0	0	0	0	46
20-50	40	77	87	89	62	24	0	379
10-20	1	0	1	5	13	24	1	45
5-10	0	0	0	0	0	0	0	0
<5%	0	0	0	0	0	0	0	0
Total	66	97	89	94	75	48	1	470

Mean k: 3.4; median = 3. Mean C_k: 32.4; median C_k: 29.1.

The second interesting result to emerge from Table 8 is that many of these potential controlling coalitions are relatively small; only a small number of shareholdings are typically required for a controlling bloc not because it tends to contain a majority of the votes but because it concentrates the voting power. According to the 90 percent rule, for only 33 companies (7% of the sample) is the coalition a majority while the 99 percent rule suggests 46 (9.8%). Therefore, the overwhelming

preponderance of companies have potential controlling coalitions of fewer than 10 members and a total combined voting strength of less than 50 percent. On the weakest, 90 percent rule, in 200 cases (42.6 % of the sample) this coalition is smaller than 20 percent ; however, on the 99 percent rule, 45 (9.6%) companies have such coalitions. The median coalition size is 21.6% on the 90 percent rule and 29.1 % on the 99 percent rule. There is therefore a contrast between the typical size of a potentially controlling coalition in Table 8 and the size of controlling shareholding in Table 3.

There appears also to be an approximate relationship between k and C_k which is shown in Figures 1, 2 and 3 for the respective control rules. We would have expected to observe no relationship whereas the data reveals a fairly strong negative association. Figure 1, for α_k = 99 percent, indicates an average 5% decline in C_k for every additional member in the potential controlling coalition.

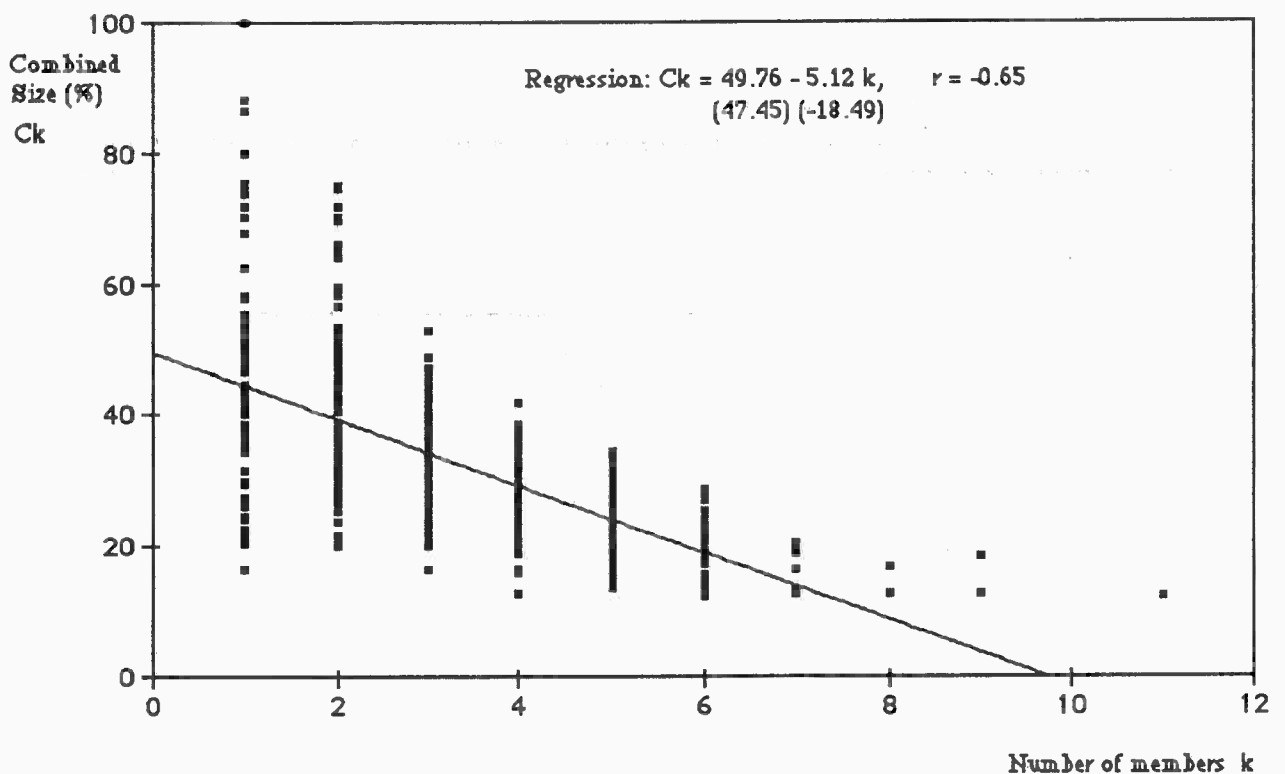Figure 1. Potential Controlling Coalitions: Size versus Membership, Degree of Control 99%

Regression: Ck = 49.76 - 5.12 k,   r = -0.65
(47.45) (-18.49)

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Figure 2. Potential Controlling Coalitions: Shareholding versus Membership, Degree of Control 95%

Regression: $C_k = 46.35 \quad -7.11\,k, \quad r = -0.58$
$(36.16) \quad (-15.39)$

Combined Size (%) C_k
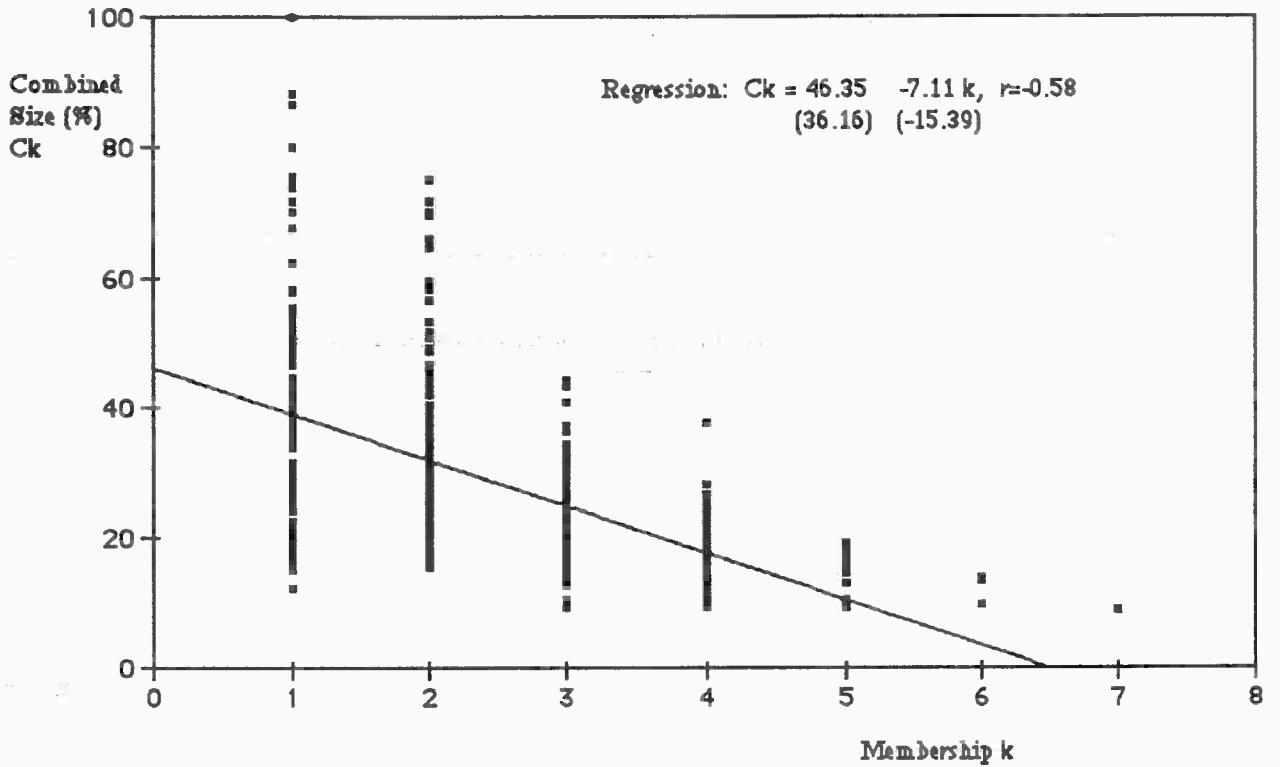
Membership k

Figure 3. Potential Controlling Coalitions: Size versus Membership, Degree of Control 90%

Regression: $C_k = 44.36 \quad -8.74\,k, \quad r = -0.56$
$(32.03) \quad (-14.47)$

Combined Size (%) C_k

Membership k
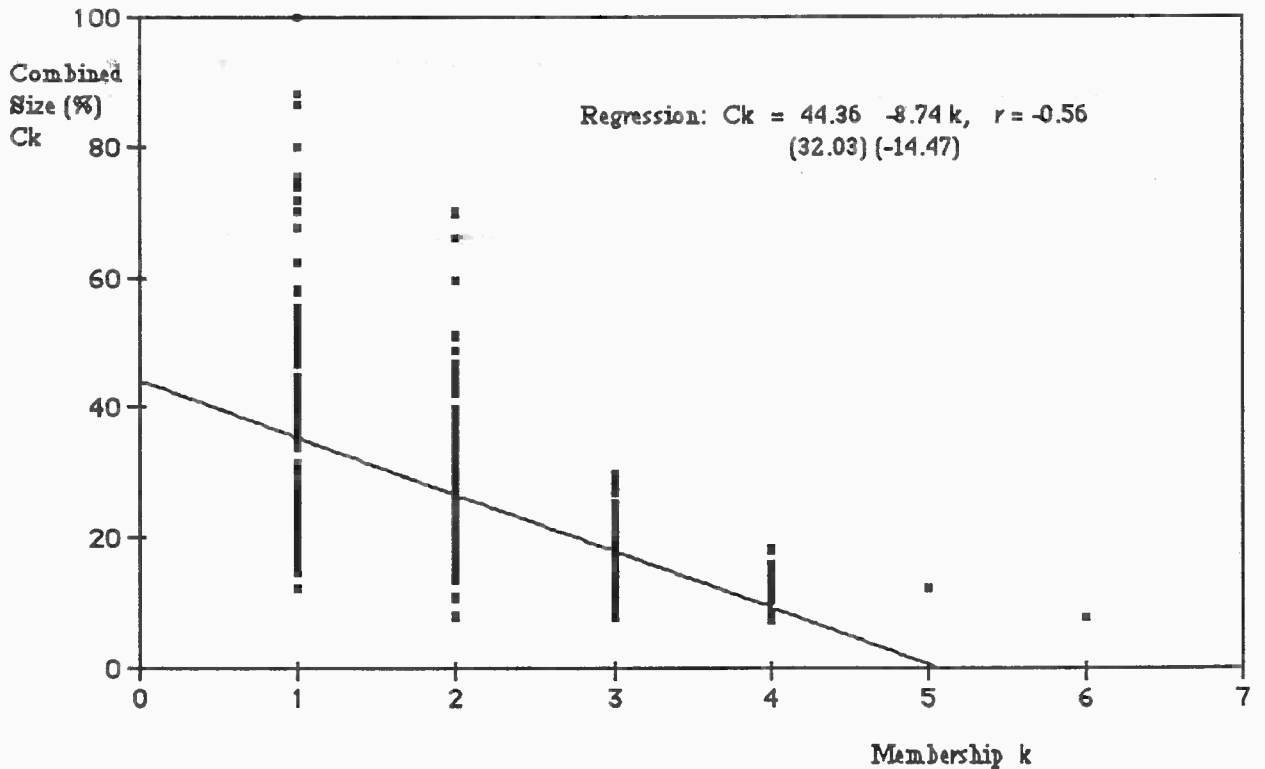
2. THE STRUCTURE OF OWNERSHIP AND COMPANY BEHAVIOUR

The literature on the separation of ownership and control assumes the existence of pecuniary or non-pecuniary management objectives other than profit maximization which affect company behaviour and performance whenever managerial discretion exists. The various managerial theories all assume a fundamental trade-off between profits and one of these goal, each of them emphasizing a different one. In the Baumol (1959) model it is the volume of sales; in Williamson (1964) the number of staff and management emoluments; in Marris (1963) the rate of growth of the firm; in Monsen and Downs (1965) management's goals include avoidance of risky activities (thereby *pace* Marris ensuring slower growth), enhancement of their own prestige and lifetime incomes; and in Comanor and Leibenstein (1969) the managerial goal is X-inefficiency. Managerial discretion to pursue such goals is constrained fundamentally by the concentration of ownership in determining voting power and control of the firm. Where ownership is dispersed to the extent of allowing control by management, a further constraint on its discretion is the potential threat that a controlling shareholding may emerge in reaction to the resulting loss of profit. Most of the literature has followed Marris (1963) in suggesting that this mechanism would operate through the threat of takeover by some outside group whenever profit and hence share values fell below its maximum potential level. A minority of authors have emphasized the second mechanism acting to discipline management through the threat that a controlling group may be formed among existing shareholders.[12]

2.1. TESTING MANAGERIAL THEORIES

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[12]Yarrow (1976), Aoki (1983), Leech (1987a)

Previous tests of the implications of the separation of ownership and control are surveyed in the references given in the introduction; they vary in the periods to which the data refer, the firms included in the sample (though most have concentrated on large firms), the definitions of control types, and the performance indicators used.[13] The majority are American and use single-equation econometric methods following the two studies by Kamershen (1968) and Monsen, Chiu and Cooley (1968) which reached mutually contradictory conclusions. Studies for the UK are respectively Radice (1971), Holl (1975), Steer and Cable (1978) and Cubbin and Leech (1986).

Looking at the studies as a whole a number of general points emerge. First, the results have tended to show that ownership-controlled firms have had higher profits, but typically the quantitative estimate of the effect of control type has either been too small to be of economic importance or statistically insignificant. The single-equation British studies of Radice (1971) and Steer and Cable (1978), using different samples and slightly different definitions of control type, both found evidence of a positive effect of ownership control on profits; the former also found higher growth rates in ownership-controlled firms. Holl (1975) obtained results which were qualitatively similar but not statistically significant. Second, although they have used different rules to define control type, all those which used purely statistical criteria have used fixed rules.[14] Moreover, none of the studies except that by Lawriwsky (1984) appears to have regarded the question of which rule to use as one deserving investigation and have not done any sensitivity analyses to compare results obtained using different definitions. Third, most of the studies have made a distinction, following Berle and

[13]Lawriwsky (1984) presents a useful table briefly indicating the main features and findings of each study.

[14]Of the British studies, Radice (1971) did not make a complete classification of his sample, but defined owner-control if the largest shareholding group held 15 percent, management control if it was less than 5 percent and left a transitional group in between. Steer and Cable (1978) defined owner control if the largest group held 15 percent or managers held 3 percent, ignoring financial institutions.

Means, between ultimate and immediate control which takes into account the type of owner of controlling shareholdings; thus, a company with a controlling holding which is identified as belonging to another company which is manager controlled is itself classified as manager controlled. This procedure, which tends to reduce the reported incidence of ownership control, has been criticized by Nyman and Silberston (1978) on the ground that control is concerned with power rather than behaviour and is best analysed in structural rather than behavioural terms. Control is defined as the capacity to influence the exercise of whatever discretion exists and specifically includes the ability to select and change senior management; this definition does not require that such influences should be observed to be exercised, merely that they exist as a potential. It therefore follows that a controlling shareholding in a subsidiary company acts as a constraint on the latter's management whether the parent company is owner-controlled or not.

Given a classification of companies in terms of the ownership-control criteria described in section 1.1, it is possible to develop more powerful econometric tests of managerial theories. We have used both a single equation approach to testing managerial theories in general and a simultaneous equations approach to testing the Marris model in which there are essentially two endogenous variables. The latter results are not reported since the levels of statistical significance obtained were extremely low.[15]

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[15]The specification we estimated was based on that of Cubbin and Leech (1986) using as endogenous variables the valuation ratio and the rate of growth (VAL and NAG). The model consists of a profit/growth tradeoff, including firm and industry characteristics as exogenous variables, in which there is expected to be a negative relation between the endogenous variables, and an expansion path, in which exogenous variables are ownership characteristics and cost of capital. The instrumental-variables estimates provided no statistically significant evidence of either control effects or ownership concentration effects in structural coefficients; nor did we find evidence of a structural tradeoff between the valuation ratio and the growth rate. The only coefficient which was consistently significant in the specifications estimated was that of the growth rate in the expansion path equation which was positive. Dobson and Gerrard (1989) provide some evidence that whether or not a tradeoff between growth and profits is observed depends on the definition of profitability used: using the rate of return gave them a positive relationship while using the profit margin they obtained a negative coefficient. However the theoretical specification is in terms of the rate of return (or valuation ratio) and their finding does not have a straightforward interpretation within the Marris model.

The basic approach adopted here is to specify a multivariate regression model (which is assumed to be a reduced form) to explain a vector of variables which are closely associated with the goals of the firm in a general managerial model; these endogenous variables include those which are presumed to be arguments of managerial utility functions as well as profitability measures. An advantage of this multivariate approach is that it enables comparative statements to be made about the impact of independent variables on the whole range of dependent variables analysed, possibly allowing a clearer descriptive picture to emerge than would be the case if considering a separate model to explain each goal independently. The regressors are a set of variables (by assumption exogenous) which describe the firm and industry effects are allowed for by dummy variables or fixed effects. Various specifications were tested, the main focus of the analysis being on the precise description of ownership structure in terms both of concentration and control-type. A full list of all the variables used in the econometric analyses described below is given in Table 9.

A possible objection to this approach is that the sample may be truncated because, according to the theory we wish to test, firms whose profitability is reduced due to the exercise of managerial discretion are the ones most liekely to be taken over. The results of regression analysis will therefore be affected by sample selectivity bias. However, we expect that this effect would be much more serious for a sample consisting of smaller companies since the evidence from takeover studies suggests that the likelihood of a firm being taken over decreases *ceteris paribus* with its size and that acquiring firms are usually larger than acquired firms.[16] We therefore assume that in a sample such as this one consisting of some of the largest firms, truncation biases might not be serious.

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[16]Aaronovitch and Sawyer (1975), Singh (1975).

TABLE 9. DEFINITIONS OF VARIABLES

VAL	Historical market value divided by ordinary share capital
TPM	Trading profit margin (%)
RSHC	Return on shareholders' capital (%)
LTS	Logarithm of total sales
LNEMP	Logarithm of number of employees (Stock Exchange Companies)
LSHR	Logarithm of number of shareholders (Stock Exchange Companies)
LH	Logarithm of Herfindahl index of share ownership
LC1, LC5, LC10, LC20	Logistic transformation of ownership concentration indices defined in Table 1: eg $LC5=\log(C5/(100-C5))$
DIV	Diversification index: sum of squares of proportions of total company sales in different areas (Herfindahl concentration index)
EXP	Proportion of sales exported (Stock Exchange Companies)
CEPE	Capital employed per employee (£0,000)
AGE1	Number of years since first registration (Stock Exchange Yearbook)
AGE2	Number of years since public quotation (Stock Exchange Yearbook)
BETA	Coefficient of systematic risk (London Business School Risk Measurement Service)
SD	Standard deviation of share price (London Business School Risk Measurement Service)
SIGMA	Unsystematic Risk: standard error of regression of share price on market portfolio (London Business School Risk Measurement Service)
TAEG	Growth rate of total assets employed (%pa)
NAG	Growth rate of net assets (%pa)
TSG	Growth rate of total sales (%pa)
BANK	Dummy variable = 1 if largest shareholder is a bank or nominee company with beneficiaries unknown (WOWLSE)
INS	Dummy variable = 1 if largest shareholder is an insurance company (WOWLSE)
NFCO	Dummy variable = 1 if largest shareholder is a non-financial company (WOWLSE)
POL	Political contributions (£000)
CHAR	Charitable donations (£000)
ND	Number of directors
HDS	Highest-paid director's salary (£000)
AVDR	Average director's remuneration((£000)

Source: Datastream unless indicated otherwise.

Full results are reported for six goals: (i) Valuation ratio (VAL); (ii) Trading profit margin (TPM); (iii) Rate of return on shareholders' capital (RSHC); (iv) Rate of growth of total sales (TSG); (v) Rate of growth of net assets (NAG); (vi) Salary of the

highest-paid director (HDS).[17] This set of variables are taken as the arguments of a managerial utility function in which pure managers benefit from rapid growth and high salaries and pure owners are interested in profits; we would therefore expect owner-controlled firms to do well in terms of goals (i) to (iii) and manager-controlled firms to do better in terms of (iv) to (vi). Therefore the approach adopted is based on the use of a general framework in which both profit maximization and pure managerial behaviour, such as growth maximization, are nested hypotheses.

Table 10 provides a comparison of the means of the six goals over the ownership-controlled and manager-controlled groups (means and other summary statistics calculated over the complete sample for all variables used in the econometric analysis are presented in Table 11 below); the table reports the differences in the means of the variables between the two groups for each of the six control-type rules, and the corresponding t statistics, allowing gross comparisons to be made.

Looking at the signs of the differences, the fixed rules give a lower average valuation ratio, VAL, in ownership-controlled firms, which is unexpected, but the variable rules give the opposite result. The difference in the trading profit margin, TPM, has the expected sign on four of the rules and the return on shareholders' capital, RSHC, is generally higher in firms classified as ownership-controlled (except on OC1). The rate of growth of sales is higher in firms classified as ownership-controlled; however, the same is not true for the rate of growth of net assets, NAG, where ownership-controlled firms appear to have a lower rate of growth on the variable rules. There is a clear result for the highest-paid director's salary, HDS, for which the average is always lower among ownership-controlled firms. All the differences observed, however, are statistically insignificant, except for HDS. The results in Table 10 provide

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[17]Several other "managerial" variables were also used, but results for them are not reported fully since they revealed little of interest.These were: Political contributions, POL, Number of directors, ND, Charitable donations, CHAR, Average director's remuneration, AVDR, Growth rate of total assets employed, TAEG.

some support for managerial theories on the basis of a variable rules classification since the expected sign is obtained for all three rules for VAL, RSHC, NAG and HDS; the *a priori* wrong sign is obtained for TSG.

TABLE 10.MEAN DIFFERENCES IN GOALS

Variable:	Fixed Rules			Variable Rules		
	OC1	OC2	OC3	OC90	OC95	OC99
VAL	-2.73	-1.60	-0.59	0.89	1.06	0.91
	(-0.69)	(-0.98)	(-0.40)	(0.56)	(0.57)	(0.39)
TPM	-1.83	1.57	3.58	4.12	4.51	-0.44
	(-0.94)	(0.82)	(1.04)	(1.04)	(0.86)	(-0.27)
RSHC	-1.57	-0.17	0.56	**1.65**	1.19	1.46
	(-0.69)	(-0.15)	(0.58)	(1.82)	(1.23)	(1.30)
TSG	0.69	1.20	2.17	1.14	1.45	1.15
	(0.36)	(0.80)	(1.33)	(0.79)	(0.95)	(0.70)
NAG	-0.07	5.90	10.89	-3.58	-1.13	-0.22
	(-0.01)	(0.84)	(0.90)	(-0.62)	(-0.21)	(-0.04)
HDS	**-30.01**	**-15.44**	**-11.22**	**-8.13**	**-7.51**	-4.90
	(-5.81)	(-5.60)	(-4.09)	(-2.75)	(-2.15)	(-1.04)

Numbers in brackets are t statistics. Statistically significant differences in bold type.

2.2 A SINGLE-EQUATION APPROACH

A firm's performance reflects factors acting on both its objective function and the constraints it faces, respectively internal and external influences. The former include internal organization variables (control type, organizational form) and factors modifying incentives (ownership concentration, risk); the latter include product market influences (market concentration, entry barriers, oligopolistic interdependence, technology), capital market influences (the cost of capital, the market for corporate control), life-cycle effects and labour market influences. In specifying a firm-level equation, however, this dichotomy is not useful since some variables may operate through both internal and external effects. A more useful distinction is between firm-level variables which vary between observations and industry or market-level variables. The latter may conveniently be allowed-for indirectly by dummy variables; this method is adequate since our concern is to investigate the role of ownership structure rather than construct a complete model. This has the advantage that it avoids bias due to omission of industry-

level variables, its disadvantages (shared by all industry-level studies) are that the industry rarely corresponds to the market and that assigning a multi-product company to a particular industry is anyway arbitrary.[18] The explanatory variables used are described below. Their choice has been dictated by the availability of reliable company-level data covering a large proportion of the sample.[19]

Ownership structure is hypothesized to affect behaviour in two ways: (i) directly by its effect on the incentives facing share owners and (ii) indirectly through the distribution of power (which determines control) within the voting body comprising all the shareholders. We include variables to measure both effects within the specification: ownership concentration and control type.

Ownership concentration. Ownership concentration has direct effects on managerial incentives independent of control type. Where ownership is highly dispersed, individual owners have very little incentive to discharge their duties as shareholders (as those to whom directors are ultimately accountable) since any costs in terms of poorer performance by the firm are shared by all owners in proportion to their relative holdings. Conversely the more concentrated is ownership the greater the proportion of these costs borne by an individual owner and the greater his incentive to attend to his shareholder duties. On the other hand, in the diffused-ownership case risk-averse shareholders prefer to hold a diversified portfolio and to sell their holding if earnings fall below market levels; the firm is restrained from departing too far from profit-maximizing behaviour by its need to maintain its share price (as a defence against takeover and to keep down the cost of raising new capital). This argument would

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[18]For these reasons our definitions of industries are based on the Stock Exchange classification of listed equities rather than the Standard Industrial Classification; using the latter requires us to assign each firm to an industry while using the former does not, the assignment being made by the Stock Exchange.

[19]It did not prove possible to collect data on all suitable variables and there are some omissions, for example unionization, organizational form, advertising and R&D expenditure.

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therefore suggest an ambiguous sign for the coefficient of an index of dispersion: greater ownership concentration would lead, on the one hand, to behaviour closer to profit maximization and less management discretion through its effect on the owners' incentives, but on the other hand, there would be a less well developed market for its shares and therefore weaker market discipline. In the results discussed below, a specification search has been made over five concentration indices: C1, C5, C10, C20, H. (These variables are referred to as CONC.)

Control Type. The relationship between ownership control and ownership concentration has been described above in section 1.1. A managerial hypothesis would predict a positive coefficient on control-type in the profit equations and a negative coefficient in the other equations, given an accurate assignment of companies to the two categories. The econometric analysis reported below is the outcome of a specification search over the six control-type variables: OC1, OC2, OC3, OC90, OC95, OC99. By using six different assignments (three using fixed-percentage rules and three based on different degrees of control) in a specification search, we adopt a general approach which avoids having to make an arbitrary choice of control-type criterion.

Risk Two different measures of financial risk have been included based on the variability of returns on the company's shares: (i) SD, the standard deviation of the rate of return, which measures *total risk*; and (ii) a measure of *systematic risk*, BETA. BETA is estimated from a market model as the coefficient in a regression of its rate of return on the market average and it expresses the sensitivity of the expected rate of return to general market conditions. The residual standard error in this regression, SIGMA, measures the unsystematic risk which is unrelated to general market conditions; from the point of view of a risk-averse portfolio investor this variable is irrelevant since a high degree of unsystematic risk can be eliminated by diversification. Systematic risk, on the other hand, cannot be diversified away and the Capital Asset

Pricing Model[20] predicts that investors in shares having a high BETA will seek compensation for the high risk in a high expected rate of return; BETA is an index of the cost of capital. While systematic risk is relevant to shareholders, it is total risk which matters to managers (and employees) since their commitment to the firm is total and they are unable to offset high risk (for example of bankruptcy) by diversification. These two variables, total risk, SD, and systematic risk, BETA, are therefore both included as explanatory variables[21] on the grounds that they are relevant to different groups within the firm and therefore likely to influence behaviour in different ways. We expect systematic risk BETA to have a positive coefficient in the profit equations but have no *a priori* expectations about the signs of the SD coefficients, except a positive sign in the HDS equation.

Size. Size (measured in the specification by the logarithm of total sales, LTS[22]) influences performance in a number of ways determining the extent of product market and capital market constraints. The level of output itself raises entry barriers through economies of scale. Market share determines the market power of the firm given entry barriers and hence the scope for managerial discretion that exists. This effect is picked up by company sales given our methodology of using dummy variables to stand for industry effects and it is unnecessary to include market share explicitly in the specification.[23] Size also has capital market effects since larger companies have a

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[20]See Fama and Miller (1972).

[21]Alternative specifications were tried using SIGMA, unsystematic risk, instead of SD but the overall fit of the model was little different and the results hardly changed.

[22]Other specifications were tried using other size measures: number of employees, total gross assets employed but which measure was used made little difference to the results and sales was chosen as the preferred index of size.

[23]Suppose the equation is written in the form: $y_i = \alpha + \beta(x_i - z_i)$ + other terms, where x_i is (the logarithm of) company sales and z_i is the (logarithm of) total sales of the industry to which firm i belongs. Consider the dummy-variables specification $y_i = \alpha + \beta x_i + \gamma_j d_{ji}$ + other terms, where d_{ji} is the industry dummy which takes the value unity when firm i belongs to industry j and zero otherwise. Then the two are equivalent since we can write $\gamma_j = \beta z_i$ for all j.

greater capacity for financing expansion by internally generated funds. They are also able to raise finance more easily through the capital market and there is a better secondary market in their shares. Size also has life-cycle effects since opportunities for growth are likely to be greater for smaller firms.

Diversification. An index of product diversification is included partly to reflect the imperfect nature of the industrial classification employed and partly to allow for differences in risk. We would also expect more diversified firms to have greater market power and efficiency advantages. This is proxied by the variable DIV, defined as the sum of squares of the shares of company sales in different product groups (defined by Standard Industrial Classification three-digit codes). A value of DIV = 1 implies a single-product firm and one of less than 1 indicates a degree of diversification; as a Herfindahl index, DIV has a numbers-equivalent property whereby, if the firm sells an equal proportion of its total sales to each of n markets, DIV = 1/n.

Age. The age of the firm (the number of years since first registration), AGE1, is included to allow for a number of possible life-cycle effects of the age of the firm as an organization: profits of older firms may be enhanced by productivity gains resulting from learning by doing or by reputation effects leading to increased demand; on the other hand older firms might make lower profits as they become bureaucratic and less dynamic or because their technology has become dated or, following Mueller (1972), because their management has become able to exercise a degree of influence, independent of owners, on the objectives they pursue.[24] The age of the company is a rather poor indicator of life-cycle effects since: (i) each firm has a different life cycle; and (ii) it can be totally misleading as a guide to the age of the organization if a merger

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[24]We might expect such effects of age to be non-monotonic and therefore a non-linear specification would be appropriate. In the estimation we experimented with different specifications in which the age variable was entered nonlinearly by including the square of AGE1 but the quadratic term was insignificant and the other coefficients were little different. We therefore found little evidence to support non-monotonic life-cycle effects of this type.

or other major restructuring has resulted in the creation of what is formally a new company with its own registration date.

Export intensity. We include a measure of the export intensity of sales as an index of exposure to competition in world markets. The measure used is denoted by EXP, the proportion of total sales exported.

Capital intensity of technology. An approximate capital/labour ratio is included to allow for any technological effects; also managerial of the technostructure on firm performance. It is measured by the ratio of capital employed to employees, CEPE.

2.3. SINGLE-EQUATION RESULTS

The single-equation approach described above has been applied using financial and sales data from Datastream. In order to minimize the effects of measurement errors and transitory fluctuations, five years' Datastream entries were used covering the period 1981-5, for those variables and firms for which it was available; in some cases the series was incomplete, due to omissions in the filing of company reports on the database and the averages have had to be calculated over those years for which data was complete[25]. The analysis is therefore interpreted as being long-run in nature and the regression results reasonably free of bias due to measurement errors. Additional variables have been collected from the Stock Exchange and LBS Risk Measurement Service; descriptions of the full set of variables used are given in Table 9 and summary statistics are presented in Table 11.

Because of the uncertainty surrounding the control-type classification and the appropriate index of ownership concentration, the model has been estimated separately for each pair and the choice of specification made using an appropriate model-selection

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[25]Where this occurred it introduced heteroscedasticity due to the use of group means calculated from different numbers of pieces of data; this was corrected for in the standard way by the use of suitable weights in estimation.

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criterion. We have therefore allowed the data the opportunity to choose the appropriate indices; if there is evidence to support the separation thesis then the appropriate ownership-control dummy variable should appear with a statistically significant coefficient in the equation of best fit. Each equation reported represents the result of a search over 30 combinations (six control types and five concentration indices).

The results are presented in Table 12. All equations reported have been estimated by least squares but Breusch-Pagan statistics indicated heteroscedasticity which might bias the inferences; because of this the t statistics reported are based on the use of White's heteroscedasticity-consistent standard errors. The results show that the single-equation model gives a relatively good explanation in terms of R^2 with the variables being jointly significant for all six principal goals. One of the ownership structure variables has a statistically significant coefficient in every equation except that for HDS, the highest paid director's salary. The specification search for the two appropriate ownership-structure variables produces the result that, when its coefficient is statistically significant, the appropriate concentration index is C20 and the ownership-control dummy variable with the greatest explanatory power is one of those based on variable rules, all three being chosen in different equations.[26] In no case did a fixed-rule dummy variable have a significant t statistic.

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[26]We carried out sensitivity analyses for each equation testing its specification using a likelihood-ratio-type criterion. The criterion was based on the standard formula $-2\log(\lambda)$, where λ is the likelihood ratio. Although this is not a rigourous non-nested hypothesis test, we used it informally to compare the specifications, comparing the value of $-2\log\lambda$ with the critical value of χ^2 with 2 degrees of freedom. (This formula was corrected for the differences in the numbers of observations used.) The results (using a 5% significance level) showed a general pattern for TSG, RSHC, TSG and HDS where there was no significant difference with respect to different ownership-control dummies; there were significant differences between different concentration indices. For VAL all the ownership-control dummies were rejected apart from OC90.

TABLE 11. SUMMARY STATISTICS FOR VARIABLES

Variable	Minimum	Maximum	Mean	St. Deviation
AGE1	1	203	53.43	29.75
AGE2	1	203	42.91	29.92
BETA	0.44	1.35	0.93	0.16
CEPE	1777	5073000	68980	327300
DIV	0.168	1.0	0.6673	0.2741
NAG	-265.8	1651.0	11.79	83.53
NEMP	0	221200	5702	13110
NSHAR	92	140100	6744	12450
HDS	1.5	240.5	55.56	28.37
RSHC	-117.4	27.76	6.079	10.64
SD	0.15	0.80	0.36	0.11
TAEG	-53.59	93.49	10.80	16.07
TPM	1.545	422.5	10.80	22.08
TS	118.0	4252000	244700	468500
TSG	-36.66	117.6	12.27	15.08
VAL	0.4760	167.5	10.11	15.67
C1	1.94	75.50	15.86	11.96
C5	6.87	84.73	36.94	15.94
C10	11.58	90.25	48.90	16.52
C20	18.07	94.77	60.47	16.57
H	0.003964	0.5732	0.0612	0.0658

An ownership-control type variable is significantly positive in four equations, TPM, RSHC, TSG and NAG, suggesting ownership-controlled companies to be relatively profitable and fast growing. The numerical values of the coefficients suggest that the effect of ownership-control is to raise profit margins by 1.89 percent, the rate of return on shareholders' capital by 4.54 percent, rate of sales growth by 5.06 percent per annum and the rate of growth of net assets by 10.59 percent per annum. Although the coefficient in the preferred specification for VAL is insignificant, specifications which were rejected did have OC90 or OC95 significant, suggesting a weak effect on the valuation ratio. By contrast the variable rules control-types were never statistically significant for HDS, while OC1 was in some specifications; CONC was never significant in this equation. This result and the coefficient value suggest a weak tendency for the salary of the highest paid director of a company where the largest shareholding exceeds five percent to be lower by some £10,000. Control type was never significant in the other regressions with other "managerial" dependent variables,

POL, ND, CHAR, AVDR, TAEG, reported briefly at the foot of Table 12. Our general conclusions are: (i) any control-type effects are detected by using the variable rules rather than the fixed rules as the basis of classification; (ii) ownership control has positive effects on *both* profit rates *and* growth rates; (iii) there is no evidence of manager-controlled firms incurring excessive discretionary expenditure.

Ownership concentration has significantly negative coefficients in VAL, TPM and NAG but not in the other three equations. The fact that the coefficient in RSHC is near zero suggests that the effect of ownership concentration via shareholder incentives is unimportant while the negative sign in the equation for the valuation ratio reflects the market discipline effect: where ownership is highly concentrated the market for shares is not well developed and this is reflected in an adverse market valuation irrespective of the rate of return on shareholders' capital. Ownership concentration also has a negative coefficient in the equations explaining political contributions POL and charitable donations CHAR, perhaps because of discretion enjoyed by powerful owners. The negative effect of ownership concentration on the rate of growth of net assets reflects the dilution of shareholding as a result of equity finance of expansion; this effect is apparently unimportant in explaining the growth of sales.

TABLE 12. REGRESSION RESULTS FOR GOALS

Independent variable:	Dependent variable:					
	VAL	TPM	RSHC	TSG	NAG	HDS
LTS	**-2.04**	**-2.68**	0.15	**-4.03**	-1.75	**10.20**
	(-3.12)	(-7.23)	(0.28)	(-3.63)	(-1.52)	(5.89)
DIV	**4.12**	-0.23	1.88	-4.18	4.72	-2.47
	(2.64)	(-0.20)	(1.16)	(-1.39)	(1.24)	(-0.51)
EXP	**3.56**	**4.98**	3.04	**9.41**	**6.65**	**18.33**
	(2.09)	(3.08)	(1.77)	(2.66)	(2.20)	(2.90)
CEPE	0.01	**0.15**	**0.03**	-0.03	0.10	-0.003
	(1.10)	(3.27)	(2.02)	(-0.88)	(1.54)	(-0.07)
AGE1	**-0.03**	**-0.02**	-0.01	-0.03	-0.01	**-0.11**
	(-2.60)	(-2.09)	(-0.67)	(-1.15)	(-0.38)	(-2.00)
BETA	**7.05**	**12.22**	**7.36**	8.02	-9.43	**19.02**
	(2.19)	(3.80)	(2.47)	(1.42)	(-1.13)	(2.02)
SD	**-22.33**	**-27.23**	**-53.50**	**-31.20**	**-26.07**	**-19.39**
	(-4.59)	(-8.60)	(-6.64)	(-2.34)	(-2.64)	(-2.00)
CONC	**-0.11**[a]	**-0.71**[a]	0.007[a]	-0.06[a]	**-0.21**[a]	0.01[b]
	(-2.89)	(-2.83)	(0.14)	(-0.85)	(-2.39)	(0.12)
OCdummy	2.96[A]	**1.89**[B]	**4.54**[C]	**5.06**[A]	**10.59**[C]	-10.25[D]
	(1.55)	(2.00)	(2.15)	(2.41)	(3.69)	(-1.73)
	plus industry dummies and constant					
F(variables,9df)	**5.95**	**15.90**	**11.52**	**3.67**	**3.30**	**18.53**
F(dummies,23df)	**3.93**	**3.93**	**2.38**	1.74	**3.42**	**3.77**
R^2	0.39	0.53	0.43	0.24	0.29	0.45
n	314	314	314	314	314	337
RSS	13716	8142.7	21700	50635	60007	162610
meanY	8.66	9.67	6.34	12.21	8.50	56.36
sdY	8.50	7.42	11.01	14.70	16.41	29.72
SE	6.99	5.38	8.79	13.57	14.61	23.13

(a) C20; (b) C10; (A) OC95; (B) OC90; (C) OC99; (D) OC1. All equations include a constant and 23 industry dummy variables. Significant coefficients and test statistics are in bold. (Significance levels: F 1%, t 5%) All six equations reported had significant Breusch-Pagan statistics indicating heteroscedasticity; biased inferences due to this cause have been avoided by use of White's heteroscedasticity-consistent standard errors in the calculation of the test statistics.

Other regressions (same specification as above including C20 and OC95):

Dependent variable	Significant regressors	R^2	n
POL	EXP(+),C20(-)	0.53	98
ND	LTS(+),EXP(+),CEPE(+)	0.53	314
CHAR	LTS(+),C20(-)	0.42	260
AVDR	LTS(+)	0.18	314
TAEG	LTS(-),SD(-)	0.26	311

Of the two financial risk variables, total risk SD comes out highly significantly negative in all six equations, the significance level being higher for VAL, TPM and RSHC. Finding this variable to be important in all equations was slightly surprising since our expectation was that it would matter in determining "managerial" goals but not necessarily "ownership" goals since systematic risk would be likely to be more important in the explanation of those. The systematic risk variable BETA has a positive coefficient in four equations, the three "ownership" goals and HDS; the first three of these are consistent with *a priori* expectations based on the capital asset pricing model that higher risk implies higher profits on the average. These results contrast somewhat with those of Mueller (1986) who obtained a negative sign on covariance-type measures of risk like betas and a positive sign on total risk when they were included in the equation separately. Product diversification, as measured by DIV, is insignificant in all equations except VAL where its coefficient is positive; by the definition of DIV this implies that greater diversification reduces the valuation ratio.

Total sales LTS comes out highly significant in a number of equations with the expected signs reflecting life-cycle and scale effects: larger firms have lower profit margins and valuation ratios, are slower growing and have better paid directors. The age of the company AGE1 is important in VAL, TPM and HDS, older firms having lower valuation ratios and margins and paying their highest paid director less. The export intensity variable is statistically significant in most equations: firms which export a higher proportion of their sales perform better in all the goals except the return on shareholders' capital.

3.DETERMINANTS OF OWNERSHIP STRUCTURE AND CONTROL TYPE

In this section we treat ownership structure endogenously and attempt to provide some empirical evidence of the factors which determine the wide variations in observed patterns of ownership among large companies. We report two analyses, one a

regression analysis using ownership concentration indices and the other a probit analysis of the control-type classifications.

3.1.DETERMINANTS OF OWNERSHIP STRUCTURE: THEORY

Most of the standard literature on the separation of ownership and control assumes a firm's control type to result from the concentration of ownership, the implicit assumption being that changes in the latter are exogenous to the former. There is an evolution of control whereby increasing dispersion of ownership occurring over the life of the company is seen as resulting in a transition from owner control to manager control. On the other hand, the probabilistic voting model suggests we would not expect to observe any simple relationship between ownership concentration and control type, greater dispersion, as measured by a simple concentration index, not necessarily implying control loss.[27] We would not therefore expect to observe the same effects in the two sets of analyses; the factors which determine concentration would not necessarily appear significant in explaining control type, if the control type classification we use is an accurate one.

We hypothesize that ownership structure depends on three broad factors: firm size, the riskiness of its environment and its age. In addition we have also attempted to allow for other determinants by including the industry dummies as in the previous analysis.

Firm Size. The larger the firm the greater the market value of a given fraction of ownership and therefore the greater the cost to investors of a controlling shareholding. Moreover, risk averse investors would wish to avoid holding a large proportion of their portfolio in a single asset. The probabilistic voting model suggests that it is possible that control may be maintained by a reducing fraction of ownership if ownership is

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[27]Leech (1987a) has shown that it is possible to observe increasing dispersion of ownership in a minority-ownership-controlled firm with growth financed by expansion of ownership.

sufficiently dispersed, an observation which is well-supported empirically. We would therefore expect to find a negative effect of size in an equation to explain a concentration index but no effect in the probit analysis of control type.

Risk. The riskiness of the firm's environment might be expected to have an influence on its ownership structure because of its effect on managerial discretion; where it is characterized by stability of prices, technology, market shares and so on the firm's performance is easily monitored by shareholders. Where there is a lot of uncertainty the behaviour of management has a greater impact on performance, in that frequent changes in the environment require frequent adjustments to the deployment of the firm's productive assets, and is correspondingly more difficult for an outsider to monitor. Shareholders therefore have a greater incentive to exercise control in this case and this would lead us to expect a positive relationship between a measure of risk and ownership control. On the other hand, we would expect risk averse investors to diversify away from relatively risky assets and therefore we would observe a negative relationship between risk and concentration. The distinction between the two measures of risk, systematic or diversifiable risk BETA and total risk SD, is important here since we expect the former to be negatively associated with *concentration* of ownership and the latter to be positively associated with ownership *control*.. We also include diversification DIV as a risk measure.

Age. Some of the literature assumes that the passage of time reduces the concentration of ownership as large blocs of shares held by individuals and families become fragmented through marriage and inheritance. This dispersal of shareholdings would tend to suggest an eventual loss of control. We therefore expect to observe a negative effect of this variable on both ownership concentration and ownership control. In the empirical analysis we have used the age of the company since going public since the age effect we are seeking to test relates to the size distribution of shareholdings rather than the age of the firm.

3.2.DETERMINANTS OF OWNERSHIP STRUCTURE: RESULTS

Two sets of results, for ownership concentration and for control type are reported in Tables 14 and 15. The equations were estimated with and without industry dummies, although there are no strong a *priori* reasons for expecting industry effects in these equations; the results were not particularly sensitive to their inclusion but since they were statistically significant, the former results have been reported in Tables 13 and 14.

In Table 13, all the dependent variables are transformations of the respective measures of concentration. In the cases of the four concentration ratios, C1, C5 C10, C20, we have used the logistic transformation; for example $LC1 = \log(C1/(100-C1))$. This transformation has been used to convert an otherwise bounded dependent variable into an unbounded one. The Herfindahl index and the number of shareholders have been transformed into logarithms.

The F statistic is significant in every case. The individual coefficients reveal, first, that ownership concentration depends on size, LNEMP, with the expected negative coefficient. Second, diversifiable risk, BETA, appears significantly in every equation with a negative coefficient, consistent with risk-averse diversification by investors. Third, the index of diversification DIV is generally significant with a positive sign indicating a negative association, *ceteris paribus*, between diversification and concentration of ownership; this may also represent risk aversion by shareholders. Fourth, there is no evidence of any tendency for firm-specific, non-diversifiable risk (reflected in the measure of total risk SD) to be associated with greater concentration, the control effect described above. The results for the financial risk variables are the opposite to those of Demsetz and Lehn (1985) who found ownership concentration to depend positively on measures of instability in a large sample of US corporations. They

included only a single variable as an index of total risk, corresponding to SD and assumed the diversification effect to be sufficiently allowed for by firm size.[28] They interpreted their result as evidence for the control effect. Fifth, the coefficient on the age variable has the expected sign but is insignificant in every equation explaining the concentration indices; it is significant on a one-sided test in the equation for the number of shareholders. This suggests that there is some evidence of a weak tendency for the number of shareholders to increase over time but without this affecting concentration.

TABLE 13. OWNERSHIP CONCENTRATION EQUATIONS

Independent Variables:	Dependent Variable					
	LC1	LC5	LC10	LC20	LSHR	LH
LNEMP	**-0.12**	**-0.19**	**-0.21**	**-0.24**	**0.53**	**-0.19**
	(-2.64)	(-5.71)	(-6.49)	(-7.69)	(13.94)	(-4.95)
DIV	**0.45**	0.27	0.28	**0.36**	**-0.66**	**0.44**
	(2.14)	(1.78)	(1.90)	(2.55)	(-3.89)	(2.42)
AGE2	-0.001	-0.001	-0.0003	-0.001	**0.003**	-0.001
	(-0.49)	(-0.67)	(-0.21)	(-0.62)	(1.89)	(-0.76)
BETA	**-1.20**	**-1.26**	**-1.31**	**-1.13**	**1.57**	**-1.35**
	(-3.08)	(-4.50)	(-4.83)	(-4.25)	(4.95)	(-4.00)
SD	0.70	0.48	0.31	-0.35	-0.11	0.47
	(1.30)	(1.24)	(0.83)	(-0.94)	(-0.25)	(1.02)
	plus industry dummies and constant					
F(variables)	**8.07**	**20.60**	**24.43**	**30.46**	**82.25**	**17.47**
F(ind. dummies)	**2.10**	**2.06**	**2.14**	**2.09**	**3.53**	**2.10**
R^2	0.23	0.33	0.35	0.39	0.61	0.31
n	388	387	385	359	373	388

t values in brackets, significant coefficients and test statistics in bold, levels of significance: t statistics 5%, F statistics 1%.

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[28]Demsetz and Lehn used three measures of instability: the standard error of estimate from a market model (our SIGMA), the standard deviation of stock market rates of return (our SD) and the standard deviation of accounting rates of return. All three had significantly positive coefficients.

TABLE 14. PROBIT ANALYSIS OF CONTROL TYPE

Independent Variables:	Dependent Variable:					
	OC1	OC2	OC3	OC90	OC95	OC99
LNEMP	**-0.73**	**-0.28**	-0.12	-0.001	0.04	0.06
	(-4.68)	(-4.20)	(-1.91)	(-0.01)	(0.50)	(0.77)
DIV	**1.96**	0.42	0.43	0.60	**0.74**	**0.89**
	(2.91)	(1.45)	(1.41)	(1.95)	(2.18)	(2.22)
AGE2	0.001	0.001	-0.003	-0.003	-0.0001	-0.001
	(0.25)	(0.37)	(-1.10)	(-1.10)	(-0.04)	(-0.28)
BETA	-1.83	**-1.48**	**-1.93**	**-1.20**	-1.19	-1.18
	(-1.67)	(-2.67)	(-3.38)	(-2.12)	(-1.95)	(-1.59)
SD	-1.15	0.38	1.13	0.00005	1.15	**2.45**
	(-0.75)	(0.51)	(1.48)	(0.001)	(1.37)	(2.53)
	plus industry dummies and constant					
Log Likelihood	-59.98	-219.69	-200.24	-200.46	-167.39	-114.20
χ^2(slopes,5df)	**67.6**	**37.0**	**37.2**	14.0	11.2	13.9
χ^2(ind.dums,22df)	**72.5**	**48.6**	31.4	27.8	34.9	40.08
n = 388						

Significant coefficients and test statistics in bold; levels χ^2 1%, coefficients 5%.

Table 14 gives the results of the corresponding probit analyses of the six control-type classifications. Statistically significant results, in terms of the χ^2 test of joint significance of the coefficients, have been obtained only for the three fixed rules, OC1, OC2 and OC3. That is not surprising in view of the previous results since these control classifications are based closely on a simple concentration index C1. The individual coefficients indicate that, as before, smaller companies are more likely to be classified as ownership-controlled as are those with higher diversifiable risk as measured by BETA (in the equation for OC1, however, DIV appears to be picking up this effect). An interesting result is that we have no explanation of control type based on the three variable rules, OC90, OC95 and OC99, on the basis of the χ^2 test of overall explanatory power at the 1% level of significance.[29] These results are consistent with

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[29]This significance level has been used in all the joint tests in this paper; however, if we use a 5% level, then all the χ^2 statistics are significant. In the three analyses for variable rules, there is no effect

the belief that a variable rule based on a voting model gives a more realistic classification of control type than a fixed rule and that this is exogenous and independent of the size of the firm.

4. CONCLUSIONS

We have investigated three aspects of ownership structure among large UK companies: (i) a descriptive analysis of ownership concentration and control type classification; (ii) an econometric test of the effect of ownership structure on company behaviour and performance and of the separation hypothesis; (iii) an econometric investigation of the determination of levels of concentration indices and of control types. A major consideration in all three parts of the study has been to consider the methodological question of obtaining an appropriate definition of ownership control as the basis of the control type classification of firms.

On the general question of the extent of ownership control among large companies, any conclusions we reach are very strongly dependent on which definition we use: whether we use a classification rule based on a fixed percentage shareholding or one based on a given degree of control, and whether ownership control is defined in terms of the voting power of the largest individual shareholding or that of some potential coalition of leading shareholders which might be formed. The fixed rules give no consistent pattern of ownership control. The variable rules are fairly consistent and classify a relatively low proportion of firms as ownership-controlled when the classification is made on the basis of the single largest shareholding alone. By contrast, a criterion which defines ownership control when there is a potential coalition having a high enough degree of control is satisfied by every company.

of size on control type, but there is evidence of a product diversification effect and the coefficient of BETA is still significant.

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On the question of the effects of ownership structure on performance both concentration indices and control type dummies are found to have significant effects on a vector of performance indicators. The results for control type indicate that, *ceteris paribus*, companies classified as ownership-controlled have a higher valuation ratio, profit margin and return on shareholders' capital; these companies are also found to have higher growth rates of both sales and net assets. For a given control-type, greater dispersion of ownership, and therefore a better developed market for the company's shares, suggests a higher valuation ratio, profit margin and growth rate of net assets.

Ownership structure has been analysed both in terms of ownership concentration indices and control type classifications. Ownership concentration depends on the size of the firm, diversifiable risk and product diversification; whichever concentration index is used the results are similar. The results of a probit analysis to explain control-type depend on the control classification used; for a classification based on fixed percentage rules we obtain a significant equation with control type depending on the same three variables as the ownership concentration indices. However, for control classifications based on variable rules using the degree of control, very weak results are obtained, control type being independent of the size of the firm, although there is still weak evidence of effects of product diversification and diversifiable risk.

We have used six control type classifications in all analyses in order to examine the sensitivity of our results to definitions but we have been unable to arrive at any definite recommendation as to which is the best reflection of reality. There is some slight evidence in favour of using a classification based on the degree of control from the results in section 2 where one of the variable rules was always chosen on our model selection criterion whenever its coefficient was significant. In section 3 the results for the fixed rules and variable rules are quite different , and are consistent with the belief that control types are exogenous while ownership concentration is endogenous, variations in the latter not necessarily having any implications for the former.

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APPENDIX

TABLE A1 THE SAMPLE COMPANIES BY INDUSTRY

Industry:	No. in sample (1)	% of sample (2)	No in pop. (3)	% of pop. (4)	% of firms (5)
Building Materials	21	4.5	59	4.0	35.6
Contracting & Construction	25	5.3	72	4.9	34.7
Electricals	15	3.2	31	2.1	48.4
Electronics	15	3.2	63	4.3	23.8
Mechanical Engineering	42	8.9	151	10.3	27.8
Metals & Metal Forming	15	3.2	48	3.3	31.3
Motors	18	3.8	46	3.1	39.1
Other Industrial Materials	15	3.2	39	2.7	38.5
Brewers & Distillers	15	3.2	30	2.1	50.0
Food Manufacturing	17	3.6	43	2.9	39.5
Food Retailing	10	2.1	22	1.5	45.5
Health& Household Products	3	0.6	12	0.8	25.0
Leisure	15	3.2	69	4.7	21.7
Publishing & Printing	15	3.2	32	2.2	46.9
Packaging & Paper	15	3.2	32	2.2	46.9
Stores	33	7.0	70	4.8	47.1
Textiles	15	3.2	107	7.3	14.0
Chemicals	15	3.2	37	2.5	40.5
Office Equipment	9	1.9	15	1.0	60.0
Shipping & Transport	15	3.2	31	2.1	48.4
Miscellaneous	35	7.4	136	9.3	25.7
Oil & Gas	12	2.6	31	2.1	38.7
Property	15	3.2	101	6.9	14.9
Overseas Traders	14	3.0	47	3.2	29.8
Banks	3	0.6	13	0.9	23.1
Insurance	10	2.1	17	1.2	58.8
Insurance Brokers	5	1.1	10	0.7	50.0
Merchant Banks	10	2.1	13	0.9	76.9
Other Financial	23	4.9	84	5.7	27.4
Total	470	100	1467	100	

FT Actuaries Classification of Listed Equities. No companies from Tobaccos and Telephone Networks. Col.(5)=Col.(1)/Col.(3).