The Separation of Corporate Ownership and Control : A Reinterpretation of the Evidence of Berle and Means

by

Dennis Leech

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Abstract

Berle and Means' classic study of the separation of ownership and control remains authoritative and influential despite having been criticised on various grounds by a number of authors. This paper argues that, firstly, the Berle and Means approach to determining company control implicitly assumes a static framework inappropriate to analysing early twentieth century corporations. Secondly, accepting their approach, their control-type criterion in terms of shareholding concentration is too high and biases their results. Thirdly, the use of the same criterion for all companies fails to recognise the importance of shareholding dispersion and further biases their results. A probabilistic-voting model is described which makes explicit the assumptions behind the concept of factual control. This is applied to the data on 16 companies used by Berle and Means and their classification of them as managerial is shown to be invalid.

More than fifty years after its publication, The Modern Corporation and Private Property, by Berle and Means[1], still occupies a unique place in the industrial economics literature. Its authoritative stature was established immediately and has been retained ever since. Three important features contribute to this predominance.

Firstly, Berle and Means demonstrated the full extent of the changes in patterns of ownership of large-scale industrial capital which had taken place over the previous half-century. By a detailed statistical analysis of shareholding distributions of leading American companies they show that the typical pattern had become one in which holdings were dispersed among a large number (often many thousands or tens of thousands) of individuals each having a small proportion of the total. Subsequent studies for the United States[2] in later years and of other countries[3] have revealed a similar picture and it is a well-established part of the institutional framework.

Secondly, in some companies, this dispersion had gone so far that it even appeared impossible that corporate control could be exercised through the ownership of enough voting stock. In such companies Berle and Means found that the largest shareholder possessed no more than a tiny fraction of the equity (in some cases as little as less than one per cent), while the combined holding of the directors was also small. In the case of the Pennsylvania Railroad Company, for example, they state that "no individual or small group was in a position to dominate the company through stock ownership..." This finding led them to develop a typology of control which includes a category of management control where the separation of ownership and control is complete. Applying this to their statistical data, they estimated that 44 per cent of large companies were of this type.

Thirdly, having introduced their control categories and demonstrated that management control could be an important type, Berle and Means argue that such firms might deviate from profit maximisation. This line of analysis has given rise to a large managerial discretion literature and led to well-known reformulations of the theory of the firm.[4]

In this paper it is suggested that the major contribution of Berle and Means is in the first of these, in demonstrating the extent of changes in the nature of ownership of the modern corporation. The separation of ownership from control introduces a second distributional process within the firm. Not only is there a question of the distribution of output between factors of production but also of profits between dividends distributed to shareholders and other forms of income received by those in control, which usually includes management.[5]

The main focus of the present paper is on Berle and Means' second thesis. They demonstrated that many companies were under factual control rather than control deriving from legal title. Their argument, that many of these were managerially controlled because shareholding dispersion had reached extremes which permitted management to ignore shareholders' interests, is challenged directly using their own data. It is argued that recent developments in the analysis of the relationship between stockholding and company control call for a reappraisal of this result.[6] Before doing that, however, it is necessary to give some consideration to the appropriate conceptional framework within which the analysis should be set.

I. The Framework of Analysis

In Book One, Chapter V, "The Evolution of Control", Berle and Means identify the stages through which they suggest corporate control passes in the lifetime of a typical company. As the enterprise grows from its beginnings as a traditional entrepreneurial firm into a large joint stock company, economic power is concentrated in the hands of management, a group personified by the board of directors. This concentration occurs alongside the increasing dispersion of shareholdings which is a necessary counterpart of the same evolutionary process. A serious limitation of their discussion, however, is that it is based on an analysis of these distributional changes considered in isolation from other features of the company, rather than an examination of the whole enterprise.

This evolutionary process is described by Berle and Means in terms of the concentration of the shareholding size distribution. They observe a progression from the initial position in which ownership is vested in an individual or small group to an asymptote where the capital has passed to an enormous mass of individuals - running into tens or hundreds of thousands - each owning a more or less small proportion of the total.

They relate the process of dispersion directly to control by reference to changes in the <u>percentage</u> distribution of voting strength resulting from it rather than by an examination of concomitant changes in the personal wealth of those in control. When the largest

shareholding (or the combined size of an identifiable group of shareholdings) falls below some figure such as 20 per cent, the company is taken to pass from one evolutionary stage to another, from a type of owner control to management control.

By focussing exclusively on this size distribution, their analysis of control is, therefore, placed in a static and economically ahistorical framework.[7] Their perspective would be appropriate to analysing a company which did not grow in size but in which shareholdings were broken up into small units by some process, resulting in an increase in the number of shareholders and the dilution of ownership. Such a case might occur, for example, where a founding family allowed its controlling holding to become fragmented in the course of time, parts being sold off to outsiders, due to the exigencies of marriage and inheritance. In this case there could indeed have occurred an evolution of control away from the founding family brought about by purely external changes in the pattern of ownership.

At numerous points in their exposition, Berle and Means write in this vein. For example they refer to "... a corporation in which a large measure of separation of ownership and control has taken place through the multiplication of owners" (p. 5) and "... the corporation is a means whereby the wealth of innumerable individuals has been concentrated into huge aggregates and whereby control over this wealth has been surrendered to a unified direction" (p.4). "This dissolution of the atom of property destroys the very foundation on which the economic order of the past three centuries has rested." (p. 8) The impression

is created of a quantum of property being redistributed with consequent implications for control over it. The parallel in this perspective between corporate control and political power in the state is obvious and has given rise to quasi-political discussions of corporate development such as Burnham's "Managerial Revolution".[8]

This framework is inappropriate to an analysis of American corporations in the early decades of the twentieth century. At that time of development of the corporate system, the typical large company was, in most years, growing rapidly and patterns of ownership were changing as an internal response to the problems of financing that growth. Changes in shareholding size distributions were occurring because of conscious decisions by companies to finance expansion by the sale of new stock to new stockholders. What is needed for a discussion of control in this context is an approach which analyses the growth of the enterprise in terms of a rational calculus which makes it optimal for new investment to be financed in this way. Since deliberate transfer of control does not fit in an optimising framework, it follows that increasing shareholding dispersion cannot have the automatic and immediate control implications claimed by Berle and Means. Thus increasing the number of shareholders dramatically is consistent with a profit-maximising strategy only if these shareholders can be counted on not to use their combined voting strength to take control for themselves. Rather than an "evolution of control" there would have to be an "evolution of ownership" in this dynamic, optimising approach. The appropriate issue to be addressed is then how the growth of ownership affects firms' behaviour, rather than how the separation of ownership from control affects it.

In order to test this model it is necessary to examine the company's development over time and look for evidence of significant changes of control.[9] Berle and Means infer control from shareholder concentration. But by itself this is inadequate. If shareholdings have become dispersed as a result of external events their approach may be valid. Statements about control then turn on the purely empirical point of the accuracy of their statistical criteria. But if dispersion results from an internal process of wealth maximisation sustained over a long period of time, there will be no evidence of a transfer of control.[10] In this case the wealth of those in control which can be attributed to the company is expected to have continued to grow in absolute terms, while their shareholding declined in relative terms. There would only remain the academic problem of providing an explanation of how control could be maintained by a group or individual with such a very small relative holding.

The present paper, however, restricts itself to a re-examination of Berle and Means' data within their static framework using essentially their approach. Their conclusions are shown to be unsupported by their evidence.

II. The Typology of Control

Berle and Means define "control" as something distinct both from management and from ownership. It is assumed to lie "in the hands of the individual or group who have the actual power to select the board of directors (or its majority), either by mobilising the legal right to choose them... or by exerting pressure which influences their choice." (p. 66, italics added) This definition in strategic terms allows an individual or group to be said to be in control whether or not they use their position actively. All that is needed for control is the potential to influence the choice of directors.

Thus a study of control would not differentiate between the following situations: (a) where the controlling group are completely indifferent to the affairs of the company; (b) where they take an interest in the company's progress and let their views be known to management privately and informally; (c) where their shares are voted formally at annual company meetings. This makes it difficult to identify control in many cases since it is infrequent in the extreme for control to be asserted in a contested vote such as would lead to (c). In practice it is usually the case that everyone involved in the company, whether a shareholder or manager, is generally aware of who is in control and modifies his behaviour accordingly - management by making itself accountable to the controlling group, shareholders by recognising the likelihood of defeat if they forced a vote.

This makes it difficult to observe the exercise of control without employing a case-study approach[11] requiring detailed knowledge of each company, much of which is not public. Berle and Means avoided this problem by restricting their attention to an examination of shareholding concentration. Even so, they were still unable to obtain enough data on many of the companies in their sample.

Berle and Means identify five control types.

1. Control through almost complete ownership

Companies in this category correspond roughly to private companies. Control is in the hands of an individual or small group holding all (or almost all) the stock. Ownership and control are unambiguously combined.

2. Majority control

A majority of the stock is held by an individual or small group. To the extent that control is exercised by a simple majority of voting stock, the controlling group is in a similar position to a sole owner while, at the same time, the minority shareholders are excluded from all control. Some decisions may require more than a simple majority, however, (such as amendments to the charter or the discontinuance of the enterprise) and therefore the degree of control is lower than in category 1. above.

3. Control through a legal device

Various legal devices allow the exercise of control without the ownership of a majority of the share capital. Berle and Means describe three.

(a) Pyramiding. This involves the ownership of the majority of the stock of one company which owns the majority of the stock of another. This process can be repeated several times until a very small holding is capable of controlling a large company by its being able to use its majority at each stage in the structure of the pyramid. Well-known examples of this have been described among railroads and utilities.

(b) Non-voting stock. Two classes of share capital are issued, only one of which has voting rights. Control is exercised through a small shareholding by ensuring that the overwhelming mass of stock is of the non-voting class. A majority of the small class of voting shares is then enough for the exercise of control.

(c) A voting trust. A majority of stock is held by the trust which is administered by a group of trustees - who are often drawn from senior management. Voting rights are exercised by the trustees at their discretion, while ownership is by individuals who have purchased trust certificates. In this case there is complete separation of ownership from control over voting rights.

In each of these three types, control of the company is unambiguously exercised through the control of a majority of voting stock. Factual control is also legal control. In the remaining two categories, however, factual control does not rest on legal entitlement.

4. Minority control

Control is exercised by an individual or small group with a shareholding which, although a minority (in some cases a very small proportion of the total shares outstanding), is still large enough to dominate the company through voting. The holding of such a group is large enough to be capable to acting "as a nucleus around which to gather a majority of the votes" at the annual company meeting. This presupposes there is no other grouping in an equally strong strategic position and therefore requires the controlling shareholding to be the largest voting bloc.

Berle and Means point to the location of control as a major factor influencing minority control. The security of a controlling minority is much higher where management is within the controlling group than where control is external to management. In the latter case should there be a major policy difference between them leading to a contested vote at the company meeting, it is much harder for the controlling minority to assert its control. The proxy machinery is operated by management who in such circumstances will deny them access to it. This, combined with the usual apathy and indifference of the small shareholder (who either fails to use his proxy vote or, in the absence of any information to induce him to do otherwise, votes for the incumbent directors), gives management a considerable advantage. The controlling minority group are then faced with the expensive recourse of distributing duplicate proxy forms and circulating alternative information to individual stockholders. In this eventuality the outcome is determined by majority vote and the proportion of individual shareholders who exercise their votes may be very high. However, cases where the question of control is resolved by actual voting in this way appear to be rare.

5. Management control

A residual category where no individual or small group has enough stock to be in a position to dominate the company. Voting at company meetings can never be more than a mere formality and control passes to management by default. Management becomes a self-perpetuating and unaccountable oligarchy. Management is able to discount completely the possibility of any attempt by a group of shareholders to exert pressure or instigate a vote against it, even though its own holdings may be negligible.

The first three categories of control require little discussion. In each case there is no uncertainty surrounding the question of control since legal control and factual control coincide. They do differ, however, in the extent of separation of ownership and control since there is a greater or smaller minority of stockholders excluded from control. Nonetheless control is exercised with certainty by shareholding interests.

In classifying the companies in their sample, Berle and Means employ arbitrary figures for the critical proportion of shares held by an individual or small group to define borderlines between categories. Companies are classified as private where this figure is in excess of 80 per cent. Present concern, however, focusses on the boundary between categories 4 and 5.

III. Factual control

The critical shareholding employed by Berle and Means to define the boundary between minority and management control is 20 per cent, although they do acknowledge the arbitrariness of this figure and that it does not apply to all firms. In some firms in their sample minority control is assumed on the basis of a holding of well under 20 per cent. They do not, however, completely resolve the question and instead resort to the device of inventing an intermediate category of joint minority-management control for some companies with a figure between 5 per cent and 20 per cent.

The basis for Berle and Means' choice of 20 per cent as the critical controlling shareholding is a single case study of a dramatic proxy battle for control of the Standard Oil Company of Indiana in 1929. The largest shareholder had 14.9 per cent of the voting stock, had been in minority control for many years and was a member of the founding family. He sought the resignation of the chairman of the board of directors. The chairman refused to resign and would not allow the shareholder use of the proxy machinery in the ensuing annual election of directors. The result, after a vigorous campaign by both sides in which 91 per cent of shares were voted, was an overwhelming majority of almost two-to-one against the management. The votes had been cast in support of the largest shareholder in the ratio 58:42 (not counting his own holding). Such a clear outcome would suggest that there should never have been any real doubt that this company was under (external) minority control.

In their discussion of the implications of this case for their study of the 200 largest corporations, Berle and Means conjecture that the outcome was not determined only by the size of the leading shareholding but also by the particular circumstances of the case: that the public sided with the shareholder on the details of the particular dispute and the personal standing of the shareholder, J.D. Rockefeller, Jr. was of the highest. Berle and Means imply that these latter two factors were peculiar to this case and not typical of others where control might be challenged.

This is not self-evident, however, and Berle and Means do not supply any supporting evidence. In a discussion of the separation of ownership and control involving consideration of possible conflicts of interest between managers and shareholders, it would be more natural and quite realistic to assume, as the general case, a community of interest among the latter. It would be expected, therefore, that a majority of shareholders would be likely to exercise their voting rights to support shareholders' interests generally against management's attempts to usurp them, as in this case.

It is undoubtedly true that the personal prestige of Rockefeller was very high in the business community at the time of this incident. But that has no bearing on the question of the minimum size of shareholding necessary in order to attract majority support in this case. The outcome would have been the same had his personal holding been considerably smaller since he already had a clear majority before casting his own 14.9 per cent of the votes. Moreover, had the voting among shareholders been in the ratio 60:40 <u>against</u> Rockefeller, his 14.9 per cent would

still have been enough to give him victory. The largest shareholder may have been popular in this instance but it remains true that, had the personalities been different such that the board chairman was considerably more popular than the largest shareholder, a holding of only 14.9 per cent would have been enough to secure the latter's control.

To conclude, as Berle and Means do, that this case "probably marks the dividing line between minority control and management control" is unwarranted. To establish that borderline would require consideration, not only of cases of clear minority control such as this one, but also examples in which management had been successful in winning a vote against determined opposition by shareholding interests. That Berle and Means fail to provide any case studies of this type is a serious weakness of their analysis and renders their 20 per cent criterion totally arbitrary. Moreover, it biases their analysis towards assigning too many firms to the management-control category. It could also be argued that this failure raises questions about the existence of their management-control type as a real-world phenomenon.

Applying their five-fold categorisation of control to the largest 200 corporations in 1930 reveals the breakdown of immediate control shown in Table 1. From Table 1 it is clear that Berle and Means are able to find only 21 companies which definitely fall within their management-control category on the 20 per cent rule, although this may be partly due to lack of information on some companies - the "Doubtful" categories contain as many as 73.

Table 1

Berle and Means' Results

Category	Control Type	Number of companies
1	Private ownership	12
2	Majority control	10
3	Legal device	21
4	Minority control	44
5	Management control	21
Doubtful, presumed minority		29
Doubtful, presumed management		44
Joint control		16
Special situations (e.g. in receivership)		3
TOTAL		200

Source: Berle and Means, Table XIV.

In arriving at their well-known estimate of 44 per cent of these 200 companies under management control, Berle and Means depart from their stated methodology in two important ways. First, companies in the "Doubtful" or "Joint Control" groups are assigned to category 3, 4 or 5 on the subjective basis of "general street knowledge".[12] Secondly, they introduce a distinction between "immediate control" and "ultimate control" to deal with those cases where the controlling minority shareholder of one company is another company. The control type of the former is assumed to be that of the latter. In this way firms are somewhat arbitrarily removed from category 4 and assigned to category 5. The first of these ad hoc procedures necessarily makes the 44 per cent figure very uncertain since the information they use is likely to be fragmentary while the second biases it upwards.

The focus of the present paper is on the question of the empirical determination of the critical controlling shareholding which is crucial in empirically dividing minority control from management control. Berle and Means' procedure of using a fixed figure of 20 per cent makes no allowance for variations in shareholding dispersion among companies and in any case is too high, as other authors have shown.[13] The context in which to think about possible values of the critical controlling shareholding as the basis of factual control is one of a voting situation in which the voters are more or less indifferent and command variable numbers of votes (proportional to shareholdings). It seems appropriate to model this formally in terms of a probabilistic-voting model.

IV. A Probabilistic-Voting Model

In an earlier paper (Cubbin and Leech (1983)), a model of random voting by shareholders is described and applied to British data. It is here adapted and applied to allow a rigorous re-examination of the evidence presented by Berle and Means. The assumptions which underly the model are a formalisation of the conditions which support the notion of factual control in Berle and Means' categories 4 and 5.

Shareholdings are partitioned into the controlling bloc, of size p_1 per cent, and the other holdings, of sizes $p_2, p_3, \ldots, p_N$ per cent respectively. The number of shareholdings is N and $p_1 \geq p_2 \geq \ldots \geq p_N$. The largest shareholder always votes. The model employs three assumptions (whose realism is considered more fully below) about voting by other shareholders.

> Assumption 1: Uniformity. The probability that shareholder i exercises his vote is π, constant for all $i \geq 2$.
>
> Assumption 2: Indifference. The conditional probability that shareholder i votes to support the controlling bloc, given he votes at all, is $\frac{1}{2}$.

Denoting the percentage vote cast by shareholder i (for $i \geq 2$) in support of the controlling bloc by x_i, these two assumptions define the distribution of x_i for every i. The sample space is $\{p_i, o, -p_i\}$ with associated probabilities $\{\pi/2, 1-\pi, \pi/2\}$. It follows that $E(x_i) = o$ and $E(x_i^2) = \pi p_i^2$.

Assumption 3: Independence. Shareholders vote independently.

The independence assumption, together with the distributions of x_i for all $i \geq 2$, gives the distribution of the margin of support for the controlling bloc. The percentage margin is $m = p_1 + \sum_{i=2}^{N} x_i$. On the assumptions, m is a random variable with $E(m) = p_1$ and variance $\sigma^2 = \sum_{i=2}^{N} E(x_i^2) = \pi \sum_{i=2}^{N} p_i^2$. Moreover, since N is large, the central limit theorem establishes that m has a normal distribution.

An alternative expression for the variance of m is written in terms of the Hirschman-Herfindahl index of concentration of the shareholding size distribution as $\sigma^2 = \pi(H-p_1^2)$, where $H = \sum_{i=1}^{N} p_i^2$. This formulation allows for variation in shareholding concentration among companies.

The degree of control is defined as the probability of the controlling group winning a vote given the distribution of shares. Denoting the degree of control by α it follows from knowledge of the distribution of m that the probability that m is positive is $\alpha = \Phi(p_1/\sigma)$, where $\Phi(.)$ is the standard normal distribution function. This gives a direct measure of the voting strength of the controlling bloc.

An alternative use of the model is to calculate a critical controlling shareholding for each company. In all cases of factual rather than legal control, the degree of control must be less than unity since it is logically possible for the controlling group to be outvoted. This theoretical possibility is highly unlikely, however, and this is formalised

by associating with the notion of factual control an arbitrary but large probability, α. The analogy with a statistical confidence level is obvious and it seems appropriate to choose a value for this degree of control of 99 per cent or 95 per cent.

Defining a value of the standard normal deviate, Z_α, by $\Phi(Z_\alpha) = \alpha$, the critical controlling shareholding can be obtained as $p^* = Z_\alpha \sigma$. Comparing p_1 with p^* for a given company enables it to be classified by control type. If $p_1 > p^*$ it is assigned to the minority-control category. Otherwise it is assumed to be under management control in the absence of a controlling shareholding. This methodology is identical in its essentials to that used by Berle and Means, except that the p* criterion allows for the effect of variation in shareholding concentration between companies, rather than being an arbitrary constant. The assumptions behind p* are brought out explicitly.

If the probabilistic-voting model is to be used to describe the evolution of the company over time rather than as the basis of a classification by control type, the p* criterion is inappropriate since changes in p_1 cannot occur without corresponding changes in σ. An alternative criterion can be derived by treating the Hirschman-Herfindahl concentration index as a parameter. If the critical controlling shareholding on this definition is denoted p**, then $p^{**} = k\sqrt{H}$, where $k = Z_\alpha \sqrt{\pi/(1 + Z_\alpha{}^2\pi)}$ is a constant whose value is fixed by the choice of α and π.

For purposes of classification on the basis of an observed size distribution, however, either criterion will suffice since the ranking of p_1 and p* is the same as that of p_1 and p**.[14]

The three assumptions behind the probabilistic-voting model are sufficient to establish these results but vary in their realism. Assumption 1 (Uniformity) is arguably too strong. Since the benefits of enforcing profit maximising behaviour are proportional to share-holding, while the costs associated with participating in a vote are independent of holding, it would be expected that larger shareholders would be more likely to do so than smaller ones. Assumption 1 therefore would appear to give too much weight to smaller holdings leading to an overstatement of the degree of control.

The same argument can, however, be used to question the realism of Assumption 3 (Independence) and to suggest a bias in the opposite direction. Since the benefits from collusive voting by a group of larger shareholders are so much greater than those for any similar-sized group of small shareholders, it would be expected that the latter would be more likely to vote independently than the former. Since such collusion is not indicated in the data, application of the model will understate the degree of control actually enjoyed by the controlling group and may result in a misclassification of control type to management control.

Assumption 2 (Indifference), however, is the irreducible basis of the model. Its justification is not in behavioural terms; it is not suggested that individual shareholders exercise their right to vote indiscriminately. Rather the analysis is concerned with the distribution of power and a measure of the power of the controlling group can be obtained by examining all possible outcomes and calculating or estimating the proportion where it is in the majority. Since N is large and data are unavailable for every shareholding, it is impossible to do this exactly. The central limit theorem with Assumption 2, however, provides the basis for a simple approximation.[15] Moreover, the approximation is better the larger is N and the smaller is H.

These three assumptions are clearly implicit in Berle and Means' analysis of factual control. They refer, for example, to the "usual apathy and indifference of the small shareholder" and their use of data on individual holdings implies a belief in independent voting. The probabilistic-voting model is therefore nothing more than a formalisation of their model. It makes explicit the assumptions and parameters on which their model depends and makes possible quantitative statements about the uncertainty inherent in factual control through the notion of degree of control.

V. Application to Berle and Means' Data

Applying the probabilistic-voting model requires two parameters: σ (or H) and π. The former is descriptive of an empirical size distribution and must be calculated for each company using shareholding data. The latter is the behavioural parameter measuring the likelihood of voting. It does not reflect actual voting behaviour in normal circumstances surrounding company meetings, however, but is taken to be the probability of voting in the hypothetical event of a contest for control. This parameter may be assumed constant for all companies and Berle and Means' case study described above is taken as the basis for an upper bound on possible values of π. In the application in Section VI, results are presented for different alternative values of π.

Berle and Means provide enough data on 16 out of the 21 companies they suggest are definitely under management control to obtain bounds on H (Table XII). This consists of p_1, p_2, p_{20} and c_{20} (the combined holding of the largest 20 shareholders). This superficially barren data source is enough to yield bounds on H which, although wide apart, are informative. For the three companies with the most dispersed shareholding distributions, Berle and Means also provide the largest 20 shareholdings and this permits an assessment of the adequacy of the method of calculating bounds.

In the Appendix to Cubbin and Leech (1983), bounds are derived for the situation where data are available in the form of the leading n holdings. In the present case, for three companies, n = 20 and the bounds are given by

$$(1) \qquad J < H \leq J + (1-c_{20})\, p_{20},$$

where $J = \sum_{i=1}^{20} p_i^2$. For the other 13 companies, however, it is necessary to make further limiting assumptions about the distribution of p_i for i = 3,..., 19 to establish bounds on J.

The upper bound is obtained by assuming these shareholdings to be as highly concentrated as possible given the data. As many holdings as possible are assumed to be of size p_2 - this number is a. Then the distribution is assumed to be: a of size p_2, (17-a) of size p_{20} and one of $\bar{p}$ where $\bar{p} = c_{20} - c_2 - ap_2 - (17-a)p_{20}$ and $a = \text{int}((c_{20} - c_2 - 18p_{20})/(p_2 - p_{20}))$. The upper bound on J is then

$$Jmax = p_1^2 + (a + 1)\, p_2^2 + \bar{p}^2 + (17 - a)p_{20}^2 .$$

The lower bound is obtained by assuming all 17 intermediate holdings to be equal to $\hat{p} = (c_{20} - c_2 - p_{20})/17$. Then the bound is

$$Jmin = p_1^2 + p_2^2 + 17\hat{p}^2 + p_{20}^2.$$

The bounds used in the empirical application described below are therefore

$$(2) \qquad Jmin < H < Jmax + (1 - c_{20})p_{20}.$$

A comparison of bounds (1) and (2) for the three companies for which detailed data are available is given in Table 2. The two pairs of bounds are substantially the same with only a slight discrepancy in the upper bound. The lower bounds are somewhat further apart in every case. It would therefore seem that the main limitation of data in this form for calculating the H index (and hence σ) is the truncation of the distributions after the 20th largest holding and that the lack of the observations numbered between 2 and 20 need cause no concern. It is therefore feasible to apply the model to the 16 companies.

Table 2

Bounds on H[16]

	Bounds (1)		Bounds (2)	
Company	Lower	Upper	Lower	Upper
Pennsylvania Railroad	.00004303	.00072406	.00004053	.0007256
AT & T	.0001578	.0009206	.00010803	.0010064
US Steel	.00028343	.00149932	.00026425	.001585

In applying the model to Berle and Means' data, two cases are considered below for each company: (i) using the original data; and (ii) using the data after amalgamating the largest 20 holdings. Berle and Means implicitly consider using data in this latter form in their discussion of the three companies with the most dispersed distributions but dismiss it presumably on the grounds that it would not make any difference to the classification of control. In their empirical work the possibility of using data in this form is ignored and their company classification is based on individual shareholdings. This is likely to have inflated the number of firms in the management-control category.

In Section VI below, results are presented for different values of π. What constitutes a reasonable value to assume for this parameter is a matter of conjecture. In the case where there is a contest for control between two large groups of shareholders, a relatively low value might be appropriate. In this case, whatever the outcome, the company will remain under minority control and the mass of shareholders may not necessarily see their essential interests threatened. On the other hand, in a contest for control between management and the leading shareholding group there are likely to be large policy differences reflecting the different objectives of the two groups. Individual small shareholders are much more likely to be aware of the conflict of interests involved and consequently more likely to exercise their votes.[17]

The upper limit for π chosen is 0.9 on the basis of the case study discussed in Section III above. Given that 91 per cent of shares were voted and $p_1 = 14.9$, then it follows that setting $\pi = 0.89$ gives an appropriate estimate in that case.

V. Results and Reinterpretation

A. Individual Holdings

Table 3 reports the results of applying the probabilistic-voting model to the 16 companies in the management-controlled category for which Berle and Means provide detailed data. That these are mainly railroads is due to the fact that information on ownership was publicly available[18] mainly for regulated companies such as railroads at the time of their study. Many of the industrial companies were relegated to the large "Doubtful" groups because of this.

For each company Table 3 lists the bounds on the Hirschman-Herfindahl index, Hmin and Hmax, the largest shareholding, p_1, and various values of the critical controlling shareholding. Two values of p* are listed: one calculated using Hmin and $\pi = 0.5$ and one using Hmax and $\pi = 0.9$. The larger of these is truly an upper limit since Hmax is likely to very considerably overstate H because of the extreme assumptions on which it is based. Similarly two values of p** are presented: a value which is probably an underestimate, using Hmin and $\pi = 0.5$, and an upper limit, using Hmax and $\pi = 0.9$. All employ a degree of control of 99 per cent.

Assuming extreme values for α, π and H in this way leads to a very strong criterion for minority control and biases the analysis towards supporting Berle and Means' results. However, it does mean that whenever the criterion is satisfied this can be taken as definite evidence of minority control.

The critical controlling shareholding varies considerably between companies with different degrees of shareholding concentration whichever measure is taken. The range of variation of the upper bound of p* is between 5.89 per cent and 17.86 per cent. It would appear, therefore, that the 20 per cent rule used by Berle and Means is inappropriate for these companies for two reasons: (i) it is too high for all of them; and (ii) variations in shareholding concentration among companies cause the criterion to vary. The fixed 20 per cent rule may not be far out for some firms but is highly misleading for others.

The p* criterion is derived by considering the uncertainty inherent in a hypothetical vote and its value depends on σ rather than a parameter of the whole shareholding size distribution; p* does not, therefore, correspond to any actual attainable shareholding. p**, on the other hand, is defined by the concentration of the distribution as measured by H. The H index has certain useful theoretical properties[19] and is widely used to measure industrial concentration. It therefore seems appropriate to use p** as an attainable value for the criterion for a given level of concentration. The range of variation of p** is between 2.45 per cent and 8.66 per cent which suggests that Berle and Means' fixed 20 per cent criterion is far too restrictive and could have biased their results in favour of their hypothesis.

Table 3

Critical Controlling Shareholdings for 16 Companies: Individual Holdings

	Hmin	Hmax	P_1(%)	P* (%) Lower(a)	P* (%) Upper (b)	P** (%) Lower(a)	P** (%) Upper(b)
1. Atchison, Topeka & Santa Fe Railway Co.	.0002307	.0019784	0.76	2.16	9.65	1.69	4.05
2. Baltimore & Ohio Railroad Co.	.0009038	.0022017	2.56	2.58	8.65	2.57	4.27
3. Chicago, Milwaukee, St. Paul & Pac. Railroad Co.	.0008315	.0027011	1.36	4.18	11.04	2.46	4.73
4. Chicago & North Western Railway Co.	.0022355	.0046667	3.45	5.31	12.97	4.04	6.22
5. Delaware & Hudson Co.	.0008697	.0043206	1.51	4.15	14.08	2.52	5.98
6. Great Northern Railway Co.	.0007745	.0027361	2.12	2.95	10.53	2.38	4.76
7. Missouri-Kansas-Texas Railroad Co.	.0010129	.0033812	2.23	3.74	11.80	2.72	5.30
8. New York Central Railroad Co.	.0056263	.0090416	5.35	8.63	17.31	6.40	8.66
9. Northern Pacific Railway Co.	.000916	.0029841	2.13	3.53	11.07	2.58	4.97
10. Pennsylvania Railroad Co.	.0000405	.0007256	0.34	0.88	5.89	0.54	2.45
11. St. Louis-San Francisco Railway Co.	.0040058	.0081873	4.01	8.03	17.86	5.40	8.24
12. Southern Pacific Railroad Co.	.0009392	.0026062	1.65	4.25	10.63	2.62	4.65
13. Southern Railway Co.	.0009364	.0020744	1.92	3.90	9.09	2.61	4.15
14. Union Pacific Railroad Co.	.0008763	.0030266	2.27	3.11	11.02	2.53	5.01
15. American Tel. & Tel. Co.	.0001080	.0010064	0.60	1.39	6.87	0.89	2.89
16. United States Steel Corp.	.0002643	.001585	0.88	2.25	8.55	1.39	3.62

$\alpha = 0.99$. (a) $H = H_{min}$, $\Pi = 0.5$; (b) $H = H_{max}$, $\Pi = 0.9$

Nevertheless, comparing p_1 with p* (or equivalently p**) as the basis of classification, the result is unambiguously that, using data on individual holdings, none of the 16 companies should be assigned to the minority control category since $p_1 < p^*$ in every case. This is true whether the upper or lower value of p* is used. This does not mean that each company is definitely under management control. Rather it shows that, taking the data at face value and making strong assumptions about what is meant by control and voting probabilities, none of the companies is shown to be under minority control.

B. Combined Holdings

Table 4 reports the results of a similar analysis for the companies after amalgamating the top 20 holdings of each into a single bloc. The analysis is directed at the question of whether it would be feasible for these leading shareholders to exercise control if they voted as a bloc. This approach accords well with that of Berle and Means since their definition of control is in strategic rather than functional terms. If the top 20 shareholders combined have a controlling shareholding then it follows that collectively they have the actual power to select the board of directors and are therefore in control.

The table reports, for each company, c_{20}, the percentage holding of the top 20 shareholders combined, α, their degree of control, p* and p**, alternative measures of a critical controlling shareholding for these data. Only upper values for p* and p** and a lower limit for α are given, calculated using $\pi = 0.9$ and assuming the most concentrated shareholding distributions.

Table 4

Critical Controlling Shareholdings for 16 Companies: Combined Holdings

	c_{20}(%)	(b) α	(a) p* (%) H=Hmax	(a) p** (%) H=Hmax
1. Atchison, Topeka & Santa Fe Railway Co.	6.1	0.94	9.05	6.70
2. Baltimore & Ohio Railroad Co.	8.7	>0.99	7.28	8.47
3. Chicago, Milwaukee, St. Paul & Pac. Railroad Co.	11.9	>0.99	8.26	8.63
4. Chicago & North Western Railway Co.	14.7	>0.99	8.38	13.83
5. Delaware & Hudson Co.	12.4	0.99	12.69	12.45
6. Great Northern Railway Co.	9.5	>0.99	9.37	9.48
7. Missouri-Kansas-Texas Railroad Co.	11.2	>0.99	9.95	11.00
8. New York Central Railroad Co.	19.3	>0.99	7.12	17.82
9. Northern Pacific Railway Co.	10.8	>0.99	9.30	10.56
10. Pennsylvania Railroad Co.	2.7	0.86	5.75	3.42
11. St. Louis-San Francisco Railway Co.	20.0	>0.99	9.02	18.59
12. Southern Pacific Railroad Co.	12.1	>0.99	7.45	11.44
13. Southern Railway Co.	10.0	>0.99	4.18	9.10
14. Union Pacific Railroad Co.	10.4	>0.99	10.21	10.37
15. American Tel. & Tel. Co.	4.0	0.92	6.47	4.52
16. United States Steel Corp.	6.5	0.98	7.67	6.72

$\pi = 0.9$; (a) $\alpha = 0.99$; (b) to 2 decimal places.

In Table 4, p* varies between 4.18 and 12.69 per cent while p** varies in the range 3.42 to 18.59 per cent. (The latter is probably inappropriate with these data since it is based on an H index which is dominated by the single large bloc, c_{20}). Even making these strong assumptions about α, π and concentration, the criterion is in every case much less than 20 per cent.

Moreover, using the p* criterion leads to changes in the classification of most companies. Eleven out of 16 companies are assigned to the minority control category, since $c_{20} > p^{*}$.

These results show that Berle and Means' approach is biased towards supporting their managerialist position for two interacting reasons: (i) their use of data exclusively in the form of individual holdings without considering possible groupings of them into controlling blocs; and (ii) their use of a fixed 20 per cent criterion. Removing one of these sources of bias by itself makes little difference to the conclusions. Table 3 shows that using the p* criterion with individual data yields the same classification as Berle and Means. Table 4 shows that grouping the top 20 holdings into a single bloc and using the 20 per cent rule alters the classification of only one company. But using the p* criterion with these data produces a radically different distribution of control type.

C. United States Steel Corporation

Table 5 provides the basis of an analysis of control in the United States Steel Corporation, for which Berle and Means supply not only a shareholding distribution but also details of holdings by board members. Five cases are investigated corresponding to different assumptions about the existence and behaviour of voting blocs. Case 1 is an analysis using the original data already investigated in Table 3 above. The leading shareholding represents 0.88 per cent of the stock outstanding, while the second largest shareholder has 0.78 per cent. Despite these figures being so small and so close together, the leading shareholder can reckon on winning at least 60 per cent of votes. However, this is a long way short of working control. In case 2 the board of directors is assumed to vote as a single bloc, while all other shareholders vote uniformly, indifferently and independently. The board controls 1.38 per cent and the second voting bloc 0.88 per cent.[20] The degree of control of the board is still short of working control but is now over 65 per cent. In the other three cases considered it is possible to identify voting blocs with minority control.

Case 3 combines all the shareholders identified by Berle and Means, whether directors or not, into a single bloc with 6.76 per cent. The next largest bloc is the 21st shareholder with less than 0.13 per cent. The degree of control is over 98 per cent and for practical purposes this small group of large shareholders must be said to be in control (although US Steel was one of the companies which narrowly failed to satisfy the strict application of the p* criterion with $\alpha = 0.99$ in Table 4.).

Table 5

United States Steel Corporation: Degree of Control

Case	Largest bloc (%)	2nd largest bloc (%)	Degree of control of the largest bloc, $\pi = 0.5$	$\pi = 0.9$
1. Original data. Individual shareholdings	0.88	0.72	0.63	0.60
2. Board treated as 1 bloc. No other grouping	1.38	0.88	0.70	0.65
3. Top 20 shareholders and board treated as one bloc	6.76	$\leq$0.13	>0.99	0.98
4. Board treated as one bloc, largest 18 external holdings as another bloc. Blocs opposing each other.	5.38	1.38	0.95	0.89
5. Largest 18 external holdings treated as one bloc, board as another bloc. Board voting indifferently.	5.38	1.38	0.98	0.94

Degree of control based on σ calculated using the upper bound on concentration.

Case 4 analyses the situation where there are two large blocs committed to opposing each other. It is assumed that the directors vote collectively as one bloc while those of the largest 20 shareholders who are not directors vote as another bloc. The external bloc has 5.38 per cent and the internal 1.38 per cent of the votes and the degree of control is evaluated by applying the probabilistic-voting model to the difference. The same value of σ as in case 3 is used but with a bloc of 4 per cent. The degree of control is at least 89 per cent, suggesting, if not almost total security, at least that this group of external shareholders would be capable of winning against determined opposition from the board of directors about nine times out of ten. That would not give them minority control on the definition used in the present paper, which is much more stringent, requiring a degree of control of 99 per cent.

Case 5 groups the 18 largest external shareholders into one bloc as in case 4, but the board is assumed to behave randomly. The degree of control increases to at least 0.94. These results suggest that in practice little more than 5 per cent might be a controlling shareholding for a company with as dispersed a shareholding distribution as US Steel had in 1930.

VI. Summary and Conclusions

Three major criticisms are levelled at the Berle and Means methodology for determining control type using statistical shareholding data.

Firstly, and fundamentally, their analytical framework does not allow for dynamic profit maximisation by controlling groups in which changes in shareholding distributions are endogenous. Such changes are treated as exogenous and, while that may be a reasonable assumption for a company which is not growing, it is inappropriate to an analysis of large corporations in the early twentieth century.

Secondly, accepting Berle and Means' analytical framework, their criterion for distinguishing minority- from management control does not fully take into account the implications of the notion of factual control which they use. The case study on which they base their twenty percent rule does not establish its general validity. Moreover, this rule is misleading for two reasons: it is too high for most large companies and it does not vary either over time or between companies to reflect variations in shareholding concentration.

Thirdly, the methodology used by Berle and Means in their empirical study of leading companies is inconsistent with their concept of control. While control is defined in terms of the possible existence of an identifiable group of shareholders having the power (whether exercised or not) to influence company policy, no attempt is made in their statistical analyses to identify such groups systematically.

This paper has shown that it is possible to analyse factual control using the notion of degree of control within a probabilistic-voting model. The assumptions underlying this model are essentially the same as are made by Berle and Means. It predicts that a critical controlling shareholding defining the boundary between ownership control and management control varies in proportion to the square root of the Hirschman-Herfindahl index of concentration.

It has also been shown that it is possible to apply the probabilistic-voting model to the data provided by Berle and Means on their "management-controlled" companies. The assumptions which have been made in doing this are very strong and bias the analysis towards supporting Berle and Means' results. Using data in the form of individual holdings leads to the same classification of companies. However, combining the leading twenty holdings into a single bloc before applying the model changes the results entirely. The conclusion is that the results obtained by Berle and Means on the incidence of management control are not supported by the evidence they used.

Footnotes:

1 Berle and Means (1967), originally published in 1932.

2. Larner (1966), Burch (1972), Chevalier (1969).

3. Florence (1961), Nyman and Silberston (1978) for UK evidence.

4. Baumol (1959), Marris (1964), Williamson (1964).

5. Cowling (1982).

6. Cubbin and Leech (1983)

7. A similar criticism of this methodology has been made by Pitelis and Sugden (1983).

8. Burnham (1941).

9. For example, a transfer of control with its implications for shareholders' interests might be expected to be attended by higher than usual levels of litigation and contested proxy votes.

10. The directors will not change over long periods and when change occurs it will be within a family, group of families or some other group which is (in principle) identifiable - for example, representatives of certain financial institutions.

11. Such an approach has been advocated and applied by Nyman and Silberston (1978) and Francis (1980).

12. The nature and quality of this evidence are uncertain as no further details are given. However, doubt is inevitably cast on it when Berle and Means assign United States Steel to the management control category on the basis of shareholding concentration without further comment when, as their own evidence reveals, the son of the company's founder is a director. Such close involvement of powerful, and undoubted, ownership interests (the House of Morgan) has a bearing on the question of control and warrants at least some discussion. Zeitlin (1974) has emphasised the importance of investigating whether management comprises a separate and cohesive group with identifiable interests different from those of owners.

13. Larner (1966) used a 10 percent rule. Burch (1972) and Chevalier (1969) based their classifications on a 5 percent rule but used other evidence than shareholdings alone.

14. By definition, $p^* = z_\alpha(\pi(H-p_1^2))^{\frac{1}{2}}$ and $p^{**} = kH^{\frac{1}{2}}$

where $k = z_\alpha(\pi/(1+z_\alpha^2\pi))^{\frac{1}{2}}$.

Squaring both expressions gives, from the second,

$H = (1+z_\alpha^2\pi)p^{**2}/z_\alpha^2\pi$

and substituting for H in the first, yields

$p^{*2} = (1+z_\alpha^2\pi)p^{**2} - z_\alpha^2\pi p_1^2$

and therefore,

$$p^{*2} - p_1^2 = (1+z_\alpha^2\pi)(p^{**2} - p_1^2).$$

Hence, sign (p^*-p_1) = sign $(p^{**}-p_1)$.

15. Assume all shares are voted. Then $x_i \in \{p_i, -p_i\}$ and the margin $m\ (= p_1 + \frac{1}{2}\sum_2^N x_i)$ can take any of 2^{N-1} values.

Let T be the number of outcomes for which $m > 0$. Then the measure of voting strength of the largest shareholding bloc is $T/2^{N-1}$, the proportion of outcomes in which the margin of support is positive. This is interpreted as a probability if all outcomes are assumed equally likely. This interpretation is the same as that obtained from the probabilistic-voting model on setting $\pi = 1$. Allowing $\pi < 1$ introduces greater realism without sacrificing the essential features of this interpretation.

16. The H indices in Tables 2 and 3 have been calculated from shareholding data in the form of proportions rather than percentages.

17. This does not imply relaxation of the assumption of indifference. The model is still being used to analyse the distribution of voting power. Relaxing this assumption by allowing shareholders to cast their votes in support of shareholding interests more frequently than in support of management would undermine the notion of management control in this case.

18. For these companies there is therefore an added incentive to conceal large shareholdings by various devices. The results obtained for them should therefore not be regarded as typical of all companies including those for which data are publicly unavailable but as being biased in favour of managerial control.

19. See, for example, Hannah and Kay (1977).

20. The largest individual shareholder is not a board member.

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