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AN ASPECT OF INDUSTRY PERFORMANCE

by

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CHAPTER I

INTRODUCTION

The raw material of this study is a record for a number of years of the rates of return earned by quoted companies in the United Kingdom. Previous authors[1] have identified a systematic component in such data: regression of profitability towards some central value. It is this systematic component in the inter-temporal behaviour of rates of return that is to be isolated, measured and interpreted in the following chapters.

In order to avoid confusion, two terms need to be introduced. Firstly, the regression of profitability towards a central level is hereafter called "the decay of profitability"; and secondly that central point towards which decay is directed is called the "decay origin".

The connecting theme of this study is the particular interpretation that it puts upon the decay of profitability. The main exposition of this interpretation is in the next chapter, but a brief sketch is presented at this stage. In the model of the working of perfectly competitive markets, resources are allocated in order to eliminate supernormal and subnormal profits. It is this process that we are observing when we study the decay of profitability. Just as the speed at which resources are transferred and introduced will determine in part how speedily the non-normal profits are eliminated, so we regard the rate of decay of profitability as a measure of the speed and efficiency with which resource allocation takes place. The aim of the theoretical work is to examine and develop that chain of argument and to consider how divergence from the competitive model will affect the decay of profitability.

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1) References to this literature are given in Chapter II.

In isolating and measuring the decay of profitability, a second aim of this study is fulfilled. This is to develop and demonstrate a statistical technique that has advantages over the direct application of regression analysis when a large body of data is available. This technique is based upon the transition matrix of the Markov stochastic process.

A third aim is to report a piece of research. This involves recording not only the finally selected sequence of analysis but also reporting when certain directions turned out to be unrewarding.

To return again to the main theme, the literature on allocative efficiency has, of necessity, mainly dealt with static questions. Both neo-classical and Walrasian general equilibrium systems are primarily concerned to develop the characteristics of an equilibrium state. More recent work has considered the (mathematical) existence of such an equilibrium. Where dynamic systems are developed, major simplifications are made and very simple types of change imposed on the resulting models. In observing the real world, change is a complex phenomenon; different variables shift in conflicting directions and shocks are overlaid one upon another. It is the process of compensation for shocks and of adjustment for once-and-for-all changes that concerns us here and, in particular, the role of the firm in this process.

In the static general equilibrium system, the firm plays a very small part. This point is made by G C Archibald[2] when, having sketched the allocation problem, he remarks:

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2) Archibald G C (Ed), "The Theory of the Firm", Penguin London 1971, Editor's Introduction p 10

> "It will be noticed that the allocation problem was set out without any mention of 'firms'. This is because of its universality: it exists whether there are firms or not, and however they may be owned or organised. Yet firms exist, and must fit in somewhere. Formally we may think of them as intermediate agents, between resource owners and consumers, that perform certain organisational tasks. In neo-classical general equilibrium theory, firms are completely described by their production functions."

Without wishing to overstate the case it is not very far from the truth to regard the firm as essentially a creature of disequilibrium.[3] In equilibrium, as Archibald says, the firm is merely a production plant combining inputs in specific proportions to produce a given set of outputs. If there is a change in prices then the firm will move along its production function and/or its product transformation frontier to a new equilibrium position. But it is in that process of movement from one point of equilibrium to another that the raison d'être of the firm lies.

To talk of a "firm" is to refer to more than those "organisational tasks" involved in operating a production plant efficiently - managers do more than just stand guard over a production function. Our usual idea of a firm involves more than this because the firm operates in a world of disequilibrium and it is the aspects of its operations that are connected with disequilibrium and its companion, uncertainty, that receive predominant attention. It may be helpful to draw a distinction between those actions of firms that tend towards the restoration of equilibrium and those that are disequilibrating. No one category of actions can be fitted into this classification without error, but, for example, we generally expect investment decisions to be equilibrating and innovation to be disequilibrating. The intention in making this distinction is to emphasize

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3) Arrow K J, "The Firm in General Equilibrium Theory" in Marris R and Woods A (Eds) "The Corporate Economy", Macmillan London 1972, p 68 where he states that in classical theory the role of the firm was "that of overcoming disequilibria."

that only part of the economically relevant behaviour of firms tends to restore equilibrium and it is only this part of the role of the firm that is examined here.

In the real world, however closely pure competition is approached, change ensures disequilibrium. So it is at least as interesting to examine the strength of the tendency to restore equilibrium as it is to consider the extent to which structural conditions compatible with an optimal allocation are attained (particularly in a second best world). Knowledge of the structure of an industry is needed to assess whether equilibrium, should it be attained, will be optimal. But if the movement of that industry towards equilibrium is exceedingly slow, such information is of arguable relevance.[4]

Such an industry may be more efficient in disequilibrium than another is in equilibrium but that is not easy to test and, indeed, may not be a meaningful question.[5] The intention is not to dismiss measures of industry structure but to emphasize that amongst the important aspects of industry performance is the speed of adjustment of the industry to disturbances.

How can this speed of adjustment be observed? In the competition model, profits greater or less than normal only occur in disequilibrium. It is the existence of non-normal profits that motivates the shift of resources towards those products whose output is too low and away from those whose output is too high. This process eliminates the non-normal profits and

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4) Svennilson I, "Monopoly, Efficiency and the Structure of Industry" in Chamberlin E H (Ed), "Monopoly and Competition and Their Regulation", Macmillan London 1954, p 275: "A cross-section of industrial structure at a given moment ... can only be regarded as a snapshot of an industry in perpetual change."

5) The characteristics of an industry in disequilibrium change from time period to time period. Therefore a comparison at time t may be incorrect at time t+1.

we observe it as the decay of profitability. The performance measure that is required would seem therefore to be the rate of decay of profitability.

The aims of this study were set out at the start of this introduction and a brief sketch of the ideas underlying the primary theme has been given. It is this primary theme - the rate of decay of profitability as an aspect of industry performance - that is the main contribution of this study. The theoretical development, whilst directed to an unconventional goal, deviates from common practice only by recognising both the heterogeneity of industries and the multiproduct nature of firms. While it is not claimed that the statistical technique employed represents radical innovation, it is new and it does have some merits in work of the kind attempted here. Although the decay of profitability has been observed and measured before, the present study presents a fuller examination than has previously been made.

The three themes of the study are pursued in parallel. The economic ideas have been introduced in this chapter and their main theoretical development occurs in Chapter II. The conclusions of that chapter are given mathematical formulation in Chapter VI, Section 1. Chapter VII reports the estimation of the equations and the estimated coefficients are used in Chapter VIII to calculate a summary measure of the behaviour of rates of return within industries. The characteristics and behaviour of the measure are also investigated in that chapter. Finally, in Chapter IX this measure is compared with established measures of industry structure and performance.

The statistical theme originates in Chapter III where the technique is developed. The data are introduced in Chapter IV. Chapter V reports the direct application of the technique to the data. Chapter VI, Section 2, discusses the econometric difficulties inherent in using the results of Chapter V in the functional forms introduced in Chapter VI, Section 1. Then in Chapter VII the economic and statistical aspects come together at the estimation stage.

It may be noticed that the preceding description of the structure of this study made no mention of a literature survey. The view has been taken that there is little of precise relevance but much that relates to particular aspects of the development. The literature whose influence pervades many of the following chapters has been treated in one of two ways. Firstly two works[6] particularly important in the theoretical development are discussed in Section 2.7. The other works[7] are empirical and deal with a broad range of questions, only some of which are relevant here. For these, the policy adopted has been to refer to them either textually or by footnote at the appropriate points in the argument.

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6) Downie J, "The Competitive Process, Duckworth London 1958
Robinson J, "The Impossibility of Competition" in Chamberlin E (Ed) "Monopoly and Competition and their Regulation", Macmillan London 1954

7) Singh A & G Whittington, "Growth, Profitability and Valuation", Cambridge University Press 1968
Whittington G, "The Prediction of Profitability", Cambridge University Press 1971
Stigler G J, "Capital and Rates of Return in Manufacturing Industry", NBER 1963

CHAPTER II

THEORETICAL CONSIDERATIONS

In this chapter we are concerned to look in more detail into the process of resource allocation and in particular to consider the role played by the rate of return.

Section 2.1 introduces some basic ideas and assumptions. In Section 2.2 we consider the organizational means for resource transfer and the types of resources that are transferred. Section 2.3 introduces the way the firm decides upon the allocation of its resources. A model is proposed in which the firm constructs a preference ordering of the markets it either operates in or feels itself capable of entering. Then the influence of the expected rate of return on that ordering for various hypotheses of firms' objectives is analysed. Section 2.4 looks more closely into the expected rate of return and its relation to the present market rate of return, bearing in mind market structure and possible multiple entry. Section 2.5 summarizes the foregoing before in Section 2.6 the move is made from market to firm rates of return. Also in this penultimate section there is an examination of the problem of the point towards which convergence occurs and of the form that the relationship between rate of return in one period and in the next should take. Section 2.7 discusses the similarities and contrasts between the arguments of this chapter and those of Downie in his book "The Competitive Process". This leads it into an additional examination of the problem of over-capacity and industry contraction. Finally, Section 2.8 summarises the chapter.

Section 2.1 : Initial Definitions and Assumptions

The argument in this chapter will be based on a narrow precise idea of a commodity. This contrasts with the usual assumption in industrial economics that commodity, market and industry are of similar extent.[1] Therefore some clarification of the idea of a commodity as used here must first be attempted.

Van Praag[2] gives a warning of the problems involved in attempting to define a commodity: "One of the vaguest concepts employed in economic theory is that of a homogeneous or basic commodity." This is reinforced by Samuelson's opinion that the pursuit of the narrowly defined or "basic" commodity is endless:

> "... even if we confine our attention to what is ordinarily called a commodity, such as 'wheat', we find ourselves dealing with a composite commodity made up of winter wheat, spring wheat, of varying grades. Each of these in turn is a composite of heterogeneous components and so forth in an infinite regression."[3]

Such views suggest that the pursuit of a definition is not a task to be attempted here. The approach will therefore be to regard the basic commodity as a primitive idea and merely attempt some clarification.

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1) e.g. Bain J, "Industrial Organisation", John Wiley New York 1967, p 7 "We may define a market as including all the sellers in any individual industry and all the buyers to whom (in common) they sell."

2) Van Praag B M S, "Individual Welfare Functions and Consumer Behaviour", North Holland Amsterdam 1968, Section 3.3

3) Samuelson P A, "Foundations of Economic Analysis", Cambridge Mass. Harvard University Press 1947

We are concerned with the movement of resources between markets and we regard the firm as the allocating agent. Therefore our idea of a market need not, should not, be more specific than that which is distinguishable by the firm. Producers of soap powders and detergents distinguish between the markets for materials for standard washing, for fine fabrics and for machine washing. On the other hand they will not regard powder in red boxes as being sold in a different market from that in blue boxes. A single distinct commodity must be dealt with in a distinct market and for two markets to be operationally distinguishable by firms the rewards must vary independently in each of them. Thus at any one time there may be an excess supply of standard washing powder and an excess demand for power for machine washing. The profitability of the two markets will be different and firms will recognize and react to this. On the other hand, physical distinction may not imply a separate product either because consumers are indifferent to a particular variation or because there are so many variations of the product that only categories of the good can be distinguished for market purposes. This latter situation is well shown up by Stigler's example of hot rolled carbon steel sheets of which at least 135 million varieties can be distinguished.[4] It would be exceedingly difficult to specify at what point a product distinction becomes too fine or too broad for our purposes. In the following market and commodity will be used in the narrowest sense consonant with resource allocation by firms between markets.

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4) Stigler G J and Kindahl J K, "The Behaviour of Industrial Prices", NBER 1970 pp 4-5

With this sense of "commodity" established, it becomes unreasonable to limit analysis to the single product firm. Therefore multiproduct firms will be treated as the usual case, but this does not of course imply the assumption that there are no single product firms. It will be assumed that firms generally restrict their activities to one industry and that any firms that do operate in more than one industry have a divisional structure in which no division overlaps industry boundaries. But the single industry firm will be taken as the general pattern.[5] At various points these assumptions will be supported by the argument but nonetheless they are to be taken as prior to the ensuing discussion.

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5) See "Company Income and Finance 1949-1953", NIESR 1956, Appendix A, where it is shown that an average of 87% of the employees of quoted companies classified to a particular SIC order worked in establishments of that order. It is thus not a serious simplification to regard firms as operating in a single industry.

Section 2.2 : The Allocation of Resources

In this section there are two matters to consider. Firstly, what mechanisms are available to shift resources between uses, and secondly the nature of these resources.

In Chapter I one role of the firm in the capitalist economy was said to be to act as the agent by which adjustment to change is made. The firm is therefore the prime means of resource transfer and allocation. This function may be carried out in a number of ways. We may classify these in two dimensions: the activities of single or multiproduct firms and exit/entry or expansion/contraction. It is suggested that expansion and contraction by multiproduct firms is the most important of these methods. This means that the firm either transfers its existing resources or allocates new resources among those markets in which it is already operating. The other possibilities for the multi-product firm are complete withdrawal from one of its markets or entry into a new market. The equivalent actions of the single product firm are expansion or contraction within its market, withdrawal from that market, which would usually imply the death of that firm, or the birth of a new firm into a market.

Of these devices, births and deaths of single product firms seem least likely to make any significant contribution to the adjustment of resource allocations. It is necessary that a birth involve the introduction of new capital and a death the withdrawal of existing capital. In these terms births and deaths among any but the smallest companies are rare. If deviations from equilibrium are small, it may be that the marginal effect of births and deaths among the smallest members of an industry is sufficient to push the whole industry back into equilibrium. There are activities for which births and deaths of small firms are the typical pattern but they are not major sectors in a developed economy.[6] Therefore in the presentation of the argument the emphasis will be on multiproduct firms and on expansion and contraction rather than entry and exit; although the substance of the argument is not dependent upon such emphasis.

What are the resources to be transferred? In the short run the capital stock of the firm is given and therefore conventional analysis allows only variations in the labour input. More labour can be applied by shift working that increases the rate of utilisation of the existing capital, by using it to bring into operation capital equipment that was otherwise idle and, lastly, labour can be applied to increase the number of men operating the capital equipment at any one time. Labour may be newly recruited for the purpose or may be transferred from another product within the multiproduct firm.

Discretionary expenditure may be used to improve a firm's competitive position in a market by advertising, marketing or improved credit terms. These activities and their corresponding resources are of some importance in the process of eliminating extremes of profitability. They must usually be accompanied by a rise in production if they are to have an effect upon market profitability.

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6) Downie J, "The Competitive Process", Duckworth 1958, similarly concludes that births are unimportant, p 101

In the long run fixed capital may be adjusted and any major shifts in production must require changes in capital allocation. A different model will follow from the assumption that existing fixed capital can change its use than from a "clay" type assumption that existing capital is fixed in its use. In the latter model only the allocation of new capital can bring about the return to equilibrium. In the absence of any empirical studies of this, an assumption must be made. The most obvious is the moderate one that it is possible for some existing fixed capital to change its use. As a use of capital is intended to mean the production of a single commodity, the change of use of existing capital may involve only trivial alteration. For example, most machine tools can be quickly adapted to produce a considerable range of simple metal goods and this change of use is a fact of everyday life in the engineering industry. Of course, there are pieces of capital equipment for which a change of use is impossible. The general point is that change of use of existing capital can often occur.

While allowing for the possibility that capital equipment may be transferred between products, the major way of altering the resources committed to different markets is by applying new capital. A firm must choose how to employ its investible funds and it is the commitment of these to a particular product and thus to a particular market that provides the basic means of adjustment.

Section 2.3 : The Allocation Decision

In this section we first consider how a firm will order the various opportunities for employing its available resources. Then assuming that the firm formulates an expected rate of return for these opportunities we look at the influence of that expected value on the firm's preference ordering for a range of objective functions that might characterise the firm.

The process by which a firm decides on the allocation of its resources[7] involves firstly information and secondly criteria for assessing that information. The information required is first a selection of markets to be considered - the whole set of markets could not be scanned by one firm. Once a subset of markets has been selected, the data needed on each one can be decided. With this data on a subset of markets, the aim must be to construct a preference ordering of the markets.

The selection of a subset of markets is a necessary first step in any periodic appraisal of a firm's range of products. Clearly such an appraisal must involve those products which the firm is presently producing, although the firm must be expected to apply rather different standards from those used for potential products. It is not feasible for a firm to consider all potential markets, primarily because of the search cost but also because some markets will be so dissimilar from those the firm knows that it may judge itself incapable of a competent appraisal.[8] For such

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7) That this is an area of decision facing the firm is suggested by Williamson J H, "Profit, Growth & Sales Maximization", Economica Vol 33 1966, pp 1-16: "There are the decisions on input levels required to satisfy the efficiency conditions - the selection of least-cost input combinations, the optimal distribution of given investment funds between alternative projects, and the optimal distribution of sales effort."

8) Downie op cit p 102: "... specialisation means that any point of time there will be what we may call a technological horizon, within which the firm will follow the light but beyond which it will not normally leap."

reasons, it is reasonable to expect that the vast majority of firms restrict their attention to markets within their own industry. The firm has regularly to decide upon the allocation of its scarce resources between the markets that it is operating in. The two problems of deciding the product range and deciding resource allocation will not be dealt with independently. The former is just as much part of the problem of allocating resources within the firm as is the latter. Perhaps it is worth inserting here a reminder of the narrowness of the idea of a product that is being used here in order that this model of regular appraisal of potential products does not seem too far fetched. Where perhaps it does deviate from reality is in terminology; the firm will regard itself as looking for profitable opportunities rather than scanning potential markets, the substance is the same. The first component of the adjustment model is, then, the multiproduct firm with a resource allocation decision to make and a limited set of markets (some of which it is already engaged in) to consider - the set being limited by considerations of search costs and the firm's own range of competence.[9] Such a situation must also describe the completely new firm (or independent entry in Downie's terms). The entrepreneur or embryonic management must consider a range of markets and they are at least equally constrained by the costs of search and range of competence.

One situation in which range of competence may not be immediately relevant is where a firm decides to enter a new industry and to buy the necessary skills. In general the purchase of skills will take the form of a takeover. Such a happening is not directly an entry as the

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9) This range of competence is likely to include more than just technological factors; different marketing skills are clearly of relevance. It might be useful to regard both firms and markets as embedded in a space whose dimensions are measures of such relevant factors as technology and marketing. The subset examined by any firm might then be defined as an area of that space centred upon the point at which the firm is located.

immediate consequence is not an expansion of capacity.[10] Once the takeover has occurred, the range of competence again constrains the actions of the firm.

With a range of markets to consider, the next stage for the firm is to order them according to their attractiveness as uses of the firm's resources. This demands information upon each of these markets but not merely contemporaneous information but predictions of future conditions. Our limited scope is to consider how the rate of return influences the preference ordering. The first stage is to assume that firms have an expected rate of return in these markets and to consider how that expected value influences the ordering.

The effect of expected rate of return on the preference ordering of the firm will depend on the firm's utility function. This is a controversial matter. There are three "families" of utility function: profit maximising, growth maximising and satisficing. Each major type of function has numerous variants. In this confusing situation, the one attitude that does not seem acceptable is to settle on any of these models as being <u>the</u> theory of the firm, that is to say, the model which describes all firms. Indeed, a case might be made for suggesting that the utility function of a firm is so complex that all three models must be amalgamated to describe it. We must briefly consider how each of these behavioural patterns affects the decision upon which our attention is directed.

If a firm is a profit maximiser, its criterion for ranking markets will quite simply be the rate of return that it expects to earn in them.

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10) Bain J S, "Barriers to New Competition", Cambridge Mass. Harvard University Press 1956: "Entry requires both the arrival of a new legal entity in the industy and an addition to industry capacity in use."

We may assume that the higher the rate of return expected in a market, the higher that market will appear in the preference ordering of a profit maximising firm. The only difficulty that arises is whether profit maximising means lump sum maximisation or rate of return maximisation. Either interpretation may be single or multiperiod. In the latter case the lump sum is a net present value and the rate of return is a yield rate[11] or internal rate of return. The ordering of projects should be invariant under these different methods but not, of course, invariant as between single and multiperiod assessments, or between different multiperiod horizons or for firms with different discount rates. The simple profit maximisation model is always formulated in lump sum terms[12] but as it is a short run analysis the capital stock is unchanged and therefore lump sum and rate of return maximisation are completely equivalent. In the single period case, the rule then becomes that the firm invests until the return on the marginal project equals the cost of capital - i.e. a rate of return argument is used. Again this is completely equivalent to lump sum maximisation. This model leads to a preference ordering based solely upon the expected rate of return.

If the firm is operating under a constraint which limits its expansion the lowest rate of return on a project undertaken may be considerably above the cost of capital. Considerations of risk may also lead to such

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11) Merrett A J & Sykes A, "Finance & Analysis of Capital Projects", Longmans London 1963, p 36

12) Henderson J M & Quandt R E, "Microeconomic Theory", McGraw-Hill New York, 1st edition 1958; "The entrepreneur .... his ultimate aim is the maximisation of profit .... this profit is the difference between his total revenue and his total cost". p 53

a cut-off point. Even under these conditions the preference ordering will be rate of return determined. The reformulation of the discussion in terms of multi-period comparison of investment opportunities does not alter that conclusion, although the expected multiperiod returns may produce a different ordering from that based on single period assessment. The assumption up till now has been that the firm involves itself in projects starting from that for which it has highest preference and continuing to less preferred projects until it decides either that subsequent projects are not attractive or that it has used up its available resources. But most projects will involve a minimum size of resource commitment, i.e. there are indivisibilities. It may therefore be that selecting projects in order of preference leads to a residual resource amount that is too small to be employed on the next most preferred use. The most desirable project that can be attempted with those resources may offer a very low rate of return. In such a situation, there may be a different set of markets from that selected by a simple preference ordering that provides the highest rate of return or, equally, the highest joint lump sum.

We can conclude that for the profit maximising firm its preference ordering will be solely determined by the expected rate of return. It is possible to say that the higher the expected rate of return is, the more likely it is that that project will rank high. But the complications of multiperiod assessment, project indivisibilities or conflicts, and constraints make it impossible to state that the preference ordering will exactly match the ordering by expected rate of return.

When we come to the family of firm utility functions that have been loosely called growth maximisers, the first task is to consider the variations in this group of functions. The first type is Baumol's static sales revenue maximisation and its dynamic counterpart is the maximisation of the present value of future sales revenue. Then there is the simple growth rate maximiser. As in the profit maximisation case, the static theory is not appropriate in the present context of resource allocation. In sales revenue maximisation more will be produced than in profit or growth maximisation[13] subject to some minimum profit constraint. The present value of sales revenue is dependent upon the growth of sales revenue, therefore there is some similarity between maximising this variable and maximising the growth rate, but they are not formally identical. Our concern is how the expected rate of return will affect the preference ordering of markets for firms whose utility function is best described by this type. It is to be expected that such firms will have some minimum rate of return that they demand from any project.[14] Therefore for any market, the higher the expected rate of return, the more likely it is that it will be in the operational section of the firm's preference ordering. The second way that the expected rate of return can have influence on the preference ordering is if the firm has a finance constraint. For the sales revenue maximiser, the importance of finance will depend upon the importance of future sales, which in its turn will depend upon the discount rate applied. But in any case, the expected rate of return must have some influence upon the preference ordering in this case. A growth rate maximiser must pursue a maximal investment policy which means maximising available funds if finance is a constraint. This implies the selection of projects according to their expected rate of return.

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13) Williamson J H, op cit, deals with the three theories and proves the basic results.

14) This is usually explained as a management security device - to prevent takeover by maintaining shareholder satisfaction.

If, on the other hand, finance is not the operational constraint but management capacity, for example,[15] there is no need for the firm to take note of the expected rate of return in determining its preference ordering as long, that is, as the projects satisfy the minimum return requirement. On the other hand, a firm in this position, when faced with a multiplicity of directions for expansion, is more likely than not to be partially influenced by the expected rates of return.

Generally, however, the sales revenue maximiser will, in the absence of a finance constraint, look primarily at expected future sales in determining his resource allocation plan. The growth rate maximiser will pursue a policy which minimizes the effect of whatever constrains his growth. In the most plausible situation where management capacity restricts growth, the growth rate maximiser will be concerned to operate in markets which themselves permit considerable growth. This assumes that diversification is more costly in its use of management resources than is expansion within a market. It is therefore likely that both growth rate and sales revenue maximisation will lead to the selection of markets that offer greatest growth of sales within them.

The third way in which the rate of return may have an important influence upon market selection is if there is a relationship between expected sales and expected rate of return. Whilst it is not possible to state a universal rule for the sales/rate of return relation, it is likely that a market rate of return that is high indicates a considerable discrepancy between demand and supply - price is well above marginal cost. The greater this discrepancy, the greater ceteris paribus the potential for increasing sales in the market without eliminating profits. Therefore

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15) Penrose E T, "Theory of the Growth of the Firm", Oxford University Press 1959

it is reasonable to presume that a highly profitable market will be attractive to both the sales revenue and the growth rate maximiser. On the other hand, markets may offer future increases in sales without presently displaying any supernormal profits. Such situations are those where either demand is expected to shift or costs to fall. Therefore we may conclude that high rates of return will be attractive to both types of firm, whether or not there is a finance constraint operating.

Before leaving this topic, the satisficing firm demands brief attention. It will have some minimum rate of return that it must attain for security reasons, but beyond this it is hard to develop any specific rules to describe its resource allocation behaviour that would suggest a connection with the expected rate of return.

To summarize the impact of the expected rate of return on resource allocation: the profit maximising firm will be guided by expected rate of return, sales revenue and growth rate maximisers with a finance constraint will be primarily though not solely guided by the expected rate of return. Without a finance constraint, markets with a high rate of return will be attractive but others may be equally or more attractive. The relationship is thus weaker. For the satisficing firm, the expected rate of return will only generally have influence through the minimum requirement. In all cases the higher the minimum requirement, the more influence the rate of return will have on resource allocation.

Section 2.4 : Determination of the Expected Rate of Return

In assessing a market, the firm will consider a number of time periods. For these periods it will forecast resources and outgoings and it may then be assumed to follow conventional techniques of investment appraisal and discount these cash flows in order to get a single measure of the profitability of entering the market. Such a measure might be either a net present value or an internal rate of return. It is not material to this argument which is employed but for convenience the internal rate of return will be used in the following.

In forecasting the future of the market, three components may be identified: how the industry as a whole may be expected to perform, how that particular market will fare relative to the industry and how that firm would perform in the market. The first component leads us to the previously made assumption that while the majority of firms are taken to be multiproduct, spanning of more than one industry is rare. To support this state of affairs, firms will only in exceptional circumstances include a market outside their own industry in the set of markets they consider. So the expected profitability of the industry will not affect the allocation of resources by a firm but only their total amount. In other words, we are concerned with intra-industry equilibration and not with inter-industry equilibration[16] and so need only attend to profitabilities relative to the industry. That is with the latter two components listed above.

The market and firm effects cannot be completely separated. The situation is a firm considering a market in order to calculate how profitable the

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(16) Stigler G J, "Capital and Rates of Return in Manufacturing Industry", Princeton University Press for NBER 1963, Ch 3 looks at the process of movement towards equilibrium between industries.

firm would find it were that firm to join the market. It must therefore take into account its own effect on that market and it must distinguish between the situation whilst it is establishing membership of that market and that prevailing after entry is established.

Consider first the case where the market involves a large number of firms and entry can be made on a small scale. In addition the entrant may presume that he and any other entrants will have little or no effect on price by their entry. He may therefore expect that his revenue per unit will be the same as the present firms in the market but that while he is building up output, sales and expertise, both in the technique of production and in the approach to selling relevant to that market, he will have higher costs per unit than established firms. As his experience in the market increases so his cost will shift downwards. He may not expect to have identical costs even after adjustment is complete and he is an established member of the market. He may be using adapted capital equipment that is less efficient than that of other producers or he may be located further from the market and have higher transport costs. Therefore after becoming established he may expect a continued deviation from the market rate of return. Downie[17] suggests that a firm will expect to lie in about the same relative position in a new market as it does in its present markets, thus if it is in the second quartile of rates of return at the present it will expect to occupy the same position in a new market.

If the usual approach is taken, the expected market rate of return in this case where the entrant has no significant impact upon it may be assumed to be represented adequately by the present market rate of return.

(17) Downie J, op cit P 105

The firm's expected rate of return (after adjustment) may therefore be presumed to be the present rate of return in the market times some factor unique to the firm and the market. But it follows that the higher the market rate of return and therefore the higher the expected market rate of return, the more likely it is that a given firm will find even with its unique multiplying factor that an attractive return is to be gained in that market, once the adjustment period is over. Similarly, the higher the profitability in the market the quicker the new entrant will get his costs below price and start earning profits. Also the higher the profits once adjustment is over, the more adjustment costs will be worth bearing for the longer term benefit. Therefore the higher is the present rate of return, the higher is the firm's expected overall rate of return in the case where the entrant assumes that entry will have no impact on price.

A second case is that where the market is atomistic but the firm considering entry expects sufficient other entrants for there to be an aggregate effect upon the market. This may be the way case one develops when the present rate of return is very high. The market's attractiveness and visibility is likely to induce a large amount of entry. If significant entry is to be expected, the potential entrant must expect a fall in rates of return. Should the expected rate of return react so that a rise in the present rate of return produces a fall - through the increased level of expected entry - then there would be a disequilibrating tendency. This is probably only possible where the market is on the margin of the atomistic category where there are only just sufficient firms and where the minimum efficient scale is just small enough. Although such a reversal of the effect of the present rate of return on the expected level may be rather unlikely, the expectation of there being other entrants will reduce for a single firm the attractiveness of a given present rate of return and thereby moderate the strength of the equilibrating tendency.

Once we move onto the situation where a single entrant may have a marked effect on a market, we enter the realm of oligopoly with its attendant problems. Considering first the post-adjustment state: the firm is assumed to have become established in the industry. The new entry may have precipitated a movement away from oligopolistic behaviour in the market to something more freely competitive. The likely result of this is a decline in price and profits and a rise in output. Should the entrant correctly forecast this occurence then the expected rate of return will still be influenced by the present rate of return as any competing away of excess profits earned under oligopoly conditions will take some time and therefore the average rate will bear some relation to the initial rate. The result holds more strongly if the firm fails to predict its effect on the conduct of the firms in the market. It will therefore expect to enjoy the higher profits of an oligopolistic situation and regard present rate of return as a good proxy for future rates of return.

The preceding paragraph presumes the effect of oligopoly is higher than normal profits; while this may not be so in any time period under the assumptions of some oligopoly models, it will prevail under collusive joint maximisation or Cournot-type models. It is a reasonable assumption except in cases where the oligopolistic interdependence has generated considerable instability in the actions of the member firms.

So far the case where the entrant has no effect on the market and the case where his noticeable arrival in the market results in a reduction of the amount of oligopolistic interdependence have been considered.

This latter case was only considered once entry had been completed; before considering the problems of the adjustment process in such a case, there is a third possibility to be considered. It is not impossible for the new entrant to precipitate more collusion or more interdependence[18] though it is clearly a relatively unlikely occurence. Prediction of it by the entrant is sufficiently unlikely for it to be ignored in this discussion of the process by which firms form their rate of return expectations.

The question now is the adjustment process. If adjustment is quick, then the costs and revenues involved in it will not carry very much weight in the discounting process and therefore unless the costs are for some reason very large, the expected steady rate of return may be taken as the overall expected rate of return. But most of the difficult problems arise in considering the process of entry and adjustment to a market. It is necessary to point out that in this section the concern so far has been to show that under most conditions the present rate of return will be the prime determinant of the expected rate of return. Turning as we are now to the adjustment costs, this is to consider factors that may influence the relation between the firm's expected rate of return in a market and the present rate of return.

Adjustment costs may be divided into three categories: Those costs that are incurred in increasing productive capacity in a market even if the investment is made by a firm already established in the market; those costs experienced by any entrant to the market; and thirdly those unique to a particular entrant. The basic costs of investment are straightforward and, therefore, for the present purposes, the first category

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18) Clearly this does not agree with Cournot's result that for firms maximising profit by output variations the more firms there are in a market the closer that market will be to pure competition. See Henderson J M & Quandt R E op cit p 179

need not delay us. Leaving temporarily the second category to one side, the third - factors unique to a particular firm - can next be dealt with. Entry to a new market involves in general the acquiring of new techniques, learning how to produce a different product and learning how to sell in a new market and, perhaps of lesser importance, learning how to buy new raw materials and intermediate goods and specialised factors of production. Each potential entrant to a particular market will differ in the degree to which it is equipped to engage in that market, so the costs of learning will differ. The expected rate of return will consequently differ from one firm to another. Therefore the number of entrants to a market will, amongst other things, be affected by the number of firms employing similar skills to those relevant to that market.[19]

Turning now to the second category - those factors common to all entrants to a particular market. Such factors are of course those usually known as "barriers to entry".[20] They are costs that must be born by a new entrant but not usually by an established firm considering expansion. More correctly, of the three types of barrier suggested by Bain, one is definitely only a barrier to entrants and not to expansions of capacity, while the other two may affect all investments in the markets. Bain's three types of barrier are: product differentiation, absolute cost advantages and economies of scale. Product differentiation only affects new firms coming to a market as an established firm must have an established product. Established firms may decide that to expand they should launch a new product, but this is a result of weighing relative costs, whereas the new entrant cannot avoid the costs of launching and establishing a new product. The second barrier - absolute cost advantages - conveys the possibility that established firms (or some of them) have

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19) This might be represented in terms of the space described in Footnote 10 as the density of firms in the area of the market.

20) The primary source is J S Bain's "Barriers to New Competition" op cit

control of superior production techniques and/or advantageous positions in factor or raw material markets. The third barrier - economies of scale - refers to the case where the minimum optimal scale of operation is a significant fraction of the total scale or capacity of the industry. If, in addition, unit costs are significantly raised at lower than minimum optimal scales, then entrants must either bear higher average costs than established firms or enter at the minimum optimal scale and thereby make a marked increase in the total capacity of the industry. The existence of any type of barrier means that adjustment costs for the new entrant will be high and that the adjustment is likely to be lengthy. Therefore the expected rate of return will be well below the present market rate of return.[21]

So far the discussion has been of new entrants to markets and the way they formulate the rate of return expectations that they use in making diversification decisions, in particular about how this expectation will relate to the present rate of return being earned in that market. But a very considerable amount of resource allocation will be done by firms between the markets they already operate in. Again the formation of the expected rate of return plays a part in the decision process, a part whose importance depends upon the objective function of the firm. But the factors that suggest a divergence between the present rate of return and the expected rate will be, apart from the barriers to entry, the same as for new entrants.

Briefly and finally in this section, what about exits? As the resource allocation decision is based on the firm's assessment of the future of

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21) Modigliani F, "New Developments on the Oligopoly Front", Journal of Political Economy June 1958 discusses Bain's and Sylos-Labini's assumptions about the likely reaction of established firms to new entrants. According to the view that the entering firm has of the policy that established firms will adopt, the expected to present market rate of return relationship will vary.

each market it considers, not all firms will jump the same way. Some will be entering or increasing their activity in a market while others are reducing their activity or actually leaving the market. Any change in the market will be the net effect of various actions by firms.[22] Actual withdrawal from a market is probably a rare phenomenon, but given a certain degree of capital adaptability there may conceivably be occasions when the benefits of moving it to a new use outweighs the costs of that move and the profits to be earned in the original market. There it is profit relatives that decide the allocation of resources rather than levels of profit. Generally we may regard exit as determined by the same process as entry - in each case there are costs to be borne that may or may not be compensated for by later profits.

22) Andrews P W S, "Industrial Analysis in Economics" in Andrews P W S and T Wilson (eds) "Oxford Studies in the Price Mechanism", O U P 1951 p 169, "The market will be in equilibrium as long as - any loss of capacity due to businesses being driven from production is made up by extensions to existing capacity or by the entry of new capacity."

Section 2.5 : Resource Allocation and the Rate of Return - A Summary

We have argued that allocation of resources between markets is achieved by firms either expanding and contracting or entering and leaving those markets, and that expansion and contraction by multiproduct firms within the markets they are already established in is the most important. The resources shifted (or newly applied) are labour, working capital (advertising, marketing, credit terms, etc), existing fixed capital and new capital.

It is suggested that the firm makes its resource allocation decisions after considering a number of markets - those in which it is already operating and a number of others within its horizon of technical, marketing etc, competence. The influence that the rate of return the firm expects to make in each of these markets upon the way in which it orders its preferences for increased (or new) activity in these markets is dependent upon the utility function of the firm. Expected rate of return will be the sole determinant of the ordering for the profit maximising firm, and it will be an important determinant for the growth rate or sales revenue maximiser if there is a finance constraint operative. It will still have some effect upon the ordering for these latter two groups even without the finance constraint. But then it is through the minimum profit constraint that rate of return will primarily have an influence, as it is solely for the satisficing firm.

The final stage of the argument is to link the expected rate of return with the present rate of return in the market. We find that the more atomistic the market and the fewer expected entrants, the closer the present rate of return to be expected. As the market becomes more oligopolistic, or as more entrants are expected, so the rate of return the firm expects to earn in the market diverges from the present market rate of return. Similarly the higher the barriers to entry, the greater is this divergence.

We may therefore expect that the speed with which resources are allocated towards the most profitable opening will be increased by the presence of broadly diversified firms that can reallocate internally. An industry of single product firms will be much slower. Secondly the more capital intensive is production, the less swift will be adjustment. For a given level of capital intensity, adaptability and short life of capital assets will lead to faster adjustment. These factors will aid both expansion and contraction.

The more similar are the markets of an industry, the easier firms will find it to move into new activities and so the swifter resource allocation within that industry. An industry of profit maximising firms or growth maximisers under a finance constraint will transfer resources towards profitable opportunities more quickly than one of growth maximisers without a finance constraint, or one of satisficers. Whatever the utility function, a factor that raises the level of the minimum profit constraint will speed the elimination of high rates of return.

Generally the closer the industry structure is to the purely competitive - the more atomistic, the lower barriers to entry - then the faster high rates of return will be reduced. The reduction of high rates of return will be faster if firms expect few other entrants than if they expect many.

The nature of the production process - its capital intensity, capital adaptability and capital life - and the multiproduct or single product nature of the firms within the industry must influence both expansion and contraction. Although it is perhaps less immediate a deduction, the profit maximisers and growth maximisers with a finance constraint are likely to get out of low rate of return activities more quickly than those without a finance constraint and satisficers, and presumably none will tolerate persistent returns below their minimum standard. So the higher the minimum standard, the more rapidly will contraction of the market take place. On the other hand, market structure and barriers to entry are likely to have a weaker influence upon the rate of contraction than upon the rate of expansion. But any firms that contemplate the withdrawal of their resources from the unprofitable market and entrance to another market will be affected, as will any entrant, by the nature of that market. A much more general problem relating to the contraction rate is that capital assets wear out slowly and whilst low rates of return may kill firms, assets are more difficult to eliminate. This will be returned to in Section 2.7, but the general view taken by writers in this area is that contraction is much less speedy than expansion and therefore low rates of return may take more to eliminate than high rates of return.

Section 2.6 : The Firm's Rate of Return

This section argues the connection between the firm's rate of return and the market's rate of return. It then discusses the implied point towards which profitability of firms tends, and finally specifies the basic requirement of the function relating the rate of return in one period with that in the ensuing period.

So far we have talked of firms allocating resources in response to market rates of return and of the consequences for the market rate of return of this transfer of resources. Simply we have said high (low) market rates bring in (drive out) resources that cause a fall (rise) in those market rates. But the observable variables are firms' rates of return and these are averages of the rates of return earned in each of the markets that a particular firm is engaged in. Conversely, the market rate of return must be the average of the returns earned in that market by all firms active in it. Therefore if the rate of return in a given market declines by a certain proportion, so on average must (by definition) the rates of return earned in that market by the firms operating in it. So the effect of resource transfer on the market rate of return must on average be reflected in the rates of return earned in that market by firms operating in it. This effect will be experienced in every market in the industry to a greater or lesser extent and therefore every firm will experience it on average for all the markets in which it continues to operate. Therefore in the absence of entry to markets, we may expect that, on average, high (low) firms' rates of return will be reduced (increased) through the transfer of resources. This continues to be true unless the rather unlikely situation occurs in which a very high proportion of industry resources are used in entry.

This pattern is an average one as some firms in a market whose rate of return is decreasing may achieve increasing profitability. Some firms may for various reasons be thus situated in a number of markets and so, despite high average profitability, experience a rise in profitability. Some firms may undertake entry on such a scale that their change in profitability is dominated by the effect of this. But all these possibilities notwithstanding, the average effect upon firms' rates of return will be as the markets' rates of return. Observing the average behaviour of all firms in an industry is to observe the average effect across all the markets of the industry.

So far we have spoken of high profitability inducing the inward movement of resources and low profitability outward movement. The consequence of this being a downward tendency for high profitability and an upward tendency for low. High and low need clarification. The movement of resources is motivated in a complex way - there will be markets where some firms are withdrawing resources while others are bringing them in. We are therefore concerned with net movements of resources within an industry. There will be some level of the rate of return below which there is net loss of resources and above which there is a net gain of resources.

The precise point at which this reversal occurs is, in what follows, called the "decay origin" and is assumed to be the industry mean rate of return. Whilst it is not possible to formulate a strong argument for any specific rate of return, it does seem unlikely that the decay origin will deviate far from the mean. It is also likely that there is quite a range of rates of return over which net flows are approximately zero, so any point within that range will serve. In general rates of return in all that follows will be expressed as deviations from the mean.

We must now consider how we may describe this intertemporal behaviour of rates of return in mathematical form. We will speak of the tendency to convergence as the "decay of profitability". If we write the rate of return (expressed as a deviation) of firm j at time t as r_{jt}, then the function we are interested in is

$$r_{jt} = f(r_{jt-1}) + u_{jt}$$

where u_{jt} is an error term with mean zero that encompasses all movements of profitability that counter its decay.

To put forward such a function is not to deny that more lagged rates of return would be relevant to a complete description of r_t. But we are concerned with the annual movement of rates of return and it is therefore this first order function that we must investigate.

For there to be decay of profitability, such a function must satisfy

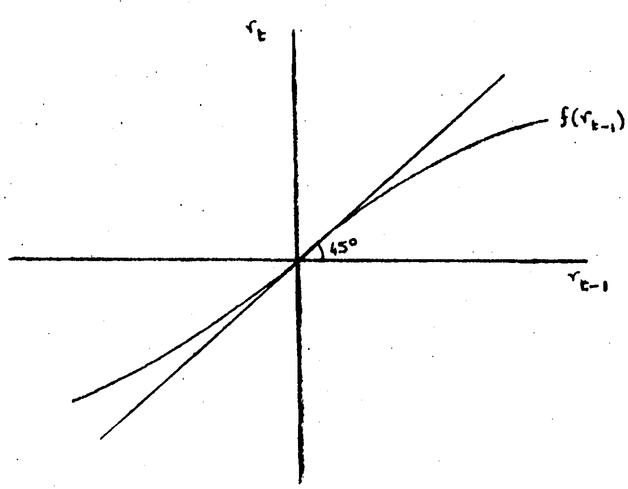
$$0 < f'(r_{jt-1}) < 1$$

This ensures that for high rates of return $r_{jt} < r_{jt-1}$ and for low rates of return (i.e. negative deviations) $r_{jt} > r_{jt-1}$. No attempt has so far been made to specify decay of profitability any further, and indeed a rigorous theoretical exercise would demand more than we know of the dynamics of micro resources allocation. What we should expect is that the faster resources may flow in, the faster will the decay of profitability occur, i.e. the smaller will be $f'(r_{jt-1})$. So the more quickly an industry moves towards competitive equilibrium, the lower will be the first derivative of the function. It is plausible to argue that the transfer of resources will tend to be faster into (out of) markets with very high (low) rates of return than into (out of) markets with more moderate rates of return. We might therefore suspect that the second derivative of the function would be negative (and certainly nonpositive):

$$f''(r_{jt-1}) \leqslant 0$$

Graphically we may represent this as in Diagram 2.1 in which the axes are rates of return measure as deviations. The 45 degree line is the locus of points for which $r_{jt} = r_{jt-1}$ and we expect the decay of profitability line to intersect it at the origin: there is no decay of average profitability.

Diagram 2.1



The algebraic specification of the function is necessarily a matter related to empirical convenience and will be discussed in Chapter Vl. For the present, we conclude that the function should have positive slope of less than unity and, if not linear, the second derivative should be negative. If the point of convergence is specified correctly and all rates of return are expressed as deviations from it, then the function should pass through the origin.

The final empirical point to be mentioned in this section involves the dispersion of the rates of return of firms within an industry. In order to eliminate the effect of variations in this on inter-industry comparisons, each industry's data have been expressed in standard deviation units as well as in deviations from the mean, before the decay of profitability function has been estimated. The precise details of this transformation of the data are described in Section 4.3

Section 2.7 : Downie's "Competitive Process" - A Comparison

This section looks at the way the preceeding arguments relate to those in the most relevant other work: that of Downie.[23] This leads to Joan Robinson's paper "The Impossibility of Competition"[24] and from there to a further consideration of the problems involved in the contraction of markets.

Although large portions of the industrial economics literature is relevant to particular aspects of this study, only Downie's is pervasive in its connections. He is concerned with the competitive forces and defines two: the "transfer mechanism" and the "innovation mechanism". The former term is used to describe the process which transfers market shares from the less to the more efficient. This tendency towards concentration is countered by the "innovation mechanism", which is the process by which firms change their efficiency by innovating. His argument relies upon the idea that such efficiency-enhancing innovations are brought about by the pressures of competition. As these pressures bear more heavily upon the less efficient firms, they will be the main innovators. Thus the concentrating effect of the "transfer mechanism" is reduced by the "innovation mechanism" throwing up new leaders for the industry.

The first aspect demanding clarification is - what is meant by efficiency? Downie uses it in the sense of the difference between the value of inputs and outputs, constructing an expression whose numerator is the value of

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23) Downie J, "The Competitive Process" op cit

24) Robinson J, op cit

inputs and the denominator the value of outputs. He tempers the ideal with his view of the practical and reaches an expression for efficiency which takes a final form:

$$\epsilon = 1 - \beta(r - \bar{r})$$

where β is the capital output ratio, r = rate of return on capital (pre-tax and post-depreciation) and $\bar{r}$ is the average rate of profit on the assets of the industry. Such a measure will generally relate in a simple way to the actual rate of return earned by firms unless the capital output ratio fluctuates considerably. "The efficiency ranking indicated by rates of return on capital ... will ... usually provide a fair guide."[25] This measure of efficiency will therefore correlate very highly with the rate of return of the firm expressed as a deviation from the industry mean - the variable used in this present study.

The main distinction that must be drawn between Downie's analysis and the present study's is that Downie is concerned with a longer run process. Thus he states: "The plausibility of my account therefore rests upon the assumption that fundamental disequilibrium will be corrected fairly quickly."[26] On the other hand, this study is concerned primarily with the strength of forces working to correct fundamental disequilibrium. Downie's transfer mechanism operates to shift market shares to the most efficient who will be able to win this increase because they can expand capacity more quickly than their competitors. This is possible because their efficiency provides a greater supply of internal finance for investment. The general operating environment is one characterised by excess demand that must be met rather than by a need to work to create

25) Downie op cit p 48

26) op cit p 113

extra demand.[27] Downie therefore concerns himself with the relative increases in capacity and the tendency of the transfer mechanism to increase concentration.

The counter-force is changing relative efficiency through changes in technique. That this does counter the transfer mechanism is dependent upon the assumption that falling market shares will inspire such innovations and so will originate in the less efficient firms. The most efficient are too concerned to increase their capacity to get involved in innovation of this kind. Therefore the innovation mechanism will work to change the relative efficiencies that direct the workings of the transfer mechanism. Just as the idea of the transfer mechanism ignores market creating activities, so the innovation mechanism is discussed in terms of technique rather than product innovations. This throws up the second main distinction between this and Downie's work: he talks in terms of industries rather than markets. He means by "industry", "a group of firms whose techniques of production are sufficiently alike for it to make sense to conceive of one as being able to do the business of another" and points out that this definition is "very close to that used by the authors of the standard Industrial Classification in the United Kingdom."[28] Whilst the weight he has put upon technique rather than product innovation and upon meeting rather than creating demand may be appropriate at this level of aggregation, the problems of different markets within an industry do cause him some difficulty.

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27) op cit p 113 "... makes it possible to virtually ignore the fact that an expanding firm needs to pursue an active selling policy in order to win new customers."

28) op cit p 33

He has a chapter (No VIII) in which he considers the effect of entry and exit upon his model of competition. The entry that he considers important is that resulting from an existing firm deciding to diversify into another industry.[29] The statement that he makes about this action by a firm also reveals very clearly that his firms are solely motivated by growth: "The potential migrant becomes an actual crosser of industrial frontiers when it believes that its combined rate of growth in two (or more) industries will be greater than that which it would achieve in only one."[30]

So diversification is motivated by growth as are all other firm actions and it means crossing to a new industry. Before looking at the impact of this complication upon the two mechanisms of the competitive process, the point must be made that Downie's reliance upon the industry rather than the market means that it is only the rare "crosses of industrial frontiers" that are explicitly treated as multiproduct. He does discuss the firms' choice of "production objectives"[31] in a way that would permit the consideration of the multiproduct but one industry firm, but does not develop the point. It is important because he points out that once firms have diversified, industries will contain firms that are insensitive to the transfer mechanism as their losses may be financed by the parent from activities outside the industry. Once firms are thus shielded from the transfer mechanism, the pressures that bring about innovation will also be severely diminished.

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29) He calls these "dependent firms" and argues that "independent firms" (i.e. new firms) cannot be significant influences because of the constraint upon new capital.

30) op cit p 103

31) op cit p 86

Diversification by the firm will thus reduce the strength of Downie's two forces and therefore "the tendency to ossification in the structure of concentrated industries will be all the stronger."[32] On the other hand, he argues that the working of the two forces will be accelerated in, what he terms, the "colonised industry". The transfer mechanism will be reinforced by the new entrants and this will, in its turn, enhance the operation of the innovation mechanism. Thus there are very different consequences of diversification according to whether the industry is colonising or colonised. This distinction is very difficult to maintain once the parts of the firm lose their clear parent-subsidiary relationship and become competing users of the resources available to the firm. At this stage we are faced with the multiproduct firm again and it has already been pointed out that Downie does not deal with this case.[33] As long as moving into a new industry is rare and as long as the industry can be treated as homogeneous, this is not a serious omission.

Having pointed out these two main contrasts between Downie's and my approach, the connections should also be discussed. To deal first with the innovation mechanism: in so far as it is restricted to techniques, its main place in the present study is amongst those factors that counter the decay of profitability and maintain the dispersion of profitability. On occasion an innovation of technique may permit one or a minority of firms to compete more effectively in a particular market and therefore bring about the decay of profitability for the majority of firms in the market. It might also be argued that if it is falling profitability rather than falling market share that inspires innovatory efforts, the innovation mechanism may underlie some of the decay of profitability from

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32) op cit p 109

33) See preceding page

low rates of return. Probably rather more rare but perhaps important nonetheless is the role of innovation in overcoming barriers to entry, particular scale barriers and absolute cost advantage barriers. Therefore the innovation mechanism, whilst playing mainly a disequilibrating role can, on occasion, contribute to the tendency towards equilibrium.

The transfer mechanism is a differential growth of capacity. It is the most efficient and therefore, in general, the most profitable who increase their capacity most rapidly. Within a model recognising industry heterogeneity, a proportion of firm profitability is explained by the profitability of the markets in which it operates. Therefore Downie's transfer mechanism in this context is equivalent to the allocation of resources towards the most profitable markets. It therefore induces the decay of profitability. It is Downie's emphasis on the effects of this process on industry structure rather than on the elimination of fundamental disequilibrium that leads to the different interpretations of the effect of this mechanism.

The pervading, although often implicit, assumption that growing demand is the usual situation means that Downie does not spend much time on the problems of excess capacity. He recognises the problem:

> "... what is needed to kill a firm is a period of negative gross profits, or a good takeover bid from another. But what is needed if capacity is to be scrapped is that reasonable men should believe that under no future conditions which it is reasonable to envisage will it be possible to earn any positive gross profit by working the capacity. Such a view will usually be taken only if the capacity is either very decrepit or, technical innovation in the industry having been very rapid, very old fashioned. In other words, firms can be killed by prices, but capacity only by time." 34

The situation of excess capacity will interrupt the working of the transfer mechanism and because of low profits and need for the security of liquidity in an industry suffering from over-capacity, the innovation

34) op cit p 120

mechanism will "tend to be suspended for the duration of the disequilibrium which will be longer in consequence."[35] Thus Downie's model of the competitive process suggests that readjustment of excess capacity will be a slow process. He points out that the "saving grace of growing demand"[36] will usually deal with the problem and therefore believes persistent over-capacity to be rare.

A more pessimistic discussion of this problem is that of Joan Robinson's.[37] The problem as she expresses it is that: "Supernormal profits are usually wiped out by new investment more quickly than subnormal profits are raised by disinvestment."[38] The conclusions are much the same as Downie's. There clearly are examples of the over-capacity continuing for extended periods but the industries where this is most likely to occur are suggested by the statement that: "We will confine the following argument to an industry producing a homogeneous commodity"[39] and by the remark that "most plant is highly specific"[40]. In the situation postulated as common in this present study - that is, multiproduct firms operating in industries encompassing many markets with capital permitting some degree of change of use - only quite extreme degrees of over-capacity or industry-wide over-capacity are likely to be particularly prolonged. Clearly this does occur: Cotton and Shipbuilding may be cited. These examples also have quite specialised and unadaptable capital. Therefore while the Downie and Robinson situation does occur, its frequency can be overstated due to the assumption of industry homogeneity and capital equipment specificity. The present study uses post-war data and therefore will deal with the full employment growing demand that, Downie says, makes over-capacity an abnormal situation.

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35) op cit p 121
36) op cit p 122
37) Robinson J op cit
38) op cit p 247
39) op cit p 247
40) op cit p 251

Section 2.8 : Summary

In Section 2.5 the various factors that may influence the speed of resource allocation were summarized. Here we may therefore merely state that resources will tend to be transferred from markets offering low profitability to markets offering high profitability. The nature of the industry will affect the strength of this process but is very unlikely to reverse it. It is net resource transfers that matter and there will be some rate of return (referred to as the "decay origin") at which net outward movement will change to net inward movement.

It is argued that this resource transfer will lead to a tendency for market rates of return to move toward the decay origin. We then conclude that firm rates of return will display a similar tendency and assume that the decay origin may be represented by the industry mean. We then suggest the basic form that the relationship between the rates of return at time t-1 and at time t should obey and point out that we will use standardised data.

Finally it is argued that in the most closely related study to this one there is an emphasis on the long run problem of changes in industry structure and that much of the divergence between conclusions follows from the present study's recognition of the heterogeneity of industries and the ubiquity of the multiproduct firm. In particular this leads to a differing view of the likely period involved in eliminating excess capacity.

CHAPTER III

STATISTICAL TECHNIQUE

In this chapter, the main statistical technique used in the study is developed. It is based on the ideas of Markov chains, so Section 3.1 presents the fundamentals of the Markov stochastic model. Section 3.2 goes on to develop the continuous analogue of the Markov transition matrix, continuous in the state rather than the time dimension. Section 3.3 introduces the method of using this device. The development of mathematical ideas here is intended to be heuristic rather than rigorous.

Section 3.1 : The Markov Process

The first order Markov process is a particular form of stochastic process in which the outcome of any trial depends only on the outcome of the preceding trial. So if there are a set of outcomes E_1, E_2, ..., E_n, and if E_j is succeeded by E_k at the next trial, we describe this transition by (E_j, E_k) and ascribe a probability p_{jk} to it. The outcome of the trial preceding that at which the outcome was E_j does not affect the value of p_{jk}. An example of such a process is given by Howard[1] where he introduces the usual terminology of Markov processes;

> "As time goes by, the frog jumps from one lily pad to another according to his whim of the moment. The state of the system is the number of the pad currently occupied by the frog; the state transition is of course his leap."

Thus "state" is used rather than the usual "outcome" of probability theory and instead of referring to trials and pairs of trials, state transitions are used.

This study is concerned with the change in rates of return from one period to the next. It is therefore acceptable to use the first-order Markov process as a model. It is not to deny that, at least, a higher order process is necessary for a full description of the behaviour of profitability over time.

Consider a system to be in one of N discrete states at time t and in another state at time t+1. Then if we denote the initial state by i and the state after transition by j, the transition probability - the

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1) Howard R A, "Dynamic Programming and Markov Processes", MIT Press, Cambridge, Mass, 1960, p3.

probability of that particular transition from i to j - may be written p_{ij}. The behaviour of such a process may be summarised by a matrix of transition probabilities:

$$T = \{ p_{ij} \} \qquad i,j = 1, \ldots, N \tag{1}$$

Certain conditions can of course be imposed on these probabilities. Firstly the fundamental:

$$0 \leq p_{ij} \leq 1 \tag{2}$$

Secondly for any i, p_{ij} is a conditional probability - the probability of the system being in state j next period given that it is in the state i this period. If not moving is treated as a transition (i.e. i = j is not ruled out) then clearly in the next period the system must be in one of the set of N states. So the sum of the conditional probabilities must be unity:

$$\sum_{j=1}^{N} p_{ij} = 1 \qquad \text{for } i = 1, \ldots, N \tag{3}$$

With these two conditions, T is a stochastic matrix.

At this stage a simple example may be useful. Let there be two states; above average profitability and below average profitability. There is a quite high chance that a firm will stay in the above average state next period and similarly a firm presently in the below average range will most probably stay there. Therefore the transition matrix will look something like:

$$T = \begin{pmatrix} 0.8 & 0.2 \\ 0.3 & 0.7 \end{pmatrix}$$

The rows - the conditional distributions - add to unity as required. In such a model, the firm is allowed no history. That is to say, if a below average firm lifts into the above average state it is then no more or less likely to stay above average than a firm that has been above average for some time. This is clearly a very sweeping assumption. It is of the kind fundamental to first order Markov processes. Generally Markovian analysis does have this implication that all that is relevant of the past is given when the state is specified.

Instead of treating a single firm by such a transition matrix it is equally possible to take a frequency distribution and apply the transition probabilities to that to get the next period distribution. So, if there are x_{01} companies in state 1 and x_{02} in state 2 at time zero, then the next period distribution is given in our example by:

$$(x_{01} \quad x_{02}) \; T$$

which we may write:

$$(x_{11} \quad x_{12}) = (x_{01} \quad x_{02}) \; T$$

Converting this into vector notation gives:

$$x_1 = x_0 \, T \qquad (4)$$

where x_0 is the vector of initial state distribution and x_1 is the vector of the state distribution after transition. Note that the number of individuals in the state distribution is constant over transitions, i.e. if the sum of the elements in the vector x_0 is M, then so is the sum of the elements in x_1. Therefore we can divide both sides of equation (4) by M and reduce the two x vectors to probability vectors, i.e.:

$$x_1 u = x_0 u = 1$$

where u is the sum vector.

The most interesting characteristic of the Markov process is its propensity to attain a steady state where the state probability distribution vector does not change between transitions. Assume that the transition probabilities are constant over time, then if x_2 is the vector at time 2

$$x_2 = x_1 T \qquad (5)$$

Substituting (4) in (5)

$$x_2 = x_0 T^2$$

or generally

$$x_n = x_0 T^n$$

Now there is a common type of transition matrix for which after some number of transitions the state probability distribution becomes constant, i.e.:

$$x_{n+1} = x_n T \qquad (6)$$

or we may write this

$$x = x T \qquad (7)$$

It is not necessary that this should hold for any particular transition matrix. A Markov process in which this characteristic holds, that state probability distributions for a large number of transitions are independent of the starting distribution, is known as completely ergodic. I do not intend to go into the discussion of ergodic and non-ergodic states.[2]

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2) Howard, op. cit., has a very elegant discussion of these aspects in his first chapter.

Returning now to the example concerning firms of above and below average profitability, let that matrix be completely ergodic and the steady state distribution is then (0.6, 0.4). That is, if the transition probabilities are unchanged, a stage will be reached when 60% are in state 1 and 40% in state 2. Once this has been reached these proportions will be constant over time.[3] The main comment must be that it is a very strong assumption that the transition probabilities are unchanged.

Any economic study which presented a steady state distribution as a forecast would only be reasonable if the steady state distribution was quite similar to the prevailing observed distribution. This is not to deny the value of deriving a steady state distribution for a transition matrix based on economic data, but that value lies not, except in exceptional circumstances, in accuracy as a predictor but rather in convenience as a description of tendencies inherent in present conditions and policies. That pressures of one kind or another are very likely to ensure that the steady state is not attained does not cancel the evidence on the desirability or undesirability of present tendencies. For example, if the steady state distribution of income is more inequitable than the present one, it suggests that the process working to change the distribution of income is inconsistent with any desire to reduce inequities. This is valuable information, but the steady state distribution is nontheless not to be regarded as a forecast of the future income distribution.

The idea of a steady state distribution does not imply stability for the individuals involved in the process. This is well shown by recourse

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3) This is a steady state solution for that particular transition matrix. It has not been proved here that this will be reached whatever the starting distribution, but this must be so for a completely ergodic process.

to Marshall's[4] example of the "trees in the forest" where the number of trees or each height may remain constant but:

> ".. one tree will last longer in full vigour and attain a greater size than another; but sooner or later old age tells on them all. Though the taller ones have better access to light and air than their rivals, they gradually lose their vitality, and one after another they give place to others, which, though of less material strength, have on their side the vigour of youth."

Marshall was talking about the growth of firms and it would be reading too much into his writing to claim that he was describing a complete steady state. But his metaphor applies to the situation of a stable frequency distribution describing a population within which individuals are all the time mobile. It is well described as a statistical equilibrium.

The idea of the steady state distribution has been used in empirical economics a number of times, for example, Vandome's investigation of the distribution of income[5] and Adelman's study of the distribution of firms by size within an industry.[6]

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4) Marshall A, "Principles of Economics" 8th edition, Macmillan, London, 1949 reprint, Bk IV Ch XIII para 1 p 263.

5) Vandome P, "Aspects of the Dynamics of Consumer Behaviour", Bulletin of the Oxford Institute of Economics & Statistics, Vol 20 1958 pp 65-105.

6) Adelman I, "A Stochastic Analysis of the Size Distribution of Firms", Journal of the American Statistical Association, Dec 1958 pp 893-904.

Section 3.2 : Continuous Analogue of the Markov Chain

Much has been done to avoid the temporal discreteness of the Markov chain, but this is not a problem when accounting data is being used. On the other hand, the discrete states are inconvenient in economic work as continuous variables are usually employed. Unfortunately the work done on developing the Markov chain in this direction seems to lie in the more unapproachable realms of mathematical statistics.[7] The alternative is to seek some other stochastic model, but the simplicity of the transition matrix idea is valuable. Therefore in this section an attempt is made to develop a continuous analogue of the Markov chain, or to show how the Markov model relates to simple ideas of distributions and conditional probability.

For any particular state probability distribution x_0, let the probability of a particular state i be written $P(i_0)$. That is, the vector x_0 is a probability vector and therefore each element is the probability of the corresponding state being occupied under that probability scheme. Similarly for the subsequent vector x_1 the jth element may be written $P(j_1)$. A conditional probability is defined:

"Let H be an event with positive probability. For an arbitrary event A we shall write

$$P(A|H) = \frac{P\ (A,H)}{P\ (H)}$$

The quantity so defined will be called the conditional probability of A on the hypothesis H (or for given H)".[8]

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7) Feller W, "An Introduction to Probability Theory and its Applications" Vol I 3rd edition, John Wiley & Co, New York 1967, p 375 refers to A Kolmogorov for the theory of chains with infinitely many states, his work being briefly reported in a German language paper and fully developed only in Russian.

8) Feller op. cit. p 115

We can construct such a conditional probability statement: state i is occupied at time 0, what is the probability of j being occupied at time 1 given this information?

$$P(j_1 | i_0) = \frac{P(i_0, j_1)}{P(i_0)} \tag{8}$$

rearranging:

$$P(j_1 | i_0).P(i_0) = P(i_0, j_1) \tag{9}$$

summing over all the states at time 0:

$$\sum_{i_0=1}^{n} P(j_1 | i_0).P(i_0) = \sum_{i_0=1}^{n} P(i_0, j_1) \tag{10}$$

The right hand side becomes the probability of j and all possible states at time 0. This latter is unity, therefore the equation may be written:

$$\sum_{i_0=1}^{n} P(j_1 | i_0).P(i_0) = P(j_1) \tag{11}$$

This is equivalent to the jth equation of the set given by the matrix equation (4).

Now let the system be described by a single variable so that the N states of the system can now be specified as intervals in the range of the variable. These intervals are not necessarily adjacent and the problem is still in a discrete form. Let this variable be Z and let the ith state be defined by $Z_i \leqslant Z \leqslant Z_i + \triangle Z$. Let the period be denoted by a superscript so Z^0 is the value of Z at time 0 and Z^1 at time 1.

Equation (9) may now be rewritten in this notation:

$$P(Z_j \leqslant Z^1 \leqslant Z_j + \Delta Z | Z_i \leqslant Z^0 \leqslant Z_i + \Delta Z) . P(Z_i \leqslant Z^0 \leqslant Z_i + \Delta Z)$$

$$= P(Z_j \leqslant Z^1 \leqslant Z_j + \Delta Z, Z_i \leqslant Z^0 \leqslant Z_i + \Delta Z) \quad (12)$$

It is now possible to introduce probability density functions into the relationship. We may write the conditional probability of being in the interval Z_j to $Z_j + \Delta Z$, given the state at time 0 is the interval Z_i to $Z_i + \Delta Z$ as $g(Z_j | Z_i)\Delta Z$, the function being defined for a standard value of Z. Similarly, the state probability distribution may be described by a function $f(Z_i)\Delta Z$. The time zero distribution may be written $f^0(Z_i)\Delta Z$ and the distribution at time 1: $f^1(Z_i)\Delta Z$. Each of these functions is dependent upon a standard value of ΔZ.

At this point it is perhaps helpful to explain the steps so far taken. The aim is to show the relationship between the conventional Markov model of discrete states and a variant allowing a continuous variable to fulfill the function of the states of the system. The initial stage was to convert from the specific notation of Markov chains to standard probability notation. For this step equation (4) is shown to be derivable from the definition of conditional probability, once the elements of the transition matrix are recognised as conditional probabilities and the state vectors are converted to state probability distributions. As the exact meaning of the elements of the state probability distributions is perhaps not yet clear, they may be regarded as the probability of a particular state being occupied at a particular time by a particular individual. Thus in the example employed before, if there are a number of companies operating subject to the given transition matrix, then the probability of company A, about which one has no previous knowledge, being in state 1 at time 1 is given by x_{11}.

With the translation to probability notation, we may choose to define the states in any way we wish. The use of intervals in the range of a continuous variable is selected here as a useful step towards the aim of defining the states of the system as a continuum. The last notational change takes us further towards our end result where functions must replace vectors and matrices if continuity is to be achieved. In this newest notation it is important to emphasize that the functions are defined for a specific interval in the range of Z. Using new functions in equation (11) we get:

$$\sum_{i=1}^{n} g(Z_j|Z_i)\Delta Z \,.\, f^0(Z_i)\Delta Z = f^1(Z_j)\Delta Z \qquad (13)$$

If at this stage the intervals of Z are assumed to be adjacent, then these variables may now be regarded as continuous and once ΔZ tends to zero the problem is converted to a straightforward continuous one and (13) may be written in integral form. One difficulty needs dealing with first; the summation is only over the states occupied in the first period, that is, Z_i varies but Z_j does not. This leads to a rather confusing notation, therefore let the final state be denoted by W and the initial state by Z.

Then (13) becomes:

$$\int_{Z=a}^{Z=b} g(W|Z)\, f^0(Z)\, dZ\, dW = f^1\,(W)dW \qquad (14)$$

Where a and b are the limits of the range of the continuous state variable. Just as (13) is equivalent to the jth equation of the set summarised by (4) so is (14). The function of $g(W|Z)$ is the analogue of the transition matrix.[9] It is not therefore a bivariate joint distribution, but rather a set of conditional distributions of W for given values of Z. Therefore:

$$\int_{W=a}^{W=b} g(W|Z)dW = 1$$

g(W|Z) will be referred to as the transition function in what follows.

In the later empirical work it will be the transition function that we are investigating, summarising, as it does, all probability changes within an industry. But predominantly attention will be directed at one function that may be derived from it. This relates the mean of the conditional distribution for a given Z to the value of Z. Other functions considered are those that relate the variance, skewness and kurtosis of the conditional distribution to the value of the prior variable. The results of this work are described in Chapter V. For the present the need is to clarify the empirical method and the meaning of such functions.

9) The demonstration of this analogy is obviously non-rigorous, hopefully it does have a heuristic value. It is done in the spirit expressed by Feller op. cit. p 444 when, having stated that much of Markov process theory is beyond the scope of the book, he says: "However many problems connected with such processes can be treated by quite elementary methods provided it is taken for granted that the processes actually exist. We shall now proceed in this manner."

Section 3.3 : The Transition Function in an Empirical Context

The transition function summarises all the year to year changes in rates of return (or any other variable to which it is applied). To identify its functional form and estimate the parameters involved would clearly be the ideal. But this is a difficult job that is made more so by some of the characteristics of the transition process that will be described in Chapter 5. It is therefore likely that any function fitted directly would involve considerable compromise. For these reasons the problem is attacked by considering the relationships between various summary statistics of the conditional distributions and the value of the prior variable. For example, the relationship between $E(W|Z)$ and Z - i.e. the relationship between the mean of the conditional distribution for a given Z and the value of Z (the prior variable). Clearly such an approach could still lead to an estimation of the transition function.

An example of how this might be done can easily be set out. Let the mean of the conditional distribution be given by the function $\mu(Z)$ for any Z and let the standard deviation be given by the function $\sigma(Z)$. Then, presuming that the distributions are symmetric and mesokurtic, the normal distribution may be taken to be a satisfactory approximation for the transition function. The normal distribution may be written in the form:

$$f(x) = \frac{1}{\sigma\sqrt{2\pi}} \exp\left\{-\tfrac{1}{2}\left(\frac{x-\mu}{\sigma}\right)^2\right\}$$

Substituting for μ and σ we may write:

$$g(W,Z) = \frac{1}{\sigma(Z)\sqrt{2\pi}} \exp\left\{-\tfrac{1}{2}\left(\frac{W-\mu(Z)}{\sigma(Z)}\right)^2\right\}$$

Were the distribution function to involve extra parameters corresponding to higher moments of the distribution, then a similar approach could be adopted. In other words, the procedure consists in observing how various measures of the conditional distributions (the row distributions of the transition matrix) vary as one moves over the range of the prior variable. This information can then be inserted into a univariate distribution function which fits the conditional distributions.

In fact this step becomes less important when it is realised that it is these very functions relating characteristics of the conditional distributions that are of prime interest. Actually estimating the transition function is unnecessary. The first function is that relating $E(W|Z)$ to Z; this is the regression line of W on Z, if we quote Hoel:[10]

> "A theoretical regression curve is basically the graph of the mean of the conditional distribution $f(y|x)$ .... (or) the locus of such mean points, that is, the graph of $\mu_{y|x}$ as a function of x ....."

Thus we see that it is only study of the higher moments of the conditional distributions that give more information than would straightforward regression analysis. On the other hand, information on the whole transition function makes it less likely that an inappropriate form of function will be fitted to the means.[11]

Turning now to the variance relation, its interpretation in regression analysis terms is again illuminating. If the mean relationship is the regression line of W on Z, the variance relationship describes the

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10) Hoel P G, "Introduction to Mathematical Statistics" 3rd edition, J Wiley & Sons Inc New York 1962, p 194

11) Another advantage is that the demands on computer size can be much less than for a straightforward regression. This is relevant when, as in this study, there would be up to 3500 observations for a single regression. This point, with respect to grouping data, is made by Prais S J and Aitchison J: "The Grouping of Observations in Regression Analysis". Review of the International Statistical Institute Vol 22, p 1.

errors of the regression, and so if the variance is related to Z the simple regression of W on f(Z) would suffer from heteroscedasticity. This, in

$$W = f(Z) + \epsilon$$

ϵ is not distributed with constant variance and its variance is not independent of Z. What of the regression line relating the means of the conditional distributions to a function of Z? If there is heteroscedasticity in the straightforwardly estimated equation, then this equation will also have heteroscedastic errors. The errors in this equation are the result of sampling errors in the means of the conditional distributions and this will have a variance given by $\{\sigma(Z)\}^2/\{N(Z) - 1\}$ where $\sigma(Z)$ is the standard derivation of the conditional distribution given Z, and N(Z) is the number of observations in that distribution. So if there are heteroscedastic errors in the straightforward regression of W on f(Z) there will also be the same problem in the regression using the conditional distributions. That is, unless N(Z) varies with Z so as to compensate for the variation in $\sigma(Z)$. One final point is that the total sum of squares in the regression of the conditional distribution means will be much lower than in the straightforward regression and this will lead to a much higher R^2.

Finally, the skewness and kurtosis of the conditional distributions are primarily of interest as an indication of how far these distributions deviate from the normal. Major divergence from normality would indicate that the usual tests of significance on the estimates produced by a straightforward regression would be inexact. This applies more to skewness than kurtosis, as t and F tests are robust as long as the distributions are unimodal and approximately symmetrical. On the other hand, the regression using the means of the conditional distribution will avoid this problem to a considerable extent as the skewness of the sampling distribution of the mean is much less than the skewness of the original distribution.[12] A similar result applies to the kurtosis, the sampling distribution being more mesokurtic than the original distribution.[13] In other words, the regression using the means of the conditional distributions will be closer to possessing the desirable properties of having normally distributed errors than a straightforward regression.

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12) See Croxton Cowden & Klein, "Applied General Statistics" 3rd edition, Pitman, London 1968, p 538-9

13) Croxton Cowden & Klein op.cit., p 540-541

Section 3.4 : Summary

The Markov chain is a stochastic model that describes transitions from one state to another. In the usual first order model, the only factor influencing the probability of a transition to a particular state is the present state occupied. This simple model can be developed to permit the substitution of a continuous variable for the set of discrete states. Such a substitution leads to a transition function rather than a transition matrix.

The form of the transition function can be investigated by considering the relationships between the value of the prior variable and the characteristics of the conditional distributions produced by setting a value to the prior variable. In particular the relationship involving the mean of the conditional distribution is equivalent to the regression of the final variable on the prior variable. The functions involving higher moments provide information on the errors of that regression.

CHAPTER IV

THE DATA

This chapter is concerned with the data used - their origin, nature and problems. In Section 4.1 the history of the company accounts data is briefly given and their overall scope described. Section 4.2 deals with the rate of return employed in this study, the reasons for selecting it and the way it is calculated from the company accounts data. Section 4.3 brings us to two problems of time; firstly the choice of period to be used in the analysis and secondly whether to correct for differences in accounting date, and if so, how. Section 4.4 describes the sample of companies for which the company accounts data is available and the classification of those companies first into industrial orders and then into more narrowly defined industry sub-groups. Finally, in Section 4.5, the annual distributions of the rate of return by industry are examined.

Section 4.1 : The Data

The National Institute of Economic and Social Research started to collect and standardize the accounts of UK quoted companies after the passing of the 1948 Companies Act had set new standards for the information to be provided in published accounts. They continued this work for five years for all quoted UK companies other than those engaged mainly in financial activities, shipping and agriculture.[1,2] After the National Institute had ceased this work, the Board of Trade continued it. In 1961 the sample was considerably reduced, therefore the data 1948-1960 are conveniently used where long runs of observations for a large number of companies are required.

The Department of Applied Economics at Cambridge converted the data for this period on to magnetic tapes. The results of their use of the data are reported in "Growth, Profitability and Valuation" by A Singh and G Whittington, CUP 1968, "The Prediction of Profitability" by G Whittington, CUP 1971, and "Takeovers" by A Singh, CUP 1971. The first of these three books contains a useful account of the data in Appendix A. The Cambridge magnetic tapes were further organised at Stirling for convenience of use, but the company records are just as used at Cambridge.

Briefly there is for each company in the sample a record for each year that the company existed.[3] This record consists firstly of indicative

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1) NIESR, "Company Income and Finance 1949-1953" op.cit, summarises and describes the data.

2) Tew B & Henderson R F (eds), "Studies in Company Finance", CUP 1959, does further analysis on these data.

3) A few were brought into and removed from the sample during the period, but generally companies appear when they gain a quotation and disappear upon death or merger.

data specifying, amongst other things, the accounting date, the industry and the industry sub-group to which the company belongs. The second and major part of the record is a set of standardized accounts for the company for that year. This comprises a Balance Sheet, Appropriation of Income Statement and a Sources and Uses of Funds Statement. The components of these accounts are listed in Table 4.1.

Table 4.1 : List of Standardized Variables in the Basic Accounting Data

Variable No.	Title
	Capital and Reserves
1	Issued Capital - Ordinary
2	do - Preference
3	Capital and Revenue Reserves
4	Provisions
5	Future Tax Reserves
	Memorandum
6	Contracts for capital outstanding
	Liabilities
7	Interest of minority shareholders in subsidiaries
8	Long term liabilities
9	Bank overdrafts and loans
10	Trade and other creditors
11	Dividends and interest liabilities
12	Current taxation liabilities
	Memorandum
13	Total depreciation

Variable No.	Title
Assets	
14	Fixed Assets: tangible, net of depreciation
15	do : intangible
16	do : trade investments
17	Stocks and work in progress
18	Trade and other debtors
19	Marketable securities
20	Tax reserve certificates
21	Cash
Summary	
22	Total net assets
Sources of Funds	
23	Issue of Shares : Ordinary
24	do : Preference
25	Increase in liability to minority interests
26	Issue of long term loans
27	Bank credit received
28	Trade and other credit received
29	Increase in dividend and interest liabilities
30	do current tax liabilities
31	do future tax reserves
32	Balance of profit : depreciation provision
33	do : provision for amortization
34	do : other provisions
35	do : retained in reserves
36	Other receipts

Variable No.	Title
	Uses of Funds
37	Expenditure, less receipts, on fixed assets - tangible
38	do - intangible
39	do - trade investments and investments in subsidiary companies
40	Increase in value of stocks and work in progress
41	Increase in credit given - trade and other debtors
42	Expenditure ex provisions
43	Sundry expenditure
	Adjustments
44	Consolidation adjustment
45	Conversion do
46	Residual do
	Balance
47	Change in securities
48	do tax reserve certificates
49	do cash
	Appropriation of Income
50	Operating profit (before depreciation)
51	Dividends and interest received (gross of income tax)
52	Other income
53	Interest paid on long term liabilities - gross
54	Tax on current profit
55	Dividend, net of income tax, ordinary
56	do other
57	To minority interests in subsidiaries (net of taxation)
58	Prior year adjustments - tax
59	do - general

Variable No.	Title
Summary	
60	Total capital and reserves (items 1 to 5)
61	Total liabilities (items 7 to 12)
62	Total fixed assets, net of depreciation (items 14 to 16)
63	Total current assets (items 17 to 21)
64	Total sources (items 23 to 36)
65	Total uses (items 37 to 43)
66	Total profit (items 50 to 52)
67	Total balance of profit (items 32 to 35)

Taken from Singh & Whittington op. cit., Appendix C.

Section 4.2 : The Rate of Return

The present analysis is concerned with the rate of return on net assets. The numerator is calculated gross of tax and net of depreciation. It is thus insulated from the immediate effects of changes in tax rates or the tax system. But in so far as accounting figures permit, capital consumption is deducted. Profits are also calculated before deduction of interest on long term debt, so that the effects of variations in capital structure are removed.[4] Included in this profit figure is investment and other income. This is on the assumption that such income is usually derived primarily from activities within the same industry as that of the firm. In general it is small relative to operating profit so the choice of inclusion is unlikely to have any significant effect. In terms of the accounting quantities listed in Table 4.1, the profit figure used is the sum of operating profit (before depreciation) (variable number 50), dividends and interest received (gross of income tax) (51), other income (52) and prior year adjustments (general) (59), minus the three components of balance of profit - depreciation provision (32), amortization provision (33) and other provisions (34).

Such a quantity departs considerably from the economic concept of profit - including as it does income to be paid as interest explicitly. It is, of course, unavoidable that any reported profit figure bears rather a distant relation to economic profit: in many cases some component that is strictly management wages will be included and some part of the income accruing to the equity holders is strictly interest.

4) Some interest is deducted before the operating profit figure is presented - bank interest for example. The removal of capital structure effects is therefore not complete.

One has to trust that the relation with the pure economic concept is sufficiently close for the analysis to be interpreted in terms of economic theory.

The denominator of the rate of return is net assets. This is calculated as the sum of issued capital (ordinary and preference) (variable numbers 1 and 2), capital and revenue reserves (3), future tax reserves (5), interest of minority shareholders in subsidiaries (7) and long term liabilities (8). This encompasses what is usually known as Capital and Reserves.[5] From the balance sheet identity it can be deduced that it is equal to the sum of fixed and current assets minus current liabilities, which may be regarded as fixed capital plus working capital. The fixed capital component being net of depreciation. Note also that, just as the profit figure includes investment income, so the net assets figure includes trade investments (variable number 16). The choice of net assets rather than equity assets, or any other denominator, is based on the arguments of Chapter II in terms of resource allocation. Net assets being the sum of the two types of capital employed (fixed and working). On the other hand, what evidence there is suggests that the rate of return on equity assets behaves very similarly to the rate of return on net assets.[6]

This study is concerned with changes in rates of return - comparing values for two years for the same company - and the consequences of the weaknesses in the data are therefore not too serious. For example,

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5) In Table 4.1 provisions are included and minority interests and long term debts are excluded. This is to accord with the NIESR and Board of Trade treatment.

6) Singh & Whittington op.cit. Ch 6.5.
P E Hart (ed), "Studies in Profit, Business Saving and Investment", Vol 1, Allen & Unwin 1965, Ch 8 "Alternative Measures of the Size of Firms" p 149: "... in practice it does not seem to matter very much which measures (of size) are used, since they are mostly highly correlated with each other."

any persistent undervaluation of assets will tend to be reduced in importance through these year to year comparisons. Secondly, all the analysis is within industries or more narrowly defined groups of firms and relative to the average of the industry or group. Common accounting practices are thereby allowed for. But finally there is no choice. Measures derived from the accounts have to be used[7] and as such quantities are the information or part of the information used within industries to guide resource allocation, they are not inappropriate measures to employ here.

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7) Hart P E (ed), "Studies in Profit, Business Saving and Investment", Vol II, Allen & Unwin 1968, p 269: "Rates of return calculated from balance sheets of samples of companies may be used for this purpose because it was found .... that accounting data are a reliable guide to trends in rates of return, in spite of the well known objections to balance sheet figures."

Section 4.3 : The Accounting Period and Accounting Date

There is nothing in economic theory to suggest the correct interval at which rates of return should be calculated. On the other hand, the data constrain us to using a period of one year or a number of years. Fractions of years are ruled out by the convention of the annual account.

There are two main arguments for using a period of more than one year. The first is that any concern with resource allocation is concerned with the long run. But to this it may be said that in the case of many capital goods the long run is less than a year. Additionally, the reallocation of working capital and labour can usually be achieved (or partically achieved) in less than a year. Complete adjustment of the allocation of productive resources may be a lengthy process but partial adjustment - and some profitability effects - will generally be possible within the basic accounting period.

The second argument is that year to year changes in rates of return will include many random factors that would average out over a longer period. This is undeniable but the assumption must be that these weaken the postulated relation between rates of return in adjacent periods rather than biasing that relation. The method of statistical analysis described in Chapter III, in effect, averages over large numbers of observations and so reduces the impact of these random factors. Therefore it may be said that this second argument is one of statistical desirability and the results to be reported later will deal with it.

It seems fair to conclude that the case against using the single year as a basis is not strong. On the other hand, the empirical argument for not wasting observations seems very strong. Therefore the single year is hereafter used. The likely effect is to provide us with a rather low figure for the rate of decay of profitability.[8] It will be low because if resource allocation is slow, only a small amount will be completed within the year and therefore only a small movement of rates of return brought about. But with each industry covering a number of markets and firms some reallocation will occur within any year and so therefore there will be some decay of profitability.

The other time period problem is that of accounting date. Firms' accounting years end at different times in the year, although this does not matter in so far as we are looking at year to year changes in rates of return. But it causes problems because we are using rates of return relative to the industry experience - the industry mean. The industry mean for the year ending March 31st is different to that for the year ending December 31st. Before proposing a solution to this problem it is necessary to clarify the function of the industry average rate of return in this work. Primarily it is that rate of return to which the decay of profitability is assumed to occur - the decay origin. This implies that markets with rates of return below that level are likely to experience a net withdrawal of assets, whereas markets with rates of return above that level are likely to experience a net addition of assets. Such a phenomenon will not follow the precise industry average but rather some idea of mean experience. This is likely to have a lagged response to actual changes in the average. For this reason the slight variations from one quarter to another are likely to be unimportant, therefore on this basis adjusting for accounting date would not be necessary.

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8) Whittington op cit estimates a function like the linear regression used later, but on figures that are five year averages. We may therefore expect that he finds a higher rate of decay of profitability. See Chapter IX Section 3.

But the rate of return average does serve another purpose; it removes the variations in rates of return that are experienced by all firms in the industry. Effects of macroeconomic circumstances are thus dealt with. The process of inter-industry equilibration is also removed.[9] Clearly netting out these effects would be done more completely if allowance were made for variations in accounting date. There is therefore a choice to be made and it has been decided that allowance should be made for accounting date. It is very difficult to see that this will lead to any consistent bias in the estimated rate of decay of profitability and it does have the empirical advantages outlined earlier in this paragraph.

Having taken this decision, the next stage is to describe how the allowance is made. Firstly the data ascribes each company to a quarter according to its accounting date. Each company whose financial year ends in a particular quarter is treated as having the same financial year. Given that the two most common accounting dates are at the end of quarters December 31st and March 31st, this assumption does not involve any serious approximation. Secondly the average rate of return is calculated for each industry for each year for each accounting date. This average is the average rate of return of companies in the sample, i.e. most quoted companies. Theoretically it should include all and not just quoted companies but the lack of data makes this impossible and as in most industries the quoted companies account for a very large portion of total assets or total turnover, the divergence is probably not serious. In a few industries the number of companies with a particular accounting date is small and the mean is therefore

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9) Stigler G J, "Capital & Rates of Return in Manufacturing Industry", NBER 1963, Ch 3 deals with inter-industry equilibration and its effects on rates of return. See also Chapter IX Section 2 of this study.

liable to considerable error. The ameliorating factor is that where there are few companies involved their impact on the full body of data for that industry will also be small. Industry 8 is an exception to this but, throughout, the small number of companies for this industry makes its figures suspect.

Just as means by accounting date have been used, so the standardization has employed standard deviations by accounting date by year by industry. The caveat in the case of small numbers applies *a fortiori* to this.

Finally it must be mentioned that in calculating both means and standard deviations very extreme observations have been thrown out. In practice any rate of return with an absolute value greater than 150% has been rejected - there were twenty such observations. These are indicated in Table 4.2 which also gives the numbers of companies with each accounting date by industry.

In summary, the data are standardized, the means and standard deviations are calculated separately and applied separately according to both year and accounting quarter.

Table 4.2 : Accounting Date and No. of Companies

Code	Industry	No. of Companies 6 April - 5 July	6 July - 5 Oct	6 Oct - 5 Jan	6 Jan - 5 April
1	Bricks, pottery, glass & cement	14	16	58	33
4	Shipbuilding & non-electrical engineering	42(1)	59	136	84
5	Electrical engineering	13	17(1)	48	46
6	Vehicles	11	36	31	15
7	Metal goods n.e.s.	16	37	85(1)	51
8	Cotton & man-made fibres	4	5	9	21
9	Woollen & worsted	7	8	31	26(2)
11	Clothing & footwear	15	15	51(3)	17
12	Food	20	22	55	35
13	Drink	19	83	33	41
15	Paper, printing & publishing	31	13	55	44
16	Leather, leather goods & fur, timber, furniture, other manufacturing	21	33(1)	84(3)	50(3)
17	Construction	5	6	33	13
18	Wholesaling	47(2)	20	120(2)	82
19	Retailing	14	31	37	106
20	Entertainment & sport	13	15	39	17
21	Transport & communication Miscellaneous services	32	35	70	36

Numbers are for 1954. Those in brackets indicate number of company years omitted from that industry and accounting date, not just for 1954 but for all years 1948-1960.

Section 4.4 : The Nature of the Sample

The analysis is mainly done by industry although some smaller subdivisions - referred to as "industry subgroups" - are employed later. The industries and the number of companies in each is shown in Table 4.3. Also given in this table are the number of pairs of years observations, that is, the number of transitions. The industry classification is based on the 1948 Standard Industrial Classification. It has, of course, to be a little arbitrary as classifying financial units must involve more anomalies than classifying establishments. Nonetheless, an exercise carried out by the Board of Trade revealed that 87% of employees worked in establishments belonging to the industry to which their employing firm was classified.[10] Therefore the broad industry classification is probably satisfactory.

When we turn to the industry subgroups the extent to which activities not relating to that group become included must increase considerably. Only those subgroups that have over 20 members have been used and these are shown, together with their meaning in terms of 1948 S.I.C. minimum list headings, in Table 4.4. Forty subgroups have been used out of a possible 71. Again the classification was done during the collection of the data by the NIESR and the Board of Trade.

One way in which the sample does differ from that used by Singh and Whittington is that it has not been restricted to continuing companies. Every transition from one rate of return to the next year's has been used.[11] This means that nearly double the number of companies can be

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10) See NIESR op. cit. Appendix A for the report of this work.

11) There is one general exception: the profit figure uses values from the Sources and Uses Statement. As this is produced by comparing two Balance Sheets, it is never available for the first year in which a company appears in the data. Therefore the first rate of return that is usable refers to the company's second year.

used; of course, as the companies brought in in this way provide fewer years observations than continuing companies, the number of transitions is by no means doubled. The number of continuing companies, companies born and companies dying in the data is shown in Table 4.5.

Table 4.3 : Number of Companies and Transitions for Each Industry

Code	Industry	No. of Companies	No. of Transitions*
1	Bricks, pottery, glass & cement	146	1227
4	Shipbuilding & non-electrical engineering	370	3199
5	Electrical engineering	146	1261
6	Vehicles	107	916
7	Metal goods not elsewhere specified	217	1906
8	Cotton & man-made fibres+	44	376
9	Woollen & worsted+	73	729
11	Clothing & footwear	118	994
12	Food	152	1299
13	Drink	206	1753
15	Paper, printing & publishing	167	1470
16	Leather, leather goods, fur Timber, furniture, Other manufacturing	212	1863
17	Construction	75	586
18	Wholesaling	294	2620
19	Retailing	236	1841
20	Entertainment & sport	95	872
21	Transport & communication Miscellaneous services	333	2260

* After omitting all rates of return more than three standard deviations from the mean - see Section 5.1.

\+ This is only a part of the industry - see Table 4.5.

The industry codes and descriptions are taken from Whittington op. cit. p 6 Table 1.1. Certain industries - Chemicals & Allied Industries (2), Metal Manufacture (3), Hosiery, Carpets & Other Textiles (10) - have been omitted as their data was not available. The Tobacco industry (14) has been omitted as being too small.

Table 4.4 : Subgroup Definitions and the Number of Companies and Transitions for Each

Code	Industry Subgroup	SIC Minimum List Headings	No. of Companies	No. of Transitions
1.2	Building materials	461, 469, 102, 103, 109(5) & (3)	98	804
1.3	Pottery	462	27	220
4.1	Shipbuilding	370	38	351
4.2	Machine tools	332, 333	33	314
4.4	Constructional engineering	341(2)	23	206
4.5	Other engineering	331, 334, 336-9, 341(1), 342, 349	258	2219
5.3	Wireless etc.	363, 364	28	268
5.4	Other electrical manufactures	365, 369	77	615
6.4	Vehicle components	381, 382	38	340
7.1	Other metal goods	364(2), 391-6, 399, 499(1)	176	1514
7.2	Instruments etc.	351, 352	43	418
8.1	Cotton spinning	412	31	255
9.1	Wool	414	66	658
11.1	Clothing	441-446, 449	86	725
11.2	Footwear	450, 888	32	278

Table 4.4 (continued)

Code	Industry Subgroup	SIC Minimum List Headings	No. of Companies	No. of Transitions
12.2	Baking etc.	212, 213	34	306
12.4	Sweets	217	33	257
12.6	Other food	215, 218, 219, 229	43	364
13.1	Brewing	231, 810(1)	184	1572
15.1	Paper	481 - 483	79	674
15.2	Newspapers	486	33	322
15.3	Printing etc.	489	55	483
16.1	Rubber	491	33	316
16.2	Timber	471, 474-5, 479	43	365
16.3	Furniture	472, 473	43	373
16.4	Leather	492, 431, 432	32	307
16.5	Other manufactures	433, 493-496, 499(2)	61	502
17.1	Building	500	68	531
18.1	Food wholesale	810(1) & (2)	57	526
18.2	Building merchants etc.	831	57	506
18.3	Other wholesale	831, 832, 810(3) - (8)	150	1432
19.1	Food retail	820(1) & (2)	45	388
19.2	Stores	820(6) & (7)	45	326
19.3	Other retail	820(3) & (5), 831, 887	145	1117
20.2	Dog racing	882-3	26	263
20.3	Entertainment	881(2)	52	461

Table 4.4 (continued)

Code	Industry Subgroup	SIC Minimum List Headings	No. of Companies	No. of Transitions
21.2	Catering etc., hotels etc.	884	74	677
21.3	Laundries etc.	885-6	28	244
21.4	Storage	709(2)	28	245
21.5	Transport & communication	702, 703, 705-7, 709(1) & (3)	30	270
21.6	Other services	889, 899	42	342

Source of definitions: Board of Trade working paper.

Table 4.5 : Numbers of Births, Deaths and Continuing Companies by Industry

Code	Industry	Total no. of cos.	No. of continuing cos.	No. of deaths	No. of births	Double counting**
1	Bricks, pottery etc.	145	81	26	42	4
4	Non-electrical engineering	369	214	70	102	17
5	Electrical engineering	147+	84	33	35	6
6	Vehicles	107	57	30	23	3
7	Metal goods n.e.s.	217	128	38	60	9
8	Cotton & man-made fibres	44*	18	16	15	5
9	Woollen & worsted	73*	50	17	10	4
11	Clothing & footwear	118	70	26	26	4
12	Food	152	75	51	35	9
13	Drink	208+	103	83	28	8
15	Paper, printing, publishing	169+	105	35	33	5
16	Other manufacturing	208	124	44	42	2
17	Construction	75	40	8	29	2
18	Wholesaling	294	170	65	67	8
19	Retailing	237+	112	79	56	11
20	Entertainment etc.	95	65	19	11	0
21	Misc. services	333+	125	182	28	7
	TOTAL	3015	1624	832	651	102

** This allows for companies that were born after the start of the period and died before the end.

+ These rows do not add correctly, due to the presence in the data of a few companies for which some observations in the middle of the period are not available.

* These are smaller than the corresponding figures in Whittington op. cit. Table 1.2 because some companies were temporarily inaccessible on the Stirling magnetic tapes.

Section 4.5 : Annual Distributions of Rates of Return

Before looking at the transition functions of rates of return from one year to the next, it is useful to look at the distributions of rates of return in any given year. Clearly the form of these distributions will have a profound influence upon the transition function, and in particular on the distribution of r_t (rate of return at time t) for a given range of r_{t-1}.

For each industry, for each year, the mean, variance, skewness and kurtosis have been calculated. Note that this has been done before the standardization of the data mentioned in Section 2.6. The results for the Shipbuilding & Mechanical Engineering Industry (No. 4) are shown in Table 4.6 and for all industries in Appendix A.

The measure of skewness used is that based on the third moment of the distribution.[12] This measure is computationally the most convenient and there is a significance test available.[13] The precise form of the measure (β_1) is μ_3^2 / μ_2^3 where μ_2 and μ_3 are second and third central moments of the distribution. The second moment providing a scale factor so that the measure is of relative skewness. A symmetrical distribution will have β_1 equal to zero and in particular this will be so for the normal distribution. The significance test is based on the null hypothesis that the distribution is normal. This measure, involving as it does the square of the third moment, does not indicate the direction of skewness. This is recorded in Table 4.6, from the sign of the third central moment.

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12) This leads to considerable sensitivity to outlying observations.

13) Pearson E.S., "A Further Development of Test of Normality", Biometrika Vol XXII pp 239 ff. Tables reproduced in Croxton, Cowden & Klein op. cit. Appendix O.

Table 4.6 : Annual Distributions for the Shipbuilding and Mechanical Engineering Industry (No. 4)

Year	Mean	Variance	Sign of Skewness	Skewness	Kurtosis	No. of Firms
1949	0.2090	0.01556	-	0.01760	5.694*	274
1950	0.2189	0.01748	+	0.005377	6.945*	283
1951	0.2394	0.01830	+	0.6859*	7.875*	292
1952	0.2200	0.01385	+	0.2098*	4.288*	304
1953	0.2008	0.01532	+	0.1334*	7.705*	312
1954	0.2039	0.01211	-	0.1612*	5.816*	315
1955	0.2006	0.01015	+	0.02550	3.064	324
1956	0.1900	0.01121	+	0.02979	4.550*	332
1957	0.1845	0.01047	-	0.003957	3.935*	328
1958	0.1637	0.01158	-	0.01189	4.828*	330
1959	0.1605	0.01152	+	0.008471	4.996*	313
1960	0.1527	0.01356	+	0.1239*	6.833*	298

* indicates - for skewness: significantly different from zero at the 10% level

- for kurtosis: significantly different from 3 at the 5% level

The varying number of decimal places is a result of the need to use a computer output format of four significant figures.

All rates of return greater than 100% or less than -100% have been excluded from the calculation.

The measure of kurtosis used is that known as β_2: the ratio μ_4/μ_2^2, that is, the fourth central moment divided by the second central moment squared. The denominator providing (as in β_1) a scale factor to ensure a relative measure. β_2 takes the value 3 for the normal distribution. A leptokurtic (peaked) distribution has a value greater than 3, whilst a platykurtic (flat) one has a value below 3. A test for whether the distribution is significantly non-mesokurtic is available.[14]

Referring now to Table 4.6, the means for this industry show the common pattern for the 1950s: a decline in the rate of return. As this is the pattern reported by such studies as that of Samuels & Smyth[15] and as the results will be required in Chapter IX, a regression of the average rate of return against time has been done for each industry. The results are reported in Table 4.7, columns 1, 2 and 3. Nine out of seventeen industries have a significant trend and of these only those of the Drink Industry (No. 13) and Miscellaneous Services (No. 21) are upward. Overall the slope coefficient is negative in 13 out of 17 cases.

The main question of interest at this point is the stability of the average rate of return. Brief inspection shows that there are only rare cases of the average falling below 10% of exceeding 25% and a good number of these occur in the Textile Industries (Nos. 8 and 9) whose varied career in the 1950s is notorious. The stability across years within industries, even without taking note of the trend, is considerable. The coefficient of variation (Table 4.7, column 7) ranges between 0.76968 for Industry 8 (Cotton) and 0.08077 for Industry 5 (Electrical

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14) Pearson E S op. cit., also Croxton, Cowden & Klein op. cit., Appendix P.

15) Samuels J M & Smyth D J, "Profits, Variability of Profits and Firm Size", Economica Vol 35 pp 127-140.

Table 4.7 Variability of the Industry Mean

Industry No.	Constant	Slope Coefficient	R^2	Standard Deviation of Errors	Standard Deviation Errors ÷ Overall Mean	Standard Deviation of Annual Mean	Coefficient of Variation of Annual Mean
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
1	0.148 (18.5)	0.00128 (1.2)	0.121	0.0119	0.0757	0.0126	0.0808
4	0.238 (33.1)	-0.00660 (6.7)	0.820	0.0107	0.0547	0.0252	0.129
5	0.214 (21.3)	-0.00203 (1.5)	0.182	0.0148	0.0741	0.0164	0.0819
6	0.234 (17.1)	-0.00921 (5.0)	0.711	0.0203	0.116	0.0377	0.216
7	0.222 (20.2)	-0.00472 (3.2)	0.501	0.0163	0.0851	0.0230	0.120
8	0.276 (6.4)	-0.02244 (3.8)	0.595	0.0639	0.490	0.100	0.770
9	0.266 (12.1)	-0.0152 (5.1)	0.720	0.0327	0.196	0.0619	0.371
11	0.184 (7.7)	-0.00520 (1.6)	0.205	0.0353	0.235	0.0396	0.264
12	0.192 (27.5)	-0.00413 (4.4)	0.655	0.0104	0.0627	0.0176	0.107
13	0.101 (30.4)	0.00272 (6.0)	0.783	0.00493	0.0416	0.0106	0.0892
15	0.188 (8.9)	-0.00345 (1.2)	0.125	0.0315	0.190	0.0337	0.203
16	0.169 (11.9)	-0.00383 (2.0)	0.285	0.0209	0.146	0.0247	0.172

Table 4.7 contd. Variability of the Industry Mean

Industry No.	Constant	Slope Coefficient	R^2	Standard Deviation of Errors	Standard Deviation Errors ÷ Overall Mean	Standard Deviation of Annual Mean	Coefficient of Variation of Annual Mean
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
17	0.178 (13.8)	-0.00071 (0.4)	0.016	0.0192	0.111	0.0193	0.112
18	0.169 (13.5)	-0.00434 (2.6)	0.395	0.0186	0.132	0.0239	0.169
19	0.168 (24.6)	-0.00035 (0.4)	0.014	0.0101	0.0612	0.0102	0.0616
20	0.123 (13.1)	0.00091 (0.7)	0.048	0.0139	0.108	0.0143	0.111
21	0.0888 (20.7)	0.00442 (7.6)	0.852	0.00637	0.0542	0.0165	0.141
Average (all industries)					0.131		0.188
Average (excluding industries 8 and 9)					0.103		0.137

Engineering), but the high value is exceptional: the next highest, again in Textiles, is 0.37072 for Woollen & Worsted (No. 9). Over all industries, the average coefficient is 0.18810, which reduces to 0.13715 if the two Textile industries (Nos. 8 and 9) are omitted. The industry average is thus quite a stable variable.

If note is taken of the trend, then we may discuss the stability in terms of the trend coefficient and the standard deviation of the errors (Table 4.7, columns 2 and 4). Only the two Textile industries have slope coefficients that indicate an annual change in average of more than one percentage point. The Vehicle Industry (No. 6) is close to this with 0.9. For those industries showing a downward trend, the average annual change is 0.6, which falls to 0.4 percentage points if the Textile industries are omitted. To assess the variability about trend, the ratio of the standard deviation of the errors about trend to the mean rate of return has been calculated for each industry (column 5). This may be compared with the coefficient of variation in column 7. Allowance for the trend has a particular impact on the two extreme cases - the Textile industries - in each case bringing about an approximate halving in the coefficient. Apart from these two industries, the crude variability without allowance for trend was small. In these two cases, allowance for trend has eliminated a considerable proportion of the variability and the residual standard deviation is quite small relative to the mean.

For the present purposes, only one aspect of the behaviour of dispersion of the annual distributions need concern us. That aspect is the stability over time. In Table 4.8, the average standard deviation over the twelve years is shown in column 1. There is a considerable degree of uniformity in this measure between industries, but it is the behaviour over the years within an industry that is of interest. Column 2 of the table therefore presents the standard deviation of the annual distribution standard deviations. The maximum value is for the Entertainment & Sport Industry (No. 20) where the average standard deviation is approximately 10 percentage points and this has a dispersion over the twelve years of something less than 4.5 percentage points. Clearly, even this is not a great amount of fluctuation. A useful standard of comparison is to calculate the coefficient of variation of the standard deviation for each industry. This has been done and the results are shown in Table 4.8, column 3. Only four industries have a coefficient that exceeds 20%: Vehicles (No. 6), Cotton (No. 8), Woollen & Worsted (No. 9) and Entertainment & Sport (No. 20). As usual, the Textile industries are distinguished for their extremely variable experience. In contrast, four industries have a coefficient well below 10%: Building Materials (No. 1), Drink (No. 13), Retailing (No. 19) and Miscellaneous Services (No. 21). The conclusion is that the standard deviation of the annual distributions is a relatively stable quantity. This stability suggests that, in so far as we regard rates of return as an example of a first order Markov process, the distribution of rates of return approximates to a steady state solution to the process.

The evidence on the direction of skewness of the distribution of rates of return on net assets is inconclusive. In nine industries, there are more years in which the distribution is negatively rather than positively skewed. The converse is true for five industries and there are equal numbers skewed in each direction in the remaining three industries. When only significantly skewed distributions are used, the

Table 4.8 : Standard Deviations of the Annual Distributions

Ind. No.	Average Annual Standard Deviation	Standard Deviation of Annual Standard Deviations	Coefficient of Variation
1	0.09654	0.00756	0.07826
4	0.11534	0.01108	0.09610
5	0.13070	0.01559	0.11927
6	0.12240	0.02617	0.21384
7	0.12781	0.01188	0.09296
8	0.11567	0.03313	0.28642
9	0.09952	0.02968	0.29823
11	0.14221	0.02316	0.16286
12	0.12099	0.01970	0.16280
13	0.06307	0.00527	0.08353
15	0.12221	0.02130	0.17430
16	0.13204	0.01996	0.15118
17	0.12412	0.01563	0.12592
18	0.11136	0.01624	0.14587
19	0.09726	0.00532	0.05473
20	0.10140	0.04379	0.43182
21	0.07984	0.00647	0.08103

same results are achieved.[16] Taking all distributions together, we find 90 positively and 114 negatively skewed, which is hardly sufficient to support a firm conclusion.[17] Hart [18] in his work concluded that there was a slight positive skewness.

It is of interest to see if this uncertain evidence can be strengthened by considering whether certain years are characterised by positive and others by negative skewness. If macroeconomic influences were producing such an effect, the average over a number of years would depend on the precise years chosen. In our case the years chosen appear approximately unskewed on average. The number of industries, positively and negatively, significantly and insignificantly skewed, are shown in Table 4.9 for each year.

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16) Except that there are too few observations in Industry 8 to allow a test of significance. There are therefore 8 industries for which it can be said that the majority of significantly skewed distributions are negatively skewed.

17) There is a 12% chance of there being 90 positive signs out of 204 samples when the population is symmetric. The chance of this outcome when the population is positively skewed is, of course, less. It might be argued that rejection of all observations whose absolute value exceeds 100% will tend to produce spurious negative skewness in the remaining data. In fact, similar analysis employing all observations found more negative skewness, e.g. 120 distributions were negatively skewed and only 84 positively skewed.

18) Hart P E (ed) op. cit. Vol II p 263; "The arithmetic mean and median rates of return of the 1844 companies .... are 15.6 and 14.4, indicating a slight positive skewness."

Table 4.9 : Direction of Skewness by Year

	Year	1949	50	51	52	53	54	55	56	57	58	59	60
POSITIVE	Significant	10	5	9	4	6	3	3	2	6	4	6	5
	Insignificant	-	4	1	2	3	3	3	4	1	0	2	2
NEGATIVE	Insignificant	3	3	1	3	1	3	5	3	3	4	2	3
	Significant	3	4	5	7	6	7	5	7	6	8	6	6

Industry 8 has been omitted from this analysis, as the significance test cannot be applied, there being insufficient observations.

A majority of years are negatively skewed: 7 against 4 if all values are used, 6 against 3 if only significant ones are counted. The four years that are predominantly positively skewed occur at the beginning of the period: 1949, 1950, 1951 and 1953. 1953 is lost from this list if only significant skewness is considered. If we further restrict attention to those years in which there is a marked difference in the numbers displaying significant skewness in each direction, we are left with 1949 and 1951 being positive and 1952, 1954, 1956 and 1958 being negative. There does seem to be some support for the proposition that the direction of skewness varies between years. It is not the intention here to pursue this matter much further. It is worth interpreting this preliminary result: positive skewness means that the lengthy tail of rates of return points towards the higher values, whereas negative skewness means that the distribution tail points to lower values. Or, positive skewness means that we find more observations at a given large positive deviation from the mean than at an equal negative deviation. So in the early years of the period very high rates of return were more common than very low ones. The distribution of rates of return might be regarded as having a partial constraint at zero - firms will try very hard to avoid reporting losses. Therefore positive skewness might be the result of low average profitability and this partial constraint. But in the early period rates of return were high relative to their values in the 1950s (see above). Therefore this type of explanation does not look very promising given that it is the later years of lower average rates of return that display the negative skew. It is tempting to conclude that negative skewness is the usual situation and that the positive skew of the early years is a consequence of special conditions then prevailing. Particularly one might point to the age of the capital stock at that time and its resultant low net book value.

Having pursued the ambiguities of the skewness a little, the behaviour of the kurtosis is satisfactorily straightforward. In every industry, more years have leptokurtic than platykurtic distributions, in fact only 14 out of 204 distributions are platykurtic and none is significantly so. We may therefore conclude that rates of return are leptokurtically distributed.

Section 4.6 : Summary

The data used in this study are the NIESR - Board of Trade collection of standardised accounts for quoted companies as organised for machine processing by Singh and Whittington at Cambridge. The period covered is 1948-1960. Within this body of data companies are arranged by industrial orders (1948 S.I.C.) and within these into more homogeneous groups whose meaning in terms of Minimum List Headings is given in Table 4.4.

The variable used is the rate of return on net assets calculated before tax and interest payments but after depreciation. The time period used is one year and the rates of return are standardised according to year and accounting quarter for each industry (and for each of the smaller groups where these are used).

In the examination of the annual distributions of rates of return, it was found that, within industries, the means and standard deviations are quite stable. There was slight evidence that the distributions are usually negatively skewed but it would appear that positive skewness predominated at the beginning of the period. There was strong evidence that the distributions were leptokurtic.

CHAPTER V

TRANSITION MATRICES

In this chapter certain characteristics of the transition matrices are considered. The intention is twofold: to obtain an initial pointer to the consistency of the decay of profitability and secondly to get some guidance on the form of the conditional distributions.

For the decay of profitability aspect we must first ask whether there is decay at all and, if it does occur, is it general, within an industry for all rates of return, for all industries and for all subgroups. Then it is possible that certain parts of the range of profitability display more consistent decay than others. The main tool used for this is comparison of the final and prior means - if there is decay then the prior mean should have a greater absolute value than the final mean.

The investigation of the form of the conditional distributions is pursued in terms of the skewness and kurtosis.

These topics are discussed for one industry in Section 5.1, then for all industries in Section 5.2 and for all subgroups in Section 5.3.

Finally, in Section 5.4 the relationship between the variance and the prior mean is explored. This is preparatory to the consideration of the heteroscedasticity of the decay function in Section 6.2.

Section 5.1 : Transition Matrices for Industry 1

At an early stage in the statistical work here described, conventional discrete transition matrices were prepared, an example of which is shown in Table 5.1. Note that the class intervals relate to deviations from the mean but are in rate of return percentage point units rather than standard deviation units. The general pattern is immediately apparent: the mode of the row distribution lies on the main diagonal while the mean lies to the right of the mode for rows above and to the left for those below the industry average. That is, as each row is a conditional distribution for a given rate of return interval in the initial period, the expected value in the next period is lower than in the initial period. It appears that there is regression towards the mean. The transitions on which this matrix is based are all pairs of rates of return for adjacent years in the period 1948-1960 for Industry 1 (Building Materials, Pottery & Glass). This pooling of 12 years data is discussed in Section 6.3.

As described in Chapter III, the analysis is carried out using discrete intervals for the initial states but calculating summary statistics (without grouping) for the row or contingent distributions. It will be seen that the initial impressions from the discrete transition matrix are confirmed when this technique is used.

The process by which these transition matrices are produced is as follows: the data is read into the computer on paper tape and standardised. Observations more than three standard deviations from the mean are rejected. Then for each year up to the penultimate one the rates of return are ordered. This set of rates of return is the set of all the first members of the pairs of rates of return that make up transitions.

Table 5.1 Matrix of Profitability Transitions

Industry: Building Materials, Pottery & Glass

Final Class (percent pts)

Initial Class (percent pts)	20.00 and above	20.00 to 17.51	17.50 to 15.01	15.00 to 12.51	12.50 to 10.01	10.00 to 7.51	7.50 to 5.01	5.00 to 2.51	2.50 to .01	.00 to -2.49	-2.50 to -4.99	-5.00 to -7.49	-7.50 to -9.99	-10.00 to -12.49	-12.50 to -14.99	-15.00 to -17.49	-17.50 to -19.99	-20.00 and below
20.00 and above	12	4	5	3	0	1	0	0	1	0	0	0	0	0	0	0	0	0
20.00 to 17.51	4	2	1	4	0	3	0	0	0	0	1	0	0	0	0	0	0	0
17.50 to 15.01	4	3	7	5	0	4	4	1	0	0	0	0	0	0	0	0	0	0
15.00 to 12.51	2	0	3	8	8	12	3	2	0	1	0	0	0	0	0	0	0	0
12.50 to 10.01	1	2	4	4	14	12	12	5	4	2	0	0	0	0	0	0	0	0
10.00 to 7.51	0	2	4	6	14	16	24	12	6	5	2	1	1	0	0	0	0	0
7.50 to 5.01	0	1	5	4	7	17	29	29	13	7	7	2	0	0	0	0	1	0
5.00 to 2.51	1	0	0	1	7	15	24	29	32	14	5	6	0	0	0	0	0	0
2.50 to .01	0	0	0	1	2	5	12	24	47	30	12	9	2	0	0	0	0	0
.00 to -2.49	0	0	0	0	0	1	5	15	24	31	29	22	3	3	2	1	1	0
-2.50 to -4.99	0	0	0	1	0	1	4	8	13	20	32	24	8	5	1	0	1	0
-5.00 to -7.49	0	0	0	0	1	0	1	4	5	14	24	31	17	9	3	4	1	1
-7.50 to -9.99	0	0	0	0	0	0	1	11	2	6	6	20	15	5	5	2	2	2
-10.00 to -12.49	0	0	0	0	0	0	2	1	1	2	1	3	11	11	4	7	3	4
-12.50 to -14.99	0	0	0	0	1	0	0	0	0	1	1	2	3	9	8	2	4	3
-15.00 to -17.49	0	0	0	0	0	0	1	0	0	1	0	0	1	3	5	5	1	4
-17.50 to -19.99	0	0	0	0	0	0	0	0	1	0	0	0	2	6	2	0	1	0
-20.00 and below	0	0	0	0	0	0	0	0	0	1	1	0	4	2	2	1	2	11

Now for a given number of transitions for each row distribution, the class intervals can be fixed using this ordering of rates of return. Thus the class intervals are determined in each case to maximise the number of rows subject to a constraint on the minimum number of transitions necessary per row. With the data standardised and the class intervals set, the statistics of each row distribution can be calculated. Mean, variance, skewness and kurtosis are produced, as is the mean of the prior variable.[1] The measures of skewness and kurtosis are those described in Section 4.5. As before, the sign of the third moment is recorded to indicate the direction of skewness.

The industry transition matrices are given in Appendix B but for convenience that for the Building Materials Industry (No. 1) is presented in Table 5.2. The pattern observed in the discrete matrix is repeated. The final mean is in nearly every case nearer to the industry average rate of return than the prior mean. So companies with an above average rate of return in one year do, on average, experience a decline in profitability in the subsequent period. For those companies below the industry mean, the corresponding effect is an improvement in profitability, but even casual inspection of columns 2 and 3 suggests that the process is less consistent for firms with below average profitability. There are more cases[2] where the absolute value of the final mean is greater than that of the prior mean in those classes below the industry average (referred to in the ensuing text as the "negative range") than in

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1) The calculation of the prior mean rather than the assumption that it is the midpoint of the class avoids the usual need in the grouping of data to apply Sheppard's correction.

2) Classes 11, 15, 19 above average; classes 23, 25, 31, 35, 38 below average; and class 22 about on the average value.

Table 5.2 : Transition Matrix - Industry 1

No. of transitions = 1227 No. of rejected observations = 5

Class No.	Lower Limit	Prior Mean	Mean	Variance	Sign of Skewness	Skewness	Kurtosis	No.
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1	1.714	2.145	1.737	0.359	-	0.296	3.008	43
2	1.489	1.604	1.349	0.234	+	0.041	2.800	30
3	1.321	1.410	1.176	0.251	+	0.438	3.449	30
4	1.183	1.244	0.880	0.272	-	0.252	2.785	30
5	1.068	1.127	0.727	0.384	-	0.066	2.497	30
6	0.961	1.010	0.775	0.291	-	0.124	2.324	30
7	0.872	0.917	0.819	0.309	+	0.325	3.361	30
8	0.802	0.843	0.710	0.212	+	0.539	4.479	30
9	0.705	0.759	0.674	0.393	-	0.318	3.403	30
10	0.638	0.674	0.662	0.293	-	0.009	2.639	30
11	0.581	0.607	0.611	0.189	-	1.094	5.042	30
12	0.522	0.555	0.522	0.215	-	0.392	2.652	30
13	0.476	0.498	0.445	0.264	-	0.250	3.278	30
14	0.424	0.454	0.214	0.234	+	0.035	2.542	30
15	0.357	0.396	0.412	0.382	-	1.900	7.343	30
16	0.290	0.327	0.207	0.131	+	0.127	2.387	30
17	0.241	0.266	0.219	0.094	+	0.311	2.457	30
18	0.175	0.212	0.187	0.263	+	0.205	3.330	30
19	0.115	0.143	0.169	0.111	+	0.003	2.125	30
20	0.052	0.083	0.021	0.181	-	0.137	6.139	30
21	-0.017	0.024	0.010	0.249	-	0.104	2.198	30
22	-0.069	-0.044	0.055	0.356	+	3.826	8.788	30
23	-0.116	-0.091	-0.144	0.159	-	0.086	2.750	30
24	-0.173	-0.144	-0.122	0.308	-	0.769	6.334	30
25	-0.233	-0.208	-0.435	0.202	+	0.006	2.624	29
26	-0.274	-0.252	-0.212	0.083	-	0.008	2.313	31
27	-0.323	-0.299	-0.292	0.447	+	0.271	3.533	30
28	-0.395	-0.360	-0.303	0.230	+	0.172	4.425	30
29	-0.467	-0.425	-0.386	0.297	-	2.707	7.962	30
30	-0.535	-0.498	-0.462	0.112	-	0.124	3.334	30
31	-0.592	-0.562	-0.603	0.277	+	0.101	2.394	30
32	-0.642	-0.618	-0.461	0.235	+	0.214	3.665	30
33	-0.723	-0.687	-0.547	0.190	+	0.294	2.623	30
34	-0.821	-0.768	-0.692	0.181	+	0.002	5.232	30
35	-0.927	-0.882	-0.943	0.273	-	0.363	3.952	30
36	-1.025	-0.969	-0.880	0.535	+	0.722	3.181	30
37	-1.152	-1.086	-0.933	0.241	-	0.016	2.822	30
38	-1.317	-1.242	-1.249	0.379	+	0.304	4.441	30
39	-1.576	-1.445	-1.268	0.620	+	0.129	3.537	30
40	-	-2.075	-1.529	0.475	-	0.035	2.592	44

those classes above the industry average (the "positive range"). Such an occurence means that the average rate of return in time t+1 of firms whose time t standardised rate of return lies in that class is further from the mean than their average in time t. Profitability relative to the industry has moved against the general regression. This is perhaps an appropriate point to emphasize that measurement is now in terms of standardised rates of return, whereas the discrete matrix was in terms of rates of return expressed as straightforward deviations from the mean.

Another simple indicator of the stability of the regression towards the mean is to count the number of cases where the final mean of class N is greater than that of class N-1. As the prior means take successively lower values, an inversion in the size of final means means a disturbance in the regression. There are eight such inversions out of 40 classes evenly split between the positive and negative ranges. Finally in the discussion of these two columns, it is to be noted that two of the cases where the prior mean is less divergent than the final mean occur at the industry origin, as does one of the inversions in the final mean column.

Moving onto the variance column, there appears to be little regularity in the behaviour of this statistic; a few classes have very large values, in particular the last two, the result no doubt of extreme values. It would not be surprising if both extreme classes had very high variance because of the much wider range of values encompassed by them. While this effect is observable, it is perhaps less marked than might be expected, especially at the upper end. Although later analysis will reveal a relationship between the variance and the initial mean, there is little evidence on inspection of this. The standard deviation of column (4) is 0.1154, which when linked with a mean of 0.2727 suggests a reasonably stable variable. The variance is considered further in Section 5.4.

Moving now from the question of the consistency of the decay process to the form of the conditional distribution, we must first consider the direction of skewness. Neither appears dominant - 20 classes have negative and 20 positive skewness. Neither the positive range nor the negative range shows any divergence from this even split. But this ignores whether the skewness is significant or not. In testing for significant skewness the problem arises that Pearson's tables[3] are only for more than 50 observations, at which the 10% level is 0.285. It is evident from the tables that the value of β_1 corresponding to a 10% chance that a sample from a normal population may exceed that value rises rapidly as the number of observations diminish. It would clearly for this purpose have been preferable to use larger class sizes, but given the more important need to have a good number of classes this had to be foregone. Therefore some approximate way of distinguishing the seriously skewed distributions had to be used. It was considered that error should be of Type I rather than Type II, that is, the null hypothesis of normality should be rejected mistakenly rather than accepted mistakenly. Then the procedure adopted is to use the 10% significance level of 50 observations as the standard. This might roughly be a 20% significance level. On this crude basis, 16 distributions are seriously skewed, 9 of these being positively skewed and 7 negatively skewed; these being evenly spread between the positive range of classes and the negative range, and within the ranges evenly spread between directions of skewness. This even balance continues even if a more stringent cut-off level is used. It may, therefore, reasonably be concluded that the conditional distributions for this industry are not skewed. Although such a result is awkwardly doubtful, given the

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3) See Croxton, Cowden & Klein op. cit., Appendix O.

inability to properly test for significance, it is reassuring to record that some earlier results on a transition matrix for this industry, with acceptable numbers in each class, produce supporting evidence.[4]

Turning now to the kurtosis of the distributions, the same significance testing problem arises. The lowest number of observations in the published table[5] for β_2 is 100. Again a crude test must be used and again the preference is for Type I rather than Type II errors. So the 5% limits for the 100 observations are used. But first the simple count of leptokurtic and platykurtic distributions: 23 distributions have $\beta_2 > 3.0$, i.e. are leptokurtic, and 17 are platykurtic. Each range of classes shows a similar balance. Using $\beta_2 > 3.77$ as a test of serious leptokurtosis, 11 distributions exceed this value of which 7 are in the negative range of classes. Only 4 distributions are platykurtic ($\beta_2 < 2.35$) with 2 in the positive range and 2 in the negative range. Thus there is some evidence of leptokurtosis.

Before going onto the other industries, a little more consideration of the crude tests used on the measures of skewness and kurtosis is in order. The main reason for Pearson restricting his tables to large numbers of observations lies in the numerical approximation that he was employing[6] but undoubtedly the sampling error of both β_1 and β_2 increase very rapidly as the sample size diminishes. Therefore the tests of significance employed are certainly equivalent to a high probability of Type I errors. It then becomes likely that with the

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4) In that work 6 out of 17 classes had skewness significant at the 10% level and 2 of these were positive and 4 negative.

5) See Croxton, Cowden & Klein op. cit., Appendix P.

6) Pearson E S op. cit., p 244 et seq.

number of distributions for each industry, even with normal populations, a number of the distributions will reveal values of β_1 and β_2 that lie outside the significance limits. On the other hand, some cut-off point must be employed and in a context where the desirable (and convenient) result is that the population is normally distributed, it is only proper that the cut-off point should err against the desired result. On the other hand, it is not really possible to conclude anything about the distributions by the application of such methods to one industry. It is to be hoped that the accumulated evidence of all the industries will enable a more positive conclusion to be attained.

Section 5.2 : Transition Matrices for Each Industry

Rather than present transition matrices for each industry in this chapter, a table summarising their characteristics is given - Table 5.3. The full data are given in Appendix B.

Column 4 of the table gives the number of classes used in each industry. Only two industries provide less than 20 classes; these are No. 8 (Cotton) for which the data used are not complete, and No. 17 (Construction). The maximum is not surprisingly provided by the Shipbuilding and Mechanical Engineering Industry (No. 4) with 106. Of more interest is the way in which the classes divide between above and below the industry average (column 5). The only industry in which the numbers in the two groups diverge to any great extent is Miscellaneous Services (No. 21) for which there are 33 classes in the positive range (above average) and 42 in the negative range (below average). This means that the median is well below the mean and therefore the distribution of rates of return appears positively skewed. The distribution here is the sum of the annual distributions after they have been standardised. Of the annual distributions for Industry 21 (see Appendix A) 8 are positively skewed and it is therefore to be expected that the aggregate standardised distribution would be positively skewed. This similarly explains why Industry 13 (Drink) has 27 classes in the positive range to 31 in the negative, and Industry 20 (Entertainment and Sport) has 12 and 17 respectively. Overall in column 5 eleven industries show a negative skew and 5 a positive skew, whilst one (No. 5, Electrical Engineering) appears symmetrical. It is probably a fair conclusion that in the two positively skewed Service industries, low asset to turnover situations generate a tail of very high rate of return of firms. The explanation of the

Table 5.3 : Summary of Industry Transition Matrices

Ind No.	No. of Trans-itions	No. of Rejected Observ-ations	No. of Classes			Final Mean > Prior Mean		Nth Mean > (N+1)th Mean	
			Total	Pos. Range	Neg. Range	Pos. Range	Neg. Range	Pos. Range	Neg. Range
(1)	(2)	(3)	(4)	(5)		(6)		(7)	
1	1277	5	40	21	19	3	6	4	5
4	3199	44	106	54	52	10	20	21	19
5	1261	16	42	21	21	2	8	5	6
6	916	11	30	17	13	3	1	3	4
7	1906	33	63	31	32	3	7	10	11
8	376	3	12	7	5	1	2	1	0
9	729	8	24	13	11	2	3	5	2
11	994	24	33	18	15	1	8	6	4
12	1299	12	43	22	21	5	8	6	5
13	1753	34	58	27	31	7	15	10	13
15	1470	18	49	26	23	4	4	9	7
16	1863	36	62	32	30	2	9	9	12
17	586	10	19	9	10	2	3	2	2
18	2620	43	87	45	42	3	16	20	19
19	1841	16	61	31	30	2	10	10	9
20	872	15	29	12	17	1	3	3	4
21	2260	37	75	33	42	2	14	8	19

positive skew of the Drink industry is less obvious.

As an indicator of the consistency of the decay process, column (6) gives the number of cases where a final mean is further from the industry mean than the corresponding prior mean. Numbers are shown for each industry and separately within industries for the positive and negative ranges. In total, the highest number relative to the number of classes for that industry is for the Drink industry, where it is just over a third, the usual value being about one quarter. But generally the total number of such cases is of less interest, once we have seen they are a small minority, than the distribution of them between the positive and negative ranges. The total number relative to the number of classes is likely to be reflected in the later regression analysis. The number of instances of the final mean being more divergent than the prior mean in the negative range exceed the number in the positive range in all industries but two. The one case where the opposite is true is Industry 6 (Vehicles) and in that there are only 4 instances, 3 in the positive and 1 in the negative range. So the effect found for Industry 1 is supported by the evidence of other industries: this is the perhaps unsurprising result that the regression towards the mean (which requires that the final mean be closer to the average than the prior mean) is a less even process for firms of below average profitability. In other words, transfer of resources from unprofitable markets is less straightforward than the movement of resources into profitable ones.

The next column also gives a guide to the consistency of the decay process as it records the number of cases where the final mean of class N is greater than that of class N-1. That is, cases where the expected profitability for a group of firms whose prior mean is r_1 is less than for a number of firms whose prior mean r_2 is more than r_1. It is another indication of how steady the regression is towards the mean and again the overall number shows what will be better shown by the goodness-of-fit of the regression of the final mean on the prior mean. Considering the distribution between the positive and negative ranges, the number of industries with a majority of such inversions in the positive range is balanced by the number that displays the converse. Only Miscellaneous Services (No. 21) displays a marked disparity in the numbers in each range, there being eight in the positive and 19 in the negative.

Coming to the evidence on the skewness of the conditional distributions, shown in Table 5.4, the first stage is to count the number of positive and negatively skewed distributions without consideration of significance. In 13 out of 17 industries there are more negatively skewed than positively skewed distributions. When only significantly skewed (in the sense described above) distributions are counted, the predominance of negative skew increases: 16 industries have more negatively than positively skewed distributions. In many cases there is a considerable divergence between the numbers of each type. This seems reasonably to establish that the general form of the contingent distribution shows a negative skewness, that is, the long tail of the distribution stretches towards the low rate of return end. This means that a large fall in profitability is more likely than an equally large rise. This is observed despite the rejection of very extreme observations - more than 3 standard deviations from the mean.

It is of interest to question whether this holds equally both for above industry average and below industry average distributions. The analysis

Table 5.4 : Skewness of the Industry Conditional Distributions

Ind No.	All Values				Significant Values Only			
	Positive Range		Negative Range		Positive Range		Negative Range	
	No.with pos. skew	No.with neg. skew	No.with pos. skew	No.with neg. skew	No.with pos. skew	No.with neg. skew	No.with pos. skew	No.with neg. skew
1	9	12	11	8	4	5	4	3
4	19	35	20	32	5	22	6	17
5	12	9	12	9	5	7	4	8
6	7	10	6	7	2	7	5	5
7	12	19	16	16	4	11	6	11
8	0	7	2	3	0	3	1	2
9	3	10	5	6	1	7	1	4
11	5	13	2	13	1	8	0	7
12	7	15	7	14	4	8	5	7
13	13	14	14	17	6	9	10	12
15	10	16	8	15	4	7	5	8
16	8	24	10	20	3	13	5	9
17	0	9	2	8	0	0	0	4
18	17	28	20	22	7	14	14	14
19	10	21	22	8	1	12	13	3
20	6	6	10	7	1	2	5	3
21	11	22	21	21	3	11	14	11

separately for these two sets of distributions for each industry is also shown in Table 5.4. The conclusion has to be that negative skewness predominates in both ranges, although there are more industries for which the dominant skewness is positive in the negative range than there are for which the same is true in the positive range. There is a hint that the Service industries (Nos. 18-21) are slightly different in this respect as the nonconforming cases seem primarily to be from these four industries.

The conclusion on the kurtosis of the distributions is more definite - leptokurtosis is shown to be predominant in Table 5.5. Taking no account of the significance of deviations from mesokurtosis, every industry has more distributions that are leptokurtic than ones that are platykurtic. This is equally true for the negative range, in the positive range 3 industries show more platykurtic distributions but the difference in numbers in these industries is small. When the previously described test of significance is used, the result is unchanged for all distributions taken together. In the negative range, the only change is that one industry (Woollen & Worsted, No. 9) with only two significantly nonmesokurtic distributions has one leptokurtic and one platykurtic. In the positive range only one industry (Construction, No. 17), again with very few significant values, has more platykurtic than leptokurtic distributions. Generally it may be concluded that the conditional distributions are leptokurtic both in the positive and negative ranges.

So far we have considered the conditional distributions together and separately for the positive and negative ranges. Now we separate out those distributions whose prior means are close to the industry mean. It is not surprising that it is here that most of the cases where the final mean is further from the industry average than the initial mean occur, on the other hand inversions in the declining order of the final

Table 5.5 : Kurtosis of the Industry Conditional Distributions

l = leptokurtic p = platykurtic

Ind No.	All Values				Significant Values Only			
	Positive Range		Negative Range		Positive Range		Negative Range	
	No.of l	No.of p	No.of l	No.of p	No.of l	No.of p	No.of l	No.of p
1	10	11	12	7	3	0	7	0
4	40	14	38	14	26	5	23	5
5	15	6	17	4	13	0	14	0
6	12	5	11	2	7	1	8	2
7	18	13	24	8	10	1	16	3
8	4	3	3	2	2	0	1	0
9	9	4	8	3	3	0	1	1
11	14	4	9	6	9	1	6	1
12	15	7	16	5	13	2	13	2
13	23	4	24	7	15	1	22	0
15	19	7	17	6	15	1	9	4
16	21	11	23	7	14	3	11	0
17	4	5	7	3	1	2	3	0
18	39	6	36	6	30	3	25	1
19	19	12	25	5	8	2	18	0
20	5	7	14	3	3	3	11	1
21	25	8	37	5	13	2	22	0

means appear to be evenly spread throughout the range. The central group has been separately analysed for 4 industries (7,11,12,16) and the results are presented in Table 5.6 with those for the whole of these industries for comparison. About one quarter of the classes symmetrically arranged about the industry mean have been used as this central group. Apart from the final prior mean observation, this group is not distinguishable from the overall set of distributions in any way. Although in one industry (No. 7) the predominant direction of skewness is positive, which is opposite to that for the whole distribution of that industry, this phenomenon is not repeated in any of the other industries. In none of the four industries does the nature of the kurtosis for the central group differ in any way from that for the whole industry.

The few classes at the industry mean do show up one other matter. As is to be expected in some cases, the sign of the final mean differs from that of the corresponding prior mean. If such occurrences are random, they are of no interest, but if there is any pattern it is a guide to the suitability of the industry average as a proxy for the decay origin. There is such a regularity: in nearly every case the sign errors are of the kind where the prior mean is positive and the final mean negative. They are also, usually, together nearest the zero class. There would seem to be a suggestion from this that the industry mean is higher than the point towards which the regression of profits is directed.

The salient points that emerge from this examination of the transition matrices are five; firstly the regression of profits towards some central value does certainly occur although there is some evidence to suggest that the central value is lower than the mean. Secondly, this regression appears more regular above the industry average than below.

Table 5.6 Analysis of the Central Conditional Distributions

Ind. No.		Final Mean > Prior Mean		N^{th} class > $N-1^{th}$ class		Skewness		Kurtosis	
		+ve range	-ve range	+ve range	-ve range	positive	negative	lepto-	platy-
7	all classes	3	7	10	11	28	35	42	21
	classes 17-46	3	6	5	6	17	13	22	8
11	all classes	1	8	6	4	7	26	23	10
	classes 11-26	0	8	3	2	3	13	12	4
12	all classes	5	8	6	5	14	29	31	12
	classes 12-33	5	6	3	3	8	14	16	6
16	all classes	2	9	9	12	18	44	44	18
	classes 20-45	2	5	3	5	11	15	18	8

Thirdly, the conditional distributions are best represented with negative skew. Fourthly, they are leptokurtic. Fifthly, these two characteristics prevail throughout the profitability range.

In this section the variance has not been examined beyond the very earliest stage as this will be pursued with regression analysis in the next section.

What can be concluded is that an assumption of normality would be unjustified by the evidence that the conditional distributions are assymetric and more peaked than the normal curve. On the other hand, the evidence of the leptokurtic form of the distribution suggests that the lognormal curve might fit; it would require some transformation to produce negative skewness and would introduce the problem of negative values. In the absence of an immediately applicable distribution, this line of development will be pursued no further[7] and consolation must be found in the remark[8] that: "The fitting of distributions to observational data has a certain intrinsic interest which is apt to outrun its statistical usefulness." The rest of this study will therefore be concerned with relations between the prior mean and the final mean.

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7) See Pretorius S J, "Skew Bivariate Frequency Surfaces", Biometrika Vol 22 1930-31 for a study of the type that would be appropriate to the characteristics of the data so far uncovered.

8) Kendall M G & Stuart A, "Advanced Theory of Statistics" Vol I, Charles Griffin & Co Ltd London, 3rd edition 1969 p 173.

Section 5.3 : Transition Matrices - Subgroups

The only need in this discussion is to comment on any ways in which the results for subgroups deviate from those for industries. The results for each subgroup are shown in Appendix C and a summary is given in Table 5.7.

The only difference in their calculation from those for the industries is that the generally fewer companies meant that using means and standard deviations by accounting date was usually not possible, in fact only 11 subgroups out of 41 were large enough to allow this. For the rest annual averages and standard deviations were used. Overall the small number of observations led to a small number of classes in each transition matrix - the minimum number was 12 which occurred in a number of subgroups.

Turning now to the specific results, just as for the industries, the majority of subgroups had more classes in the positive range than in the negative, indicating that the median is greater than the mean and there is therefore negative skewness.[9] Only Industry 7 Subgroup 2 (Other Metal Goods - Instruments etc) shows any marked difference between the numbers in the ranges with 14 positive and 6 negative range classes.

Again the industry pattern is repeated when we turn to enumerating the classes where the final mean exceeds the prior mean: 28 out of 41 have more such occurrences in the negative range. Similarly the overall negative skewness of the conditional distributions is again found, as

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9) $Sk = \frac{3(\bar{x}-Med)}{s}$ Pearson's measure

See Croxton, Cowden & Klein p 202.

Table 5.7 : Summary of Subgroup Transition Matrices

l = leptokurtic p = platykurtic

Ind No.	Sub-Group No.	No. of Trans-itions	No. of Rejected Observ-ations	No. of Classes			Final Mean > Prior Mean		Skewness		Kurtosis	
				Total	Pos. Range	Neg. Range	Pos. Range	Neg. Range	No. Pos. Skewed	No. Neg. Skewed	No. of l	No. of p
1	2*	804	4	26	14	12	1	3	14	12	17	9
	3	220	-	14	6	5	0	3	4	7	5	6
4	1	351	4	17	8	9	1	3	10	7	9	7
	2	314	2	15	7	8	1	2	5	10	9	6
	4	206	-	10	5	5	1	2	4	6	6	4
	5*	2219	29	73	38	35	9	12	23	50	57	16
5	3	268	9	13	7	6	0	2	3	10	6	7
	4*	615	5	20	10	10	2	4	6	14	20	0
6	4	340	2	17	9	8	0	2	7	10	14	3
7	1*	1514	27	50	24	26	4	10	17	33	34	16
	2	418	7	20	14	6	4	0	13	7	11	9
8	1	255	4	12	7	5	2	3	5	7	4	8
9	1*	658	10	21	12	9	4	2	8	13	14	7
11	1*	725	16	24	13	11	2	5	5	19	19	5
	2	278	2	13	7	6	1	2	4	9	8	5
12	2	306	4	15	7	8	2	4	6	9	11	4
	4	257	3	12	7	5	2	0	4	8	9	3
	6	364	4	18	9	9	3	2	8	10	11	7
13	1*	1572	32	52	26	26	4	10	24	28	40	12
15	1*	674	2	22	12	10	3	3	7	15	15	7
	2	322	4	16	8	8	1	2	6	10	11	5
	3	483	6	24	13	11	4	5	12	12	12	12
16	1	316	4	15	8	7	2	2	6	9	6	9
	2	365	11	18	10	8	2	1	7	11	12	6
	3	373	9	18	10	8	3	3	9	9	7	11
	4	307	4	15	8	7	2	1	6	9	4	11
	5	502	9	16	7	9	0	6	10	6	11	5
17	1	531	13	17	9	8	2	1	7	10	11	6
18	1	526	7	26	13	13	2	5	13	13	16	10
	2	506	14	25	13	12	4	4	10	15	12	13
	3*	1432	21	47	23	24	6	9	24	23	38	9
19	1	388	3	19	9	10	1	2	9	10	7	12
	2	326	4	16	8	8	1	6	6	10	10	6
	3*	1117	7	37	19	18	4	7	15	22	26	11
20	2	263	1	13	6	7	1	1	5	8	7	6
	3	461	11	23	9	14	2	6	12	11	12	11
21	2*	677	10	22	10	12	1	5	9	3	14	8
	3	244	4	12	5	7	1	3	5	7	6	6
	4	245	1	12	6	6	2	2	7	5	4	8
	5	270	8	13	6	7	0	4	4	9	5	8
	6	342	1	17	8	9	1	3	13	4	14	3

* data standardised by accounting quarter

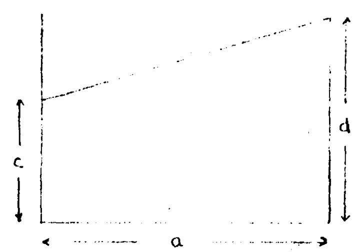
is the leptokurtosis. Both these being enhanced when only "significant" values of these two statistics are taken.

The general conclusion is that none of the characteristics of the transition matrices found for industries stemmed from their being aggregates of heterogeneous subgroups. Or at least reducing the degree of aggregation and increasing the homogeneity has not removed any of these characteristics.

Section 5.4 : The Variance of the Conditional Distribution

In Section 5.1 it was remarked that there appeared to be no regularity in the pattern of the variance except that the extreme classes had rather high variance. It is necessary to look a little more closely into the relation between the variances of the conditional distributions and their prior means.

There are 3 factors working to bring about a positive relationship between the variance and the absolute value of the prior mean. It has to be the absolute value both because of the way these factors work and the nonnegative nature of the variance. The first two of these factors derive from the bell-shaped prior distribution of rates of return. Assume that there is a nonstochastic linear relationship between rate of return at time t-1 and at time t (i.e. $r_{jt} = f(r_{jt-1})$. The distribution of r_t within a given class will be set by the distribution of r_{t-1} under this assumption. Consider class intervals of equal size imposed upon a bell-shaped distribution; the distribution within each class will be approximately shaped:



The variance of this distribution is a decreasing function[10] of (d-c), so beyond the point of inflexion of the bell-shaped distribution the class variances will increase.

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10) See the Appendix to this chapter for proof of this and a further investigation of how this problem may influence the conditional distributions.

The second factor is that the analysis has been performed with classes containing equal numbers of members, not with classes covering equal intervals. Therefore moving from the origin involves increasing the interval ('a' in the preceding diagram) and thus again increasing the variance. Although this effect applies as one moves from the origin while the first applies only from the point of inflexion, the interval effect is probably the stronger and therefore we may expect that the variance within classes containing equal numbers of members from a bell-shaped distribution will increase as one moves away from the origin.

Now if we relax the assumption of a nonstochastic relationship between r_t and r_{t-1}, the error term in the relationship may, depending upon its nature, provide the third of the factors. If the variance of the error term rises as r_{t-1} deviates further from the mean, then this heteroscedasticity will add to the strength of the variance-prior mean relationship. If the errors are homoscedastic then we are left with the effect of the first two factors. Were they to be heteroscedastic but decreasing with increases in r_{t-1}, then there is a theoretical possibility that the end result could be constant variance of the conditional distributions (excepting, of course, the open-ended extreme distributions).

It seems most likely that it is the former kind of heteroscedasticity that applies, for some of the firms earning very high profits owe their position to very short term factors and are likely to experience a very rapid return to more modest profitability. Also there are some firms which continually strive to reach high profit positions where others are quietly content with average returns.[11] It is reasonable to expect that,

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11) For example, see Political and Economic Planning: "Thrusters and Sleepers", Allen & Unwin London 1965.

of firms with high rates of return, an exceptional proportion are such strivers. More attempts will therefore be made to go against the competitive pressure on profitability by firms with high rates of return. There is thus likely to be more variability of experience and behaviour among high profit earners.

A similar pair of arguments for high variability may be made for the case of firms with rates of return well below average. Some will be there through short term random influences and will rise quickly back to more acceptable levels of profitability. Although there may be few striving companies among those with low profitability, the threat of bankruptcy or takeover may alter the behaviour of firms and inspire them to great efforts to raise their rate of return. Therefore it seems at least plausible that the variability of profit movements will increase as the absolute value of the prior mean increases and that there are three factors all working to strengthen this relationship.

A linear regression of the variance on the prior mean for the full range of classes would not be helpful. Rather than try a parabolic form (say), straight lines have been separately fitted to each range. The Durbin-Watson statistics indicate that this method does not lead to any serial correlation. The expected signs were found in every case: a positive slope coefficient for the positive range and negative for the negative range. In the majority of cases the slope coefficient was significant[12] but generally the explanatory power of the equation was quite low. But overall there was sufficient evidence to support the predictions about the variance-prior mean relation.

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12) Three industries (8, 9, 20) show no relationship in either range, industries 16 and 17 none in the positive range and 6 in the negative range.

Section 5.5 : Conclusion

It is clear that the transition matrices for the industries and for the subgroups do not display any different characteristics. We can therefore report our findings as applying at both levels of aggregation. These findings are that profit decay is displayed in every industry and subgroup, and that it is a less steady process in the negative range than in the positive range, i.e. above average profitability is more steadily (this does not imply more quickly) eroded than below average profitability is built up. Apart from this we find no other differences between the ranges.

The conditional distributions are predominantly negatively skewed and leptokurtic. These last two conclusions rule out the normality assumption for the conditional distribution and lead to the decision that an attempt to fit a distribution function to them would be difficult, quite possibly unsatisfactory and certainly of doubtful value in the present context. Therefore the prior mean to final mean relation will be the sole aspect of the transition function to be further developed.

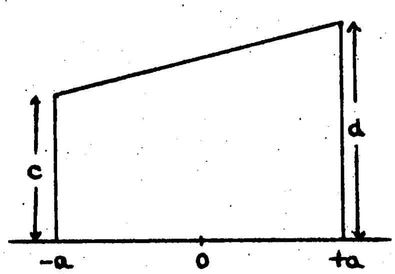
Separate analysis of those conditional distributions whose prior means were close to zero revealed only one way in which they differed from the whole set: the majority of cases where the final mean was further from zero than the prior mean occurred in these central distributions. Perhaps unsurprisingly this indicates that the profit decay process is more disturbed near the industry average. Also the cases where the final mean had the opposite sign to the prior mean were mainly with the final mean negative and suggested that the industry mean was perhaps higher than the point of convergence.

Finally, we found that the variance of the conditional distribution is an increasing function of the absolute value of the prior mean.

APPENDIX TO CHAPTER V

The Influence of the Distribution of r_{t-1} on the Conditional Distributions

The r_{t-1} are distributed according to an approximately bell-shaped distribution. Deviations from normality with respect to kurtosis or skewness are not important in the following. The distribution is divided into intervals and it is intended to consider the characteristics of the distribution within an interval. This interval distribution may be illustrated:



Such a distribution has a density function:

$$f(x) = \frac{(c+d)}{2} + \frac{(d-c)}{2a}x$$

We require that: $$\int_{-a}^{+a} f(x)dx = 1$$

$$\text{i.e.} \quad a(c+d) = 1$$

The mean is given by:

$$\mu_1' = \int_{-a}^{+a} xf(x)dx = \frac{(d-c)}{3}a^2$$

The second origin moment:

$$\mu_2' = \int_{-a}^{+a} x^2 f(x)dx = \frac{a^2}{3}$$

The variance $= \frac{a^2}{3} - \frac{(d-c)^2}{9} a^4$

This decreases as the difference between d and c increases, or as the absolute value of the slope of the bell-shaped distribution decreases. Therefore maintaining a constant (i.e. equal class intervals) and moving away from the centre of the distribution will first produce decreasing variance until the point of inflexion on the distribution is reached, whereafter the variance will increase.

In practice the class intervals are not kept constant but are chosen to provide equal numbers in each class. This necessarily means that a increases as one moves away from the centre of the distribution and therefore so does the variance.

It is an obvious development to consider the skewness and kurtosis of these interval distributions. It is immediately apparent that the sign of the skewness will depend upon (c-d) and that interval distributions to the left of mean of the bell-shaped distribution will be negatively and those to the right positively skewed.

For the kurtosis the 4th origin moment:

$$\mu_4' = \frac{a^4}{5}$$

and the 4th central moment:

$$\mu_4 = \mu_4' - 4\mu_1'\mu_3 + 6(\mu_1')^2\mu_2' - 3(\mu_1')^4$$

$$= \frac{a^4}{5} - \frac{2}{45}(d-c)^2 a^6 - \frac{1}{27}(d-c)^4 a^8$$

It can easily be shown that the ratio μ_4/μ_2^2 cannot take a value as large as 3 and therefore that the interval distributions are platykurtic.

So far we have considered the distributions of r_{t-1} within the class intervals and we have found these distributions to have increasing variance as the deviation of the class from the mean r_{t-1} increases. It has also been shown that these interval distributions will be negatively skewed on one side of the mean r_{t-1} and positively skewed on the other. They will be platykurtic.

Now were the relation between r_t and r_{t-1} to lack a stochastic term, these characteristics would be carried straight over into the conditional distributions of r_t and the form of these distributions would be purely a consequence of taking intervals in the range of r_{t-1}. Even if the equation linking r_{t-1} to r_t is stochastic, the effect of the stochastic term will be overlaid on the distributions described above.

Therefore we may conclude that some of the increase in variance that accompanies increases in the absolute value of the prior mean is explained in this way. On the other hand the similar skewness pattern both above and below the mean that we have found means that the stochastic term dominates in this respect. The leptokurtosis found similarly must indicate the relative importance of the stochastic term.

CHAPTER VI

THE FORM OF THE DECAY FUNCTION AND THE PROBLEMS OF ITS ESTIMATION

In this chapter we are concerned with the regression of the rate of return at time t on a function of the rate of return in the previous period - the decay function. The actual observations to be used are those derived from the transition functions described in the preceding chapter. So we are concerned with standardized rates of return and the data are the means of the conditional distributions and the means of the initial period values falling within a particular class - in the terminology of Chapter III, the final means and the prior means.

This chapter falls into three main sections; firstly an attempt to isolate functional forms that fulfill the criteria set out in Chapter II for the behaviour of the decay of profitability (Section 6.1); secondly, a consideration of the problems of estimating these functions (Section 6.2). The third section considers the pooling of the data (Section 6.3).

Section 6.1 : The Form of the Function

For brevity, the final mean will be written as r_{st} and the prior mean as r_{st-1}, each referring to the sth class of the transition matrix. Our topic is therefore:

$$r_{st} = f(r_{st-1}) \quad (1)$$

In Chapter II we argued that the first derivative of this function should only take values between 0 and 1:

$$0 \leqslant f'(r_{st-1}) \leqslant 1 \quad (2)$$

and that the second derivative should be nonpositive above the mean and nonnegative below. The first condition (2) is to ensure that there is decay of profitability.

Before developing any more constraints upon the functional form, it is appropriate to indicate how the concept of regression towards the mean that is employed here differs from that of Galton's. Hart and Prais[1] summarise it and emphasize the reduction in dispersion thus: if variable x at time t is related to variable x in the previous period by a simple linear relationship:

$$x_{t+1} - \bar{x}_{t+1} = \beta(x_t - \bar{x}_t) + \epsilon$$

then writing the variance of x_t as $V(x_t)$:

$$V(x_{t+1}) = \beta^2 V(x_t) + \sigma_\epsilon^2$$

so the change in variance will depend upon β^2 and σ_ϵ^2.

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1) Hart P E & Prais S J, "The Analysis of Business Concentration", Journal of the Royal Statistical Society Series A 1956 p 172

Changing σ_ϵ^2 to the other side and dividing through by $V(x_{t+1})$:

$$\frac{V(x_{t+1}) - \sigma_\epsilon^2}{V(x_{t+1})} = \frac{\beta^2 V(x_t)}{V(x_{t+1})}$$

The left hand side is the ratio of explained to total variance, and is thus the square of the correlation coefficient of x_{t+1} to x_t,

$$\therefore \quad \frac{V(x_{t+1})}{V(x_t)} = \frac{\beta^2}{\rho^2}$$

There is thus a reduction in variance if $\beta < \rho$.

There was no attempt in Chapter II to claim anything about the behaviour of the variance of rates of return from year to year; the postulate was that the dominant systematic movement of individual rates of return was towards the mean (or some approximately central value). For this, the expected value of r_{st} must be closer to this central value than was r_{st-1}. Thus in the equivalent simple linear relationship to that postulated by Hart and Prais we are only putting a constraint upon β. We are saying something about the average year to year pattern of movement of individuals in the population but nothing about the year to year movement of the dispersion of the population. In fact we found in Section 4.5 considerable stability in the annual dispersion of rates of return which would suggest that on average over a number of years $\beta^2 \simeq \rho^2$. The original use of Galton's concept was with a characteristic fixed for any individual but with a changing population. Here we are considering a characteristic which changes for any individual from a population whose membership varies little. Galton's regression is the regression of a population, the regression considered here is the regression of individuals.

To continue with the main topic, although there is not any certainty that the regression is towards the mean rather than some other point, we will develop the functional form on the basis of this assumption. We may therefore state a third condition: that the function should pass through the origin:

$$f(0) = 0$$

That is, at the mean $r_{st} = r_{st-1}$ there is no profit decay. A necessary consequence of this condition and condition (2) is that the function must always take the sign of its argument or, to put that another way, that function can only lie in the first and third quadrants (see Diagram 2.1).

The second derivative condition restricts the range of curvilinear shapes and permits a straight line relationship. If a linear relationship is used, it may be argued that the working of the competitive resource allocation does bring increased pressure on very high rather than moderately high rates of return as the absolute fall in rate of return will be greater in the former case. If it is felt that this increased competitive pressure should bring about an increased proportional fall in the rate of return, then a nonlinear relationship is required. The form shown in Diagram 2.1 would meet this latter requirement.

This means that the slope diminishes with increasing positive values of r_{st-1}:

$$f''(r_{st-1}) < 0 \quad \text{for} \quad r_{st-1} > 0$$

and should increase with increases in r_{st-1} while r_{st-1} is negative:

$$f''(r_{st-1}) > 0 \quad \text{for} \quad r_{st-1} < 0$$

Therefore we must use:

$$f''(r_{st-1}) = \eta r_{st-1} \qquad \eta < 0 \tag{3}$$

We will develop this case first. Integrating (3) gives:

$$f'(r_{st-1}) = \tfrac{1}{2}\eta r^2_{st-1} + \beta$$

Now the limits within which this slope must fall give:

$$0 < \tfrac{1}{2}\eta r^2_{st-1} + \beta < 1$$

It is apparent that any such restrictions mean that the function is only suitable within some range of r_{st-1}. The limits of this range are:

$$\frac{2(1-\beta)}{\eta} < r^2_{st-1} < -\frac{2\beta}{\eta} \qquad \text{for } \eta < 0$$

These may be expressed as:

$$r^2_{st-1} < -\frac{2\beta}{\eta} \qquad 0 < \beta < 1, \qquad \eta < 0$$

The second ensures that the lower limit on r^2_{st-1} is negative and the third that the upper limit is positive.

Integrating for the second time we get the function itself:

$$r_{st} = \frac{1}{6}\eta r^3_{st-1} + \beta r_{st-1} \tag{4}$$

The constant of integration must be zero in order to ensure that the curve passes through the origin. Redefining the coefficients we have:

$$r_{st} = \beta r_{st-1} - \eta r^3_{st-1} \tag{5}$$

The limit on r_{st-1} now becomes:

$$r^2_{st-1} < -\frac{\beta}{3\eta}$$

If n is zero then we get the linear form:

$$r_{st} = \beta r_{st-1} \tag{6}$$

and $$f''(r_{st-1}) = 0$$

The range of r_{st-1} is now unrestricted and the ohly requirement for the parameter values is:

$$0 < \beta < 1$$

If we now bring into question the location of the decay origin, we derive two other forms. Let us assume that if our rates of return are expressed as deviations from the decay origin, then one of the preceding pair of functional forms will fit. Let the true decay origin be on average θ standard deviations below the mean. Then we must substitute $r_{st-1} + \theta$ and $r_{st} + \theta$ into the equations. So if a linear form is appropriate and if the rates of return are expressed as deviations from the mean, then:

$$(r_{st} + \theta) = \beta(r_{st-1} + \theta)$$

is the equation. This may be written:

$$r_{st} = \theta(\beta - 1) + \beta r_{st-1} \tag{7}$$

Therefore we may calculate from the coefficients of an equation:

$$r_{st} = a + br_{st-1} \tag{8}$$

the values of β and θ. Given $0 < \beta < 1$, a negative 'a' implies a positive θ and therefore that the decay origin is below the mean. 'a' may be insignificantly different from zero without implying that the mean is a good approximation for the decay origin if β is insignificantly different from 1. The important point is that b is an unbiased estimate of β.

Should a nonlinear form be appropriate, then under the same assumptions we must substitute:

$$(r_{st} + \theta) = \beta(r_{st-1} + \theta) + \eta(r_{st-1} + \theta)^3$$

which may be written:

$$r_{st} = \theta(\beta - 1 + \eta\theta^2) + (\beta + 3\eta\theta^2)r_{st-1} + 3\eta\theta r^2_{st-1} + \eta r^3_{st-1} \qquad (9)$$

Therefore we may estimate:

$$r_{st} = a + br_{st-1} + cr^2_{st-1} + dr^3_{st-1} \qquad (10)$$

Now calculating β, η and θ from this equation runs into the problem of overidentification - we may solve for these unknowns in more than one way and we may expect to get different numerical values for each method of solution. The usual method in this situation is to assume a value for one of the structural parameters - as we are doing when we assume the mean is the decay origin. We might regard it in the light; are b and d good estimates of β and η? The answer would be that d is a good estimate of η and as long as θ is small, b will be close but below β. We will deal with these matters again when we discuss the actual estimated equations in Section 7.1.

The objection to these power function forms is their limited range. The other family of functions that appear applicable are those based on exponentials. They have an immediate limitation in that estimation has to be done in terms of the logarithmic transforms and then we are limited to positive values of the variables. This is not insuperable in that except for a very small number of observations:

$$\text{sign}\ (r_{jt}) = \text{sign}\ (r_{jt-1})$$

and the function can be moved into the positive quadrant by multiplying both variables by -1. But it is necessary to estimate the function separately for the data above the industry mean and for the data below the industry mean.

A possible form will be briefly discussed below although it will ultimately be rejected due to the difficulty of estimating it. The function:

$$r_{jt-1} + a = ae^{br_{jt}} \qquad (11)$$

has the correct characteristics, taking logarithms:

$$r_{jt} = \frac{1}{b}\log(r_{jt-1} + a) - \frac{1}{b}\log a \qquad (12)$$

$$\frac{dr_{jt}}{dr_{jt-1}} = \frac{1}{b(r_{jt-1} + a)}$$

This is greater than zero for a, b > 0 as $r_{jt-1} > 0$. It will reach a maximum value when r_{jt-1} is at a minimum. This is $r_{jt-1} = 0$ when the slope is $^1/ab$. This is less than 1 if $ab > 1$.

Taking the second derivative:

$$\frac{d^2r_{jt}}{dr^2_{jt-1}} = -\frac{1}{b(r_{jt-1} + a)^2}$$

which is negative given the prior restriction upon b.

Finally, it goes through the origin in the form given in (11). If the constant term does not equal the coefficient of the exponential term then this is not so. It is exactly this term which causes the estimation problems - if it is assumed that the line does go through the origin, then an iterative method[3] suggests itself. Otherwise the problem looks intractible. But even in the simple case an iterative method is not a realistic proposition when a separate function for each industry has to be estimated. The third form to be considered is:

$$r_{jt} = \alpha r_{jt-1}^{\beta}$$

This assumes that the mean is the correct decay origin but otherwise the function is quite convenient. The first derivative:

$$\frac{dr_{jt}}{dr_{jt-1}} = \alpha\beta r_{jt-1}^{\beta-1}$$

is greater than zero for $r_{jt-1} > 0$ if α and β have the same sign. But we require that the sign of r_{jt} equal the sign of r_{jt-1}, therefore $\alpha > 0$ and so therefore $\beta > 0$.

The restrictions upon the coefficients can more efficiently be dealt with once the second derivative has been examined:

$$\frac{d^2 r_{jt}}{dr^2_{jt-1}} = \alpha\beta(\beta-1)r_{jt}^{\beta-2}$$

which is only negative as required if $\beta < 1$, given that we require the product $\alpha\beta$ to be positive in order that the first derivative be positive. Returning now to the slope, we require:

$$\alpha\beta r_{jt-1}^{\beta-1} < 1$$

---

3) A first pass on $r_{jt} = \frac{1}{b}\log(r_{jt-1} + 1) - \frac{1}{b}\log a$ gives a value of a, say $\hat{a}$, which can be substituted in: $r_{jt} = \frac{1}{b}\log(\hat{a}r_{jt-1} + \hat{a}) - \frac{1}{b}\log a$ This equation can be estimated and the cycle repeated.

Now as $\beta < 1$, the left-hand expression tends to infinity as r_{jt-1} tends to zero. Therefore there must be some value r of r_{jt-1} below which the slope exceeds one. This is given by:

$$(\alpha\beta)^{\frac{1}{1-\beta}}$$

It is desirable that this be as small as possible in order that the range of r_{jt-1} for which the first derivative condition is violated be as small as possible.

The estimation of this form is done by a logarithmic transformation:

$$\log r_{jt} = \log \alpha + \beta \log r_{jt-1} \qquad (13)$$

There is not an ideal function and, having rejected the exponential because of the difficulty of estimating it, we are left with the power functions or the log linear function. We may summarise the power functions into three forms:

(a) linear $r_{st} = a + br_{st-1}$

where b is an estimate of β and a of $\Theta(\beta - 1)$. The only restriction is $0 < \beta < 1$.

(b) cubic without squared form - in future referred to as linear-cubic

$$r_{st} = br_{st-1} - dr^3_{st-1}$$

where b is an estimate of β and d of η. The restrictions are that $0 < \beta < 1$, $\eta < 0$ and $r^2_{st-1} < -\beta/3\eta$. This form assumes that the mean is the decay origin.

(c) cubic $r_{st} = a + br_{st-1} + cr^2_{st-1} + dr^3_{st-1}$

where a is an estimate of $\Theta(\beta - 1 + \eta\Theta^2)$, b of $(\beta + 3\eta\Theta^2)$, c of $3\eta\Theta$ and d of η. The constraints upon β, η are as in the preceding form. There is a similar restriction upon the range of r_{st-1}.

The log-linear form is:

(d) $\log r_{st} = \log a + b \log r_{st-1}$

where a and b are estimates of α and β respectively. The constraints are that $\alpha > 0$, $0 < \beta < 1$ and $(\alpha\beta)^{\frac{1}{1-\beta}}$ should be close to zero. This form assumes that the mean is the decay origin.

Section 6.2 : Estimation of the Decay Function

We now have four possible forms of the decay function and some expectations about the values their coefficients should take. Estimation of these functions is a little out of the ordinary because of the amount of knowledge we have about the process. This information comes from the examination of the transition matrices in Chapter 5. If we had estimated the decay function from the raw data we can see that the equation would have heteroscedastic and nonnormal errors. This is apparent because we may regard the conditional distribution of r_t given r_{t-1} as the conditional distribution of the error term in the decay function given r_{t-1} - once the mean is set to zero. We therefore discover that the variance of this conditional distribution varies with the value of the independent variable and that this distribution appears negatively skewed and leptokurtic.

Neither problem is very serious for ordinary least squares regression (OLS) but they are nontheless undesirable. Their consequences are heteroscedasticity - the OLS estimator is not the minimum variance estimator but is unbiased. Nonnormally distributed errors mean that the OLS estimators are not maximum likelihood estimators and that small sample tests of significance are not exact: but t and F tests are robust as long as the distribution is unimodal and not seriously assymetrical. As was pointed out at the end of Section 3.3, the method of handling the data results in errors whose distribution is closer to the normal than would be the case of a straightforward regression on the raw data.

The problem of heteroscedasticity, on the other hand, does demand more attention. Its consideration requires clarification of the nature of the equation that we are attempting to estimate. In Section 2.6 the model for an individual firm at time t is given:

$$r_{jt} = f(r_{jt-1}) + u_{jt} \tag{1}$$

where the effect of the transfer of resources is represented by the first term on the right hand side, and random factors both internal and external by the second. For simplicity we will use the linear form and write:

$$r_{jt} = \beta r_{jt-1} + u_{jt} \tag{2}$$

We will assume:

$$E(u_{jt}) = 0$$

and $$E(r_{jt-1}\, u_{jt}) = 0$$

Now we may assume that u_{jt} is homoscedastic or that its variance is dependent upon r_{jt-1} - the heteroscedastic assumption.

The estimation process uses groups of observations, so summing over a set of firms $S = \{ j \mid a < r_{jt-1} < b \}$, (2) becomes:

$$\sum_{j \in S} r_{jt} = \sum_{j \in S} (\beta r_{jt-1} + u_{jt}) \tag{3}$$

Dividing through by N(S) - the number of members of the set S - gives the means of the variables over the set S :

$$\bar{r}_{st} = \beta \bar{r}_{st-1} + \bar{u}_{st} \tag{4}$$

Now what are the terms of this equation? We have a fixed known set of r_{jt-1}, a subset of the set of rates of return of all firms in the industry at time t-1. Now with each firm's rate of return (r_{jt-1}) at a particular time there will be associated a random drawing from the population of errors. Therefore $\bar{u}_{st}$ will be the mean of a random sample and therefore a stochastic variable. As the population mean is zero and it is distributed independently of r_{jt-1}, it follows that $E(\bar{u}_{st}) = 0$ for all sets S. The regression of $\bar{r}_{st}$ on $\bar{r}_{st-1}$ with error term $\bar{u}_{st}$ is well behaved[4] by our previous assumptions except for its possible heteroscedasticity and serial correlation. The latter we will assume only arises through a misspecification of the resource transfer expression, and so we may assume for the present exercise that the linear form is appropriate and therefore that $E(u_{rt}\ u_{st}) = 0 \quad s \neq r$.

We must therefore consider the variance of the error term. If we take the variances of equation (2) we get:

$$Var_s(r_{jt}) = \beta^2\ Var_s(\overline{r_{jt-1}}) + Var_s(u_{jt}) \qquad (5)$$

where $Var_s(r_{jt})$ indicates the variance of the rates of return at time t for those firms in set S at time t-1. The assumption of independent errors means that there is no covariance term. We have observed in Section 5.4 that:

$$Var_s(r_{jt}) = f(\bar{r}_{st-1}) + \varepsilon_{st} \text{ with } f' > 0 \qquad (6)$$

ε_{st} has mean zero and is distributed independently of $\bar{r}_{st-1}$.

In the Appendix to Ch. V

$$Var_s(r_{jt-1}) = g(\bar{r}_{st-1}) \quad \text{with} \quad g' > 0 \qquad (7)$$

This is a nonstochastic equation describing the behaviour of the variance of r_{jt-1} within the groups used in classifying the data. The

4) Note that we are not faced with the problem of lagged dependent variables as we are looking at a cross-section in one time period.

way in which this variance is related to $\bar{r}_{st-1}$ is purely a consequence of the grouping procedure.

Equation (7) may be substituted into (5):

$$Var_s(r_{jt}) = \beta^2 g(\bar{r}_{st-1}) + Var_s(u_{jt}) \qquad (8)$$

Now whether or not equation (4) has heteroscedastic erros depends upon whether $Var_s(u_{jt})$ is or is not a function of $\bar{r}_{st-1}$. If $Var_s(u_{jt})$ is not dependent upon $\bar{r}_{st-1}$, then the only cause of covariation between $Var_s(r_{jt})$ and $\bar{r}_{st-1}$ is the grouping procedure that underlies (7). So heteroscedastic errors in (4) involve some systematic variation of $Var_s(r_{jt})$ with $\bar{r}_{st-1}$ that is not covered by $\beta^2 g(\bar{r}_{st-1})$.

As estimates of (6) using a linear functional form show no evidence of misspecification, it may be presumed that that function represents all the relationship between $\bar{r}_{st-1}$ and $Var_s(r_{jt})$. In other words, the $Var_s(u_{jt})$ may be considered by comparing $f(\bar{r}_{st-1})$ and $\beta^2 g(\bar{r}_{st-1})$. This is made clear if (6) is substituted into (8):

$$Var_s(u_{jt}) = f(\bar{r}_{st-1}) - \beta^2 g(\bar{r}_{st-1}) + \varepsilon_{st} \qquad (9)$$

Both f and g are increasing functions of $\bar{r}_{st-1}$. It is argued in Section 5.4 that if $Var_s(u_{jt})$ does vary with $\bar{r}_{st-1}$, it also will be an increasing function.

Therefore taking the derivative of (9) with respect to $\bar{r}_{st-1}$ will give us an expression which, if zero, will indicate that $Var_s(u_{jt})$ is not dependent upon $\bar{r}_{st-1}$ and equation (4) has homoscedastic errors. So we must consider the nature of

$$f' - \beta^2 g' \qquad (10)$$

The function f and the coefficient β have been estimated. The function g has not been estimated or specified theoretically. As f is linear, any nonlinearity in g will lead to (10) being non zero and the errors heteroscedastic. It is apparent from the reasoning in the Appendix to Ch. V that g is nearly certainly nonlinear; on the other hand it is not clear whether the coefficients of any nonlinear terms are large enough to cause serious concern in this context.

We will have a good indication that (10) is positive, if it takes that sign when the slope coefficient of linear approximation to g is inserted. This conclusion can be drawn because g is convex downwards and any linear approximation will overestimate the coefficient of the linear term in a polynomial expression for g.

This rough estimate can be gained by graphing $a^2/3$ against $\bar{r}_{st-1}$, and fitting a line to those points. As the full expression of the variance is not $a^2/3$ but $a^2/3 - (d-c)^2a^4/9$, the graph exaggerates the variances and therefore exaggerates the slope of the function.

This exercise has been carried out on Industry 5 which has not untypical values for the estimated coefficients of f or for β. The value of g' found is 0.010 in the positive and 0.015 in the negative range. The slope coefficients of f are 0.270 and 0.180 and the estimated values of β are 0.871 and 0.743 respectively. It is evident that (10) is positive. Inspection of the other industries does not suggest that any other conclusion will apply there. So we find that $Var_s(u_{jt})$ seems to depend positively upon $\bar{r}_{st-1}$ and consequently equation (4) has heteroscedastic errors.

The estimation method appropriate to an equation with heteroscedastic errors is weighted least squares (WLS), which is a particular case of generalized least squares.[5] Let the variance-covariance matrix be:

$$E(u_{st\cdot} \quad u_{st\cdot}) = \sigma^2 \begin{pmatrix} v_{11} & 0 & \cdots & 0 \\ 0 & v_{22} & & \vdots \\ \vdots & & \ddots & 0 \\ 0 & \cdots & 0 & v_{nn} \end{pmatrix}$$

then the weights to be applied to the regression are given by the matrix:

$$M = \begin{pmatrix} 1/\sqrt{v_{11}} & 0 & \cdots & 0 \\ 0 & 1/\sqrt{v_{22}} & & \vdots \\ \vdots & & \ddots & 0 \\ 0 & \cdots & 0 & 1/\sqrt{v_{nn}} \end{pmatrix}$$

Instead of the regression:

$$Y = X\beta + u$$

WLS uses $MY = MX\beta + Mu$

and $\text{Var}(\hat{\beta}) = \sigma^2(X'M'MX)^{-1}$

This method gives minimum variance estimators.

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But we are faced with inadequate knowledge of the variance-covariance matrix, so let us consider the effect of applying incorrect weights:

$$N = \begin{pmatrix} 1/\sqrt{e_1 v_{11}} & 0 & \cdots & 0 \\ 0 & 1/\sqrt{e_2 v_{22}} & & \vdots \\ \vdots & & \ddots & 0 \\ 0 & \cdots & 0 & 1/\sqrt{e_n v_{nn}} \end{pmatrix}$$

$$= \begin{pmatrix} 1/\sqrt{e_1} & 0 & \cdots & 0 \\ 0 & 1/\sqrt{e_2} & & \vdots \\ \vdots & & \ddots & 0 \\ 0 & \cdots & 0 & 1/\sqrt{e_n} \end{pmatrix} . M$$

$$= RM$$

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5) Johnston J, "Econometric Methods", McGraw Hill 1963, p 207 et seq.

Using these weights gives an equation:

$$RMY = RMX\beta + RMu$$

and $E(u'M'R'RMu)$ will not have the form $\sigma^2 I$, in other words there will still be heteroscedasticity. In the simple case where $\rho_1 = \rho_2 .. = \rho_n$

then $E(u'M'R'RMu) = \rho^2 E(u'MMu) = \rho^2\sigma^2 I$

and $\text{Var}(\hat{\beta}) = \rho^2\sigma^2(X'M'\rho^2MX)^{-1}$

$$= \sigma^2(X'M'MX)^{-1}$$

Thus a constant proportional error is of no concern. But generally whether it is preferable to use WLS with inexact weights or OLS will depend upon the particular R matrix.

In the present case, the choice is between OLS or WLS using the $\text{Var}_s(r_{jt})$ as approximate values (or some adjustment of them). Our main concern is with the values of the estimated coefficients, and therefore the unbiasedness of the OLS estimators makes the choice less crucial. It is also made more difficult as the standard formula for calculating the standard error of estimate is biased downwards when OLS is used in the presence of heteroscedastic errors.[6]

WLS was tried for Industry 16 using the reciprocals of the standard deviations of the conditional distributions as weights. There was little consistent pattern to the differences in standard errors produced by this procedure and by OLS. The differences were also very small, none exceeding 10% and most being less than 5%. Therefore with the weights employed WLS does not seem to offer any marked improvement in efficiency. It does, on the other hand, take us into an area of some difficulty - the effects of using weights that probably overestimate the amount of variation in the error variance. We could have regarded this as less serious if the standard errors of estimate were consistently improved when we used WLS, but this not being so, OLS will be used. We

6) Theil H, "Principles of Econometrics", North Holland 1971, p 243

must therefore keep in mind their inefficiency.

A problem of estimation that arises in using the linear-cubic and cubic power functions is multicollinearity: There is very high correlation between r_{st-1} and r^3_{st-1} over the whole range of data, both negative and positive, and between r_{st-1}, r^2_{st-1} and r^3_{st-1} for data all of one sign. We must therefore expect high standard errors for the coefficients for this reason as well as because of the heteroscedasticity previously discussed.

Section 6.3 : The Pooling of the Data

In Section 5.1 the transition matrices are introduced as calculated on 12 years data of profitability. The decay functions are then estimated upon statistics calculated from these matrices. These functions and the derived statistics developed in Chapter VIII therefore bear something of the characters of 12 year averages. The question arises of whether much interesting and relevant variation is being lost by pooling such a long run of data. A complete answer can only be provided by attempting to investigate year-to-year variations in the decay function, a study that demands a separate and major exercise. A partial answer may be provided by three routes: firstly, are there any economic arguments that might suggest that the decay of profitability is quite stable. Secondly, is there any available statistical evidence already produced in this study that might suggest the answer to this problem. Thirdly, what relation will our observed functions have to the annual functions if these latter do vary from year to year.

With respect to the first: it has been argued (in Chapter I especially) that the decay of profitability measures an aspect of industry performance. In the short run, we expect the chain of causation to run from structure to performance and this linkage has been discussed in Chapter 2. Whilst it would not be sensible to argue that only changes in structure vary performance, it would not be excessive to take the view that only structural changes would bring about persistent changes in performance. Of course, changes in the general operating environment of all companies as well as those particular to the industry must be taken into account in this. Over any time period, trade cycle changes will occur and affect profitability and there will also be changes in legal and tax positions of companies. But note that in this study, factors varying the dispersion of profitability or mean profitability may be disregarded. Also profitability is calculated gross of tax and therefore straightforward changes in tax rates should have little effect. Further the one radical change in company taxation since the war - corporation tax - occurs outside our period. Therefore it seems safe to conclude that changes in the general operating environment do not have a major impact on the decay of profitability. In addition, the use to which we put the rates of decay is one based upon inter-industry relativities, so common effects upon all industries do not in practice cause difficulties.

The structure of an industry is a stable parameter. Indeed Adelman[7] was led to the use of the phrase "glacial drift" to suggest the slowness of the change in the concentration of U.S. manufacturing industry. A quantitative estimate may be obtained for our period from Shepherd's work.[8] He found 73 industries that could be compared between 1951 and 1958 Censures of Production. Of these 73, 61 showed a change in concentration of less than 10 percentage points and 42 of less than 5 points. Nearly 90% of the changes in concentration were increases. There is also evidence to suggest that relative concentration is stable over time. So in so far as the structure to performance relation predominates it is not to be expected that performance characteristics were at all volatile during our period.

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7) M. A. Adelman 'The Measurement of Industrial Concentration' Review of Economics and Statistics Vol. 33 pp 269-296

8) W.G. Shepherd 'Changes in British Industrial Concentration' Oxford Economic Papers Vol. 18 1966 pp 126-132

With respect to the second question, the results of Section 4.5 may be helpful. In that section, the annual distributions for each industry of the rates of return of firms were presented and considered. The conclusions were: mean rates of return showed gentle downwards trend movements. The annual variances showed marked stability. The skewness seemed to change its predominant direction during the period. The kurtosis was uniformly leptokurtic. It is first necessary to emphasize that changes in annual distributions may be brought about by the continuing effect of a stable Markov process. On the other hand apparent stability of annual distributions does not inevitably lead to the conclusion that a stable process is operating, though it must raise the probability that such is the case. This is the basis on which we may conclude from Section 4.5 that pooling the data for the period probably does not involve conflating markedly differing processes.

Our first two approaches have provided some degree of confidence that the rate of decay of profitability did not vary greatly during the period for which the data is pooled. But we cannot eliminate the possibility that there are some variations. Therefore we must consider the third approach to the problem.[9] This is to ask how we may, if we so wish, interpret the coefficients of the decay functions estimated upon pooled data in terms of their annual equivalents. The ideal situation would be if the pooled coefficients are arithmetic means of the annual coefficients. We will in fact find this to be so for the linear form coefficients but not for the cubed term coefficients.

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9) Justifying the pooling because of the completeness of the model would in some circumstances - but not these - be possible. If all those factors that influence the dependent variable are included in the model, then pooling would be appropriate because the model would apply to all time periods and all groups of data.

If we first investigate the linear decay function, the assumption is that the mean of the row distribution of the transition matrix is a linear function of the prior mean. Should the slope of this function vary from year to year, we must write the relationship for a particular firm j at time t:

$$r_{jt} = \beta_t r_{jt-1} + u_{jt}$$

The linearity assumption implies that β_t is uncorrelated with r_{jt-1}.

Each year's set of rates of return is separately expressed in standard deviation units from the mean. Therefore unless the form of the distribution (skewness or kurtosis, not variance) varies systematically over the estimation period, we may expect that each of the classes into which the pooled data is grouped will have equal representation from each year. The change from positive to negative skewness that is suggested by the data of Section 4.5 would lead to a slight over-representation of observations from early years in the negative (below average) range and of later years' observations in the positive (above average) range.

The data is averaged over each class. Therefore for the class $S = \{j \mid a < r_{jt-1} < b\}$ with N(S) members, summing over the individual decay relations:

$$\frac{1}{N(S)} \sum_{j \in S} r_{jt} = \frac{1}{N(S)} \sum_{j \in S} \beta_t r_{jt-1} + \frac{1}{N(S)} \sum_{j \in S} u_{jt} \qquad (1)$$

Using the notation $\bar{r}_s$ as the mean over the set S of final rates of return and similarly for the other terms, we may write (1) as

$$\bar{r}_s = \bar{\beta}_s . \bar{r}_{s,-1} + \bar{u}_s \qquad (2)$$

The question we wish to consider is the relation between $\bar{\beta}_s$ and the annual β_t values. Assuming that each class S has no disproportionate representation of observations from any one year, and further that the expected representation is of equal numbers[10] from each year, we may demonstrate, by using the zero correlation between β_t and r_{jt-1}, that $\bar{\beta}_s$ must have an expected value equal to the arithmetic mean of the β_t's.[11]

With $\bar{r}_s$ and $\bar{r}_{s,-1}$ calculated for each class, a regression line is fitted to the resultant data. The estimated slope coefficient

$$\hat{\beta} = \frac{\sum \bar{r}_s . \bar{r}_{s,-1}}{\sum \bar{r}_{s,-1}^2}$$

(the summation being over all the sets S).

This formulation follows because both $\bar{r}_s$ and $\bar{r}_{s,-1}$ have zero means. Substituting from (2)

$$\hat{\beta} = \frac{\sum(\bar{\beta}_s \bar{r}_{s,-1}^2 + \bar{u}_s . \bar{r}_{s,-1})}{\sum r_{s,-1}^2}$$

Assuming independent errors i.e. $E(\sum \bar{u}_s . \bar{r}_{s,-1}) = 0$

$$E(\hat{\beta}) = \frac{\sum \bar{\beta}_s \bar{r}_{s,-1}^2}{\sum \bar{r}_{s,-1}^2}$$

Given the nature of $\bar{\beta}_s$ previously established, the squared deviations $(\bar{r}_{s,-1}^2)$ will induce no particular and persistant direction of bias to $E(\hat{\beta})$. Therefore we may regard the calculated value β as an unbiased estimate of the arithmetic mean of the β_t's.

A similar argument may be developed for the nonlinear function with the same conclusion for the coefficient of the linear term. But there is, on the other hand, demonstrable bias in the coefficient of the cubed term.

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10) This is a simplification as the number of observations varies somewhat between years.

11) $Cov(\beta_t, r_{jt-1}) = 0$

$\therefore \frac{1}{N(S)} \sum_{j \in S} (\beta_t - \bar{\beta})(r_{jt-1} - \bar{r}_{s,-1}) = 0$ where $\bar{\beta}$ is the arithmetic mean of the β_t's.

$\therefore \frac{1}{N(S)} \sum_{j \in S} \beta_t r_{jt-1} = \bar{\beta} . \bar{r}_{s,-1}$

$\therefore \bar{\beta}_s = \bar{\beta}$

Equivalent to (2) above we get

$$\bar{r}_s = \bar{\beta}_s \cdot \bar{r}_{s,-1} + \sum_{j \in S} \eta_t r^3_{jt-1} + \bar{u}_s$$

$\bar{\beta}_s$ has the same property as in the linear form. If we assume independence between η_t and r^3_{jt-1} we may write the cubic term as the product of the arithmetic mean of the η_t's over the set S and the arithmetic mean of the r^3_{jt-1} over the same set. Again there being no reason to expect anything other than equal representation of all years in each class, the expected value of the arithmetic mean of the η_t's over the set S is the arithmetic mean of the η_t's over the whole period of 12 years.[12] Therefore we may write the cubic term:

$$\frac{1}{N(S)} \sum_{j \in S} r^3_{jt-1}$$

But the form of the cubed variable used in the regression differs from this. It is:

$$\left(\frac{1}{N(S)} \sum_{j \in S} r_{jt-1} \right)^3$$

i.e. instead of using the mean of the cubed values, the cube of the mean value has been employed. The relationship between these two quantities may be investigating by expanding the discrete expression for the third central moment of a distribution.[13] We find that

$$\frac{1}{N(S)} \sum_{j \in S} r^3_{jt-1} - \left(\frac{1}{N(S)} \sum_{j \in S} r_{jt-1} \right)^3 = \frac{1}{N(S)} \sum_{j \in S} \left(r_{jt-1} - \bar{r}_{s,-1} \right)^3 + 3\sigma^2 \frac{1}{N(S)} \sum_{j \in S} r_{jt-1}$$

where σ^2 is the variance of r_{jt-1} taken over the set S.

Let this be abbreviated to:

$$z = \mu_3 - 3\sigma^2 \bar{r}_{s,-1}$$

where z is the discrepancy between the two measures with which we are concerned.

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12) Again making the simplification that there are equal numbers of observations in each year.

13) I am indebted to Robin Ruffell for suggesting this approach.

Now $Z \gtreqless 0$ according as $\mu_3 + 3\sigma^2 \bar{r}_{s,-1} \gtreqless 0$

For all classes excepting that overlapping the mean, all the r_{jt-1} in any one class have the same sign.

Case (i) $\bar{r}_{st-1} > 0$, then $\mu_3 > 0$[14] and therefore $Z > 0$

Case (ii) $\bar{r}_{st-1} < 0$, then $\mu_3 < 0$[14] and therefore $Z < 0$

As the sign of the cube of the mean and the mean of the cubes will be the same (on our previous reasoning), these two cases may be summarised as: the absolute value of the mean of cubes always exceeds the absolute value of the cube of the means.

This result is only sufficient to indicate a possible direction of bias in the intercept on the $\bar{r}_{st}$ axis. To establish anything about the bias of η demands evidence about the way the discrepancy varies with $\bar{r}_{st-1}$. But we know that Z depends upon $\bar{r}_{st-1}$ and takes the same sign as $\bar{r}_{st-1}$. Therefore, unless the other elements in the expression (μ_3 and σ^2) counteract this, we do find that $|Z|$ varies positively with $|\bar{r}_{st-1}|$. In fact σ^2 strengthens this inter-relationship.[15] It was observed in Section 5.2 that the skewness does not seem to vary with $|\bar{r}_{st-1}|$. As skewness was measured as μ_3^2/μ_2^3 and $\sigma^2 = \mu_2 - (\mu_1)^2$, it seems likely that μ_3 also contributes to the strength of the relationship.

So the variable actually used shows an increasing discrepancy from the correct variable as $|\bar{r}_{st-1}|$ increases. Therefore we must expect an upward bias in the coefficient of the cubed term. That is, upward bias if we wish to interpret it in terms of its annual equivalents.

The conclusions of this section are, firstly that pooling does not appear to involve lumping very disparate processes together. Secondly that the estimated coefficients may be interpreted as the arithmetic means of their

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14) See Appendix to Chapter V.

15) See Section 5.4.

annual equivalents. The exception to this second result is as a consequence of the form of variable used and not of the pooling.

CHAPTER VII

THE ESTIMATED EQUATIONS

This chapter has two functions: firstly, in Section 7.1 there is a brief report of the results of estimating the various equation forms both on industry ahd subgroup data. The full results are in Appendix D. Secondly, in Section 7.2, an attempt is made to decide upon the best equation for each industry and subgroup. In this section, the principles employed are set out, a few examples of their application described and the selections tabulated. In each of these sections the industry cases are dealt with before the subgroups. Section 7.3 summarizes the chapter.

Section 7.1 : The Fitted Equations

Before reporting the results of the estimation, mention must first be made of a data problem. It will be recalled that observations involving rates of return of over three standard deviations from the mean have been rejected. Inspection reveals that a firm which earns such a rate of return in one year will usually have a rate of return in the preceding year that falls in the extreme class of the acceptable range. Therefore when we look at the average rate of return in year t of firms that occupied an extreme class in year t-1 we have a biased statistic that indicates very rapid decay of profitability. This is because a number of the adverse moves have been rejected from the sample.[1] For this reason the extreme classes at each end of the range have been rejected. If there is no bias in the extreme class, its omission should have no systematic effect upon the estimated equations. But as the nonlinearity, if any, will be mainly detectable well away from the mean, there is a strong possibility that dropping these observations lowers the amount of nonlinearity found. On the other hand, of course, the likely bias in those data points may induce a spurious nonlinearity.

7.1(a) : Industries

The four functional forms have been estimated for each industry. This has been done first for the data relating to above average profitability, then for that relating to below average profitability and then to the full body of data for that industry. These three sets of data are referred to as the "positive range", the "negative range" and the "full range". The forms estimated differ in only one respect from those summarised at the end of Section 6.1: the linear-cubic is used with a constant term. This is done so that the usual measures of goodness-of-fit such

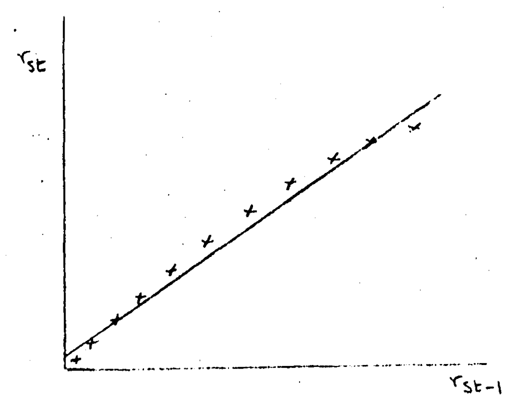
1) It may be argued that the unavoidable omission of the death of firms will also lead to a bias in the lowest class.

as R^2 and Durbin-Watson statistic can be used. If the constant is found to be significant then the equation form is inappropriate.

Although R^2 measured on these equations is not a measure of the relationship between the rate of return at time t and at time t-1 for a set of firms, it is a measure of the goodness-of-fit of the final mean r_{st} on the prior mean r_{st-1} for the set of conditional distributions. It is therefore one standard to employ in judging between the functions proposed. The corrected R^2 is nearly always above 0.9 for the linear form and this in a majority of cases is bettered when we move to the linear cubic form. The addition of a squared term only makes a worthwhile contribution in a handful of cases. The log-linear is less good than any of the power functions on this criterion although it still attains quite respectable levels.

The second indicator of the goodness-of-fit is the Durbin-Watson statistic. This measure of serial correlation may be regarded as an indicator of how satisfactory the functional form is in cross-section analysis such as this. For example, Diagram 7.1 illustrates the fitting of a straight line to data displaying the form of non-linearity we expect.

<u>Diagram 7.1</u>



The relationship between successive residuals is immediately obvious. Seven linear equations have some evidence (i.e. the Durbin-Watson statistic lies below the upper bound d_u at the 5% level of significance) of serial correlation, the number falls in the linear-cubic and the cubic having just a single case. It would seem that there is little evidence of nonlinearity provided by the consideration of serial correlation.[2]

The goodness-of-fit of the log-linear equation is in all but a handful of cases less good than any of the power functions. As it also has rather a large number of examples where one of the coefficient requirements is violated, this form was not developed any further. Our attention from now on will be limited to the three power function forms.

Coming now to the coefficients of the equations, we find for the linear form that every slope coefficient lies between 0 and 1. Thus we have further confirmation of the general occurrence of decay of profitability. For a majority of industries, the negative range slope is less steep than that of the positive range - this means that profit decay is faster below than above the mean. It is apparent from Diagram 7.1 that any nonlinearity in the data will lead to a spurious value for the constant term of a linear equation fitted to that data. Therefore we must delay consideration of this term until appropriate equation forms for particular ranges in industries have been selected.

In the linear-cubic form, there are only a few cases where the requirements of Section 6.1 are not fulfilled by the coefficients. The commonest deviation from those requirements is a significant constant term, and this

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2) When the extreme observations were included the linear form had some evidence of serial correlation in one third of cases.

is commonest in the full range equations. Although the coefficient of the cubed term is only significant (at the 5% level) in about one fifth of cases (of which only one occurs in the positive range), it is negative in 39 out of 51 equations. There are only two cases, both in the negative range, where the coefficient of the first degree term is greater than 1. In summary, the linear-cubic has acceptable coefficients but the nonlinearity in the data is insufficient in most cases to justify a nonlinear form. In so far as differences between the ranges are detectable, the positive range shows less nonlinearity than the other ranges.[3]

When we come to the cubic we find that multicollinearity has become quite a problem for the positive and negative range equations and the pattern of significance and size of coefficients is very confusing. Discussion of this will be left to the section on selecting appropriate forms for the various ranges and industries. The full range case is rather different as there is much less inter-correlation between the independent variables. This is because when r_{st-1} varies above and below zero, r^2_{st-1} is not correlated with r_{st-1} or r^3_{st-1}. In the separate range equations, r_{st-1} takes only one sign and all three terms are highly correlated. Therefore it is only in the full range that the cubic seems appropriate. As it appears that the decay process is different above and below the mean (see Section 8.4), it is also to be expected that in some cases a cubic form will be needed to describe the decay process over the full range where there is in fact no error in using the mean as the decay origin.

7.1(b) : Subgroups

Only two functional forms have been applied to the industry subgroup data: the linear and the linear-cubic, each with a constant term. Experience

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3) An effect that is stronger if the extreme classes are not rejected.

of the industry data suggested that the log-linear form was not worth pursuing, while the degrees of freedom problem meant that the cubic form would be inappropriate for a considerable number of subgroups. For fifteen industry subgroups, 3 equations have been estimated: one each for the positive, negative and full ranges. For the other 26 subgroups only a full range equation has been estimated as there are insufficient data to allow the separate treatment of above and below average values.

As for the industries, the goodness-of-fit is high. There is very little evidence of serial correlation. Generally the coefficients satisfy the requirements although there are a few cases where the slope coefficient of the linear form is greater but not significantly greater than one. The cubed term of the linear-cubic is only significant in a minority of cases.

Section 7.2 : Choice of Appropriate Equation

Industries

In attempting to select a single equation form for each range of each industry, there are two aims in view. Firstly to find the form that best characterises the decay process in that case and thereby conclude something about the decay process. Secondly, at a later stage, we will be calculating summary measures of the rate of decay in each case and for this we need, where possible, a single best form of function.

Choice of equation must take into account both the statistical aspects of the equations and the suitability of their parameter values. This has been done in two steps. First an equation was chosen on the basis of its goodness-of-fit and parameter significance, then with this initial allocation a few cases were reconsidered because of inconvenient parameter values. Final choices are shown in Table 7.1.

Ignoring temporarily the difficulties of deciding upon parameter significance, we might set up a selection scheme based on the cubic form. To show this, equation 9 of Section 6.1 is reproduced:-

$$r_{st} = \theta(\beta - 1 + \eta\theta^2) + (\beta + 3\eta\theta)r_{st-1} + 3\eta\theta r^2_{st-1} + \eta r^3_{st-1}$$

If the cubed term is insignificant, then the coefficient of r^3_{st-1} in the true relation may be taken as zero and therefore the true relation must be linear and we may go straight to that form. If, on the other hand, the cubed term is significantly different from zero but the squared term is not, then this implies

$$\eta\theta = 0 \quad \text{but} \quad \eta \neq 0$$

We may then conclude that $\theta = 0$, that is, the mean is the decay origin and the correct curvilinear form is the linear cubic. If in the cubic both the squared and cubed terms are significantly different from zero, then we conclude that the relationship is nonlinear and the decay origin diverges significantly from the mean. The cubic is therefore the appropriate form. If in this case the constant is insignificantly different from zero, it merely means that $(\beta - 1 + \eta\theta^2)$ is insignificantly different zero. If the linear form is selected and it has an insignificant constant, this does not necessarily show that the mean is a good choice for the decay origin. This is because the constant[4] is $\theta(\beta - 1)$ and its insignificance may be a consequence of β being insignificantly different from 1. On the other hand, a significant constant does necessarily imply a significant value for the divergence of the decay origin from the mean, if the linear equation is the correct choice.

The multicollinearity and heteroscedasticity from which the equations suffer both imply exaggerated standard errors and some care must therefore be taken with the judgement of coefficient significance. Multicollinearity is only a problem in the cubic form where the intercorrelation of r^2_{st-1} and r^3_{st-1} may make them both insignificant despite there being nonlinearity in the data. The correlation between r_{st-1} and r^3_{st-1} in the linear cubic is not a problem in judging significance. This is primarily because the t-statistic of the linear term is always very high and therefore there is never a problem in deciding its significance. If, on the other hand, the cubed term is insignificant, we may take this as an indication that its distinctive contribution is not required, i.e. that the data are not nonlinear. To cope with the multicollinearity in

4) Section 6.1 equation 7

the cubic we can call upon the linear cubic as supporting evidence for or against nonlinearity in the data. If the nonlinear terms are insignificant in both equations, then the linear form is chosen. An example of this is shown in Table 7.2 for Industry 1 negative range. In order to avoid incorrect rejections due not to multicollinearity but to heteroscedasticity, insignificance is only decided where the t-statistic is well below the critical 5 per cent value.[5]

Acceptance of the cubic form is the easiest choice to make, as the likely problems of the equations all tend towards spurious insignificance. So if all the coefficients of the cubic are significant, no interpretation is needed. If we permit cases where one coefficient has a t-statistic slightly below the 5 per cent significance level, then all but two of the cubic choices are explained. An example is shown in Table 7.2 - Industry 5 full range.

Choosing the linear-cubic is the most difficult of the three as we are making a decision on the basis of misleading standard errors without any other supporting evidence. The crucial indicator according to the basic selection scheme is the significance of the squared term in the cubic, by only allowing very low t-statistics for this term to guide rejection of the cubic form. In practice the very few linear-cubic forms selected (5 in all) came from the problem cases: such as those where although the linear form was indicated, it suffered from serial correlation. In this situation the linear cubic was chosen if the t-statistic of the cubed term was reasonably close to the critical value. In all, six cases did not fit well with the selection scheme of which five were in the separate ranges where multicollinearity in the cubic made its use as a basis for

5) An F-test could be applied to the pair of coefficients of r^2 and r^3, or we might use the corrected $\bar{R}^2$ to guide equation choice. The final selection would not be affected. It is helpful, though, to keep the t-statistics of the individual parameters in view in this particular exercise, as the precision of parameters is important when we come to calculate decay measures.

Table 7.1 : Choice of Equation Forms for Industries

1 = linear, l.c. = linear-cubic, c = cubic

Industry No.	Positive Range	Negative Range	Full Range
1	l	l	l
4	l	l.c.*	c
5	l	l	c
6	l	l.c.*	l
7	l	l	l
8	l	l	l
9	l	l	l
11	l	l	c
12	l	l	c
13	l	l	c
15	l.c.*	l	l
16	l*	l.c.	c*
17	l	l	l
18	l.c.*	l	c
19	l	l	l
20	l	l	l
21	l	l	l

* indicates case where selection scheme did not provide direct choice.

the scheme awkward. The 6 cases are marked in Table 7.1. Reference to the goodness-of-fit of the equations to aid selection would have led to little if any change in the chosen forms. In nearly every case the change in corrected R^2 from one form to another was extremely small. Further the lack of serial correlation meant that this aspect of goodness-of-fit would only have been appropriately considered in a very few cases - it did influence the choice on three occasions.

The separate ranges are predominantly linear while the full range has some nonlinearity. For the separate ranges, the cubic makes hardly any showing, despite the efforts made to allow for its multicollinearity. This hints that the mean may not be unsuitable as a decay origin. In the full range, by contrast, seven of the industries are best fitted by the cubic. Given the difference above and below the decay origin, the choice of the cubic for the full range cannot be taken as evidence of the need for the decay origin to be different from the mean. Rather it lends support to the feeling that a single function for the full range has weaknesses.

Subgroups

As only the linear and linear-cubic forms have been estimated for the subgroups, the choice is more restricted and the selection scheme appropriate is simpler. Because of the omission of the cubic form we do not have the problem of multicollinearity that made choice of the industry equations particularly difficult. On the other hand, heteroscedasticity is still present to make coefficient significance a problem. The scheme can nonetheless be expressed simply: if the coefficient of the cubed term of the linear-cubic form is significant then that form is chosen. Otherwise the linear is selected. In order to deal with the likely effect of heteroscedasticity, the linear is only chosen if the nonlinear term of the linear-cubic has a t-statistic well below the 5 per cent critical value.

In 58 out of 71 cases, this leads to the choice of the linear form. Most of the linear-cubic choices are straightforward but 5 have significant constant terms which suggest that the cubic would have been the appropriate equation form. There are also 5 where the coefficient of the first degree is greater than one, and in 2 of these it is significantly so. This implies that close to the mean the tendency to decay of profitability is outweighed by factors working to increase the dispersion of profitability. There are also two chosen linear equations for which the slope coefficient is greater than one (but not significantly). In the event, there is no subgroup for which the choice between linear or linear-cubic is ambiguous.

Table 7.2 : Examples of the Equation Selection Process

	Constant	r_{st-1}	r^2_{st-1}	r^3_{st-1}	$\bar{R}^2$	DW	N
Industry 1 negative range							
linear	0.0183	0.792			0.943	1.518	20
	(0.517)	(11.716)					
linear-cubic	-0.0182	0.904		-0.00208	0.938	2.374	20
	(0.350)	(7.172)		(0.033)			
cubic	-0.0247	0.854	-0.0843	-0.0397	0.933	2.369	20
	(0.292)	(1.635)	(0.099)	(0.103)			
Industry 5 full range							
linear	-0.0452	0.835			0.984	2.049	40
	(3.503)	(48.597)					
linear-cubic	-0.0422	0.865		-0.0193	0.984	2.098	40
	(3.217)	(27.930)		(1.163)			
cubic	-0.0700	0.890	0.0591	-0.0484	0.987	2.570	40
	(4.652)	(30.459)	(3.012)	(2.707)			

Table 7.3 : Choice of Equation for Subgroups

	Positive Range	Negative Range	Full Range
Linear	1/2 4/5 5/4 7/1 9/1 13/1 15/1 18/2 19/3 20/3 21/2	1/2 4/5 5/4 7/1 9/1 11/1 13/1 15/1 15/3 18/1 18/2 18/3 19/3 21/2	1/2 1/3 4/1 4/2 4/4 5/1 5/4 6/4 7/1 7/2 8/1 9/1 11/1 11/2 12/2 12/4 12/6 15/1 15/2 16/1 16/2 16/3 16/4 17/1 18/1 19/1 19/2 20/2 20/3 21/2 21/3 21/4 21/5 21/6
Linear-Cubic	11/1 15/3 18/1 18/3	20/3	4/5 13/1 15/3 16/5 18/2 18/3 19/3

Section 7.3 : Summary

The results of this examination of the estimated equations support the concept of decay of profitability. The basic evidence for this comes from the linear form - in every case at the industry level and nearly every one at the subgroup level, the slope coefficient is less than one. This means that the expected value of the rate of return at time t is closer to the decay origin than at time (t-1). When we look at curvilinear forms we find a small number where this decay does not appear to operate in the immediate vicinity of the mean, but it is only a sure result in a few instances. Therefore it may be taken that decay of profitability occurs.

In the majority of cases, the linear form proves sufficient although there are 7 full range industry cases where the cubic is needed. The subgroup full range results show much less need for nonlinear decay functions than this. Overall violations of the requirements for the coefficients were rare and the goodness-of-fit very high.

CHAPTER VIII

THE DECAY OF PROFITABILITY - ITS MEASUREMENT

In this chapter the decay functions of the previous chapter are put to use. Section 8.1 is concerned with developing a summary statistic of the rate of decay of profitability implicit in a decay function. Then in Section 8.2 the measure is calculated, the values given and their precision evaluated. Section 8.3 considers whether the differences in rates of decay between industries are statistically significant. Section 8.4 looks at differences between the ranges. Finally, Section 8.5 looks at the results for specific industries and subgroups and introduces an interpretation of the rate of decay in terms of a years-equivalent.

Section 8.1 : Measures of the Decay of Profitability

In this section, the aim is to derive from the decay function a statistic summarising the rate of decay of profitability for an industry range. For this purpose we will first presume that we have a decay function:

$$r_t = f(r_{t-1})$$

and the rates of return are measured as deviations from the decay origin.

The rate of decay of profitability may be defined as the ratio of the rate of return at time t to the rate of return at time t-1. An alternative would be the first derivative of the decay function, but it is the ratio that will be used. This choice is motivated by interest in comparing annual levels, that is, in the proportionate decay in the rate of return from one year to another towards the decay origin. The rate of decay (that we will denote by D) is therefore:

$$D = \frac{r_t}{r_{t-1}}$$

and, given our decay function, by

$$D = \frac{f(r_{t-1})}{r_{t-1}}$$

Substituting specific functional forms for $f(r_{t-1})$ will give various measures of D. Still taking the rates of return as measured from the decay origin gives two measures:

$$1D = \beta$$

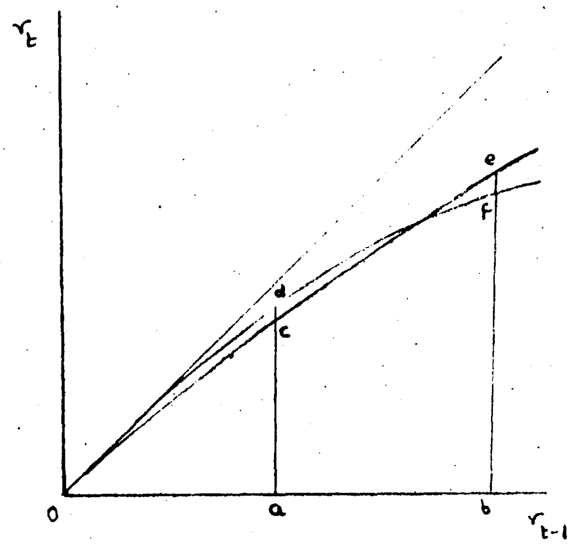
from the linear form and:

$$1cD = \beta + \eta r^2_{t-1}$$

from the linear-cubic form.

The lcD measure presents a problem in that it is dependent upon the value of r_{t-1} chosen. It is quite conceivable that for one such value industry A has a higher rate of decay than industry B, while another value reverses such an ordering. This is illustrated in Diagram 8.1.

Diagram 8.1



decay measure	at	a	for	industry	A	=	$\frac{ad}{0a}$
"	"	"	a	"	B	=	$\frac{ac}{0a}$
"	"	"	b	"	A	=	$\frac{af}{0b}$
"	"	"	b	"	B	=	$\frac{ae}{0b}$

There is clearly some interest in its value at particular values of r_{t-1} but it is also desirable to have a measure not so dependent for industries with nonlinear decay functions. Such a measure would be an average of the point measure over some range of r_{t-1}. This is provided by the integral:

$$\frac{1}{(b-a)}\int_a^b \frac{f(r_{t-1})}{r_{t-1}}\,dr_{t-1}$$

which averages over the range:

$$a \leq r_{t-1} \leq b$$

We may now redefine the linear-cubic measure:

$$\{cD = \frac{1}{(b-a)}\int_a^b (\beta + \eta r_{t-1}^2)\,dr_{t-1}$$

$$= \beta + \tfrac{1}{3}\eta(b^2 + ab + a^2)$$

This formulation permits the direct comparison of profit decay in the positive and negative ranges as the limits of integration all appear as second degree terms. If the limits of integration are:

$$0 \leq r_{t-1} \leq R$$

where R is the extreme permitted value, then the positive value is:

$$\{cD^+ = \beta + \tfrac{1}{3}\eta R^2$$

If the limits are:

$$-R \leq r_{t-1} \leq 0$$

then the negative range value is:

$$\{cD^- = \beta + \tfrac{1}{3}\eta R^2$$

although β, η will take different values from those for the positive range.

If the limits are:

$$-R \leq r_{t-1} \leq R$$

then the full range value is:

$$\{cD^f = \beta + \tfrac{1}{3}\eta R^2$$

again β, η taking different values.

This definition in terms of the integral can be used in the linear case also. Its value will always be β whatever the limits of the integral.

In practice all the equation forms have constant terms and both the linear and the cubic imply (or may imply) that the mean is not the decay origin. So we must use the coefficients of these forms to derive the coefficients of the true relationship. For the linear this causes no problems, the slope coefficient being an unbiased estimate of the slope of the true relation. This coefficient is therefore the value of 1D. The cubic is more difficult and using it returns us to the problem of overidentification previously mentioned. It will be recalled that the cubic form is postulated to occur where the true relation is linear-cubic but the decay origin is not the mean. So we wish to obtain from the cubic estimates of the coefficients of the true linear cubic. The cubed term poses no problems in that the coefficient in the cubic is an unbiased estimate of the corresponding coefficient in the true linear-cubic. But given the overidentification, the structural coefficients may be calculated in more than one way and thus produce more than one set of values. The imprecision of the coefficients of the nonlinear terms in the separate range equations suggests that any involved sequence of calculation is going to produce estimates with a very low level of precision. Therefore no attempt is made to deal with the problem by such means. Rather the coefficient of the linear term is taken as a direct estimate of the equivalent coefficient in the true linear-cubic relationship. This estimate is biased, as the cubic coefficient is (in the notation of Section 6.1) $(\beta + 3\eta_l\theta^2)$. As η_l is of the order 0.01 and θ is nearly certainly less than 0.5, the bias is likely to be less than 0.01 which is considerably less than the standard error of the linear coefficient.

The symbols used for the various measures of profit decay will abide by the following conventions: the prefix letter(s) will denote the equation form used - l for linear, lc for linear-cubic and c for cubic. The need to distinguish between linear-cubic and cubic is not to distinguish the form of the measure - which is the same - but the source of the estimates of β and η used. A superscript +, - or f will denote which range is being referred to.

Choosing the limits of integration poses a problem and the solution must be to some extent arbitrary. It seems undesirable to employ in the measure any portion of the decay function beyond the extreme points used in estimation. That is, extrapolation is to be avoided. Having rejected the extreme classes, the outer values actually used rarely exceed an absolute value of 2 standard deviations. Therefore this has been chosen as the limit of integration and its justification is purely empirical.

With this value of R we have:

$$lcD = \beta + 1.33\dot{3}\eta$$

as the decay measure for each range.

Section 8.2 : The Decay Measures - Selection and Standard Errors

In this section a set of decay measures is produced for each range and for each industry and subgroup. The definition of the measure of decay was formulated in the preceding section. We wish to find a single measure for each industry-range and it is to this end that we attempted to choose the best equation for each. Inevitably there were a number of cases where such a choice was difficult. Therefore one of our concerns in this section is to ask whether, in these cases, equation choice is critical. The second question that will be considered is the reliability of these measures.

The first task then is to examine in general how sensitive the choice of equation is for the decay measure and in particular whether the choice is crucial for those industries and subgroups which do not allow an unambiguous selection. The main tool to be employed in this is Spearman's rank correlation coefficient. The choice of this particular statistic is primarily motivated by the recognition that we cannot make judgements about the desirability of particular levels of the decay measure but only relative judgements: that industry A has a faster rate of decay than industry B. Secondly, whilst we will consider the statistical significance of differences in the decay measure, we are not able to discuss the economic importance of such differences. Therefore our prime concern will be with the ranking of rates of decay.

In Table 8.1 the rank correlations are reported for comparisons between equation forms within ranges.

Table 8.1 : Rank Correlation of Decay Measures Derived From Different Equation Forms

	1D against 1cD	1D against cD	1cD against cD
Industry			
positive range	0.77		
negative range	0.93		
full range	0.97	0.96	0.99
Subgroups			
positive range	0.73		
negative range	0.91		
full range	0.82		

Because of the unreliability of the cubic form coefficients in the separate range cases, the measure was only calculated for this equation form in the full range case. The values of the decay coefficients are given in Appendix E. In general the rank correlations are satisfactorily high and the lower values can be attributed to one or two particular industries (or subgroups) whose measures differ very markedly between one equation form and another. It is concluded that these statistics do not point to any great sensitivity to equation form.

This is not sufficient for two reasons. Firstly, it may be that the cases of problematic equation selection are the ones whose ranking changes drastically between equation forms. Secondly, we are not choosing one form for all industries (or subgroups) but rather the best form separately for each industry (subgroup). A very high correlation between two sets of measures may obscure very great differences between the numerical values attached to particular individual industries or subgroups. A new set of values taken partly from one of the original sets and partly from the other may hardly correlate at all with the original sets. We could clearly check on this by looking at the means and standard deviations of the original sets. But a simpler method is to assemble our composite set and calculate how it correlates with the originals. So we next compile the vector of the measures for each industry that are derived from the best equations and correlate this with the vectors of measures relating to the original equations. These best measures will be denoted by D with the appropriate superscript to denote the range. The results are shown in Table 8.2.

Table 8.2 : Rank Correlation of the Best Measures with those from Specific Equation Forms

	D against 1D	D against 1cD	D against cD
Industry			
positive range	0.93	0.81	
negative range	0.99	0.94	
full range	0.97	0.98	0.99
Subgroups			
positive range	0.80	0.88	
negative range	0.93	0.98	
full range	0.97	0.84	

It is apparent that the best set correlates very highly with the others and therefore in general the choice of equation form for a particular industry is not crucial. Nonetheless those cases where the choice is not obvious must be examined one by one to see whether the choice in these particular cases makes an important difference to the ranking of these particular industries (or subgroups) in the best set. There are 6 such cases and 4 involve a ranking change in the best set of 2 places or less. There are then left 2 cases, both in the industry positive range. These are noted in Table 8.3 where the best measures for each range for industries are given. The measures for subgroups are presented in Table 8.4. Apart from these three exceptions it seems safe to conclude that the ranking of industries given by the best measures (D) is unlikely to be seriously affected by any errors in the selection of the best equations.

We must next consider the calculation of the standard error of the decay measure. In the case of a measure derived from the linear form we have:

$$lD = \beta$$

and therefore the standard error of lD equals the standard error of the slope coefficient in the linear form. But in the case of the linear-cubic or cubic measure we have:

$$lcD = cD = \beta + 1.333\eta$$

Taking the variance of these:

$$\begin{aligned} Var\,(lcD) &= var(\beta + 1.333\eta) \\ &= E\left[\left\{(\beta + 1.333\eta) - (\bar{\beta} + 1.333\bar{\eta})\right\}^2\right] \\ &= E[(\beta - \bar{\beta})^2] + 2.666\,E[(\beta - \bar{\beta})(\eta - \bar{\eta})] + 1.777\,E[(\eta - \bar{\eta})^2] \\ &= Var(\beta) + 2.666\,Cov(\beta, \eta) + 1.777\,Var(\eta) \end{aligned}$$

$$\therefore \text{Standard error of } lcD = \sqrt{\left[Var(\beta) + 2.666\,Cov(\beta,\eta) + 1.777\,Var(\eta)\right]}$$

This expression can be calculated from the results for the relevant regression.

The standard errors are given for each of the chosen measures in Tables 8.3 and 8.4. Their interpretation is held over to the next section.

Table 8.3 : Values of D for Industries

(a) Positive Range

Ind No.	D^+	rank	standard error	degrees of freedom
1	0.792	12	0.045	18
4	0.760	13	0.025	51
5	0.871	5	0.038	18
6	0.710	15	0.057	14
7	0.851	7	0.028	28
8	0.630	17	0.124	4
9	0.706	16	0.092	10
11	0.843	9	0.042	15
12	0.751	14	0.034	19
13	0.836	10	0.035	24
15*	0.807	11	0.062	22
16	0.872	4	0.041	29
17	0.844	8	0.102	6
18*	0.865	6	0.038	41
19	0.874	3	0.024	28
20	0.918	1	0.068	9
21	0.883	2	0.028	30

* Choice of equation makes more than two places change in ranking.

Table 8.3 : Values of D for Industries

(b) Negative Range

Ind No.	D^-	rank	standard error	degrees of freedom
1	0.901	2	0.054	16
4	0.801	9	0.033	49
5	0.743	12	0.043	18
6	0.755	11	0.077	9
7	0.759	10	0.042	29
8	0.578	15	0.075	3
9	0.439	17	0.092	8
11	0.551	16	0.076	12
12	0.870	5	0.038	18
13	0.884	3	0.037	28
15	0.638	14	0.046	20
16	0.838	8	0.046	26
17	0.850	7	0.094	7
18	0.705	13	0.041	39
19	0.939	1	0.033	27
20	0.862	6	0.041	14
21	0.875	4	0.031	39

Table 8.3 : Values of D for Industries

(c) Full Range

Ind. No.	D^f	rank	standard error	degrees of freedom
1	0.863	4	0.020	36
4	0.830	8	0.012	100
5	0.825	9	0.017	36
6	0.745	14	0.028	26
7	0.803	11	0.015	59
8	0.642	17	0.039	9
9	0.677	16	0.041	20
11	0.761	13	0.030	27
12	0.851	6	0.016	37
13	0.907	1	0.016	53
15	0.737	15	0.021	45
16	0.797	12	0.019	56
17	0.855	5	0.037	15
18	0.813	10	0.015	81
19	0.897	2	0.011	57
20	0.847	7	0.022	25
21	0.881	3	0.012	71

Table 8.4 : Values of D for Subgroups

(a) Positive Range - D^+

Ind No.	Subgroup No.	D^+	rank	standard error	degrees of freedom
1	2	0.798	9	0.088	11
4	5	0.761	13	0.034	35
5	4	0.957	4	0.072	7
7	1	0.881	6	0.035	21
9	1	0.703	15	0.137	8
11	1	1.029	1	0.064	9
13	1	0.876	7	0.029	23
15	1	0.784	11	0.089	9
15	3	0.945	5	0.093	9
18	1	0.758	14	0.055	9
18	2	0.676	12	0.065	10
18	3	0.875	8	0.074	19
19	3	0.794	10	0.043	16
20	3	1.029	1	0.117	6
21	2	1.011	3	0.061	7

Table 8.4 : Values of D for Subgroups

(b) Negative Range - D^-

Ind No.	Subgroup No.	D^-	rank	standard error	degrees of freedom
1	2	0.916	2	0.068	9
4	5	0.819	6	0.038	32
5	4	0.803	7	0.148	7
7	1	0.709	11	0.049	23
9	1	0.557	14	0.139	7
11	1	0.401	15	0.082	8
13	1	0.866	5	0.029	23
15	1	0.638	12	0.032	7
15	3	0.799	8	0.108	8
18	1	0.886	3	0.070	10
18	2	0.632	13	0.078	9
18	3	0.712	10	0.062	21
19	3	0.881	4	0.035	15
20	3	0.740	9	0.087	10
21	2	0.998	1	0.078	9

Table 8.4 : Values of D for Subgroups

(c) Full Range - D^f

Ind No.	Subgroup No.	D^f	rank	standard error	degrees of freedom
1	2	0.843	18	0.032	22
1	3	0.972	2	0.065	7
4	1	0.812	24	0.035	13
4	2	0.759	33	0.044	12
4	4	0.888	8	0.084	6
4	5	0.847	17	0.015	68
5	3	0.746	35	0.059	8
5	4	0.858	15	0.040	16
6	4	0.802	28	0.029	13
7	1	0.808	25	0.019	46
7	2	0.737	38	0.042	16
8	1	0.636	41	0.082	8
9	1	0.665	40	0.052	17
11	1	0.800	29	0.045	20
11	2	0.907	6	0.063	9
12	2	0.940	4	0.049	11
12	4	0.794	30	0.057	8
12	6	0.807	24	0.042	14
13	1	0.901	7	0.012	47
15	1	0.760	32	0.029	18
15	2	0.850	16	0.042	12
15	3	0.816	22	0.051	19

(c) Full Range - D^f (cont'd)

Ind No.	Subgroup No.	D^f	rank	standard error	degrees of freedom
16	1	0.823	21	0.060	11
16	2	0.750	34	0.055	14
16	3	0.859	14	0.041	14
16	4	0.690	39	0.055	11
16	5	0.823	21	0.052	11
17	1	0.802	28	0.044	13
18	1	0.880	10	0.027	22
18	2	0.739	37	0.040	20
18	3	0.781	31	0.027	42
19	1	0.887	9	0.034	15
19	2	0.980	1	0.032	12
19	3	0.864	13	0.015	32
20	2	0.840	19	0.048	9
20	3	0.868	12	0.044	19
21	2	0.958	3	0.028	18
21	3	0.871	11	0.045	8
21	4	0.812	24	0.074	8
21	5	0.741	36	0.047	9
21	6	0.910	5	0.038	13

Diagram 8.2 Industries - Positive Range

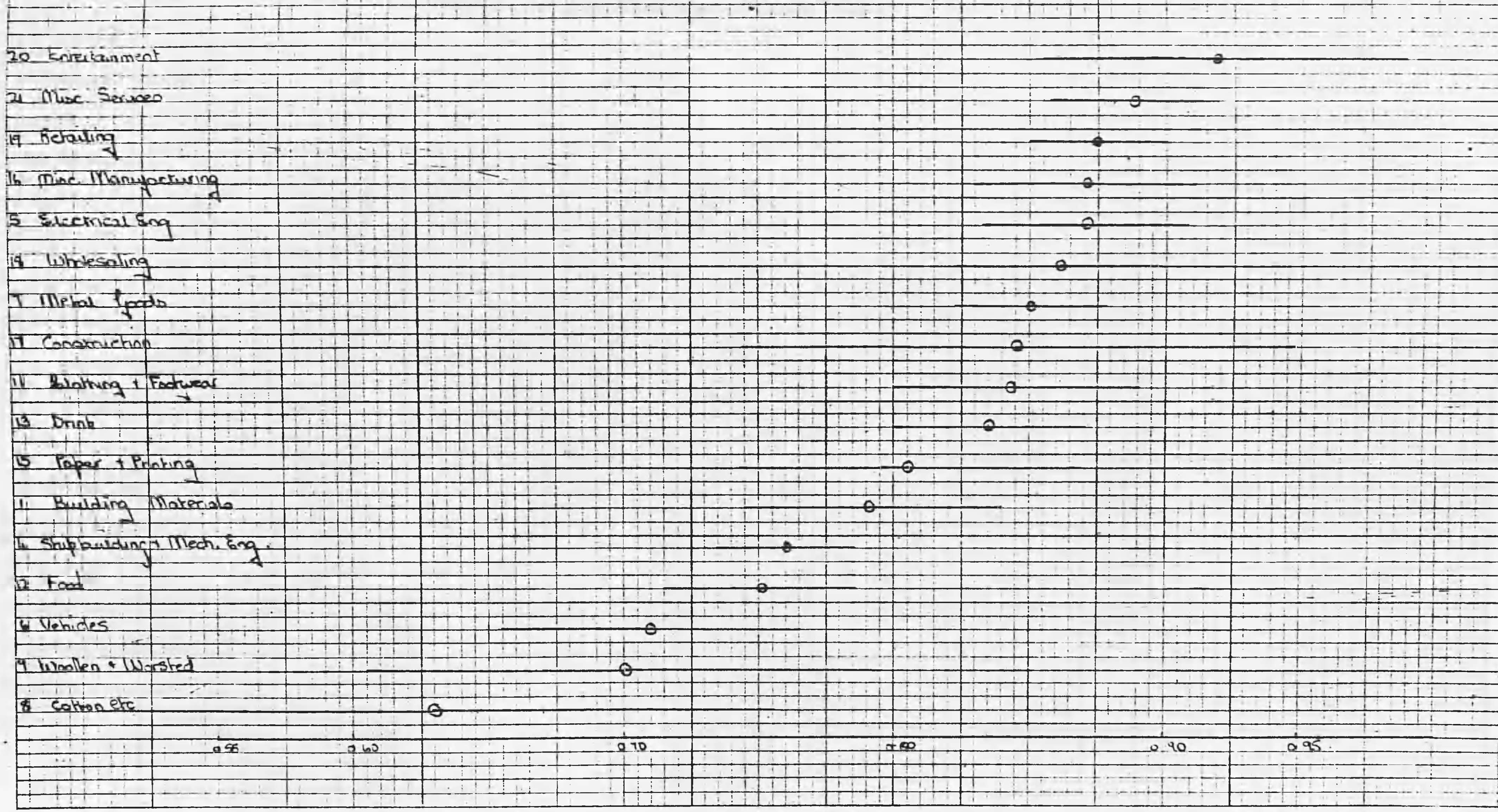


Diagram 8.3 Industries - Negative Range

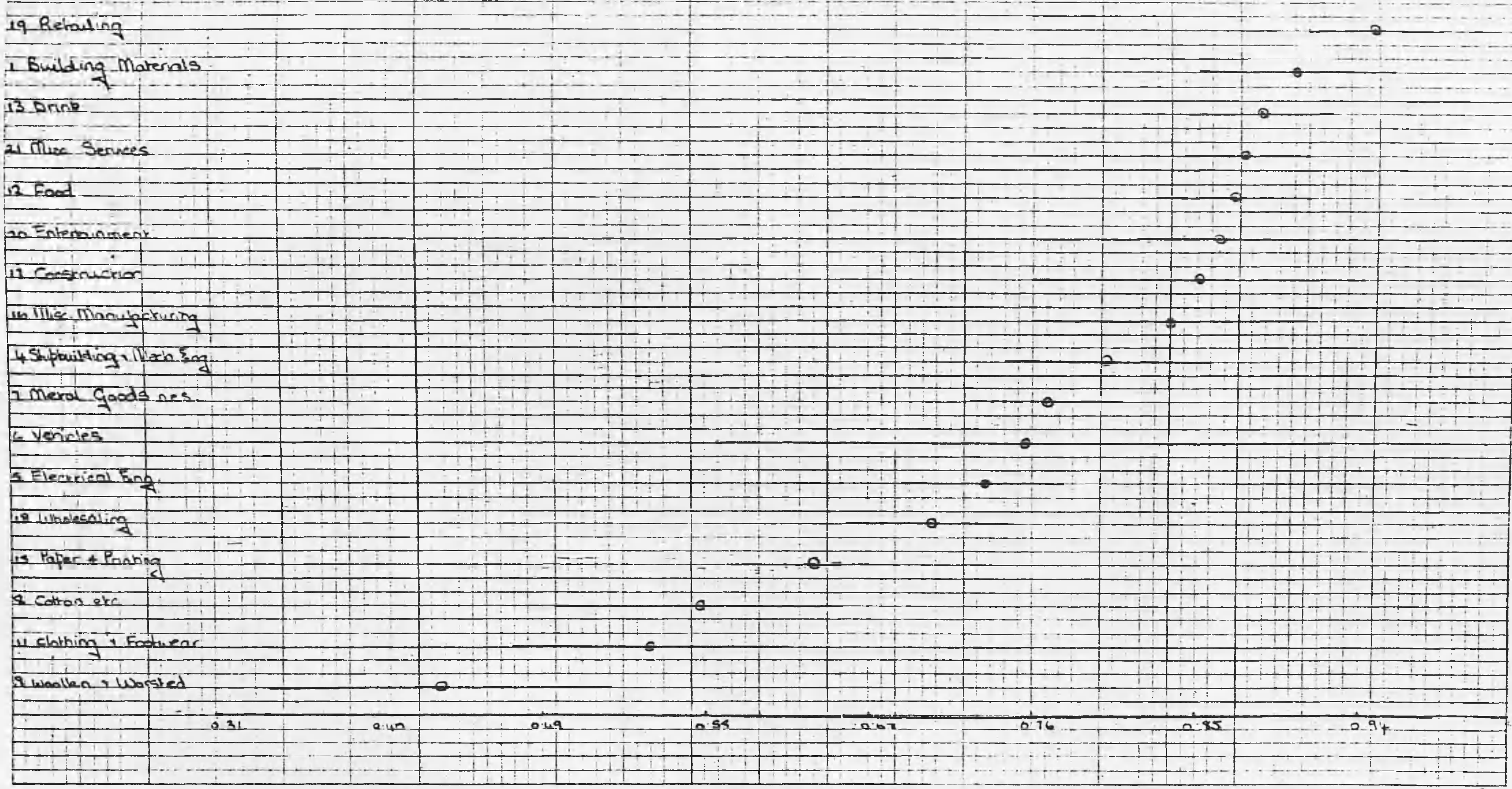
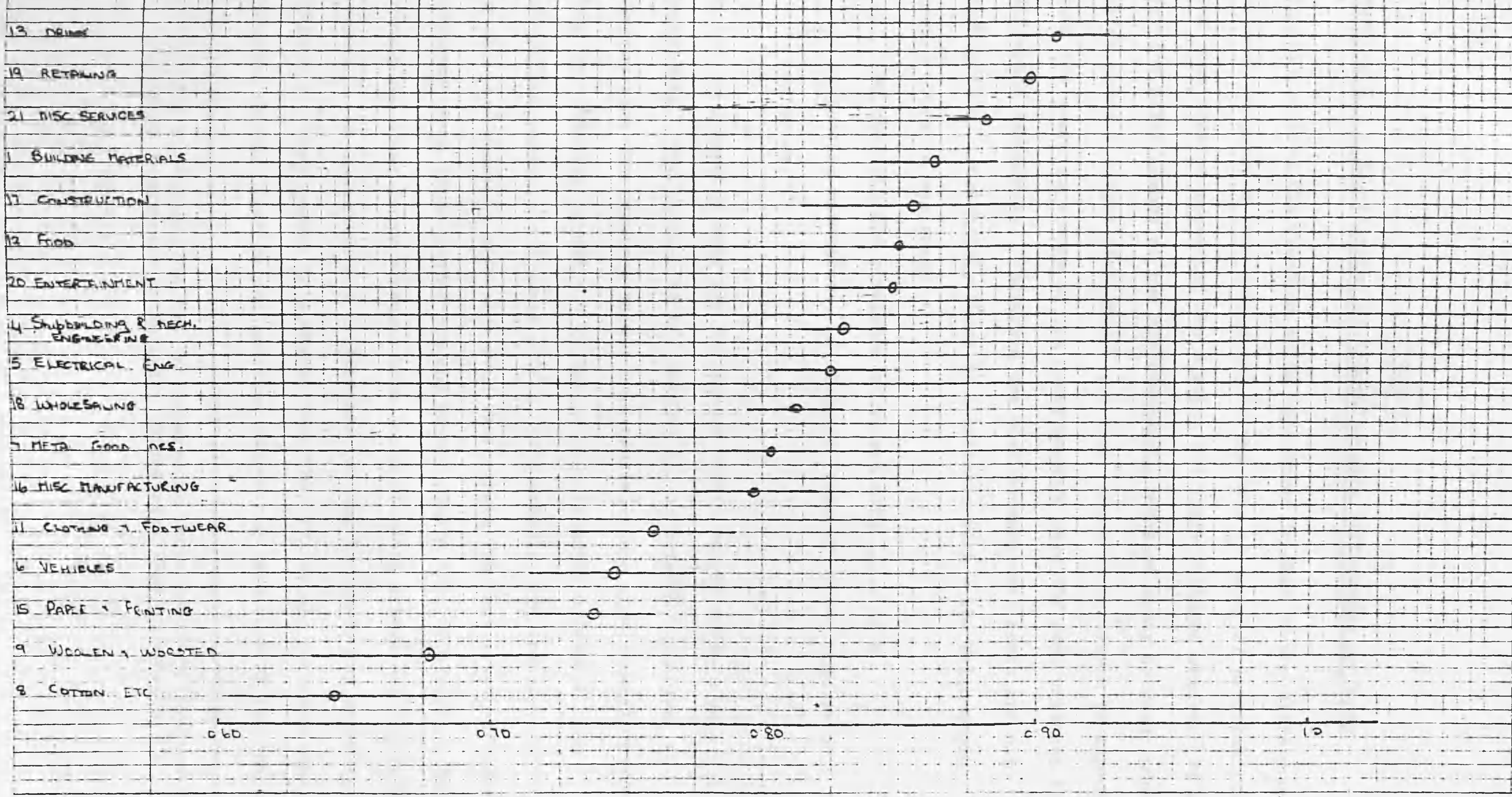


Diagram 8.4 Industries - Full Range



Section 8.3 : Significance of Inter-Industry Differences in Decay

In this section the question to be considered is that of the differences between industries (and subgroups) in the rate of decay of profitability. The last section presented the results and their standard errors. To test for the significance of the differences in rates of decay between industries poses a slight statistical problem: there is no reason to expect that the sampling errors of the decay measure have the same variance in different industries. Therefore the most conventional tests are not appropriate. Fortunately there is a suitable test - the Welch-Aspin test.[1] This is designed:

> "for use when the precision of an estimate ..... of a population parameter ..... depends linearly on two population variances."[2]

It has been used to test the difference within ranges between each pair of industries. The pattern of the results may be briefly summarised as showing that the industry ranked n is generally not significantly different from the industry ranked n + 1, but is significantly different from industries ranked n + r where r > 1. For example, the industry ranked 6th is not significantly different from that ranked 7th, but is significantly different from those ranked 8th and below. There are, of course, a few industries whose decay measures have large standard errors and break this pattern. The insignificant differences (at the 5% level) are shown in Table 8.5. They amount to somewhat less than 10% of all pairwise comparisons in the negative and positive ranges and less than 2% for the full

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1) Aspin A A, "Tables for Use in Comparisons Whose Accuracy Involves Two Variances Separately Estimated", Biometrika 1949 pp 290-293

2) Aspin A A, op cit p 290

range. The testing of significance has not been done for all the subgroup results but the behaviour of those tested is similar to that found for the industries.

The results enable us to conclude that the decay rate does vary significantly between industries and therefore that it is a dimension of industry performance by which industries may be distinguished.

Table 8.5 : Differences Between Industries in their Rates of Decay

Pairs of industries for which differences are insignificant at the 5% level.

(a) Positive Range

Industry No.	with Industry No.
1	5
4	12
6	8, 9
7	11
16	5, 13, 18, 21
17	5, 7, 11, 13, 16, 18, 19, 20, 21
19	5, 16, 20, 21
21	5, 16, 19, 20

(b) Negative Range

Industry No.	with Industry No.
5	6, 7
6	7
8	11, 15
12	20, 21
13	1, 12, 17, 21
17	4, 12, 13, 16, 20, 21

(c) Full Range

Industry No.	with Industry No.
1	17
4	5
6	15
12	17, 20
17	20

See text for test of significance used.

Section 8.4 : Comparison Between Ranges

The results for the positive and negative ranges differ and it is relevant to ask whether these differences may or may not have arisen by chance. Having considered whether D^+ is significantly different from D^- for each industry, we must turn to consider the similarity in the ordering of industries according to the decay rates in the two ranges.

Although there might be more justification for assuming a similar distribution of errors in each range for a given industry, this has not been done and so the Welch-Aspin test has again been used. Twelve out of the 17 industries have significantly (5% level) different decay measures for the positive and negative ranges.[3] It is therefore reasonable to conclude that the decay rate does generally differ above and below the mean. Whereas 12 of the 17 industries showed $D^- < D^+$, i.e. that profitability decays faster below the mean, only 7 out of the 12 with significant differences show the same inequality. This weak support for the thesis that D^+ has a tendency to exceed D^- is reinforced by the subgroup figures. These show that 12 out of 15 subgroups[4] for which separate range figures have been calculated have D^+ significantly different from D^- and 8 out of that 12 have D^+ greater than D^-. It seems safe to conclude that the general pattern is of faster decay below the mean.[5]

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3) The five with insignificant differences are Industries 6, 8, 9, 17 and 21.

4) The three with insignificant differences are Industry 13 subgroup 1, Industry 18 subgroup 2 and Industry 21 subgroup 3.

5) It might be argued that revaluations raise the rate of decay more in one range than the other. Whittington op cit pp 64-65 finds that in 1948-1954 "we cannot say whether revaluing companies would be more or less profitable than average ..." while in 1954-1960 it appears "companies which revalued were rather more profitable than the average." Therefore if revaluation introduces any bias it should lower D^+ relative to D^-.

Looking now at the ordering of industries for the two ranges, Table 8.6 shows the rank correlation coefficients between the different ranges. The correlation between the positive and negative ranges is moderate at the industry level and negligible at the subgroup level. This has important implications for any attempt to identify factors that explain the rate of decay of profitability. The process that brings about a fast rate of decay of high profitability must differ from that which brings low rates of return quickly back towards normal levels. This question will be dealt with in Chapter IX where the factors affecting the decay process receive some preliminary investigation.

Table 8.6: Rank Correlations Between Decay Measures for the Different Ranges

	D^+ against D^-	D^+ against D^f	D^- against D^f
Industry	0.41	0.48	0.91
Subgroup	-0.02	0.32	0.83

When we move on to consider the rank correlations between the separate and full range measures, moderate correlation coefficients are found between D^+ and D^f while the correlation between D^- and D^f is strong at both levels of aggregation. It would appear that the below average observations have more influence upon the full range equations than the above average observations. This may wholely or partly be explained by the fact that the negative skewness of the distributions of rates of return[6] leads to larger absolute deviations from the mean in the negative range classes.

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6) See Section 4.5

Section 8.5 : Discussion of Some Individual Cases

In this chapter we have decided upon a measure of decay and determined that there are only a handful of cases where the choice of decay function is critical. With a chosen set of measures for each range we have considered the statistical significance of differences between industries and concluded that we can distinguish between most industries according to their rate of decay. Finally, in the previous section we found that the positive and negative ranges must be regarded separately, both because of the actual values of the decay rates and because of their ordering.

Here the intention is to look a little more closely at the actual results at the industry level. The first point to be made is that we have no absolute standard by which to decide whether a decay rate is too slow or too fast. It is only in cases where great importance is placed upon sufficient incentives to technical innovation that the decay rate might be regarded as too fast. The view that will be taken here is that industries err towards the laggardly rate of decay. The causes of such impeded decay were discussed in Chapter II and will be pursued empirically in the next chapter.

Without a standard by which to discuss rates of decay, the only basis of evaluative judgements must be the performance of other industries in this respect. The question at its most basic must be: does this industry have a particularly slow rate of decay by comparison with the remaining 16? The question of whether to use the mean or median as the reference point is unimportant as their locations are close and fine distinctions cannot be drawn in this context. As a starting point in a comparison of industries, Diagrams 8.2 to 8.4 show for the three ranges the relative positions of each industry, the standard errors being also graphically represented. With these diagrams and the information about significant differences provided in Table 8.6, various patterns of grouping may be attempted. Unfortunately the positive and negative ranges differ sufficiently to prevent any similar grouping being employed in both. Even if a pattern of grouping is chosen arbitrarily and imposed upon the ranges, the dissimilarity in ordering is great enough to mean that there are few industries that fall in the same group in each range.

Therefore the method of procedure adopted is to first look at the few industries that have very slow rates of decay in both positive and negative ranges and then at those with very fast rates in both ranges. Two industries only have extremely slow rates of decay in both ranges; they are both in the Service sector - Retailing (no. 19) and Miscellaneous Services (no. 21). A third Service industry - Entertainment (no. 20) - is not quite as consistent as the other two but does have slower than average decay in both ranges, and the slowest of all in the positive range. There is no immediate explanation for this distinctive behaviour of 3 out of the 4 service industries. One reason might be the relative size of quoted companies to all companies in these industries. If, as seems plausible, quoted companies in the Service sector are very much larger than the average service company, their market power following from that size differential may permit the maintenance of rates of return at a stable level. The approximately average behaviour of the Wholesaling industry (no. 18) suits the argument as it is characterised by larger units than the other Service industries. The exceptional behaviour of Retailing is also partly explained by the conditions of local monopoly which often prevail and by the constraints upon margins that applied to retail traders during the period under examination. It is initially surprising that the Service sector, which is usually regarded as particularly competitive should have a slow rate of erosion of high profits, especially as it has a small ratio of fixed to working capital and rather unspecialised fixed capital - both factors that should lead to fast rates of decay. Of course the earlier point about the size of quoted companies in the Service sector may mean not only exceptional market power but also that in other respects the quoted companies may be uncharacteristic of the industries as a whole.

Turning now to industries with a fast rate of decay, two industries are consistent: Cotton (No 8) and Woollen and Worsted (No 9). These are perhaps predictable occupants of this particular place. The experience of the Textile industries since the early 1950's has been one of fierce, mainly foreign, competition and thus a rapid decay of above average profitability is unsurprising. There has also been a continuing policy of encouraging the scrapping of old machinery and therefore the main obstacle to the rapid restoration of normal profitability has been, at least, lowered in these industries.

Whilst no other industries clearly stand as having fast or slow decay in both ranges, the evidence of the separate ranges and the full range results does suggest two more industries are worth examination. The slow decay one is Industry 13 (Drink). This is completely dominated numerically by the Brewers, as a comparison of Tables 4.3 and 4.4 shows. Although the consolidation of the Brewing industry was only just beginning in the period under consideration, competition at the local level was not great, prices and market shares being reasonably stable. In such an environment a slow rate of decay is to be expected. The Paper, Printing and Publishing industry (No 15) is on balance a fast decay industry, but to treat it as one entity is difficult given its heterogeneity. Looking at the subgroup results reveals that whilst the Newspaper subgroup has slightly below average decay, the Printing group is very nearly average and the Paper group has quite a fast rate of decay. As the Newspaper group is the smallest and Paper the largest, the aggregate result is fast decay. It is compatible with the ideas of this study that the difficult entry and differentiated nature of the product of the Newspaper subgroup should lead to slow decay. The fast decay of the Paper industry tallies with the pressure of foreign competition in this industry.

It is appropriate at this point to look directly at the subgroup results and consider the extreme cases, as has just been done at the industry level. The subgroup results are notable first for the very great variety of rates of decay within one industry: Industry 4, for example, has subgroups ranked 8, 17, 24 and 33. The industry value is therefore very much influenced by the proportions of firms in each of its constituent subgroups and general comments about the industry (except in terms of similar summary statistics) are difficult to make. Taking as an example the previously cited Industry 4 and bearing in mind that full range decay rates reflect more of the negative than the positive range performances, we find Machine Tools (4/2) with a fast rate of decay and Constructional Engineering (4/4) with a very slow rate, whilst Shipbuilding (4/1) and Other Engineering (4/5) are around the average. Another very marked contrast occurs in the Clothing and Footwear industry (No 11) where Clothing (11/1) has a fast and Footwear (11/2) a slow rate of decay for the full range. This difference fits with basic knowledge about these two industries. As 86 out of 118 companies in this industry are in the Clothing subgroup, we find that the full range ranking for the industry is fifth fastest. In the separate ranges, D is only available for the Clothing subgroup and this behaves peculiarly. It has the slowest rate of decay amongst the subgroup results for the positive range and the fastest for the negative range. The effect of this upon the industry results lowers the ranking from ninth slowest in the positive to second fastest in the negative range.

Of the top 5 subgroups showing the slowest rate of decay, the Miscellaneous Services industry provides two: Catering etc (21/2) and Other Services (21/6). Retailing is represented by Stores (19/2). The Baking subgroup (12/2) also appears with Pottery (1/3) making up the list. At the other end of the list, fast decay is displayed by Cotton Spinning (8/1) and Wool (9/1). Building Merchants (18/2) and Leather (16/4) also appear at this end of the list, together with one subgroup from Miscellaneous Services, viz Transport and Communication (21/5).

Without bringing additional quantitative information on industry characteristics we can only conclude from this brief discussion that to some extent decay rates accord with expectations but that the very great differences between ranges makes interpretation difficult.

Much of the difficulty in discussing rates of decay follows from the lack of any economic standard by which to adjudge their desirability. The present study cannot hope to provide this, but it can help a little by proffering an equivalent measure to the rate of decay that is perhaps more intuitive.

The rate of decay tells us what proportion of the abnormal profitability is eliminated in one year. We could as well ask about the half-life of the abnormal profitability: how many years does it take to eliminate a given proportion of these abnormal rates of return? Taking the given proportion as 50 per cent we get an equation:

$$D^N = 0.5$$

where N = the half-life, i.e. the number of years to eliminate half the excess (or deficient) rates of return.

Such an equation may be evaluated by taking logs:

$$N = \frac{\log(0.5)}{\log(D)}$$

The values of this measure for the three ranges for the industry level are given in Table 8.7. The measure has the useful characteristic of throwing up more clearly than D the extreme cases. In the positive range, Industry 20 has a half-life 50 per cent longer than any other industry, whilst in the negative range Industry 19 has a half-life almost double that of any other industry. Omitting these extreme cases, the span of values in the positive range is from 1.5 to 5.6 years and in the negative range from 0.8 to 6.6 years. Such a spread of values as these might well be regarded as acceptable, leaving only the previously mentioned extreme cases representing undesirable situations; although perhaps a half-life of under one year might err on the rapid side. There is still no standard by which to judge these results absolutely, so such statements as have just been made can only be suggested appraisals. Before leaving this measure of decay, it is worth pointing out that for all three ranges the average half-life is nearly 4 years. To present a numerical example; this means that a firm earning 25% in an industry whose average is 15% would on average be earning 20% after 4 years and 17½% after 8 years. Such a rate of adjustment surely cannot be regarded as over-rapid and therefore the initial premise that decay rates generally err on the slow side does not seem unjustified.

Table 8.7 : Half-Life Equivalents to Rates of Decay

Measured in years

Industry No.	Positive Range	Negative Range	Full Range
1	2.97	6.64	4.70
4	2.53	3.12	3.72
5	5.02	2.33	3.60
6	2.02	2.47	2.36
7	4.29	2.51	3.16
8	1.50	1.26	1.56
9	1.99	0.84	1.78
11	4.06	1.16	2.54
12	2.42	4.98	4.29
13	3.87	5.63	7.10
15	3.23	1.54	2.27
16	5.06	3.92	3.06
17	4.08	3.86	4.43
18	4.78	1.98	3.35
19	5.15	11.03	6.38
20	8.09	4.67	4.17
21	5.57	5.19	5.47

The general conclusions of this section are rather negative. It is clear that decay is not simply or strongly related to other characteristics of industries - this will be pursued further in the next chapter. Secondly, only a few industries display distinctive and similar decay characteristics in both ranges. This clearly raises problems in evaluating industries unless one or the other range is regarded as the more important. Thirdly, the constituent subgroups of some industries have considerable differences in their rates of decay leading to problems in performing analysis of decay at the industry level.

Section 8.6 : Summary

In this chapter a decay statistic has been formulated. It is the average ratio of r_t to r_{t-1} over the relevant range and its form depends upon the decay function. For this purpose, the coefficients of the decay functions are regarded as estimates of the parameters of the true decay function with the decay origin properly specified. It was found that the decay statistics based on one equation form correlated highly with those from the other forms. Further, there were only a few instances of the equation choice making more than a minor impact upon the ranking of the particular industry or subgroup. Therefore it was concluded that equation choice did not have a critical influence upon the overall ranking of industries according to their rates of decay.

Consideration of the precision of the decay coefficients revealed that most pairs of industries differed significantly in this respect and therefore that decay of profitability is a dimension of industry performance which does separate and distinguish industries (and subgroups). In the last section certain industries displaying rather extreme rates of decay were briefly examined.

The positive and negative ranges were found to differ very greatly, the ordering of industries in the positive range bearing approximately no relation to the ordering in the negative range. Some evidence was also found to support the view derived from the inspection of the estimated equations, that the rate of decay is faster in the negative than the positive range.

APPENDIX TO CHAPTER VIII

The Decay Origin

So far the assumption has been made that the mean industry rate of return is a good approximation for the decay origin, that is, the point towards which the decay of profitability is directed. It is now possible to consider the validity of this assumption.

In the first part of this Appendix, the calculated values of the decay origin are presented. In the second section we directly consider the assumption that the decay origin and the mean coincide. Thirdly the evidence for differing decay origins for the positive and negative ranges is examined. Fourthly the possibility of relationships between decay origins and decay coefficients is investigated. The last two sections attempt statistical and economic explanations respectively of the foregoing observations.

8A1 Calculation of the Decay Origin

In Section IV.1 where various forms of decay function were developed, the possibility and effects of a deviation of the mean from the decay origin were considered. In the case of the linear form, if the deviation of the decay origin from the mean is θ, then the constant term equals $\theta(\beta-1)$ where β is the slope coefficient and θ is positive when the mean is greater than the decay origin. If the linear cubic form is found to be appropriate, then the mean must coincide with the decay origin. If this is not so and there is nonlinearity, the cubic form become appropriate.

It was found in Section 8.4 that, for most industries, a different decay rate prevailed in the positive range than in the negative range. This indicates that the full range function will be an untrustworthy guide to the decay origin. Therefore this appendix will restrict its attention to the separate range functions. This has a beneficial side-effect: the cubic was never chosen for a separate range and so we are not faced with the problems of estimating θ from that functional form.

Table 7.1 shows five cases[1] where the linear cubic form was found appropriate for the separate ranges. For these therefore θ may be taken to be zero - the mean coincides with the decay origin. There are another five such cases amongst the subgroups[2]. The remaining cases are all linear.

To calculate θ from the linear function, we take the ratio $^{a}/(b-1)$ where a is the estimated constant and b the estimated slope coefficient. The results at the industry level are shown in Table 8A1 in standard deviation units in columns 1 and 4 and in percentage point units in columns 3 and 6. θ takes predominantly positive values and in both ranges has an average value of between 2 and 3 percentage points. In other words, the decay origin seems to lie a small amount below the industry mean. This is more consistently demonstrated in the negative range than the positive. This contrast is also found at the subgroup level.

8A2 Does the Decay Origin Differ Significantly from the Mean?

Further discussion of the value of θ must depend upon the confidence limits that can be assigned to the calculated values. The standard error of the ratio of two stochastic quantities poses considerable problems. In what follows, reliance will be placed upon the result presented by O'Brien and Hilton[3] that gives (asymptotic) 95% confidence intervals:

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1 Positive range, industries 15, 18. Negative range, industries 4, 6, 16.

2 Positive range, 11/1, 15/3, 18/1, 18/3. Negative range, 20/3.

3 O'Brien, R.J. and Hilton, K., 'The Significance of Structural Coefficients in Economic Models', unpublished.

Table 8A1 Decay Origin - Industry level

Industry No	Positive Range: Decay Origin ( ) (s.d. units) (1)	Standard Error (s.d. units) (2)	Decay Origin ( ) (%age pts) (3)	Negative Range: Decay Origin (s.d. units) (4)	Standard Error (s.d. units) (5)	Decay Origin (%age pts) (6)
1	-0.0880	0.1399	-0.85	0.1960	0.1398	1.89
4	-0.1517*	0.0699	-1.75			
5	0.5054	0.3296	6.61	0.3887	0.4059	5.08
6	-0.0897	0.1816	-1.10			
7	0.3470	0.1776	4.44	0.1573	0.4749	2.01
8	-0.0617	0.1308	-0.71	0.1282	0.0715	1.48
9	0.1211	0.8424	1.21	0.3387*	0.0558	3.37
11	0.2191	0.2150	3.12	0.3831*	0.0512	5.45
12	-0.1558	0.1457	-1.73	0.1702	0.2450	2.05
13	-0.1359	0.1339	-0.86	0.4517*	0.1085	2.85
15				0.2099*	0.0670	2.57
16	0.6484	0.4197	8.56			
17	0.0491	0.3559	0.61	0.1280	0.2156	1.59
18				0.3627*	0.0604	4.04
19	0.1190	0.1778	1.16	0.1448	0.2985	1.41
20	1.1829*	0.1154	11.99	0.0862	0.1507	0.87
21	0.3496	0.2658	2.79	0.3384*	0.1512	2.70
Average			2.23			2.67

$$\frac{a}{(b-1)} \pm 1.96\sqrt{(\{S_a^2 - 2S_aS_t.\rho.\frac{a}{(b-1)} + S_b^2\left(\frac{a}{b-1}\right)^2\}/(b-1)^2)}$$

where S_a^2 is the estimated variance of a

S_b^2 is the estimated variance of b

ρ is the correlation coefficient between a and b

It is the square root portion of the above formula that is given as the standard error in Table 8A1.

At the industry level, the hypothesis that θ is zero is rejected in 8 instances by the above test. This will tend to reject the null hypothesis incorrectly rather than accept it because the confidence interval is asymptotic. In only 2 subgroup cases is the hypothesis that θ is zero rejected. Overall therefore the use of the mean as the decay origin does not seem to have involved very much approximation.

As the subgroup results reveal only 2 out of 30 cases where θ is significantly different from zero - a number that might well occur by chance with this test - attention will from now on be restricted to the industry level results. It is worth noting that the contrast between industry and subgroup results might be used to argue that the deviations of the industry level decay origins from the mean are a consequence of aggregating over subgroups. But inspection of the component subgroups of those industries with significant values of θ does not suggest more heterogeneity of average rates of return than usual, nor more heterogeneity of decay rates. Therefore whilst it may stand as a general explanation of the industry/subgroup contrast, it does not seem to assist in explaining differences between particular industries in this respect.

Of the 8 values of θ that differ significantly from zero, all but one are positive. Thus the evidence that, if the decay origin lies away from the mean, it lies below the mean is strengthened. Of the 12 industries with

θ having the same sign both for positive and negative ranges, 10 have θ non-negative and 2 have it non-positive. Of the remaining industries (with contradictory signs) only one has a significant value for θ: industry 13 for the negative range. So the significant results and the consistent results point to a decay origin at or below the mean. But as only 8 out of 34 estimates of θ differ significantly from zero and as the test used underestimates the standard error, the evidence against the mean is not strong.

8A3 Does the Decay Origin Differ Significantly between Ranges?

For every industry the decay function has been estimated separately for those observations relating to above average profitability and for those relating to below average profitability. Consequently there are two estimates of θ for each industry (θ^+ & θ^-). Inevitably these will differ, the question is whether the differences can or cannot be attributed to chance.

As this question is taken after that of the preceding section it must take note of the results there reported. So where both θ^+ and θ^- were there found insignificantly different from zero and of the same sign, it must be concluded that they do not differ significantly one fron another. Where one of the ranges has had the linear cubic form of decay function fitted, the exercise is more awkward. There is no standard error estimated for θ in such cases. The uncertainty relating to the value of θ is primarily derived from the fact that selection of a particular equation form is never sure. Such uncertainty is not amenable to standard statistical techniques. Therefore in the present context, θ has been taken as known with certainty to equal zero where the linear cubic form has been selected.[4] The remaining

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4 This will lead to incorrect rejection rather than incorrect acceptance of the null hypothesis of no difference. But only one industry (6) might thus be misclassified.

cases have been dealt with using the Welch-Aspin test. Apart from those involving the linear-cubic form, the test of significance has been a 5% one.

The results are evenly balanced: 8 industries[5] have θ^+ significantly different from θ^- and 9 do not show a significant difference. It therefore must be concluded that for some industries, either for statistical or economic reasons, the estimates of the location of the decay origin calculated from the separate ranges do diverge.

8A4 Decay Origins and Decay Coefficients

It proves interesting to look at the connection between θ and the slope of the decay functions. The results are summarized in Table 8A2.

Table 8A2 Decay Origin and D - Numbers of Industries

	$D^+ \geqslant D^-$	$D^+ < D^-$
$\theta^+, \theta^- \geqslant 0$	9(7)	2(1)
$\theta^+ < 0, \theta^- \geqslant 0$	1(0)	5(4)

Bracketed values give the number of industries where D^+ differs significantly from D^- see Section 8.4 footnote 3.

In the majority of cases, the sign of θ^+ is the same as the sign of $(D^+ - D^-)$. This result is not altered if the industries where D^+ does not differ significantly from D^- are rejected. Of the two industries where θ^+ is significantly different from zero, both lie in cells on the principal diagonal of Table 8A2. If we restrict ourselves to those industries where

5 Industries 1, 4, 8, 12, 13, 15, 18, 20.

θ^+ and θ^- are significantly different, then we find 7 out of 8 on the main diagonal. (3 in the top left hand cell and 4 in the lower right hand cell). Before attempting explanation of this result, it can be reported that the sign of $(\theta^+ - \theta^-)$ shows no relationship with either the sign of θ^+ or the sign $(D^+ - D^-)$.

8A5 Statistical Explanation of the Relationship between D and θ

Explanations based on linear decay relationships lead to the requirement that θ^+ and θ^- should have the same sign. The results of Table 8A2 clearly rule out that as a general explanation, though it would suffice for the upper left hand cell of that table. But in the lower right hand cell, the decay origin appropriate to the positive range function lies above the mean whilst that for the negative range lies below.

If it is assumed that there is some nonlinearity of the form illustrated in Diagram 2.1, then fitting linear functions to the separate ranges would lead to a negative value of θ in the positive range and a positive value in the negative range. This holds in the case when the decay origin is correctly located at the mean. If the true decay origin lies below the mean, then the sign prediction for θ^- is reinforced. But the sign of θ^+ now depends upon the actual shape of the curve in the positive range and the size of the deviation of the decay origin from the mean.

This argument based on nonlinearity now provides the link between the sign of θ^+ and the sign of $(D^+ - D^-)$, or rather the size of D^+. For it implies that the smaller D^+, all other things being equal, the larger θ^+ will be and therefore the more likely θ^+ is to be negative despite the decay origin lying below the mean. In fact every industry for which θ^+ is positive has a below average value of D^+ and conversely of those industries for which

θ^+ is nonpositive 7 out of 9 have above average values of D^+. Given that D^+ and D^- are only moderately correlated; it is not surprising that we have detected a relationship with the sign of $(D^+ - D^-)$.

Therefore we may fit the results into a consistent pattern with the decay origin lying below the mean. This is not to reject the possibility that there are industries where it is above the mean. But the evidence that we have suggests that the converse predominates.

8A6 The Economics of the Decay Origin

It is now possible to turn to the economics of the decay origin and consider whether it is reasonable for the decay origin to lie below the mean. In addition it would be desirable to see whether there are economic arguments for the link with the decay rate, for which we have so far only provided a possible statistical explanation.

If the decay origin lies below the mean, then the interpretation in terms of the analysis of Chapter 2 would be that there is a net inflow of resources to markets even when rates of return in those markets are below the industry average. The decay origin is the point of reversal in the direction of net resource movement.

If the positive range decay origin exceeds the negative one[6] then there would appear to be a range of rates of return where resource in and outflows are in balance. The expected change in the rate of return in the next period for a firm whose rate of return in the present period is in that range would be zero. It is important to note that any such behaviour of the decay of profitability would lead to nonlinearity in the decay function.

In a situation with no capital rationing and firms investing down to the project whose rate of return equals the cost of capital, we would expect the decay origin to be the cost of capital. It is to be expected that average

6. 12 and 17 industries share this and 7 out of 8 for which θ^+ significantly different from θ^-.

rates of return are above the cost of capital. Therefore the decay origin will be below the mean. Factors that deter firms from investing right down to the margin will raise the decay origin above the cost of capital but may very well leave it below the industry mean.[7]

A second framework for explanation can be found in the behavioural theory of the firm. The model of Chapter 2 was based upon the resource allocation decisions of a multi-product firm. We may interpret those decisions behaviourally. In Chapter 2 a periodic search of markets in which the firm was already operating and of markets the firm felt capable of entering was posited.

In a behavioural context we might expect some standard resource allocation procedure to be generally employed and for search to occur only when certain stimuli were experienced. It might be more appropriate to suggest a three level process: firstly a standard allocation procedure is employed; secondly, that procedure is adjusted but no change in the set of markets is considered; thirdly, the search for new markets is initiated.

Cyert and March have discussed a situation very much akin to that presently under examination:

"... on each dimension of organisational goals there are a number of critical values - critical that is from the point of view of shifts in search strategy"[8].

The goal of profitability is our concern and the critical values are levels of profitability that trigger off changes in the resource allocation process. Because we are talking of multi-product firms, there are two types of critical profitabilities: those for individual products and those for the whole firm. If profitability of any one product falls below a critical value, some

7. It might be argued that this would lead to a larger divergence of the decay origin from the mean if the mean is high. But no such relationship is detectable in the results.

8. Cyert, R.M. and March J.G. 'A Behavioural Theory of the Firm' Prentice Hall, Englewood Cliffs, 1963 p. 123.

assessment of that product's share of available resources is likely. This may well occur whatever the firm's overall profitability. Although some connection between that overall value and the critical value for individual products would seem probable.

It is likely therefore that change in the standard allocation scheme will occur because of experience in individual markets and this will happen whilst the firm's overall profitability is above its critical value. This in itself may induce improvements in profitability i.e. decay of profitability from below origin levels. Once the firm's overall profitability falls below the critical level, it may be that efforts are contained within the range of possibilities defined by reallocation within the existing set of markets. But it is more likely that the third level - the full search - is embarked upon. As we move upwards away from the critical value, the likelihood of search or even reappraisal of standard allocations becomes decreasingly likely. So overlaid upon the process of resource allocation developed in Chapter 2 is this behavioural process.

The other behavioural effect that must be incorporated is the accretion or erosion of organisational slack. When the firm is well clear of its critical profitability such costs increase and play some part in the decay of high profitability. Conversely once the critical value lies above actual profitability, strenuous efforts will be made to reduce slack.

Now turn to the observation that D^+ generally exceeds D^-. This means that the rate at which profitability returns towards central values is usually faster for low than for high profitability: firms recover from bad periods more rapidly than they slip from successful situations. In the present analysis high profitability is eroded by the basic resource transfer process of Ch. 2 and by the accretion of organisational slack. Whereas low profitability is corrected by the resource transfer process, by the elimination slack and by the activation of the second and third stages of the firm's decision process. It is the behavioural components that seem likely to contribute the observed asymmetry of decay. As the second and third stages of the decision process are activated, so rates of improvement of profitability are likely to be increased. The precise rate of return at which the extra factor will come into operation depends upon the whole constellation of critical values. But it may be presumed that many more firms in the negative than the positive range are engaged in the latter stages of the decision process. It is also at least plausible to expect that the sloughing off of management slack will occur more rapidly than its accumulation. So D^+, if it differs from D^- should exceed it. This we have found.

If our behavioural arguments lead to the expectation that D^+ and D^- will differ, they also lead us to expect that the decay origin will tend to lie below the mean. We have seen the role that may be made out for the critical values of profitability. It is important to bear in mind that these values are adaptive: one of the effects of failure to achieve is an adjustment of the standard. Indeed it may well be that failure to attain only affects the decision process once there is little room for their further downward adjustment. The critical value will become less flexible as it falls towards that level of profitability regarded by management as the minimum safe level. It is probably not too cavalier to ignore the role of critical values until we get near the minimum safe levels and these - playing a part rather akin to the minimum profit constraint of such models of the firm as sales revenue maximisation - may be presumed to lie well below the industry mean in all except the most troubled industries. Therefore the behavioural factors involved in the decay of profitability will tend to produce a decay origin below rather than above the mean.

The qualitative difference between the processes bringing about the decay of high and low profitabilities cannot be presumed to be separated at a point profitability. There is likely to be a range of profitabilities where some firms are, for example, eliminating management slack whilst others are accumulating it. There will be some overlap. In this range the slope of the decay function will differ from both D^+ and D^-. There will therefore be some nonlinearity about the decay origin if there is an asymmetry in the decay process. This supports the explanation of the discrepancy between θ^+ and θ^-. The lines fitted to the separate ranges will hardly be affected by a small interval of different slope such as is suggested here. Therefore they will become inaccurate very close to the decay origin and bring about the effect suggested in 8A5.

Finally, can the behavioural factors provide an explanation of the relationship between sign $(D^+ - D^-)$ and sign (θ^+)? An argument with some plausibility may be constructed: the stronger the part played by behavioural factors, the more likely it becomes that D^+ exceeds D^-. Another effect of the behavioural factors is to lower the decay origin. The further the decay origin lies below the mean, the more likely it becomes that the observed θ^+ is positive despite the negative bias in this figure because of nonlinearity at the decay origin. So we may regard both the items in the relationship under consideration as reflecting the overall strength of behavioural factors.

In summary, we have seen that the use of the mean as an estimate of the decay origin is not seriously amiss. But any error is one of overestimation. Secondly we have seen that estimates of the location of the decay origin do differ between ranges and that this is probably a consequence of some nonlinearity in the decay function near to the decay origin. Thirdly we have found a relationship between the deviation of the decay origin from the mean (as estimated from the positive range) and the divergence between positive and negative range decay coefficients. Explanation of this is probably primarily statistical. Finally by introducing ideas from the behavioural theory of the firm it has been possible to explain both the difference between D^+ and D^- and the location of the decay origin.

CHAPTER IX

DECAY OF PROFITABILITY AND OTHER INDUSTRY CHARACTERISTICS

The main purpose of this study is achieved with the final measures of the decay of profitability. But in Chapter I it was argued that this measure contributed extra information about the performance of an industry, in particular giving a measure of the speed at which the equilibrating forces in the industry could bring about competitive equilibrium. The ranking of industries according to their decay of profitability gives us a comparison between industries along this dimension. The question to be investigated in this chapter is: "How do other measures of industry structure, performance and experience relate to this measure?".

We may divide this question in a number of ways. But the main distinction must be between studying relationships because of a belief in a causal connection, that is, where we believe some factor has influence upon the rate of decay of profitability, and studying relationships between variables which may each be influenced by a third factor and therefore are likely to vary together. This approximately coincides with the structure/performance distinction. It is reasonable to presume that the structure of an industry will influence performance in general and therefore, in particular, the rate of decay of profitability. Some arguments to this effect were presented in Chapter II and will be reviewed below. Comparing the rate of decay with other measures of performance will only partly involve the idea of direct causal connection between the two performance measures. But it is worth looking at in order to see to what extent comparison between industries on the basis of other performance measures has, through close correlation, involved implicitly comparison of rates of decay.

The statistical method of this chapter is very basic and rank correlations will be the main tool. The limitations of this are recognised but what multivariate analysis was attempted did not yield qualitatively different, or indeed stronger, results. In the event, the rank correlations that are found are very weak and only a minority attain even 5% significance. Although in a few situations the consistent behaviour of rank correlations is felt to strengthen the probability that the results are not chance ones, in general we are adducing evidence in support of hypotheses rather than providing tests of those hypotheses.

The second limitation of this work relates to the data employed. It would be a separate and considerable study to prepare the usual measures of structure and performance for the industry classification used here. Therefore attention has been restricted to published figures in a convenient form, and to measures that can be derived from the data used in this study. Measures of the latter kind have the serious disadvantage that they are based purely upon quoted companies and therefore are faulty representations of the industry as a whole. Because of this data problem, fewer variables are available at the subgroup level than at the industry level. All the data used, and where necessary explanations of their derivation, are given in Appendix F.

The remainder of the chapter is divided into three portions. The first, deals with the relation between the rate of decay of profitability and five measures of industry structure. The second section looks at the rate of decay and its relation to various performance measures. The third section reports the comparison of Whittington's decay coefficients with those produced in the present study. A summary concludes the chapter.

Section 9.1 : The Decay of Profitability and Measures of Structure

Two forms of concentration ratio are used: the conventional 4-firm concentration based on full industry data[1] and a measure calculated by Whittington, namely the proportion of the total net assets of quoted companies controlled by firms owning over £4 million net assets in 1954. The former is only available for the manufacturing industries and construction but at both industry and subgroup level, whilst the latter is available only at the industry level but for the service sector as well as manufacturing and construction.

The third main concentration measure employed is the Variance of the Logarithms of Size (Net Assets) of the firms in the sample. Hart[2] says:

> "If the underlying size distribution of firms is log normal, then (the variance of the logarithms of size) is the appropriate measure of concentration."

It also has the feature that calculating it only on quoted companies is likely to lead to a downward bias, whereas the concentration ratio of Whittington is biased upwards by the omission of the unquoted sector. The remaining two structural measures used are average size (net assets) and the variance of net assets.

The levels of correlation between CR4 and the other measures in Table 9.1 suggests that the latter are reasonably robust and not too severely distorted by the omission of unquoted companies.

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1) Sawyer M C, "Concentration in British Manufacturing Industry", Oxford Economic Papers Vol 23 1971, pp 352-383

2) Hart P E, "Entropy and Other Measures of Concentration", Journal of the Royal Statistical Society Series A Vol 134, 1971, pp 73-85

Table 9.1 : Rank Correlations Between the Structural Measures

At the Industry Level

	WhCR	Var (Log Size)	Var (Size)	Average Size
Sawyer 4-firm Concentration Ratio (CR4)*	0.83	0.73	0.77	0.83
Whittington Concentration Ratio (WhCR)		0.70	0.79	0.75
Variance of the Logarithm of Size			0.64	0.63
Variance of Size				0.87

* This measure is only available for Manufacturing and Construction and therefore 13 observations, not 17, are used in calculating these rank correlation coefficients.

In Chapter II, Section 2.5, it is stated that: "The closer the industry structure is to the purely competitive ...... the faster high rates of return will be reduced." The initial presumption is therefore that rates of decay will fall as the industry structure deviates further from the competitive ideal. Talking first specifically of the concentration measure, it is to be expected that high concentrations are maintained by devices to restrict new competition. These devices, of which barriers to entry are probably the most important, will obstruct the allocation of resources according to rates of return and therefore will slow down the rate of decay (and thus raise D). Two factors may act to weaken this relationship. In the first place, the measurement of the decay of profitability is not weighted by the size of firm. A highly concentrated market structure may be composed of a few large and many small firms. The operating environment of the small firms may appear highly competitive and their decay rates may be correspondingly high. Because of their numerical dominance, the industry decay rate may be relatively high. If such cases arise, the variance measures may show a stronger relationship with D than the concentration measures. The second factor relates to firm diversification: a high industry concentration measure may not necessarily imply highly concentrated markets if the firms of the industry are all well diversified.

The average size of firm in an industry is inserted to provide a proxy (probably weak) for the capital cost barrier to entry; as such we may expect it to correlate negatively with the rate of decay for reasons already given with reference to barriers to entry in general.[3]

There is another reason for expecting a negative correlation between average size of firm and the rate of decay of profitability. It is generally found[4] that there is a negative relationship between size and the variability of rates of return. It is reasonable to expect that high rates of decay accompany highly volatile rates of return. Therefore an industry of large firms might be expected to have a higher value of D, all other things being equal, than an industry of low average size. This line of reasoning and that based upon barriers to entry may not be independent - the scale barrier to entry by obstructing the reallocation of resources reduces the variability of profit experience.

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3) Whittington G, op cit p 72, and Samuels & Smyth op cit

4) Shepherd W G, "Elements of Market Structure", Review of Economics & Statistics Feb 1972 p 29, uses log (net assets) to catch more effectively the capital-cost aspect of barriers. Such a transformation is irrelevant for rank correlation purposes.

Table 9.2 shows how these structural measures relate to the rate of decay of profitability for the three ranges. The first point is that the correlations are weak with only one attaining a 5% level of significance. On the other hand, the majority of the correlations are, as expected, positive. That is, structures that would be regarded as

Table 9.2 : Rank Correlations Between D and Measures of Structure

		$CR4^+$	WhCR	Var (Log Size)	Var (Size)	Average Size
Industry	D^+	-0.04	0.10	0.24	0.19	-0.16
	D^-	0.39	0.36	0.50*	0.34	0.25
	D^f	0.30	0.25	0.35	0.24	0.23
Subgroup	D^f	0.02	*	0.13	-0.09	-0.10

\+ Using only Manufacturing industries and Construction.

* Significant at the 5% level. For test see T Yamane "Statistics" 2nd Edition, Harper Row New York 1960, p 470

more divergent from the competitive ideal than others do tend in the present sample of industries to be accompanied by slower rates of decay of profitability. But the structural measures have been shown to be intercorrelated (Table 9.1), and therefore the correlations with the rates of decay are not independent. That is, we cannot regard the results as five separate tests and take comfort from the similarity of the results despite the general insignificance. The intercorrelations between the structural measures were not so high that similar results for each of them provides no extra evidence over and above that given by one, but it supplies considerably less than would be provided by five separate tests. As the positive and negative range decay rates show very low correlation with one another, their similar results for three structural measures might be taken as extra support for the existence of positive relationship between D and non-competitive industry structures. As was stated in the introduction to this chapter, hypothesis testing is rarely possible. In the case of structure/decay relationships, the evidence we have obtained lends support to our expectations.

Whilst the general insignificance makes any more detailed examination rather dangerous, it may just be permissible to look at the difference between the ranges at the industry level. For each structural measure the correlation is lowest with the positive range decay measure. The negative range results are in every case the strongest. This consistent pattern suggests that the industry structure has more influence upon the decay of low profitability than of high profitability. The intermediate rank correlations for D^f follow from its nature as a form of average of the separate range decay rates.

The subgroup results are disappointingly weak and contrary. This is most likely a consequence of the data - the criticisms of the measures of structure already made apply with added strength at the industry subgroup level. Also, the reliability of the rates of decay is lower at the subgroup level. The range of rates of decay is very nearly the same for industries and for subgroups, but in the subgroup case 41 observations fall within this range while only 17 industries have to be fitted in. Even if industry and subgroup rates of decay were equally well determined, more random disturbance of the ordering would be likely for the subgroups. When the subgroups are less well determined, the ordering becomes even less reliable. Therefore it is not too disturbing to find rank correlations for the subgroups are lower than for the industries.

The conclusion of this section is that what evidence we have found supports the idea that the less competitive the industry the slower the rate of decay of profitability, but the evidence is by no means conclusive.

Section 9.2 : The Relation of Decay and Other Performance Measures

The definition of performance measure is rather broad in this section. First there are two conventional measures: growth of net assets and industry average profitability; then three measures relating to the inter-temporal behaviour of average profitability. These are the standard deviation of the annual averages, the trend in the annual average and the standard deviation of the residual error of the trend equation. The final measure is the average annual dispersion of rates of return within the industry. The precise definitions of these various measures are given in Appendix F, together with their values.

The reasons for looking at these various aspects of industry performance (or, more generally, behaviour) will emerge as this section proceeds, but the second group relating to the behaviour of the industry average rate of return over the period 1948-1960 needs some initial explanation. In Whittington's book "The Prediction of Profitability" he finds that part of the variation from industry to industry of the rate of decay is explained by variations in the industry average rate of return. It will be recalled that he uses two 6-year periods in his analysis. He therefore takes the difference in industry average between those two periods as the independent variable in an equation whose dependent variable is the industry rate of decay.[5] The strength of the results that he gets makes it essential to perform similar analysis with the decay rates presented in the preceding chapter. Whereas Whittington had only one available measure of the variability of industry average profit, because of his use of only two periods, here the choice is wider with twelve periods. Two separate arguments are available that

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5) Whittington G, op cit pp 91-97

are compatible with Whittington's results but suggest different measures for the present analysis. The first is that it is the rate at which industry average profitability falls that influences the internal rate of decay of profitability: this leads to using the trend. The other argument says that it is the volatility of the industry average that affects the rate of decay: this would imply the use of the standard deviation of the industry average or, removing the trend, the standard deviation of the variations about the trend line.

With a range of performance measures to consider it is necessary to clarify their inter-relations before progressing to an examination of how each of them is related to the rate of decay. A key to the inter-relation of three of the measures - growth, profitability and trend in profitability - may be found in the inter-industry equilibrium process. So far intra-industry adjustments have been looked at, but the same arguments lead to an analogous process between industries. In reality it is not a separate process but another facet of the overall adjustment of resource allocation. It was argued in Chapter II that most entry and exit will occur within the bounds of a single industry, so the inter-industry equilibration will primarily result from differential rates of accumulation of assets in different industries. There will be some movements of firms between industries but this is of lesser importance. If there is such a process of inter-industry equilibration, resources will accumulate fastest in the most profitable industries and this will tend to reduce profitability most quickly in these industries.[6] This

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6) As Whittington points out, " no industry experienced a substantial increase in profitability." Op cit p 91. Therefore it is relative rates of decrease of profitability that are appropriate to the argument in this context.

latter conclusion is supported by Whittington, who in his empirical conclusions finds: ".. a tendency for the average profitability ... of industries to regress towards the mean for all industries by an amount proportionate to their initial distance from the mean."[7] This tendency for inter-industry profitability differences to be eroded has also been examined by Stigler.[8] It therefore seems reasonable to expect that average profitability will be positively correlated with growth[9] and that both of these variables will be correlated with the trend in average rates of return. This latter correlation will be negative as the fastest growing industries will have the steepest (most negative) trends. There is a possibility that taking 12 year averages of these variables will obscure the postulated relationships because inter-industry differentials are eliminated well within that period. Stigler, for example, considers that there is no correlation between annual hierarchies of industry rates of return after 6 or 7 years.[10] Whittington, on the other hand, has already been mentioned as finding considerable persistency of inter-industry differences in profitability using 6 year averages. Such inter-correlations between growth and profitability would tie in with well-established links between growth and profitability at the firm level and with the importance of internal financing of investment. An influx of resources will have a tendency to lower profitability and the greater the influx the stronger that tendency.

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7) op cit p 104

8) Stigler G J, op cit

9) Whittington op cit p 25, finds his evidence supports the view that: "those industries which have the most profitable companies have the faster growing companies."

10) Stigler G J, op cit p 5

Referring to Table 9.3 where these rank correlations are presented, we see that expectations are confirmed. The growth to profitability correlation is quite the highest, while the correlations with the trend in average profitability are lower but of the correct sign. The weaker relations in this latter case probably reflect both the length of the period and the more complex relationships involved.

Table 9.3 : Rank Correlations Between Growth of Net Assets, Average Profitability and the Trend in Average Profitability

	Growth in Net Assets	Average Profitability	
	Industry	Industry	Subgroup
Average Profitability	0.94*	*	
Trend in Average Profitability	-0.30	-0.23	-0.57*

* Significant at the 5% level - see Table 9.2 for test used.

The next question is: how does the inter-industry adjustment process affect the intra-industry adjustment?[11] If resources flowing into the industry were evenly spread through all markets of that industry, any effect would be upon the industry average rate of return rather than on rates of decay. The same result would hold if the allocation of these resources to particular markets was independent of the profitability of the markets. But it is assumed throughout that the profitability of a market has some influence upon the allocation of resources within an industry. This must apply equally to these additional resources. Therefore an influx of resources to an industry means an influx predominantly to the

11) Whittington op cit p 97 finds "the inter-firm persistency of profitability ... negatively correlated with profitability". For this he uses the average industry rate of return in the earlier of his two periods - 1948-1954.

above averagely profitable markets. This will partly affect the industry average rate of return but the whole effect will not be absorbed in that way because of the concentration of the extra resources in the above average markets. The remainder of the effect will appear as an increase in the rate of decay in the positive range.

This can best be demonstrated by a simple example. Let the influx of resources be divided into two parts, the first encompassing an even spread through all markets. It will only affect the industry average rate of return. The second part is that which is concentrated in the above average markets. Let this, for simplicity, be evenly distributed through all the above average markets. With similar markets, this extra influx may be assumed to lower all rates of return by an equal amount: Δr . If M markets are of above and N of below average profitability, the industry average will fall by $\frac{M}{M + N} \Delta r$ and each above average market will move towards the mean by an amount $\frac{N}{M + N} \Delta r$. Therefore the positive range rate of decay will be thus inflated.

The simple model may be extended to demonstrate the effect upon the negative range rate of decay. The extra influx of resources does not impinge upon below average markets but the industry average rate of return is lowered by $\frac{M}{M + N} \Delta r$ and therefore the negative range of rate of decay is also increased because resources flow more strongly into the above average markets of the industry. Just as in Chapter II, the argument has been developed in terms of markets, the step to firms is direct as was explained in Section 2.6.

Therefore once we move from consideration of the process that moves firms towards normal profitability relative to the industry, to the factors and way industries move towards equilibrium, we find that a net influx of resources, unless distributed without respect to profitability, will tend to raise the rates of decay of both ranges.

Unless the proportion of incoming resources that go to the more profitable markets diminishes quite markedly with increases in the volume of resources flowing in, the effect upon rates of decay will be an increasing function of the growth rate of the industry. Therefore it seems reasonable to expect that an industry with high average profitability will on average have a high rate of decay.[12] From this we may derive expectations that growth will have a negative correlation with D and the trend in average profitability will have a positive correlation with D. The results are shown in Table 9.4.

Table 9.4 : Rank Correlations of Decay with Average Profitability, Growth of Net Assets, and Trend in Average Profitability

	Growth in Net Assets	Average Profitability	Trend in Average Profitability
Industry			
D^+	-0.14	-0.27	0.65*
D^-	-0.12	-0.26	0.78*
D^f	-0.05	-0.25	0.83*
Subgroup			
D^f	-	-0.09	0.28*

* Significant at the 5% level. See Table 9.2 for test used.

With the very notable exception of the trend variable, the correlations are weak, but in every case the sign predictions are fulfilled. The argument in terms of the inter-action of the equilibration processes at industry and firm level is therefore provided with some support.

12) Most researchers find a positive correlation between concentration and average profitability, and thereby link back to the preceding section (9.1). See Weiss L W, "Quantitative Studies of Industrial Organisation" in M Intriligator (Ed), "Frontiers of Quantitative Economics", North Holland Amsterdam 1971, pp 363-366 review this research.

In Table 9.3 trend was only weakly correlated with growth and average profitability, yet in Table 9.4, despite the weak correlations of these variables with the rate of decay, trend is very strongly correlated with decay. Therefore an explanation is not sufficient that relies upon growth as the prime mover of both the trend in industry average profitability and the internal rate of decay. The results do not conflict with the idea of a causal chain working from growth to trend and influencing decay en route, but they do suggest strongly that this is not the whole explanation of the high correlation between trend and decay.

There seem to be two possibilities. The first is that the other pressures bringing about downward trends in average profitability are, like the one already discussed, more effective in the more profitable markets. This would bring about a rise in rate of decay as previously argued. The other possibility is that variability of average profitability is related to the rate of decay: "in a less stable industry individual companies might have more opportunity to change their relative profitability, for better or for worse."[13] Before considering this line of reasoning, the correlations between the three measures of the inter-temporal behaviour of average profitability must be examined.[14] They are shown in Table 9.5.

The correlation between the trend and the standard deviation of average profitability is high, as was to be expected, because a large trend coefficient will tend to mean a high dispersion. The negative sign of the correlation is explained by the general pattern of downward sloping

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13) Whittington op cit p 91

14) See Smyth D J, G Briscoe & J M Samuels, "The Variability of Industry Profit Rates", Applied Economics 1969 Vol 1, pp 137-149. They report industrial concentration is insignificantly correlated with trend and variance of industry average profitability but significantly (5%) rank correlated with the residual variance about trend.

Table 9.5 : Rank Correlations of Measures of the Inter-Temporal Behaviour of Average Profitability

	Standard Deviation of Average Profitability		Residual Error about Trend	
	Industry	Subgroup	Industry	Subgroup
Trend in Average Profitability	-0.80*	-0.64*	-0.70*	-0.51*
Standard Deviation of Average Profitability	-	-	0.80*	0.74*

* Significant at the 5% level.

trends. On the other hand, the correlation between the trend and the standard deviation of the errors about the trend line is unexpected. It implies that the faster average profitability declines, the more irregular its behaviour. A steep decline over the period will tend to be associated with year to year volatility.

It is apparent from the high correlations between these three measures that it will not be possible to distinguish between the trend effect and the volatility effect. This is borne out by the very similar correlations

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ability. He found an R^2 of 0.31 using 21 observations whereas the results
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in Table 9.6, using 17 observations, approximate to an R^2 of over 0.6.
in Table 9.6, using 17 observations, approximate to an R of over 0.6.

Before these last two sets of results were introduced, two possible explanations of the strong correlation between trend and decay were suggested. Now we are faced with the more general problem of an explan-ation of the strong correlation between decay and all three measures of

Table 9.6 : Rank Correlations Between D and Measures of the Inter-Temporal Behaviour of Average Profitability

	Trend in Average Profitability	Standard Deviation of Average Profitability	Residual Error About Trend
Industry			
D^+	0.75*	-0.59*	-0.17
D^-	0.78*	-0.87*	-0.70*
D^f	0.83*	-0.91*	-0.78*
Subgroup			
D^f	0.28*	-0.36*	-0.36*

* Significant at the 5% level. See Table 9.2 for test used.

inter-temporal variations in industry average profitability. The link between trend and decay following from the process of inter-industry equilibration has not been rejected but has been found insufficient as a full explanation.

The first possibility refers back to the process whereby movements of profitability experienced more strongly by groups of firms with above

this be generalised to explain the link between the volatility of industry average profitability and the rate of decay, or is it only relevant to the trend-decay relationship? The initial step in considering this question is to apply the argument used for the case just stated to the other possibilities. So far we have looked at a fall in profitability of above average companies. The case of a rise in profitability of the more profitable companies implies a fall in the rate of decay both above and below the mean. If it is below average companies that experience a change in profitability relative to the rest of the industry, the conclusions are reversed: a rise in profitability leads to a rise in the rate of decay and a fall in profitability to a fall in the rate of decay.

clusions are reversed: a rise in profitability leads to a rise in the rate of decay and a fall in profitability to a fall in the rate of decay.

These contradictory effects make it unlikely that volatility of industry profitability experience would lead to an overall influence upon the rate of decay in either direction. The result we are trying to explain is a negative correlation between D and volatility, i.e. that volatility raises the rate of decay. In so far as volatility is mainly produced by the movement of above (below) average firms, its effect over a number of years should be approximately neutral on the rate of decay. A rise in the rate of decay would only be produced if falls in profitability were mainly experienced by the more profitable firms and rises in profitability by firms with below average profitability. This would involve a contraction in industry dispersion which is at least not evident (see Appendix A). Further, it is hard to think of an explanation for such a continuing phenomenon.

Therefore two possibilities are left. Either it is the trend that is producing the relationship or volatility does reflect conditions within the industry conducive to the rapid adjustment of resource allocations. The first argument relies upon the statistical effect previously employed, but says that clearly the inter-industry equilibration process is not the sole cause and that some other factor(s) must be operating to lower the relative profitability of the more profitable firms in the industry. The other argument is stated by Whittington:

> "Instability in the environment of the industry, as reflected in the change in its average profitability, was associated with greater internal mobility in terms of relative profitability of the individual member companies". 15

Stigler establishes a link between the instability of industry profitability and the competitiveness of the industry. He argues that:

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15) Whittington op cit p 95

> "Competitive industries will have a volatile pattern of rates of return, for the movements into high profit industries and out of low profit industries will - together with the flow of new disturbances of equilibrium - lead to a constantly changing hierarchy of rates of return. In the monopolistic industries, on the other hand, the unusually profitable industries will be able to preserve their preferential position for considerable periods of time." 16

Such an argument may be extended to decay rates via the structure-decay relationships investigated in the previous section. Thus the association between industry volatility and internal mobility suggested by Whittington may be explained (or partly explained) in terms of the influence of industry structure upon the inter-industry equilibration process.

The last of the performance measures to be considered is the average annual dispersion of profitability within an industry. The standard deviation of the rates of return of all companies in the industry has been calculated for each year of the twelve year period and then the standard deviations have been averaged over these years. It is possible that in all industries extreme absolute (rather than relative) rates of return decay faster than moderate rates of return. If this were so a high dispersion industry would have faster rates of decay because it contained more firms with such extreme rates of return. This leads to a predicted megative correlation between D and dispersion.[17] Table 9.7 shows this prediction to be fulfilled in the negative and full ranges while there is apparently no relationship in the positive range. So in the positive range, the rate of decay appears unaffected by the dispersion

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16) Stigler op cit p 70

17) Whittington op cit p 23 observes a positive correlation between the average profitability of an industry and its inter-company dispersion of profitability. Stigler op cit p 63 finds such a relationship but an insignificant one. As we find a negative correlation between average profitability and D, these results would lead to an expected negative correlation between dispersion and D. A contrary indication is given by Stigler's finding (op cit p 6) that dispersion is larger in concentrated industries which, from Section 9.1, leads to a positive correlation between D and dispersion.

Table 9.7 : Rank Correlations of D with Average Dispersion of Profitability

Industry	
D^+	-0.01
D^-	-0.51*
D^f	-0.54*

* Significant at the 5% level. See Table 9.2 for test used.

of profitability. On the other hand, in the negative range (and consequently in the full range), wide dispersion leads to fast decay.

Section 9.3 : Comparison of D with Whittington's Profit Persistency

In his book "The Prediction of Profitability", Whittington considers the persistence of profitability.[18] This is, in fact, the same as the rate of decay examined in this study. He only considers a linear regression equation of rate of return at time t on that at time t-1. His equation differs from the ones used here in employing six year averages of relative profitability. So his independent variable is the average rate of return earned by firm i over the six years 1948-1954 expressed as a deviation from the industry average. His dependent variable is similar but relates to 1954-1960. A further difference is that he did not use standardised data.[19] The purpose here is to compare the decay measures of this study with those of Whittington.[20]

The average levels of the decay coefficients are shown in Table 9.8, and it is found that the decay rate of six year averages is faster than for year to year comparisons. If the simple first order Markov process

Table 9.8 : Average Rates of Decay

Whittington*	0.54
Full range linear ($1D^f$)	0.81
Full range (D^f)	0.81

* Using only the 17 industries of the present study.

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18) Whittington op cit Chapter 4

19) This is immaterial for a comparison of linear forms.

20) Whittington only provides industry level figures.

used in this study were a full description of the inter-temporal linkages of profitability, Whittington's rate of decay should be the sixth power of D^f. So the average of Whittington's measure should be 0.28, or conversely the average of D^f should be 0.90. This discrepancy is a valuable reminder that the decay function has a very limited purpose. It is not intended to provide the best possible explanation of its dependent variable but merely to clarify the relationship of relative profitabilities occuring in adjacent years. For the former objective it would, at least, be necessary to use a higher order Markov process.[21]

Turning now to the rank correlations between rates of decay, it can be seen from Table 9.9 that they are quite low. One industry is responsible for a considerable proportion of the apparent lack of correlation. This

Table 9.9 : Rank Correlations Between Whittington's Rate of Decay and D^f and $1D^f$

D^f	0.49
$1D^f$	0.44

is the Food industry (no 12): Whittington's decay measure is 0.27 and D^f is 0.85. For this industry, choice of equation is not critical - the range of possible decay coefficients is 0.84 to 0.85. Therefore a wrong choice cannot explain the difference. A possible solution lies in the idiosyncratic behaviour of average profitability in this industry. It has a steep downward trend (ranked 5th steepest) and a small standard deviation (ranked 15th). As was remarked in the previous section, steep trend usually accompanies a high standard deviation. The fall between two six

21) Whittington op cit pp 97-101 considers various combinations of profitabilities in previous years as independent variables in his linear decay function.

year averages will be much greater than that observed in year to year comparisons where there is a steep trend. In most cases this effect is moderated by the high volatility that accompanies the trend.

Apart from the Food industry, the ranking is not too dissimilar and may be ascribed to the various differences in technique mentioned at the beginning of this section.

Section 9.4 : Summary

This chapter has dealt with the relationships between the rate of decay and other industry characteristics. These characteristics have been divided into two broad groups: structural measures and performance measures. Rank correlation coefficients have been used to investigate these relationships which have generally been found to be weak. For that reason, the approach has not been to test hypotheses but rather to present evidence suggestive of the nature of the relationships.

Chapter II showed that obstacles to competition could be expected to slow the rate of decay. This was supported by the correlations found between the rate of decay and the structural measures. So the evidence found does not contradict the hypothesis that on average high levels of concentration are associated with slow rates of decay of profitability.

The performance measures were of three types: firstly, two orthodox performance measures, average profitability and growth. Secondly, there were three measures of the inter-temporal behaviour of average profitability. Finally there was the average dispersion of profitability within an industry. It was argued in Section 9.3 that inter-industry equilibration would link growth of assets to average profitability and to the trend in average profitability. The reasoning is analogous to that used when considering the intra-industry process of equilibration. This inter-industry process is not distinct from that operating within the industry and the two interact. A highly profitable industry will experience a faster rate of decay because the industry as a whole is under strong pressure to force it toward more normal (economy-wide) levels of profitability. The correlations suggested by this model were found.

These were: high growth with high profitability and steep trend, high growth with fast decay and the various other relations correspondingly.

Trend was too strongly correlated with the rate of decay for the preceding argument to provide the whole explanation. High correlations were found between all three inter-temporal measures and the rate of decay. It seemed necessary to conclude that this was not a statistical effect but rather that volatility of industry experience implies the conditions for a fast rate of decay of profitability.

The final section of this chapter compares Whittington's estimated measures of the degree of persistence of profitability with the rates of decay calculated in this study. Whittington's figures, being based on six year averages, should be lower than the single year figures derived here, but they are not as low as direct calculation would suggest. This is because a full description of changes in profitability demands a more complex model than that used here. Apart from one industry, the ordering of the two measures is about as high as could be expected given the differences in methods used.

C H A P T E R   X

CONCLUSIONS

Before turning to the primary theme - the rate of decay of profitability and its interpretation as an indicator of the speed of resource allocation - the secondary aim of the study will be reviewed.

The statistical technique does relax the discreteness of the Markov transition matrix: the conditional or row distributions can be treated continuously. Considering various summary statistics of these conditional distributions, and in particular their relationships to the prior variable (that upon which the distributions are contingent), does reveal considerably more about the process than straightforward regression analysis. In fact it may be regarded as information about the error variance-covariance matrix of the equivalent regression equation. Unfortunately the synthesis of the conditional distributions into a single continuous mathematical statement about the whole bivariate transition matrix proved too complex an exercise to be worth its practical (if not aesthetic) rewards.

The theoretical development of the primary theme was in terms of narrowly defined products and markets and consequently multiproduct firms were taken to be typical. In this context, a major portion of resources is allocated by management decision and the allocation is between the items of the firm's product range. Entry and exit are taken to be common but to be predominantly the results of expansions and contractions of established firms' product ranges. Births and deaths are assumed to be rare phenomena. Resource allocation decisions will depend upon the objectives of management, but, whatever these are, profitability of activities under consideration will be relevant to some extent. The weight given to profitability will depend upon the particular objective function and therefore the latter will influence the speed with which resources are shifted in response to variations in profitability. The speed also depends upon the efficacy of present profitability as a proxy for expected profitability; as it is the expected value which directs management decisions. The speed of resource movement depends also upon the flexibility of capital stock and many other technological factors. Finally, it depends upon those obstacles to competitive activity in an industry such as barriers to entry and oligopolistic interdependencies.

The allocation of resources towards markets offering high profitability and away from those offering low profitability leads to the decay of market profitability. Firms will, on average, experience changes in their rates of return that reflect those occurring in the markets in which they operate. Therefore it is to be expected that the profitability of firms will decay and that those factors previously mentioned as influencing the speed of resource allocation will also influence the firms' rate of decay of profitability.

The empirical work does establish that decay occurs from year to year in all industries and nearly every subgroup - the few exceptions are such that little weight need be put upon them. Whittington has previously shown that decay occurs in all industries when rates of return are six-year averages, that is, he finds a relatively long period decay. The present results confirm that, despite all the disturbances, profit decay is detectable in short period year by year analysis. The ubiquity of decay indicates that, with the grouping of firms used, competition is working to bring about the convergence of profitability. The evidence shows that those factors which obstruct the competitive process are never strong enough to obliterate this underlying tendency. It is important to emphasize that this evidence relates to the size of groups used and does not rule out individual markets or groups of markets where the competitive forces are completely negated. But there are neither industries nor sub-groups where such markets predominate.

The theoretical development led to the view that there might be differences between the rate of erosion of high profitability and the rate of restoration of low rates of return. For this reason, the rate of decay was measured separately for above average and below average profitability. The two rates of decay were significantly different in a majority of cases with the general pattern being a faster rate of decay below than above the mean. This rather weak evidence disagrees with the generally held view that it is harder to eliminate excess capacity than supernormal profits. The general growth in demand during the period studied may well explain this apparent conflict.

Allowance was made for a nonlinear relationship between relative profitability at time t and at time t-1. Any nonlinearity was expected to take the form of an increasing rate of decay accompanying increases in the absolute value of deviations of profitability from the decay origin. A nonlinear function was in practice only required in a minority of cases and in these the expected form of nonlinearity was found. The linear form involves increasing competitive pressure at extreme rates of return because its constant proportional decay means increasing absolute decay as rates of return deviate further from the decay origin. The nonlinear form demonstrates this increasing competitive pressure more strongly as it involves increasing proportional decay.

Perhaps, after the establishment of the fact of profitability decay, the most important conclusion is that industries do differ significantly with respect to their rates of decay. It is, of course, statistically significant differences, not economically significant ones, that have been established. This latter problem brings us to the question of the place of the rate of decay of profitability in determining public policy on industry structure, conduct and performance. It was emphasized in the first chapter that the rate of decay shows how effective the forces working to return the industry to equilibrium are; and that this contrasts with static measures of market structure which relate to the nature of an equilibrium should it be attained. Firstly, it is necessary to query whether fast decay is preferable to slow decay and secondly, whether market structure is a good indicator of rate of decay, i.e. whether both are needed.

If the equilibrium towards which the system is tending is optimal (in the Paretian sense), then unless fast decay has direct disadvantages, it is preferable to slow decay. Fast decay may be disadvantageous if it brings uncertainty and disorder to the industry - none of the decay rates measured would seem fast enough to raise this problem. The second way in which fast decay may be disadvantageous is if it acts to deter valuable activities. In particular, too rapid erosion of high profitability may deter investment in research and development as competitive advantages gained from these activities may be too shortlived.

In the case where the potential equilibrium state is not Pareto optimal, the question of whether fast decay is preferable becomes more difficult. Profit decay shows the transfer of resources from the unprofitable to the profitable activities. This must be a shift towards the optimum although the industry may be one that would reach an equilibrium situation before an optimum is attained. Abstracting from the problems of a second best situation, there must be a presumption that decay brings about an improvement and therefore fast decay is to be preferred to slow as long as the disadvantages of fast growth mentioned previously can be ignored.

The second aspect of the relevance of the rate of decay to public policy is the way that the newly suggested variable relates to other commonly employed measures of industry characteristics. These questions were examined in Chapter IX. Theory led us to expect that the rate of decay would be slower in concentrated than unconcentrated industries. The evidence did not contradict this. Therefore it seems that, on average, taking note of the rate of decay in an industry appraisal would not conflict with the evidence of industry structure. On the other hand, the correlation between decay and concentration was low and suggests that decay can only be taken account of by its explicit inclusion and not by reliance on concentration as a proxy.

The relationships between decay and various performance characteristics were less simple. They were consistent with an interaction between inter- and intra-industry allocation processes. That is to say, an industry of high profitability would be expected to grow quickly and to have a relatively rapid decay of industry average profitability towards the economy-wide normal level. The process involved would affect profitability relativities within the industry and lead to a high rate of decay of firm profitability. This now leads to a conflict between the average profitability variable and the rate of decay. Preferred values of one tend to accompany less preferred values of the other.

The whole equilibrating process between and within industries lends some attractiveness to a passive industry policy. Intervention then hangs upon whether the process is working quickly enough and this is a problem area that the economist is ill-equipped to handle. This has already been seen at the intra-industry level where no minimum acceptable value of the rate of decay could be put forward. But the question of intervention is not restricted solely to timing. The relationships between the various performance measures are average relationships - there will be cases where there is little evidence of self-equilibration. The intra-industry process applies on average over the markets of that industry and there may well be markets where no profitability decay takes place. A laissez-faire conclusion is not necessarily appropriate.

In summary, the decay of profitability has been found in nearly every instance examined. Because the rate of decay of profitability measures the speed of resource allocation, it is a relevant variable to include in any assessment of industry performance and, because industries may be distinguished statistically in this respect, it is a practical variable for such use.

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APPENDIX A

ANNUAL DISTRIBUTIONS OF RATES OF RETURN

Summary statistics of the distributions of rates of return on net assets are provided for each industry for each of the years 1948-1960.

See Chapter IV Section 5 for definitions and summary.

IND. NO. 1

	MEAN	VARIANCE	SIGN	SKEWNESS	KURTOSIS	NO IN YEAR
YEAR 1	1.320$_{10}$-01	8.969$_{10}$-03	-	1.617$_{10}$-01	2.770$_{10}$+00	108
YEAR 2	1.482$_{10}$-01	8.617$_{10}$-03	-	7.352$_{10}$-02	3.125$_{10}$+00	107
YEAR 3	1.677$_{10}$-01	1.193$_{10}$-02	-	2.432$_{10}$-01	3.063$_{10}$+00	110
YEAR 4	1.496$_{10}$-01	9.898$_{10}$-03	-	1.933$_{10}$-01	3.541$_{10}$+00	113
YEAR 5	1.530$_{10}$-01	8.939$_{10}$-03	-	1.453$_{10}$-02	2.721$_{10}$+00	116
YEAR 6	1.702$_{10}$-01	7.038$_{10}$-03	-	1.914$_{10}$-02	2.745$_{10}$+00	120
YEAR 7	1.756$_{10}$-01	8.062$_{10}$-03	-	3.763$_{10}$-02	4.113$_{10}$+00	123
YEAR 8	1.610$_{10}$-01	9.077$_{10}$-03	-	1.359$_{10}$-02	3.483$_{10}$+00	126
YEAR 9	1.477$_{10}$-01	9.034$_{10}$-03	+	1.134$_{10}$-01	4.400$_{10}$+00	127
YEAR 10	1.419$_{10}$-01	1.025$_{10}$-02	+	4.170$_{10}$-01	4.778$_{10}$+00	127
YEAR 11	1.619$_{10}$-01	1.248$_{10}$-02	-	8.923$_{10}$-04	5.012$_{10}$+00	122
YEAR 12	1.685$_{10}$-01	8.220$_{10}$-03	+	7.810$_{10}$-07	2.868$_{10}$+00	120

IND. NO. 4

	MEAN	VARIANCE	SIGN	SKEWNESS	KURTOSIS	NO IN YEAR
YEAR 1	2.090$_{10}$-01	1.556$_{10}$-02	-	1.760$_{10}$-02	5.694$_{10}$+00	274
YEAR 2	2.199$_{10}$-01	1.748$_{10}$-02	+	5.377$_{10}$-03	6.945$_{10}$+00	283
YEAR 3	2.394$_{10}$-01	1.830$_{10}$-02	+	6.859$_{10}$-01	7.875$_{10}$+00	292
YEAR 4	2.200$_{10}$-01	1.385$_{10}$-02	+	2.098$_{10}$-01	4.288$_{10}$+00	304
YEAR 5	2.008$_{10}$-01	1.532$_{10}$-02	+	1.334$_{10}$-01	7.705$_{10}$+00	312
YEAR 6	2.039$_{10}$-01	1.211$_{10}$-02	-	1.612$_{10}$-01	5.816$_{10}$+00	315
YEAR 7	2.006$_{10}$-01	1.015$_{10}$-02	+	2.550$_{10}$-02	3.064$_{10}$+00	324
YEAR 8	1.900$_{10}$-01	1.121$_{10}$-02	+	2.979$_{10}$-02	4.550$_{10}$+00	332
YEAR 9	1.845$_{10}$-01	1.047$_{10}$-02	-	3.957$_{10}$-03	3.935$_{10}$+00	328
YEAR 10	1.637$_{10}$-01	1.158$_{10}$-02	-	1.189$_{10}$-02	4.828$_{10}$+00	330
YEAR 11	1.635$_{10}$-01	1.152$_{10}$-02	+	8.471$_{10}$-03	4.996$_{10}$+00	313
YEAR 12	1.527$_{10}$-01	1.356$_{10}$-02	+	1.239$_{10}$-01 ×	6.833$_{10}$+00	298

IND. NO. 5

	MEAN	VARIANCE	SIGN	SKEWNESS	KURTOSIS	NO IN YEAR
YEAR 1	1.511$_{10}$-01	2.654$_{10}$-02	-	1.069$_{10}$+00	8.568$_{10}$+00	112
YEAR 2	1.982$_{10}$-01	2.362$_{10}$-02	-	3.606$_{10}$+00	1.533$_{10}$+01	114
YEAR 3	2.398$_{10}$-01	1.325$_{10}$-02	+	5.467$_{10}$-01	5.015$_{10}$+00	118
YEAR 4	2.138$_{10}$-01	1.450$_{10}$-02	-	5.139$_{10}$-02	5.738$_{10}$+00	118
YEAR 5	1.995$_{10}$-01	1.829$_{10}$-02	-	2.416$_{10}$+00	1.065$_{10}$+01	121
YEAR 6	2.130$_{10}$-01	2.164$_{10}$-02	-	5.410$_{10}$+00	2.092$_{10}$+01	123
YEAR 7	2.118$_{10}$-01	1.436$_{10}$-02	+	5.103$_{10}$-01	4.458$_{10}$+00	128
YEAR 8	1.952$_{10}$-01	1.319$_{10}$-02	+	3.227$_{10}$-02	3.641$_{10}$+00	128
YEAR 9	1.940$_{10}$-01	1.767$_{10}$-02	+	1.311$_{10}$-01	5.694$_{10}$+00	130
YEAR 10	1.922$_{10}$-01	1.419$_{10}$-02	+	2.692$_{10}$-01	3.538$_{10}$+00	130
YEAR 11	1.885$_{10}$-01	1.356$_{10}$-02	+	5.953$_{10}$-01	3.865$_{10}$+00	120
YEAR 12	1.767$_{10}$-01	1.709$_{10}$-02	-	1.370$_{10}$-01	4.885$_{10}$+00	113

IND. NO. 6

	MEAN	VARIANCE	SIGN	SKEWNESS	KURTOSIS	NO IN YEAR
YEAR 1	1.820$_{10}$-01	1.047$_{10}$-02	-	7.005$_{10}$-02	2.951$_{10}$+00	88
YEAR 2	2.176$_{10}$-01	1.178$_{10}$-02	+	3.163$_{10}$-03	2.519$_{10}$+00	91
YEAR 3	2.203$_{10}$-01	1.176$_{10}$-02	+	2.679$_{10}$-02	3.311$_{10}$+00	93
YEAR 4	2.131$_{10}$-01	2.061$_{10}$-02	-	4.649$_{10}$-01	4.603$_{10}$+00	95
YEAR 5	2.064$_{10}$-01	1.493$_{10}$-02	+	2.115$_{10}$-01	3.944$_{10}$+00	93
YEAR 6	1.975$_{10}$-01	1.359$_{10}$-02	+	2.590$_{10}$-02	3.399$_{10}$+00	92
YEAR 7	1.895$_{10}$-01	8.685$_{10}$-03	-	1.077$_{10}$-02	4.216$_{10}$+00	87
YEAR 8	1.520$_{10}$-01	1.005$_{10}$-02	-	2.698$_{10}$-01	3.759$_{10}$+00	87
YEAR 9	1.397$_{10}$-01	9.831$_{10}$-03	-	9.221$_{10}$-01	6.287$_{10}$+00	89
YEAR 10	1.174$_{10}$-01	1.866$_{10}$-02	-	3.432$_{10}$+00	8.379$_{10}$+00	87
YEAR 11	1.134$_{10}$-01	3.429$_{10}$-02	-	6.919$_{10}$+00	1.538$_{10}$+01	82
YEAR 12	1.427$_{10}$-01	2.335$_{10}$-02	-	1.907$_{10}$-01	1.083$_{10}$+01	76

IND. NO. 7

	MEAN	VARIANCE	SIGN	SKEWNESS	KURTOSIS	NO IN YEAR
YEAR 1	1.963$_{10}$-01	1.567$_{10}$-02	+	7.326$_{10}$-01	5.324$_{10}$+00	161
YEAR 2	1.951$_{10}$-01	2.366$_{10}$-02	-	4.003$_{10}$+00	2.041$_{10}$+01	173
YEAR 3	2.471$_{10}$-01	1.987$_{10}$-02	+	2.789$_{10}$-01	4.321$_{10}$+00	179
YEAR 4	2.159$_{10}$-01	1.892$_{10}$-02	-	8.168$_{10}$-02	5.688$_{10}$+00	182
YEAR 5	1.850$_{10}$-01	1.412$_{10}$-02	+	6.004$_{10}$-02	3.469$_{10}$+00	167
YEAR 6	1.905$_{10}$-01	1.728$_{10}$-02	-	1.466$_{10}$+00	1.046$_{10}$+01	188
YEAR 7	2.005$_{10}$-01	1.632$_{10}$-02	-	2.026$_{10}$-02	5.081$_{10}$+00	191
YEAR 8	1.910$_{10}$-01	1.348$_{10}$-02	-	8.874$_{10}$-02	6.159$_{10}$+00	193
YEAR 9	1.787$_{10}$-01	1.172$_{10}$-02	-	2.479$_{10}$-01	4.369$_{10}$+00	194
YEAR 10	1.574$_{10}$-01	1.655$_{10}$-02	-	7.275$_{10}$+00	1.886$_{10}$+01	194
YEAR 11	1.647$_{10}$-01	1.361$_{10}$-02	-	1.400$_{10}$+00	9.270$_{10}$+00	182
YEAR 12	1.699$_{10}$-01	1.652$_{10}$-02	-	2.674$_{10}$+00	9.994$_{10}$+00	177

IND. NO. 8

	MEAN	VARIANCE	SIGN	SKEWNESS	KURTOSIS	NO IN YEAR
YEAR 1	2.477$_{10}$-01	1.264$_{10}$-02	+	4.005$_{10}$-02	2.548$_{10}$+00	30
YEAR 2	2.951$_{10}$-01	2.827$_{10}$-02	-	7.080$_{10}$-03	2.627$_{10}$+00	36
YEAR 3	3.271$_{10}$-01	2.253$_{10}$-02	-	2.749$_{10}$-02	3.266$_{10}$+00	40
YEAR 4	1.520$_{10}$-01	8.566$_{10}$-03	+	1.737$_{10}$-01	2.729$_{10}$+00	40
YEAR 5	1.024$_{10}$-01	1.935$_{10}$-02	-	9.468$_{10}$+00	1.630$_{10}$+01	42
YEAR 6	1.072$_{10}$-01	7.269$_{10}$-03	-	6.223$_{10}$-01	4.102$_{10}$+00	38
YEAR 7	3.926$_{10}$-02	2.422$_{10}$-02	-	6.062$_{10}$+00	1.048$_{10}$+01	38
YEAR 8	3.575$_{10}$-02	1.969$_{10}$-02	-	6.123$_{10}$+00	1.066$_{10}$+01	37
YEAR 9	6.430$_{10}$-02	1.164$_{10}$-02	-	4.966$_{10}$+00	1.060$_{10}$+01	37
YEAR 10	2.007$_{10}$-02	9.931$_{10}$-03	-	2.623$_{10}$+00	6.229$_{10}$+00	35
YEAR 11	5.427$_{10}$-02	5.971$_{10}$-03	-	4.874$_{10}$+00	1.087$_{10}$+01	31
YEAR 12	1.208$_{10}$-01	3.569$_{10}$-03	-	2.008$_{10}$-02	2.901$_{10}$+00	28

IND. NO. 9

	MEAN	VARIANCE	SIGN	SKEWNESS	KURTOSIS	NO IN YEAR
YEAR 1	2.742$_{10}$-01	1.147$_{10}$-02	-	1.845$_{10}$-01	3.103$_{10}$+00	65
YEAR 2	2.952$_{10}$-01	1.584$_{10}$-02	-	1.316$_{10}$-01	3.439$_{10}$+00	71
YEAR 3	1.984$_{10}$-01	2.411$_{10}$-02	-	6.011$_{10}$+00	1.666$_{10}$+01	70
YEAR 4	1.713$_{10}$-01	1.682$_{10}$-02	-	7.095$_{10}$-01	4.146$_{10}$+00	72
YEAR 5	1.743$_{10}$-01	1.263$_{10}$-02	-	5.297$_{10}$+00	1.524$_{10}$+01	73
YEAR 6	1.576$_{10}$-01	7.106$_{10}$-03	-	6.808$_{10}$-01	6.673$_{10}$+00	72
YEAR 7	1.331$_{10}$-01	1.565$_{10}$-02	-	1.731$_{10}$+01	2.920$_{10}$+01	71
YEAR 8	1.565$_{10}$-01	3.569$_{10}$-03	+	2.859$_{10}$-02	2.794$_{10}$+00	69
YEAR 9	1.098$_{10}$-01	5.642$_{10}$-03	-	2.708$_{10}$-01	4.015$_{10}$+00	68
YEAR 10	6.879$_{10}$-02	8.371$_{10}$-03	-	1.073$_{10}$+00	5.061$_{10}$+00	66
YEAR 11	1.416$_{10}$-01	4.533$_{10}$-03	+	9.186$_{10}$-01	5.962$_{10}$+00	64
YEAR 12	1.219$_{10}$-01	3.704$_{10}$-03	-	1.918$_{10}$-02	3.127$_{10}$+00	56

IND. NO. 11

	MEAN	VARIANCE	SIGN	SKEWNESS	KURTOSIS	NO IN YEAR
YEAR 1	2.166$_{10}$-01	1.811$_{10}$-02	+	6.294$_{10}$-01	4.866$_{10}$+00	96
YEAR 2	2.132$_{10}$-01	1.521$_{10}$-02	+	4.858$_{10}$-01	3.631$_{10}$+00	99
YEAR 3	1.817$_{10}$-01	1.568$_{10}$-02	-	8.835$_{10}$-01	8.174$_{10}$+00	101
YEAR 4	7.957$_{10}$-02	2.802$_{10}$-02	-	2.014$_{10}$+00	6.535$_{10}$+00	100
YEAR 5	1.578$_{10}$-01	1.277$_{10}$-02	+	1.559$_{10}$+00	7.891$_{10}$+00	96
YEAR 6	1.344$_{10}$-01	2.787$_{10}$-02	-	2.690$_{10}$+00	8.519$_{10}$+00	95
YEAR 7	1.372$_{10}$-01	1.247$_{10}$-02	-	7.541$_{10}$-02	3.639$_{10}$+00	94
YEAR 8	1.348$_{10}$-01	2.628$_{10}$-02	-	2.963$_{10}$+00	1.395$_{10}$+01	94
YEAR 9	1.301$_{10}$-01	2.847$_{10}$-02	-	5.712$_{10}$+00	1.734$_{10}$+01	97
YEAR 10	9.881$_{10}$-02	2.909$_{10}$-02	-	7.367$_{10}$+00	1.603$_{10}$+01	100
YEAR 11	1.413$_{10}$-01	2.200$_{10}$-02	-	8.697$_{10}$-01	5.013$_{10}$+00	94
YEAR 12	1.759$_{10}$-01	1.314$_{10}$-02	+	1.023$_{10}$-01	3.329$_{10}$+00	90

IND. NO. 12

	MEAN	VARIANCE	SIGN	SKEWNESS	KURTOSIS	NO IN YEAR
YEAR 1	$1.856_{10}-01$	$1.456_{10}-02$	+	$2.765_{10}-01$	$3.368_{10}+00$	118
YEAR 2	$1.651_{10}-01$	$1.554_{10}-02$	+	$8.363_{10}-02$	$3.417_{10}+00$	121
YEAR 3	$1.781_{10}-01$	$2.584_{10}-02$	-	$1.959_{10}+00$	$1.751_{10}+01$	124
YEAR 4	$1.735_{10}-01$	$1.723_{10}-02$	+	$6.192_{10}-04$	$6.776_{10}+00$	126
YEAR 5	$1.832_{10}-01$	$2.194_{10}-02$	+	$1.006_{10}-01$	$3.277_{10}+00$	131
YEAR 6	$1.890_{10}-01$	$1.860_{10}-02$	+	$4.007_{10}-01$	$3.963_{10}+00$	130
YEAR 7	$1.735_{10}-01$	$1.278_{10}-02$	+	$1.632_{10}-02$	$3.209_{10}+00$	130
YEAR 8	$1.644_{10}-01$	$1.364_{10}-02$	-	$3.284_{10}-01$	$5.140_{10}+00$	127
YEAR 9	$1.487_{10}-01$	$1.014_{10}-02$	-	$1.904_{10}-02$	$2.928_{10}+00$	128
YEAR 10	$1.514_{10}-01$	$8.111_{10}-03$	-	$5.598_{10}-02$	$3.817_{10}+00$	126
YEAR 11	$1.360_{10}-01$	$1.118_{10}-02$	-	$1.351_{10}-01$	$8.053_{10}+00$	114
YEAR 12	$1.369_{10}-01$	$1.076_{10}-02$	-	$1.609_{10}-01$	$5.867_{10}+00$	101

IND. NO. 13

	MEAN	VARIANCE	SIGN	SKEWNESS	KURTOSIS	NO IN YEAR
YEAR 1	$1.141_{10}-01$	$3.873_{10}-03$	+	$3.431_{10}-01$	$6.885_{10}+00$	182
YEAR 2	$1.059_{10}-01$	$3.670_{10}-03$	+	$1.002_{10}+00$	$7.475_{10}+00$	185
YEAR 3	$1.092_{10}-01$	$3.176_{10}-03$	+	$9.935_{10}-01$	$9.629_{10}+00$	185
YEAR 4	$1.067_{10}-01$	$3.378_{10}-03$	+	$7.370_{10}-01$	$7.634_{10}+00$	188
YEAR 5	$1.122_{10}-01$	$3.504_{10}-03$	+	$2.058_{10}-01$	$7.091_{10}+00$	188
YEAR 6	$1.115_{10}-01$	$3.666_{10}-03$	-	$4.619_{10}-03$	$1.020_{10}+01$	173
YEAR 7	$1.153_{10}-01$	$4.709_{10}-03$	-	$3.896_{10}+00$	$2.105_{10}+01$	170
YEAR 8	$1.203_{10}-01$	$5.280_{10}-03$	-	$2.351_{10}+00$	$1.932_{10}+01$	165
YEAR 9	$1.335_{10}-01$	$3.963_{10}-03$	+	$2.630_{10}+00$	$7.289_{10}+00$	157
YEAR 10	$1.259_{10}-01$	$3.880_{10}-03$	+	$9.666_{10}-01$	$5.333_{10}+00$	153
YEAR 11	$1.321_{10}-01$	$5.355_{10}-03$	+	$9.090_{10}-02$	$1.186_{10}+01$	141
YEAR 12	$1.379_{10}-01$	$3.617_{10}-03$	+	$4.570_{10}-01$	$5.520_{10}+00$	124

IND. NO. 15

	MEAN	VARIANCE	SIGN	SKEWNESS	KURTOSIS	NO IN YEAR
YEAR 1	$1.725_{10}-01$	$1.420_{10}-02$	+	$2.189_{10}-01$	$4.914_{10}+00$	135
YEAR 2	$1.989_{10}-01$	$1.709_{10}-02$	+	$1.122_{10}+00$	$7.151_{10}+00$	141
YEAR 3	$2.530_{10}-01$	$2.028_{10}-02$	+	$6.304_{10}-01$	$3.710_{10}+00$	142
YEAR 4	$1.198_{10}-01$	$2.557_{10}-02$	-	$1.349_{10}+01$	$2.567_{10}+01$	146
YEAR 5	$1.293_{10}-01$	$2.020_{10}-02$	-	$5.896_{10}+00$	$1.675_{10}+01$	145
YEAR 6	$1.774_{10}-01$	$9.798_{10}-03$	+	$4.006_{10}-03$	$3.524_{10}+00$	141
YEAR 7	$1.724_{10}-01$	$8.412_{10}-03$	-	$6.636_{10}-02$	$3.799_{10}+00$	143
YEAR 8	$1.557_{10}-01$	$9.523_{10}-03$	-	$5.810_{10}-01$	$6.847_{10}+00$	143
YEAR 9	$1.445_{10}-01$	$1.066_{10}-02$	-	$4.263_{10}-04$	$4.677_{10}+00$	141
YEAR 10	$1.425_{10}-01$	$2.019_{10}-02$	-	$1.503_{10}+00$	$2.689_{10}+01$	140
YEAR 11	$1.542_{10}-01$	$1.728_{10}-02$	-	$2.852_{10}-03$	$2.313_{10}+01$	134
YEAR 12	$1.716_{10}-01$	$1.148_{10}-02$	+	$2.946_{10}+00$	$1.320_{10}+01$	132

IND. NO. 16

	MEAN	VARIANCE	SIGN	SKEWNESS	KURTOSIS	NO IN YEAR
YEAR 1	$1.694_{10}-01$	$1.781_{10}-02$	+	$6.189_{10}-01$	$4.714_{10}+00$	173
YEAR 2	$1.805_{10}-01$	$2.381_{10}-02$	-	$3.202_{10}+00$	$1.374_{10}+01$	177
YEAR 3	$1.963_{10}-01$	$2.791_{10}-02$	-	$4.127_{10}+00$	$1.638_{10}+01$	177
YEAR 4	$1.164_{10}-01$	$2.565_{10}-02$	-	$3.909_{10}+00$	$1.467_{10}+01$	178
YEAR 5	$1.235_{10}-01$	$1.443_{10}-02$	-	$6.218_{10}-01$	$5.292_{10}+00$	184
YEAR 6	$1.372_{10}-01$	$1.930_{10}-02$	-	$1.337_{10}+00$	$7.687_{10}+00$	186
YEAR 7	$1.410_{10}-01$	$1.901_{10}-02$	-	$1.813_{10}+00$	$1.030_{10}+01$	185
YEAR 8	$1.266_{10}-01$	$1.722_{10}-02$	-	$8.529_{10}-01$	$1.117_{10}+01$	181
YEAR 9	$1.268_{10}-01$	$1.111_{10}-02$	-	$1.869_{10}-01$	$4.875_{10}+00$	182
YEAR 10	$1.165_{10}-01$	$1.290_{10}-02$	-	$6.525_{10}-01$	$1.112_{10}+01$	181
YEAR 11	$1.494_{10}-01$	$1.066_{10}-02$	+	$9.197_{10}-02$	$4.209_{10}+00$	172
YEAR 12	$1.402_{10}-01$	$1.420_{10}-02$	-	$1.356_{10}+00$	$1.139_{10}+01$	165

IND. NO. 17

	MEAN	VARIANCE	SIGN	SKEWNESS	KURTOSIS	NO IN YEAR
YEAR 1	1.722$_{10}$-01	1.417$_{10}$-02	+	4.402$_{10}$-01	3.739$_{10}$+00	48
YEAR 2	1.563$_{10}$-01	1.761$_{10}$-02	+	1.309$_{10}$-02	4.425$_{10}$+00	49
YEAR 3	1.554$_{10}$-01	2.120$_{10}$-02	-	5.848$_{10}$-02	4.259$_{10}$+00	51
YEAR 4	1.702$_{10}$-01	1.373$_{10}$-02	+	1.552$_{10}$-01	2.606$_{10}$+00	54
YEAR 5	2.079$_{10}$-01	1.617$_{10}$-02	+	5.347$_{10}$-03	4.057$_{10}$+00	54
YEAR 6	2.025$_{10}$-01	1.723$_{10}$-02	+	2.100$_{10}$+00	8.695$_{10}$+00	57
YEAR 7	1.763$_{10}$-01	1.168$_{10}$-02	-	3.124$_{10}$-01	3.435$_{10}$+00	59
YEAR 8	1.819$_{10}$-01	9.315$_{10}$-03	-	4.016$_{10}$-02	2.774$_{10}$+00	62
YEAR 9	1.868$_{10}$-01	1.206$_{10}$-02	+	1.145$_{10}$+00	6.124$_{10}$+00	66
YEAR 10	1.697$_{10}$-01	1.894$_{10}$-02	-	1.132$_{10}$-01	4.585$_{10}$+00	70
YEAR 11	1.746$_{10}$-01	1.249$_{10}$-02	-	7.567$_{10}$-01	4.987$_{10}$+00	68
YEAR 12	1.302$_{10}$-01	2.332$_{10}$-02	-	3.214$_{10}$+00	7.710$_{10}$+00	67

IND. NO. 18

	MEAN	VARIANCE	SIGN	SKEWNESS	KURTOSIS	NO IN YEAR
YEAR 1	1.710$_{10}$-01	1.447$_{10}$-02	-	2.510$_{10}$+00	1.721$_{10}$+01	231
YEAR 2	1.788$_{10}$-01	1.166$_{10}$-02	-	1.173$_{10}$-02	5.692$_{10}$+00	237
YEAR 3	1.683$_{10}$-01	1.703$_{10}$-02	+	2.041$_{10}$-01	4.308$_{10}$+00	249
YEAR 4	1.207$_{10}$-01	1.795$_{10}$-02	-	1.689$_{10}$+00	8.409$_{10}$+00	257
YEAR 5	1.231$_{10}$-01	1.250$_{10}$-02	-	5.910$_{10}$-01	8.651$_{10}$+00	264
YEAR 6	1.297$_{10}$-01	1.251$_{10}$-02	-	2.330$_{10}$-01	8.589$_{10}$+00	265
YEAR 7	1.324$_{10}$-01	1.617$_{10}$-02	-	1.416$_{10}$+00	1.116$_{10}$+01	266
YEAR 8	1.398$_{10}$-01	1.032$_{10}$-02	+	6.204$_{10}$-02	4.400$_{10}$+00	266
YEAR 9	1.311$_{10}$-01	9.446$_{10}$-03	+	2.111$_{10}$-01	5.338$_{10}$+00	262
YEAR 10	1.074$_{10}$-01	1.129$_{10}$-02	-	5.106$_{10}$-01	8.971$_{10}$+00	253
YEAR 11	1.312$_{10}$-01	8.359$_{10}$-03	+	9.242$_{10}$-01	6.628$_{10}$+00	239
YEAR 12	1.390$_{10}$-01	9.264$_{10}$-03	-	5.407$_{10}$-02	1.121$_{10}$+01	228

IND. NO. 19

	MEAN	VARIANCE	SIGN	SKEWNESS	KURTOSIS	NO IN YEAR
YEAR 1	1.696$_{10}$-01	1.017$_{10}$-02	+	4.012$_{10}$-01	4.572$_{10}$+00	182
YEAR 2	1.746$_{10}$-01	8.427$_{10}$-03	+	2.463$_{10}$-01	3.249$_{10}$+00	178
YEAR 3	1.726$_{10}$-01	9.419$_{10}$-03	+	8.609$_{10}$-01	4.044$_{10}$+00	176
YEAR 4	1.520$_{10}$-01	1.088$_{10}$-02	+	9.671$_{10}$-02	4.112$_{10}$+00	179
YEAR 5	1.598$_{10}$-01	1.058$_{10}$-02	+	1.592$_{10}$-01	5.070$_{10}$+00	183
YEAR 6	1.653$_{10}$-01	1.130$_{10}$-02	+	2.219$_{10}$-03	4.491$_{10}$+00	185
YEAR 7	1.811$_{10}$-01	9.756$_{10}$-03	+	3.642$_{10}$-02	4.538$_{10}$+00	181
YEAR 8	1.598$_{10}$-01	9.074$_{10}$-03	-	5.563$_{10}$-03	6.523$_{10}$+00	181
YEAR 9	1.618$_{10}$-01	9.106$_{10}$-03	-	1.433$_{10}$+00	1.039$_{10}$+01	173
YEAR 10	1.445$_{10}$-01	8.420$_{10}$-03	-	5.456$_{10}$-01	7.436$_{10}$+00	182
YEAR 11	1.682$_{10}$-01	9.019$_{10}$-03	-	6.067$_{10}$-01	7.901$_{10}$+00	169
YEAR 12	1.776$_{10}$-01	7.712$_{10}$-03	+	2.219$_{10}$-01	5.150$_{10}$+00	157

IND. NO. 20

	MEAN	VARIANCE	SIGN	SKEWNESS	KURTOSIS	NO IN YEAR
YEAR 1	1.579$_{10}$-01	1.946$_{10}$-02	+	6.862$_{10}$+00	1.591$_{10}$+01	83
YEAR 2	1.101$_{10}$-01	2.169$_{10}$-02	-	1.051$_{10}$+00	1.578$_{10}$+01	83
YEAR 3	1.215$_{10}$-01	1.007$_{10}$-02	+	3.120$_{10}$-01	4.212$_{10}$+00	84
YEAR 4	1.294$_{10}$-01	9.002$_{10}$-03	+	1.126$_{10}$+00	4.062$_{10}$+00	84
YEAR 5	1.142$_{10}$-01	1.141$_{10}$-02	-	2.004$_{10}$-01	7.544$_{10}$+00	83
YEAR 6	1.191$_{10}$-01	6.830$_{10}$-03	+	6.319$_{10}$-01	3.618$_{10}$+00	84
YEAR 7	1.228$_{10}$-01	6.605$_{10}$-03	+	1.137$_{10}$+00	5.793$_{10}$+00	82
YEAR 8	1.210$_{10}$-01	6.774$_{10}$-03	+	2.394$_{10}$+00	7.163$_{10}$+00	82
YEAR 9	1.300$_{10}$-01	8.980$_{10}$-03	+	2.487$_{10}$+00	6.731$_{10}$+00	83
YEAR 10	1.225$_{10}$-01	7.579$_{10}$-03	+	3.502$_{10}$-01	4.227$_{10}$+00	84
YEAR 11	1.407$_{10}$-01	2.038$_{10}$-02	+	1.131$_{10}$+01	1.765$_{10}$+01	80
YEAR 12	1.533$_{10}$-01	1.760$_{10}$-02	+	7.056$_{10}$+00	1.311$_{10}$+01	76

IND. NO. 21

	MEAN	VARIANCE	SIGN	SKEWNESS	KURTOSIS	NO IN YEAR
YEAR 1	$1.014_{10}-01$	$8.526_{10}-03$	+	$2.685_{10}+00$	$1.208_{10}+01$	298
YEAR 2	$9.776_{10}-02$	$6.828_{10}-03$	+	$3.138_{10}+00$	$1.215_{10}+01$	298
YEAR 3	$9.942_{10}-02$	$6.498_{10}-03$	+	$2.863_{10}+00$	$8.389_{10}+00$	290
YEAR 4	$9.485_{10}-02$	$6.462_{10}-03$	-	$5.546_{10}-02$	$9.325_{10}+00$	280
YEAR 5	$1.018_{10}-01$	$4.513_{10}-03$	+	$1.280_{10}+00$	$5.960_{10}+00$	271
YEAR 6	$1.200_{10}-01$	$8.073_{10}-03$	-	$5.608_{10}-02$	$7.769_{10}+00$	170
YEAR 7	$1.283_{10}-01$	$6.454_{10}-03$	+	$2.139_{10}-01$	$4.138_{10}+00$	169
YEAR 8	$1.298_{10}-01$	$6.582_{10}-03$	+	$1.868_{10}-01$	$3.809_{10}+00$	163
YEAR 9	$1.325_{10}-01$	$6.084_{10}-03$	+	$2.232_{10}-01$	$3.095_{10}+00$	161
YEAR 10	$1.258_{10}-01$	$5.354_{10}-03$	-	$8.765_{10}-02$	$4.351_{10}+00$	158
YEAR 11	$1.380_{10}-01$	$5.928_{10}-03$	+	$1.736_{10}-01$	$4.671_{10}+00$	152
YEAR 12	$1.411_{10}-01$	$5.696_{10}-03$	-	$2.141_{10}-01$	$7.316_{10}+00$	144

A P P E N D I X B

TRANSITION MATRICES - INDUSTRIES

See Chapter V Section I for definitions and explanations and Section 2 for discussion of these data.

INDUSTRY 1

CLASS MID-PT	MEAN	VARIANCE	SIGN	SKEWNESS	KURTOSIS
2.1450	1.7370	0.3592	-	0.2957	3.0080
1.6040	1.3490	0.2336	+	0.0410	2.8000
1.4100	1.1760	0.2512	+	0.4378	3.4490
1.2440	0.8804	0.2717	-	0.2519	2.7850
1.1270	0.7273	0.3837	-	0.0661	2.4970
1.0100	0.7745	0.2912	-	0.1236	2.3240
0.9174	0.8190	0.3090	+	0.3248	3.3610
0.8432	0.7103	0.2119	+	0.5388	4.4790
0.7589	0.6743	0.3932	-	0.3179	3.4030
0.6740	0.6616	0.2932	-	0.0087	2.6390
0.6071	0.6109	0.1893	-	1.0940	5.0420
0.5546	0.5215	0.2153	-	0.3922	2.6520
0.4978	0.4447	0.2639	-	0.2500	3.2780
0.4540	0.2138	0.2338	+	0.0349	2.5420
0.3956	0.4122	0.3820	-	1.9000	7.3430
0.3269	0.2072	0.1308	+	0.1268	2.3870
0.2657	0.2189	0.0939	+	0.3108	2.4570
0.2117	0.1866	0.2630	+	0.2052	3.3300
0.1433	0.1688	0.1110	+	0.0026	2.1250
0.0834	0.0211	0.1807	-	0.1372	6.1390
0.0235	0.0095	0.2491	-	0.1040	2.1980
-0.0440	0.0555	0.3555	+	3.8260	8.7880
-0.0905	-0.1444	0.1592	-	0.0863	2.7500
-0.1437	-0.1216	0.3075	-	0.7690	6.3340
-0.2077	-0.4348	0.2021	+	0.0057	2.6240
-0.2524	-0.2115	0.0827	-	0.0081	2.3130
-0.2985	-0.2921	0.4467	+	0.2709	3.5330
-0.3599	-0.3030	0.2302	+	0.1723	4.4250
-0.4252	-0.3858	0.2973	-	2.7070	7.9620
-0.4983	-0.4623	0.1122	-	0.1242	3.3340
-0.5624	-0.6027	0.2767	+	0.1007	2.3940
-0.6177	-0.4609	0.2347	+	0.2140	3.6650
-0.6868	-0.5473	0.1904	+	0.2943	2.6230
-0.7684	-0.6923	0.1812	+	0.0023	5.2320
-0.8821	-0.9433	0.2730	-	0.3630	3.9520
-0.9690	-0.8799	0.5346	+	0.7224	3.1810
-1.0860	-0.9330	0.2411	-	0.0162	2.8220
-1.2420	-1.2490	0.3792	+	0.3044	4.4410
-1.4450	-1.2680	0.6195	+	0.1292	3.5370
-2.0750	-1.5290	0.4747	-	0.0350	2.5920

INDUSTRY 4

CLASS MID-PT	MEAN	VARIANCE	SIGN	SKEWNESS	KURTOSIS
2.5320	1.8530	0.4157	-	0.1200	3.5940
1.9990	1.5390	0.5223	-	0.6797	4.9510
1.7970	1.3210	0.3956	-	0.2012	4.6890
1.6730	1.2730	0.5578	+	0.0001	2.1520
1.5680	1.1720	0.4068	-	0.7370	3.6500
1.4700	1.1670	0.2136	-	0.3096	2.6710
1.3820	1.0590	0.1668	-	0.0971	3.3290
1.3100	1.0670	0.4741	-	0.0754	3.6820
1.2570	1.2170	0.3250	+	0.3904	3.2620
1.2090	1.0500	0.4111	-	0.0016	2.3440
1.1550	0.9832	0.1686	-	0.1448	3.6930
1.1040	0.6252	0.3685	+	0.2808	4.1380
1.0640	0.8667	0.3272	-	0.0000	3.9290
1.0090	0.8933	0.3764	-	0.3725	4.8860
0.9517	0.6775	0.2410	-	0.7428	3.4970
0.9138	0.6932	0.2900	-	1.0220	4.7900
0.8778	0.7218	0.4013	+	0.1450	3.2710
0.8406	0.5881	0.2912	-	0.8392	6.0610
0.8043	0.5994	0.3041	+	0.0112	3.2010
0.7799	0.4742	0.6474	-	0.2054	4.2720
0.7462	0.7077	0.2161	+	0.1805	2.1370
0.7113	0.7455	0.1888	+	0.0091	2.3350
0.6661	0.6889	0.4737	-	0.3678	5.1980
0.6349	0.3660	0.3172	+	0.0511	2.5060
0.6102	0.5907	0.1299	-	0.6766	5.4440
0.5891	0.5167	0.2035	-	4.6550	10.3500
0.5721	0.5371	0.1085	-	0.4187	3.1490
0.5498	0.5206	0.1770	+	0.0036	3.0870
0.5260	0.4619	0.2992	-	2.2970	7.8330
0.5008	0.3744	0.1927	-	1.0640	4.1070
0.4794	0.3469	0.2471	+	0.1811	4.8120
0.4614	0.3773	0.1398	-	1.2780	3.7850
0.4406	0.2199	0.4265	-	13.1600	18.0200
0.4224	0.3247	0.4478	-	6.7840	11.7700
0.4075	0.3971	0.1435	-	0.1847	2.6770
0.3892	0.4018	0.2127	+	0.3640	2.9360
0.3652	0.3023	0.1636	-	0.0374	5.7210
0.3395	0.3182	0.2710	-	0.5858	3.3660
0.3204	0.2850	0.1922	+	0.7058	4.2160
0.2981	0.3167	0.1865	+	0.5643	2.8230
0.2726	0.3446	0.3707	+	1.2710	4.5020
0.2485	0.2090	0.2817	+	0.0178	3.0180
0.2309	0.3307	0.2171	-	0.6472	5.0600
0.2100	0.1618	0.1165	-	0.0073	3.2420
0.1882	0.1719	0.1041	+	0.0123	2.5800
0.1677	0.0945	0.1471	+	0.0106	4.5970
0.1447	0.1971	0.2815	+	0.1177	3.7710
0.1233	0.1828	0.2458	-	0.2985	3.3230
0.1012	0.0458	0.1822	-	0.5041	3.5060
0.0821	0.0303	0.1533	-	0.1822	2.0980
0.0639	0.0870	0.1612	-	0.0293	2.7180
0.0451	0.0507	0.2538	-	2.7640	9.9480

INDUSTRY 4 (CONTD)

CLASS MID-PT	MEAN	VARIANCE	SIGN	SKEWNESS	KURTOSIS
0.0260	0.0218	0.1409	+	0.1275	2.7770
0.0099	-0.0894	0.1667	-	1.7660	4.7480
-0.0043	-0.0888	0.3967	-	1.6260	5.0910
-0.0226	-0.0885	0.1529	-	0.0050	3.2480
-0.0387	-0.0857	0.2148	-	0.8041	3.3900
-0.0548	-0.0957	0.1864	-	0.0235	3.2280
-0.0746	-0.1380	0.1011	+	0.5933	4.1700
-0.0950	-0.1920	0.2278	-	2.1200	5.0350
-0.1149	0.0439	0.1630	+	0.1147	2.7570
-0.1352	-0.0724	0.1679	+	0.0610	3.7120
-0.1572	-0.1122	0.1271	-	0.1188	2.0530
-0.1757	-0.1097	0.1816	+	0.0197	1.7550
-0.1955	-0.1616	0.1533	-	0.0536	2.6820
-0.2136	-0.2730	0.1339	-	0.3058	2.2340
-0.2291	-0.2528	0.2169	-	7.3370	12.9700
-0.2480	-0.2873	0.1324	-	0.5023	3.6560
-0.2681	-0.1926	0.3936	-	0.0027	4.0460
-0.2912	-0.3743	0.1189	-	1.5040	6.4860
-0.3098	-0.4480	0.3154	-	2.2300	6.7350
-0.3329	-0.2781	0.1097	+	0.0014	2.6990
-0.3496	-0.4396	0.1244	-	0.0327	3.3600
-0.3686	-0.3299	0.2237	+	0.0269	5.7230
-0.3913	-0.2764	0.0928	+	0.0406	2.9730
-0.4133	-0.2428	0.1732	+	0.0475	3.1760
-0.4417	-0.4265	0.3112	+	2.2810	7.9450
-0.4623	-0.6499	0.2041	-	0.1178	2.4340
-0.4842	-0.5473	0.4361	-	1.1080	4.0210
-0.5081	-0.5284	0.2429	-	0.6466	4.2180
-0.5283	-0.5320	0.2063	-	3.8560	8.9070
-0.5529	-0.4656	0.1908	+	0.1080	2.7880
-0.5793	-0.5435	0.2237	-	0.0766	3.6500
-0.5989	-0.5334	0.1089	+	0.0044	1.9030
-0.6215	-0.4484	0.1808	-	0.0082	3.4190
-0.6509	-0.5788	0.2858	-	8.2390	13.7900
-0.6843	-0.5153	0.2795	+	1.6720	5.5950
-0.7126	-0.7130	0.4215	+	0.0986	5.8470
-0.7391	-0.8013	0.3074	-	1.5410	5.1430
-0.7667	-0.7776	0.2226	-	0.7051	4.9550
-0.7955	-0.5599	0.2731	+	0.4017	2.7940
-0.8237	-0.7838	0.1452	-	0.5881	3.0500
-0.8489	-0.7651	0.1073	-	0.0106	2.7510
-0.8862	-0.6718	0.1040	+	1.5670	5.5180
-0.9158	-0.8034	0.4185	-	0.0956	5.0630
-0.9407	-0.9558	0.3436	-	3.3370	6.7660
-0.9740	-0.7962	0.2418	+	0.0467	4.9450
-1.0160	-0.7822	0.2063	+	0.0710	3.3310
-1.0520	-0.8649	0.1569	+	0.0136	2.6330
-1.1140	-0.8762	0.2096	+	0.3338	3.8460
-1.1790	-0.9721	0.1093	-	0.0428	4.8920
-1.2480	-1.0530	0.5512	+	0.1290	3.4910
-1.3340	-1.0830	0.3187	-	0.4129	2.5360
-1.4720	-1.1340	0.6506	-	0.0517	2.5460

INDUSTRY 4 (CONTD)

CLASS MID-PT	MEAN	VARIANCE	SIGN	SKEWNESS	KURTOSIS
-1.6820	-1.3220	0.3060	-	0.0624	3.1400
-2.3170	-1.5100	0.4411	-	0.1596	2.2410

INDUSTRY 5

CLASS MID-PT	MEAN	VARIANCE	SIGN	SKEWNESS	KURTOSIS
2.3650	1.5440	0.9707	-	9.3320	14.7500
1.8510	1.4790	0.5793	-	1.4200	5.2990
1.5820	1.3160	0.5722	-	0.1479	2.6290
1.3500	1.0210	0.4060	-	0.0008	2.4800
1.1340	0.9786	0.3655	+	0.2128	2.7380
1.0110	0.9328	0.3934	-	0.0004	3.0750
0.9114	0.6410	0.2597	-	0.3041	2.7010
0.8176	0.7676	0.1851	+	0.1336	3.2140
0.7258	0.5553	0.1850	+	0.0000	4.8410
0.6349	0.5289	0.3162	+	0.8827	5.9310
0.5551	0.4101	0.3226	-	1.4150	4.2100
0.4839	0.5275	0.2130	+	1.0120	5.5630
0.4179	0.1743	0.2959	-	0.0158	2.5190
0.3671	0.2237	0.0898	+	0.1056	2.8190
0.3026	0.1740	0.2304	-	2.1400	6.9100
0.2427	0.2884	0.2498	+	0.0579	5.2180
0.1957	0.0496	0.1870	-	1.2280	5.1750
0.1518	-0.0166	0.1736	-	2.1400	5.6490
0.1036	0.0197	0.2188	+	1.2230	7.9200
0.0546	-0.0361	0.1148	+	0.9609	5.0160
0.0020	-0.1135	0.3363	+	0.5660	4.1680
-0.0491	-0.0909	0.1415	+	0.9557	4.4090
-0.0966	-0.1595	0.5003	-	2.8320	6.8640
-0.1414	-0.2388	0.2024	-	0.8657	6.0580
-0.1923	-0.1522	0.2414	+	2.1290	4.6390
-0.2434	-0.2902	0.3250	-	1.5690	5.6230
-0.2851	-0.2795	0.2477	+	0.0361	4.7100
-0.3309	-0.3240	0.1747	+	0.0146	3.4800
-0.3731	-0.3415	0.1586	+	0.0901	2.6360
-0.4272	-0.4336	0.2473	-	3.0520	8.4750
-0.4824	-0.5424	0.2362	-	0.3179	3.8020
-0.5330	-0.5629	0.4769	+	0.0017	6.4580
-0.5897	-0.5132	0.2428	+	0.2823	3.4340
-0.6293	-0.5423	0.2370	-	0.7594	4.3370
-0.6913	-0.5959	0.2951	+	0.0794	2.7620
-0.7468	-0.8237	0.4288	-	0.1696	2.9920
-0.8260	-0.8048	0.2377	-	0.2063	2.8140
-0.9145	-0.7466	0.2246	+	1.2890	5.1130
-1.0310	-0.7702	0.3401	+	1.4710	5.3360
-1.1940	-1.0480	0.4479	-	0.7251	3.6190
-1.4310	-1.0610	0.3810	-	0.9662	3.9510
-2.0670	-0.8600	0.7063	+	0.1803	4.1740

INDUSTRY 6

CLASS MID-PT	MEAN	VARIANCE	SIGN	SKEWNESS	KURTOSIS
2.0560	1.4550	0.7035	-	1.4680	4.9490
1.5540	1.2170	0.4893	-	1.5570	6.0950
1.2830	0.7941	0.3600	-	0.1819	3.2500
1.0820	0.7437	0.2923	+	0.1414	3.2760
0.9243	0.6902	0.2324	-	0.1625	3.3480
0.8102	0.6883	0.2316	+	0.0890	3.7240
0.7192	0.6628	0.1727	+	0.0006	2.3070
0.6326	0.3519	0.2185	-	0.4451	2.5900
0.5550	0.5134	0.1944	+	0.2797	2.9620
0.4813	0.4194	0.2301	+	0.8064	5.3040
0.4080	0.2774	0.1689	-	2.6680	7.6130
0.3345	0.1384	0.1490	+	0.6465	4.0990
0.2515	0.1514	0.3475	+	0.0204	2.9240
0.1795	0.2771	0.2835	-	0.1262	4.2450
0.1231	-0.0220	0.2111	-	0.4408	2.6650
0.0611	0.0900	0.1337	-	1.7320	4.9790
0.0065	0.1034	0.3964	-	0.6617	3.2630
-0.0516	-0.0037	0.3408	-	1.5320	5.5850
-0.1331	-0.1256	0.2155	+	0.3008	3.4470
-0.2175	-0.1761	0.3269	-	1.2930	4.8290
-0.3053	-0.1434	0.3558	+	0.4271	3.8760
-0.3850	-0.3600	0.4382	-	0.8611	4.9280
-0.4542	-0.2606	0.2765	+	1.4460	4.4650
-0.5478	-0.5876	0.3964	-	0.6301	4.0890
-0.6523	-0.5838	0.4420	-	0.3307	3.0100
-0.7861	-0.7298	0.1911	+	0.0612	2.0090
-0.9272	-0.8375	0.2597	-	0.2509	3.1170
-1.0550	-0.6413	0.2866	+	2.2260	6.6440
-1.2840	-0.8120	0.7473	+	0.8074	5.6890
-1.9640	-1.5170	0.5477	-	0.0116	1.8770

INDUSTRY 7

CLASS MID-PT	MEAN	VARIANCE	SIGN	SKEWNESS	KURTOSIS
2.3340	1.8860	0.3215	-	0.0981	2.3760
1.7490	1.3110	0.4435	-	1.0400	5.1520
1.5400	1.4280	0.1701	-	0.4571	2.6640
1.3470	1.0610	0.2340	-	0.0045	2.6590
1.1900	1.0750	0.2458	+	0.0044	3.0760
1.0670	0.7798	0.2090	+	0.0014	1.7660
0.9807	0.7198	0.2094	-	1.1330	4.6490
0.8803	0.6963	0.1686	-	2.6440	7.9990
0.8054	0.7022	0.3663	-	0.1295	2.9210
0.7462	0.5532	0.2265	-	0.0047	3.1200
0.6857	0.4817	0.1046	+	0.0218	2.3740
0.6287	0.4540	0.2653	-	3.8820	9.3870
0.5867	0.4997	0.1541	-	0.0130	2.3990
0.5461	0.4206	0.1219	-	0.7193	3.2830
0.5080	0.3244	0.1061	-	0.1501	2.3800
0.4673	0.3702	0.0970	-	0.4269	3.6030
0.4261	0.3187	0.1130	+	0.0309	2.6930
0.3921	0.2275	0.1259	-	0.1552	2.2730
0.3623	0.2228	0.2223	+	0.4483	5.0530
0.3282	0.2111	0.1336	-	0.0020	2.6100
0.2943	0.3098	0.0723	-	0.4539	3.4020
0.2656	0.1960	0.0718	+	0.0032	2.8000
0.2301	0.2217	0.1795	+	3.4170	8.5950
0.1957	0.1995	0.1386	+	0.0109	3.1730
0.1721	0.0625	0.1910	-	2.6160	5.8060
0.1416	0.0209	0.1444	-	8.0050	13.4300
0.1168	0.0522	0.1427	+	0.0463	3.5590
0.0880	-0.0894	0.2155	-	1.6240	4.1630
0.0598	0.0120	0.1066	+	0.3572	5.0210
0.0330	-0.0756	0.0933	+	0.2027	2.3680
0.0120	0.0167	0.1342	+	0.3048	3.6490
-0.0160	-0.0076	0.0531	+	0.9070	4.3010
-0.0408	-0.0890	0.1034	-	0.5252	5.9510
-0.0617	-0.0454	0.0865	-	0.5242	2.9350
-0.0890	-0.0657	0.0790	-	0.6832	3.8650
-0.1171	0.0391	0.1431	+	1.3180	3.7250
-0.1391	-0.0566	0.1330	+	0.9684	3.9660
-0.1601	-0.2826	0.1743	-	1.0880	3.8080
-0.1824	-0.1848	0.0615	+	0.0007	2.1210
-0.2027	-0.2981	0.2015	-	3.5750	7.5820
-0.2249	-0.2249	0.1484	+	0.4509	3.7170
-0.2484	-0.1874	0.0619	+	0.0639	2.5570
-0.2689	-0.2648	0.0685	-	1.2130	4.1130
-0.2895	-0.4015	0.1112	+	0.5070	3.4140
-0.3165	-0.2710	0.0632	+	0.0239	4.4820
-0.3503	-0.3716	0.1333	-	0.1436	3.3180
-0.3817	-0.4273	0.4040	-	1.3850	5.6420
-0.4159	-0.2286	0.1160	+	0.0289	2.5770
-0.4454	-0.4042	0.2362	-	3.6430	9.7850
-0.4878	-0.4121	0.1866	-	1.6400	9.1260
-0.5237	-0.4769	0.3878	+	6.8030	12.7000
-0.5688	-0.4738	0.1443	-	0.0163	2.2690

INDUSTRY 7 (CONTD)

CLASS MID-PT	MEAN	VARIANCE	SIGN	SKEWNESS	KURTOSIS
-0.6162	-0.4644	0.3150	+	0.0068	3.1210
-0.6565	-0.4691	0.0956	-	0.0181	1.9680
-0.7059	-0.6855	0.1134	+	0.1562	3.2110
-0.7762	-0.4992	0.3111	-	0.0006	3.0000
-0.8436	-0.6105	0.2197	-	0.0232	4.6920
-0.9060	-0.8508	0.2923	-	1.2150	4.4420
-0.9716	-0.7199	0.1660	+	0.1999	2.5810
-1.0720	-0.7328	0.2332	+	0.1349	5.2790
-1.1980	-1.0420	0.3261	-	0.8974	3.7340
-1.3750	-1.0880	0.5699	+	0.0323	3.2940
-2.0580	-1.4930	0.6326	+	0.2222	3.8100

INDUSTRY 8

CLASS MID-PT	MEAN	VARIANCE	SIGN	SKEWNESS	KURTOSIS
1.6420	1.1040	0.6572	-	0.7325	2.9090
1.1200	0.7107	0.4302	-	0.2712	2.9270
0.7978	0.6572	0.5318	-	0.1574	2.5910
0.5650	0.2752	0.3401	-	0.2215	3.1730
0.4007	0.2604	0.3159	-	0.2846	3.5000
0.2210	0.0620	0.6743	-	1.8790	7.4540
0.0102	0.1336	0.5222	-	0.5067	5.6660
-0.1361	-0.1508	0.6393	-	0.3109	3.4260
-0.2836	-0.2922	0.4336	-	0.5710	3.4390
-0.4697	-0.2940	0.6865	-	0.1325	2.9920
-0.8457	-0.4380	0.4687	+	0.0198	2.8050
-1.5530	-1.0070	0.6836	+	0.6707	4.4590

INDUSTRY 9

CLASS MID-PT	MEAN	VARIANCE	SIGN	SKEWNESS	KURTOSIS
1.6920	1.4390	0.4878	-	0.5490	3.4110
1.4740	1.0670	0.3491	-	0.1073	2.4830
1.1940	0.7781	0.5065	-	0.5975	3.2840
1.0030	0.6824	0.5105	-	0.5764	3.0980
0.8487	0.3847	0.9714	-	1.5560	4.7630
0.6882	0.3927	0.4710	-	0.5639	3.1300
0.5830	0.6336	0.2212	+	0.0220	3.1430
0.4654	0.3792	0.3962	+	0.0840	2.5460
0.3559	0.0791	0.5888	-	2.5610	5.8580
0.2788	0.2443	0.4803	-	0.4663	3.0240
0.1920	-0.1097	0.3365	-	0.0232	2.5260
0.0942	0.0486	0.3028	-	0.1615	2.4330
0.0180	0.0756	0.5377	+	0.4043	4.5470
-0.0679	-0.2028	0.3158	-	1.0550	3.9790
-0.1447	-0.2649	0.8997	-	0.7274	3.4610
-0.2485	-0.1197	0.5233	+	0.4697	3.4010
-0.3538	-0.5743	0.5252	+	0.1238	2.4910
-0.4521	-0.3608	0.3524	-	0.1624	2.1760
-0.5546	-0.4077	0.8502	+	0.0114	3.4210
-0.6728	-0.5177	0.3965	-	1.0490	3.6140
-0.8253	-0.5785	0.3414	+	0.0095	3.1700
-0.9858	-0.5830	0.3114	-	0.2098	3.4170
-1.2700	-0.7344	0.3966	-	0.6220	3.6450
-1.8790	-0.9239	0.8471	+	0.0314	2.9450

INDUSTRY 11

CLASS MID-PT	MEAN	VARIANCE	SIGN	SKEWNESS	KURTOSIS
2.1770	1.3620	0.7028	-	1.3780	5.4500
1.5730	1.2080	0.3041	+	0.0010	2.8940
1.3180	1.0920	0.4152	-	0.4117	5.7360
1.1440	0.8826	0.2976	-	0.1745	3.3240
0.9845	0.9016	0.3957	-	0.6516	4.1240
0.8459	0.5931	0.3601	-	0.0129	2.7480
0.7198	0.6238	0.3151	-	0.2621	4.3320
0.6177	0.6054	0.2133	-	0.4220	3.7080
0.5394	0.4447	0.1120	+	0.0136	2.6670
0.4846	0.4932	0.1145	+	0.0598	3.3110
0.4260	0.3142	0.3056	-	1.0970	5.4250
0.3625	0.1670	0.3056	-	2.3500	5.1710
0.2905	0.2676	0.2105	+	0.6048	5.2890
0.2283	0.0551	0.1630	-	0.9491	4.4050
0.1760	0.0860	0.1818	+	0.0196	3.1510
0.1069	0.0900	0.0714	-	0.0000	2.1520
0.0471	-0.0345	0.2519	-	4.0620	10.4100
0.0026	-0.0619	0.1102	-	0.2394	3.1690
-0.0432	-0.2447	0.2180	-	3.5000	7.0160
-0.0857	-0.1591	0.1671	-	0.0190	2.5590
-0.1354	-0.4549	0.3944	-	3.7320	6.5960
-0.1873	-0.1997	0.1593	-	0.0921	2.8350
-0.2330	-0.2601	0.1603	-	1.6910	4.8820
-0.2960	-0.3151	0.4249	-	1.2060	4.8370
-0.3613	-0.3951	0.4953	+	0.2186	5.1510
-0.4295	-0.4684	0.4596	-	0.5630	2.8750
-0.5165	-0.2737	0.1341	-	0.0262	3.5250
-0.5919	-0.4033	0.2402	-	0.2277	3.6010
-0.6822	-0.5469	0.1065	-	0.4043	2.9040
-0.8124	-0.7174	0.4513	-	0.5678	3.2820
-0.9678	-0.7101	0.2738	-	0.0292	2.6130
-1.2520	-0.8899	0.4777	+	0.0165	4.2720
-1.9040	-1.0590	0.6117	-	0.0385	2.2500

INDUSTRY 12

CLASS MID-PT	MEAN	VARIANCE	SIGN	SKEWNESS	KURTOSIS
2.4900	1.9020	0.5479	-	1.4340	5.2850
1.9090	1.3280	0.5401	-	0.3246	2.8700
1.5590	1.3950	0.7612	-	1.8090	6.8200
1.3580	1.1140	0.4365	-	0.9314	5.2530
1.1820	0.9489	0.5227	-	1.2280	5.5340
1.0570	0.7741	0.9429	-	0.6658	4.3130
0.9449	0.7146	0.4700	-	3.3420	8.7170
0.8199	0.6349	0.2756	-	0.0008	2.3460
0.7320	0.6917	0.1726	-	0.2021	4.4060
0.6650	0.5102	0.2383	-	0.0066	2.7930
0.6026	0.4382	0.2250	-	0.0009	2.2730
0.5476	0.4559	0.2095	+	0.0066	2.6140
0.4832	0.3952	0.2243	-	2.9020	7.5020
0.4344	0.2175	0.2310	-	0.1895	3.2400
0.3673	0.3525	0.2470	+	1.6590	5.9190
0.3150	0.3421	0.1084	+	0.0540	2.5770
0.2627	0.2170	0.1218	+	0.8560	3.7820
0.2195	0.2796	0.1317	+	0.9119	5.8910
0.1717	0.1238	0.1284	-	0.0246	3.4550
0.1249	0.1403	0.1523	+	1.4190	8.1940
0.0765	0.1123	0.3177	+	0.1134	8.0990
0.0326	0.0477	0.1365	-	0.0069	2.5350
-0.0113	0.0365	0.2224	-	0.8699	4.8210
-0.0953	-0.0344	0.1550	-	2.3980	7.6950
-0.0956	-0.1479	0.2687	-	1.7460	5.1540
-0.1370	-0.1465	0.1340	+	0.0366	2.3470
-0.1884	-0.1261	0.1408	-	0.0011	2.1820
-0.2606	-0.2800	0.1142	-	0.5486	3.4390
-0.3172	-0.1641	0.1406	-	0.0329	3.5200
-0.3775	-0.3577	0.1520	-	0.4231	3.9630
-0.4335	-0.4533	0.1986	-	0.1867	2.9830
-0.4983	-0.5807	0.2693	-	0.1817	4.0340
-0.5577	-0.5467	0.2983	-	0.8855	5.5560
-0.6077	-0.6176	0.4778	-	0.1747	5.1470
-0.6875	-0.7511	0.2164	-	0.0194	2.4870
-0.7511	-0.5785	0.2225	+	2.3850	6.0350
-0.8366	-0.6755	0.2853	+	0.4528	5.0020
-0.9250	-0.8209	0.1411	-	0.9286	4.6140
-1.0140	-0.9613	0.1916	+	0.8993	4.4620
-1.1530	-0.9726	0.3835	+	1.2710	4.8780
-1.3420	-1.2140	0.4563	+	0.0263	2.8320
-1.5610	-1.3230	0.4415	-	0.0426	3.4610
-2.0790	-1.3290	0.5844	+	1.0470	4.4770

INDUSTRY 13

CLASS MID-PT	MEAN	VARIANCE	SIGN	SKEWNESS	KURTOSIS
2.5290	2.0680	0.3535	-	0.5468	3.0940
1.9220	1.5450	0.4556	-	0.6277	3.3860
1.6480	1.4060	0.2195	-	0.9654	5.4540
1.4110	1.1160	0.3133	-	2.8070	8.2560
1.2150	0.9646	0.1661	+	0.0013	2.2360
1.1090	0.9796	0.1945	+	0.0440	3.1650
0.9876	1.0460	0.1691	+	0.4653	3.2150
0.9050	0.7575	0.1924	-	2.7060	8.8100
0.8000	0.8403	0.1887	-	0.1989	6.3290
0.7252	0.7681	0.2203	-	0.0012	3.7930
0.6549	0.6338	0.4438	+	0.0857	7.2890
0.5989	0.5395	0.1410	+	1.0440	5.5580
0.5498	0.4846	0.1098	+	0.0747	2.6290
0.4936	0.4097	0.1697	-	0.7107	4.2100
0.4330	0.2346	0.3505	-	4.5920	8.7190
0.3878	0.3506	0.2362	+	0.2540	6.1150
0.3471	0.3678	0.1266	+	0.2944	3.1380
0.3215	0.2296	0.1074	-	0.5451	4.3030
0.2792	0.1927	0.3332	-	0.1928	6.2320
0.2315	0.1605	0.0649	-	0.7514	3.7300
0.1897	0.2554	0.1779	+	2.5120	8.4380
0.1628	0.1460	0.0488	+	0.5247	2.6760
0.1246	-0.0276	0.2297	-	16.2000	20.5700
0.0975	0.0266	0.1061	-	0.0621	4.6320
0.0662	0.0556	0.0357	+	0.0384	2.9850
0.0376	0.1084	0.0871	+	0.1367	3.4920
0.0135	0.1261	0.0953	+	0.9214	3.0890
-0.0131	-0.0612	0.0804	-	0.5805	4.0630
-0.0350	-0.1160	0.0590	-	0.1076	2.9320
-0.0622	-0.0771	0.1497	+	0.4017	6.7580
-0.0929	-0.2090	0.0647	-	0.1230	2.8820
-0.1220	-0.1535	0.1439	-	4.4940	10.0600
-0.1569	-0.2547	0.2086	-	4.8760	7.2650
-0.1859	-0.1608	0.0481	+	0.0278	2.8290
-0.2113	-0.0555	0.1355	+	6.0740	11.7100
-0.2376	-0.3274	0.2553	-	8.4300	13.9800
-0.2634	-0.2954	0.0637	-	1.9480	5.5150
-0.2946	-0.3511	0.0682	+	0.8833	4.9070
-0.3305	-0.2404	0.0462	-	0.1967	2.8490
-0.3706	-0.4135	0.1156	+	0.8103	6.1880
-0.4058	-0.3972	0.0830	-	3.8440	9.9440
-0.4423	-0.4616	0.0933	-	0.7934	4.2590
-0.4732	-0.6193	0.1536	-	2.2000	6.3000
-0.5018	-0.4449	0.0898	+	0.9841	5.7020
-0.5329	-0.5792	0.1881	-	7.2040	13.5400
-0.5729	-0.5481	0.1238	+	0.9959	4.3910
-0.6210	-0.6125	0.0645	-	0.4394	3.9400
-0.6599	-0.6836	0.0385	-	0.0000	2.8240
-0.7165	-0.6799	0.2247	-	0.0010	4.3150
-0.7620	-0.7552	0.0384	-	0.3515	2.9740
-0.8112	-0.6771	0.0941	+	1.8510	5.3960
-0.8747	-0.7822	0.0761	+	0.4571	3.5600

INDUSTRY 13 (CONTD)

CLASS MID-PT	MEAN	VARIANCE	SIGN	SKEWNESS	KURTOSIS
-0.9382	-0.7743	0.1548	+	0.9014	4.2130
-1.0140	-0.9838	0.1066	+	0.2448	4.5430
-1.0920	-0.8979	0.0834	+	0.0200	2.5490
-1.2120	-1.2140	0.2159	-	1.3160	5.6670
-1.3650	-1.3290	0.1212	+	0.0141	3.3790
-1.9220	-1.4210	0.5941	+	4.5050	11.5000

INDUSTRY 15

CLASS MID-PT	MEAN	VARIANCE	SIGN	SKEWNESS	KURTOSIS
2.3550	1.6480	0.8152	-	0.2124	1.8660
1.7310	1.2900	0.5929	+	0.0068	2.4330
1.4520	1.0250	0.4856	+	0.0450	2.3690
1.2700	0.7312	0.6394	-	1.7060	4.6410
1.1350	0.8428	0.4475	-	0.2269	5.6900
1.0260	0.8375	0.2721	-	0.6613	5.2620
0.9356	0.7890	0.4325	-	0.5926	4.7080
0.8365	0.5904	0.2852	-	0.8123	5.4910
0.7696	0.6171	0.4757	-	0.2443	6.9510
0.7113	0.5620	0.3441	-	1.4840	5.0920
0.6564	0.5958	0.4326	-	0.0000	4.5730
0.6056	0.4536	0.2735	-	0.1051	3.4050
0.5493	0.5064	0.1662	+	0.0003	3.6300
0.5054	0.5759	0.2784	+	1.1380	4.2820
0.4666	0.3134	0.2484	+	0.0021	2.7790
0.4109	0.3046	0.2539	-	0.0107	3.8410
0.3534	0.5099	0.2657	+	1.1280	5.4070
0.3039	0.2901	0.4275	-	0.1446	2.6400
0.2646	-0.0062	0.3581	-	0.0216	2.7220
0.2340	0.0793	0.1762	-	1.8720	6.6150
0.1970	0.2019	0.2321	-	0.0286	4.2660
0.1629	0.2322	0.2188	+	1.5730	4.5080
0.1183	0.0184	0.1809	+	0.1428	2.6120
0.0850	-0.0086	0.1703	+	0.1303	3.4170
0.0443	-0.0627	0.3791	+	0.5855	3.9170
0.0127	-0.1415	0.1978	-	0.2853	3.2100
-0.0206	-0.1690	0.3777	-	0.1028	3.3520
-0.0634	-0.1733	0.4726	-	0.6475	4.2290
-0.1121	-0.0362	0.2145	-	0.4538	4.6430
-0.1468	-0.3179	0.3038	-	0.5380	3.6440
-0.1901	-0.0245	0.3396	+	1.4200	5.9740
-0.2331	-0.2194	0.2353	-	0.6907	4.2330
-0.2805	-0.2677	0.3198	+	1.0670	7.4530
-0.3321	-0.3348	0.3473	-	0.0285	4.7430
-0.3778	-0.1742	0.2225	+	0.4538	3.5000
-0.4197	-0.3423	0.1996	-	0.0485	2.2550
-0.4574	-0.3284	0.2608	+	0.0237	1.9410
-0.5216	-0.5095	0.1763	-	0.3417	2.9230
-0.5818	-0.3556	0.2067	-	0.5272	3.5010
-0.6489	-0.5710	0.2701	-	0.6344	3.2090
-0.7190	-0.6350	0.3047	-	0.0284	3.0220
-0.7933	-0.6271	0.4517	+	2.0330	6.1480
-0.8831	-0.5278	0.4733	-	0.5736	4.7780
-0.9575	-0.5672	0.5560	+	0.6469	4.0680
-1.0410	-0.8383	0.4848	-	0.0039	3.7230
-1.1810	-0.9021	0.4289	-	0.0313	2.2600
-1.3760	-0.9167	0.5626	-	0.0201	2.5850
-1.6990	-1.1570	0.4831	+	0.0214	3.0910
-2.2420	-1.1700	1.1720	+	0.1309	2.2960

INDUSTRY 16

CLASS MID-PT	MEAN	VARIANCE	SIGN	SKEWNESS	KURTOSIS
2.2630	1.7250	0.2813	-	1.5980	5.1140
1.9340	1.6270	0.2811	-	0.1244	2.3350
1.6810	1.3810	0.3370	-	0.0195	2.0980
1.4790	1.1990	0.5710	-	2.5960	6.7240
1.3530	0.9253	0.3075	-	0.0293	3.2890
1.2420	0.8380	0.5322	-	1.6920	4.5450
1.1550	0.9900	0.2608	+	1.6990	5.4850
1.0740	0.8146	0.3259	+	0.1561	3.7040
0.9999	0.7962	0.2560	-	0.0443	2.8770
0.9369	0.6780	0.2826	-	3.1720	6.6790
0.8792	0.8704	0.1256	-	0.5446	3.3910
0.8182	0.7057	0.2282	-	0.0000	3.7230
0.7699	0.6072	0.2249	+	0.0437	2.6660
0.7198	0.5920	0.1532	-	0.0000	2.7610
0.6701	0.6344	0.2702	-	1.6630	5.6010
0.6273	0.4133	0.3352	-	0.0061	2.6110
0.5815	0.3030	0.5082	-	0.4620	4.4300
0.5381	0.3358	0.3859	-	1.1770	4.3890
0.4882	0.4573	0.2257	+	0.1872	3.7120
0.4448	0.5321	0.1649	-	0.0245	2.4040
0.3948	0.2359	0.1902	+	0.1440	2.6750
0.3548	0.3390	0.1557	+	0.4175	2.4780
0.3313	0.2832	0.1782	-	0.8712	4.8800
0.2962	0.2390	0.2324	-	0.8857	3.5990
0.2584	0.1148	0.1454	-	0.1531	2.0750
0.2182	-0.1370	0.4563	-	2.2330	5.3170
0.1784	0.1835	0.0964	+	0.4051	2.7140
0.1423	0.0506	0.2666	-	0.0190	4.3720
0.1132	-0.0243	0.0975	+	0.2320	3.1080
0.0799	-0.2010	0.4277	-	1.8210	6.7900
0.0552	0.0095	0.2318	-	2.8310	6.7940
0.0279	-0.1990	0.2609	-	0.2150	4.6460
-0.0071	0.1617	0.2606	+	1.0390	3.0050
-0.0285	0.0754	0.2432	+	2.4160	7.4850
-0.0543	0.0333	0.2306	+	0.7127	3.1110
-0.0899	-0.1640	0.1268	+	0.0077	3.5830
-0.1220	-0.1411	0.1716	-	0.0002	2.9610
-0.1579	-0.1750	0.3326	+	0.0900	3.7170
-0.1877	-0.1022	0.1365	-	0.3039	3.1840
-0.2223	-0.2651	0.1879	-	0.0471	3.2160
-0.2490	-0.3538	0.3099	-	1.7060	5.7410
-0.2874	-0.1961	0.2835	-	0.2598	4.2830
-0.3227	-0.3070	0.2228	+	0.0734	2.3580
-0.3629	-0.2994	0.1781	+	0.5728	5.2210
-0.3915	-0.2314	0.0801	-	0.2300	2.8580
-0.4234	-0.5021	0.2557	-	0.0311	2.6790
-0.4650	-0.4722	0.2024	-	0.0028	2.5710
-0.4971	-0.4724	0.3465	-	0.1554	3.7380
-0.5264	-0.6109	0.1963	-	0.6406	3.6440
-0.5714	-0.5529	0.2270	-	0.9516	4.7050
-0.6238	-0.4368	0.2861	-	0.2462	3.0990
-0.6873	-0.6020	0.3793	-	0.6198	4.5360

INDUSTRY 16 (CONTD)

CLASS MID-PT	MEAN	VARIANCE	SIGN	SKEWNESS	KURTOSIS
-0.7329	-0.6689	0.2565	-	2.1890	5.6330
-0.7910	-0.8461	0.3660	-	0.0251	3.0760
-0.8481	-0.8370	0.5165	+	0.0570	3.0920
-0.9331	-0.7999	0.3777	-	0.9749	5.3590
-1.0210	-0.8043	0.2742	-	0.0773	3.1920
-1.1060	-0.8768	0.2862	+	0.1002	3.8620
-1.2210	-0.8379	0.3273	-	1.6340	6.2960
-1.4160	-0.9402	0.6648	-	0.3282	2.6880
-1.5970	-1.1810	0.5970	+	1.3760	4.3680
-2.1860	-1.1530	0.4838	-	0.1253	2.5250

INDUSTRY 17

CLASS MID-PT	MEAN	VARIANCE	SIGN	SKEWNESS	KURTOSIS
1.6800	1.0990	0.3926	-	0.0327	2.1460
1.2130	1.0110	0.1819	-	0.0136	2.3340
0.9808	0.9371	0.2216	-	0.2181	2.5150
0.7620	0.4811	0.1769	-	0.0582	2.3910
0.5890	0.4391	0.3050	-	0.0008	3.2650
0.4531	0.4620	0.2431	-	0.0000	3.2820
0.3175	0.2052	0.2314	-	0.2657	3.3830
0.1984	0.2749	0.2984	-	0.1820	3.8040
0.0938	0.0185	0.1446	-	0.0820	2.4820
-0.0014	-0.0476	0.1864	-	1.0210	3.7690
-0.0947	-0.0725	0.1440	-	0.1810	3.0730
-0.1843	-0.2293	0.2287	-	0.8782	4.2540
-0.2639	-0.2460	0.2702	-	0.0002	3.6410
-0.3440	-0.3656	0.2592	+	0.0104	3.8170
-0.4744	-0.2839	0.2567	-	2.0660	9.2500
-0.6199	-0.5929	0.2448	-	0.2674	2.5130
-0.8267	-0.5906	0.4002	+	0.0130	2.8680
-1.0420	-1.0200	0.2865	-	0.7194	3.5900
-1.5360	-1.2170	0.4470	-	0.2804	2.7760

INDUSTRY 18

CLASS MID-PT	MEAN	VARIANCE	SIGN	SKEWNESS	KURTOSIS
2.6680	1.7080	0.9337	-	1.3620	4.0230
2.2090	1.4910	0.6837	-	0.0198	2.0620
1.8630	1.3980	0.3653	-	0.0384	4.4820
1.6400	1.0320	0.4959	-	0.3604	3.8750
1.5130	0.9924	0.6379	-	1.9490	5.1790
1.4200	1.1230	0.5197	-	0.0077	3.8010
1.3260	1.0780	0.5634	-	0.6683	4.4250
1.2470	1.1310	0.3535	-	0.0039	4.1310
1.1910	0.8903	0.6467	-	0.0753	3.5860
1.0980	0.9340	0.4121	+	0.0502	4.5700
1.0280	1.0150	0.3051	+	0.1487	3.5020
0.9692	0.8474	0.2674	+	0.1981	3.1320
0.9229	0.6236	0.3530	+	0.8532	4.6160
0.8830	0.7801	0.2748	-	0.0962	2.1770
0.8439	0.8419	0.3969	+	1.1700	4.5230
0.8007	0.7172	0.1750	+	0.0006	2.5280
0.7552	0.5624	0.5301	-	2.9490	8.7350
0.7116	0.5101	0.1836	+	0.5555	3.2390
0.6686	0.5151	0.5474	+	0.0102	4.1520
0.6291	0.5697	0.2180	-	0.2878	4.6010
0.5911	0.4066	0.3227	-	0.1754	3.9020
0.5552	0.5620	0.5095	+	0.0798	4.7570
0.5213	0.4936	0.1293	-	0.0010	2.9570
0.4977	0.3185	0.3933	-	4.1590	10.4300
0.4711	0.4074	0.1610	-	0.2998	3.0910
0.4498	0.4280	0.2009	+	1.6090	6.2490
0.4215	0.3428	0.0839	-	1.0790	5.3510
0.3931	0.3718	0.1890	+	0.0063	2.1680
0.3690	0.2063	0.2444	+	0.0297	5.0530
0.3462	0.3926	0.0967	+	0.1778	4.0300
0.3241	0.2410	0.2062	-	0.3006	5.0040
0.3025	0.2504	0.2207	-	3.0540	6.8510
0.2831	0.2545	0.2184	+	0.0555	4.3750
0.2601	-0.0052	0.2285	-	0.0866	2.8000
0.2388	0.1872	0.2257	-	1.2960	7.2110
0.2191	0.1283	0.2308	-	0.0763	3.4110
0.1980	0.0429	0.0798	-	0.1213	3.3140
0.1772	0.1030	0.1684	-	0.0422	4.2920
0.1521	0.0843	0.2005	-	0.0115	6.0070
0.1283	0.1137	0.1388	-	0.3598	4.6850
0.0982	0.0704	0.1212	+	2.2930	7.7670
0.0762	0.0071	0.1696	-	0.0078	3.1270
0.0554	-0.0999	0.3291	+	0.2986	5.0180
0.0301	-0.1571	0.2413	-	0.4751	4.2870
0.0019	0.0793	0.1837	+	0.3814	3.2090
-0.0194	-0.0884	0.1768	+	0.[illegible]896	3.4060
-0.0453	0.0545	0.2147	+	8.0330	12.9400
-0.0717	-0.1434	0.3097	-	2.2140	5.1490
-0.0968	-0.2382	0.4584	-	4.8290	9.0950
-0.1225	-0.2758	0.4192	-	2.6750	9.5550
-0.1415	-0.0743	0.1973	+	0.2781	3.0600
-0.1584	-0.0262	0.2437	+	0.6690	3.6840

INDUSTRY 18 (CONTD)

CLASS MID-PT	MEAN	VARIANCE	SIGN	SKEWNESS	KURTOSIS
-0.1834	-0.3069	0.1966	-	0.0087	2.7650
-0.2073	-0.3399	0.4022	-	1.6500	5.4310
-0.2259	-0.3404	0.3867	-	1.6390	6.9150
-0.2481	-0.3537	0.2336	-	0.8244	4.2920
-0.2728	-0.2389	0.3258	+	0.7334	4.6850
-0.2920	-0.2104	0.2638	+	3.6440	9.2620
-0.3162	-0.5051	0.4158	-	4.5990	8.1430
-0.3356	-0.4038	0.1930	-	0.0876	3.6310
-0.3593	-0.3685	0.1796	-	3.4010	7.8400
-0.3828	-0.3639	0.2329	+	4.4250	10.1500
-0.4079	-0.3556	0.1075	+	0.0677	3.5530
-0.4332	-0.3621	0.2104	+	0.7149	5.0060
-0.4595	-0.5877	0.3357	-	0.0448	3.7450
-0.4825	-0.5711	0.1522	-	0.3339	4.4960
-0.5065	-0.5022	0.1831	+	0.2588	3.4430
-0.5372	-0.5714	0.1414	-	0.0401	2.8270
-0.5748	-0.4728	0.3693	-	0.8885	5.7950
-0.6103	-0.4085	0.1887	+	2.5470	7.0150
-0.6387	-0.6315	0.3975	-	3.5300	7.3090
-0.6677	-0.6577	0.1840	-	1.0900	4.8780
-0.7007	-0.6630	0.2243	-	0.2070	3.8750
-0.7314	-0.6208	0.3158	-	2.8030	8.9760
-0.7671	-0.5712	0.2885	-	0.1458	5.1530
-0.8111	-0.5994	0.4421	+	10.0600	15.7300
-0.8613	-0.4141	0.3153	+	1.0310	3.6760
-0.9085	-0.9319	0.2442	-	0.0767	2.2940
-0.9570	-0.7646	0.4264	+	0.2637	3.7370
-1.0160	-0.7165	0.2429	+	0.4073	3.4650
-1.0780	-0.9770	0.2913	+	0.4926	2.5870
-1.1590	-1.0030	0.3798	-	0.1205	2.8190
-1.2230	-0.8840	0.6800	+	0.3402	3.7900
-1.3380	-1.1300	0.3624	+	0.4151	5.2120
-1.4820	-1.1430	0.4255	-	0.7067	3.0830
-1.6970	-1.2540	0.6503	+	0.0024	2.7430
-2.3200	-0.9662	0.6058	+	1.2810	7.0190

INDUSTRY 19

CLASS MID-PT	MEAN	VARIANCE	SIGN	SKEWNESS	KURTOSIS
2.3900	1.7850	0.4575	-	1.5480	5.5360
1.9670	1.6410	0.3713	-	1.1000	4.1530
1.7500	1.3880	0.2672	-	0.1599	2.8250
1.6060	1.3800	0.2223	-	0.2585	3.0910
1.4940	1.4100	0.3854	-	0.1019	3.2700
1.3670	1.2510	0.1472	-	0.4750	4.4500
1.2770	1.1880	0.2942	+	0.0565	2.1670
1.2010	1.0880	0.3269	-	0.1685	3.6850
1.1250	0.8970	0.2457	-	0.1801	2.9430
1.0330	0.8784	0.2052	-	0.0648	3.1170
0.9664	0.9092	0.1712	-	0.3214	2.6680
0.8840	0.7484	0.3785	-	0.2393	3.1380
0.8195	0.6046	0.2727	-	0.5765	2.8380
0.7707	0.6902	0.4204	-	1.6470	6.7420
0.7102	0.5901	0.1868	-	0.3151	2.8350
0.6522	0.6107	0.1041	+	0.0233	3.4750
0.6003	0.3617	0.1350	-	0.7211	3.7250
0.5476	0.4584	0.1736	-	0.3894	3.6050
0.4905	0.4592	0.5142	-	5.8600	10.5800
0.4447	0.4592	0.1389	+	0.0047	2.1280
0.4001	0.3666	0.1474	+	0.0164	3.4560
0.3508	0.3199	0.1458	-	0.0022	2.7610
0.3112	0.1510	0.3280	-	0.3134	5.7300
0.2629	0.2300	0.1080	-	0.0310	2.5210
0.2238	0.2882	0.1238	+	0.0708	3.0250
0.1963	0.1193	0.5218	+	0.4749	6.7860
0.1611	0.1132	0.0893	+	0.0160	2.7600
0.1360	0.0412	0.1328	-	0.5349	6.5570
0.1025	0.0764	0.1607	+	0.0952	2.9080
0.0712	0.0097	0.2089	+	0.1068	3.4350
0.0313	0.0190	0.0617	+	0.1338	2.3600
-0.0069	0.0311	0.0987	+	7.1460	13.4200
-0.0447	-0.1425	0.1262	+	0.4726	3.8720
-0.0810	-0.1288	0.1555	+	0.3757	2.8930
-0.1189	0.0246	0.2747	+	1.3840	6.4200
-0.1551	-0.1026	0.0863	+	0.0088	3.8760
-0.1860	-0.1580	0.1913	+	0.1320	3.2250
-0.2187	-0.2597	0.0867	+	0.8410	4.3510
-0.2525	-0.2790	0.0763	+	0.1604	3.0560
-0.2848	-0.1550	0.1290	+	0.0949	4.0500
-0.3270	-0.3987	0.0927	+	0.2145	2.7900
-0.3625	-0.4002	0.1713	-	2.1520	7.4140
-0.3987	-0.4419	0.2331	-	0.2246	5.1240
-0.4435	-0.3770	0.0761	-	0.0204	2.4300
-0.4813	-0.3529	0.1026	+	0.1169	2.4410
-0.5091	-0.6034	0.1666	-	0.7875	4.5590
-0.5473	-0.6301	0.1710	-	0.2191	3.1110
-0.5876	-0.5221	0.3206	+	4.9670	11.8700
-0.6300	-0.5913	0.1427	+	0.0259	3.0220
-0.6698	-0.6611	0.2273	-	0.0001	3.7500
-0.7209	-0.6959	0.1018	+	0.0131	4.2980
-0.7718	-0.7371	0.0810	+	0.3550	3.7190

INDUSTRY 19 (CONTD)

CLASS MID-PT	MEAN	VARIANCE	SIGN	SKEWNESS	KURTOSIS
-0.8351	-0.8343	0.2169	+	0.8373	7.1850
-0.8856	-0.7640	0.2418	+	2.5780	6.9980
-0.9519	-0.8454	0.1984	+	0.0255	3.3880
-1.0190	-1.0450	0.3069	-	1.3760	5.0510
-1.1060	-1.0210	0.1090	+	1.1990	3.9650
-1.1950	-1.1160	0.1568	-	0.1269	2.5110
-1.3340	-1.1840	0.3989	+	2.8890	8.8330
-1.5300	-1.4980	0.4120	+	0.5071	4.7850
-1.9850	-1.3800	0.6073	+	1.1770	4.4390

INDUSTRY 20

CLASS MID-PT	MEAN	VARIANCE	SIGN	SKEWNESS	KURTOSIS
2.2570	1.7330	0.5146	-	0.1644	2.7450
1.7060	1.5630	0.2469	+	0.2685	2.9470
1.3830	1.1560	0.3593	-	0.0028	2.2390
1.0490	0.6447	0.5591	-	1.7820	5.3060
0.8498	0.7176	0.1946	+	0.1484	3.0490
0.6959	0.5300	0.2300	+	0.0150	2.8370
0.5596	0.5662	0.4519	+	1.0480	4.4590
0.4561	0.3734	0.4446	+	0.0000	3.3220
0.3680	0.1035	0.1682	+	0.1590	2.6980
0.2438	0.2127	0.2041	-	0.1073	2.0820
0.1584	0.0304	0.1775	-	0.0065	1.9980
0.0735	-0.0397	0.2397	-	2.0270	6.5720
-0.0020	0.0074	0.1038	-	0.0102	2.0660
-0.0817	-0.1105	0.1897	-	0.2262	6.2400
-0.1513	-0.1290	0.1828	+	0.1105	6.7020
-0.2094	-0.1571	0.3786	+	5.6220	10.3700
-0.2729	-0.3183	0.1670	-	2.9670	8.0030
-0.3418	-0.2524	0.0976	+	0.8183	3.4080
-0.4047	-0.2866	0.1105	+	0.0356	3.2700
-0.4652	-0.3850	0.2650	+	0.0029	4.5140
-0.5346	-0.4509	0.1321	+	0.6673	3.5100
-0.6004	-0.6660	0.1234	+	0.0110	2.7230
-0.6652	-0.6417	0.1807	-	0.0377	2.7820
-0.7589	-0.6671	0.1158	+	0.6217	3.8440
-0.8468	-0.7484	0.1362	-	2.0780	5.9500
-0.9663	-0.8923	0.2959	+	0.1620	3.8630
-1.0910	-0.8677	0.2352	+	1.7670	4.3740
-1.2700	-1.0930	0.2068	-	0.0287	4.4180
-1.7570	-1.0670	0.4271	-	0.4592	4.2590

INDUSTRY 21

CLASS MID-PT	MEAN	VARIANCE	SIGN	SKEWNESS	KURTOSIS
2.6420	1.9370	0.4320	-	0.4280	3.0140
2.2490	2.0820	0.2553	-	0.6347	3.5340
2.0130	1.5060	0.5816	-	1.2310	3.6980
1.8030	1.6220	0.7738	-	0.1633	2.0810
1.5980	1.4370	0.5031	-	3.0480	8.4710
1.4360	1.0380	0.6475	-	0.8847	4.0430
1.3100	0.9854	0.5183	+	0.0687	4.1430
1.2010	1.0740	0.1904	-	0.2881	2.9440
1.0820	1.0350	0.3987	-	0.0024	3.8990
0.9972	0.9379	0.3165	+	0.2853	3.0240
0.9125	0.9042	0.2980	+	0.4014	3.8470
0.8306	0.7690	0.1789	-	0.0117	2.6020
0.7580	0.6064	0.3253	+	0.0010	3.6040
0.7071	0.4363	0.4213	-	0.3955	5.4480
0.6457	0.5485	0.1324	-	0.0138	3.5920
0.5823	0.4413	0.1316	+	0.0076	4.1100
0.5205	0.4117	0.2862	-	0.0164	2.6040
0.4635	0.3537	0.3833	-	3.9390	9.1730
0.4165	0.2947	0.0783	-	0.0346	4.1920
0.3817	0.2117	0.1122	-	0.0590	2.9200
0.3557	0.3531	0.2922	+	0.0193	5.1970
0.3189	0.3110	0.2188	+	0.0589	3.3430
0.2856	0.2391	0.1487	-	0.2015	3.1390
0.2589	0.1668	0.1860	+	0.0000	2.4420
0.2321	0.2334	0.1477	+	0.5994	3.7380
0.2091	0.1887	0.0647	-	0.2846	3.5260
0.1843	0.1493	0.2803	-	0.0098	5.2300
0.1594	0.0415	0.2278	+	0.0061	3.5050
0.1325	0.0044	0.0908	-	0.7560	4.1160
0.1012	-0.0441	0.1420	-	1.0670	3.8810
0.0717	0.0832	0.1092	-	0.3500	3.1040
0.0449	-0.0449	0.1910	-	0.0019	2.6700
0.0184	-0.0152	0.1392	+	0.0065	2.1420
-0.0102	-0.1558	0.2402	-	0.1241	3.1130
-0.0345	-0.0232	0.1022	-	0.0010	3.5240
-0.0610	-0.1282	0.1055	+	0.0889	3.4960
-0.0916	-0.0659	0.0871	-	0.0568	2.3650
-0.1254	-0.1303	0.0571	-	0.3924	3.0160
-0.1563	-0.1229	0.1581	+	5.0020	11.0900
-0.1805	-0.0962	0.1835	+	0.3582	5.2740
-0.2048	-0.2087	0.1419	+	0.3530	4.7650
-0.2288	-0.2995	0.1050	-	0.0090	3.5500
-0.2543	-0.2798	0.1120	-	0.0077	5.0220
-0.2769	-0.3550	0.1053	-	9.2960	15.3000
-0.2932	-0.2708	0.1052	+	2.3900	6.9550
-0.3132	-0.3421	0.0624	-	0.4180	3.7160
-0.3336	-0.2989	0.1058	+	0.1846	3.5390
-0.3509	-0.2578	0.0974	+	0.5181	3.0630
-0.3724	-0.3016	0.1015	-	0.1982	3.7010
-0.3950	-0.3561	0.0543	-	1.2050	6.1610
-0.4126	-0.4022	0.0931	-	0.0125	2.9300
-0.4302	-0.4993	0.1525	-	0.0642	3.3920

INDUSTRY 21 (CONTD)

CLASS MID-PT	MEAN	VARIANCE	SIGN	SKEWNESS	KURTOSIS
-0.4550	-0.4272	0.0898	+	2.4160	7.8120
-0.4776	-0.4547	0.0811	-	5.7290	11.1200
-0.4980	-0.4259	0.2823	+	3.9210	11.1500
-0.5173	-0.5110	0.1870	-	2.4830	7.5160
-0.5368	-0.5072	0.1513	-	0.5130	5.6300
-0.5605	-0.6830	0.1565	-	0.1110	4.6090
-0.5849	-0.5438	0.0772	+	0.8037	4.7900
-0.6073	-0.6953	0.1388	+	0.1522	4.7780
-0.6319	-0.4914	0.2106	+	7.6630	12.3900
-0.6562	-0.7312	0.2313	-	0.7295	3.5490
-0.6894	-0.7124	0.1372	-	1.8590	5.7490
-0.7147	-0.6652	0.0593	+	0.0219	3.0640
-0.7457	-0.7389	0.1259	+	0.2919	3.4800
-0.7957	-0.7420	0.0976	+	2.2630	6.7640
-0.8434	-0.8456	0.1508	-	0.6137	4.3780
-0.8986	-0.7760	0.1667	-	0.0178	3.0000
-0.9697	-0.9268	0.2344	-	3.6980	8.8470
-1.0450	-0.9232	0.2727	+	1.2500	6.4100
-1.1270	-0.9907	0.2335	+	0.1913	3.1010
-1.2350	-0.9449	0.4836	+	2.3060	7.5640
-1.3750	-1.1690	0.4175	+	0.5174	3.4620
-1.5690	-1.5420	0.6567	+	0.0989	2.7070
-2.1080	-1.4030	0.3952	+	0.0032	2.5230

A P P E N D I X C

TRANSITION MATRICES - SUBGROUPS

See Chapter V Section I for definitions and explanations and Section 3 for discussion of these data.

INDUSTRY 1 SUBGROUP 2

CLASS MID-PT	MEAN	VARIANCE	SIGN	SKEWNESS	KURTOSIS
2.0180	1.6800	0.3121	-	0.0126	2.3070
1.4740	1.2470	0.2288	-	0.0000	2.2750
1.2380	1.0480	0.2674	-	0.0003	2.7990
1.0320	0.4577	0.3601	-	0.0078	3.3000
0.8698	0.7961	0.2018	-	0.2915	2.9770
0.7416	0.5817	0.2562	-	0.4413	3.8930
0.6240	0.6067	0.2172	+	0.0264	2.9460
0.5294	0.5220	0.3242	-	0.4543	3.4400
0.4492	0.4508	0.3063	+	0.0695	3.0350
0.3523	0.3034	0.2019	-	0.0233	2.7450
0.2539	0.2345	0.1420	+	0.1468	2.4910
0.1684	0.1554	0.1620	+	0.5917	4.3710
0.0867	-0.0774	0.1973	-	0.1402	3.5190
0.0268	0.0207	0.2739	+	0.0003	3.0020
-0.0602	0.0545	0.1123	-	0.3435	3.6940
-0.1582	-0.2014	0.1694	+	0.0002	2.5060
-0.2484	-0.2702	0.2118	+	0.0262	2.6880
-0.3186	-0.2906	0.1692	+	1.6140	5.7790
-0.4140	-0.4078	0.3267	+	0.4955	4.5110
-0.5249	-0.3413	0.1879	-	0.0596	3.0900
-0.6441	-0.6004	0.1752	+	0.0028	4.4180
-0.7541	-0.5653	0.1643	+	0.8203	4.0100
-0.8667	-0.8717	0.3234	-	0.4098	4.6370
-1.0150	-0.9001	0.2836	+	0.7346	4.5270
-1.2040	-1.0920	0.2609	+	0.6286	5.1820
-1.8480	-1.6370	0.4722	+	0.0960	3.6130

INDUSTRY 1 SUBGROUP 3

CLASS MID-PT	MEAN	VARIANCE	SIGN	SKEWNESS	KURTOSIS
1.7520	1.3850	0.3514	-	0.0260	3.1940
1.1400	1.2480	0.2684	-	0.1026	3.6730
0.8264	0.6602	0.1500	-	0.6598	3.7280
0.5544	0.3554	0.1563	+	0.2819	2.8440
0.2916	0.1680	0.2668	+	0.4651	4.1730
0.1273	-0.0003	0.3802	-	0.3110	2.4110
-0.0389	-0.1204	0.1793	+	0.4427	3.4660
-0.2596	-0.3559	0.2483	-	0.3555	2.5580
-0.5500	-0.6803	0.3155	-	0.0227	2.1590
-0.9067	-0.7841	0.5567	+	0.0008	2.1120
-1.6790	-1.1150	0.5322	-	0.0163	2.3390

INDUSTRY 4 SUBGROUP 1

CLASS MID-PT	MEAN	VARIANCE	SIGN	SKEWNESS	KURTOSIS
2.0190	1.0810	0.8442	-	0.0299	2.1360
1.2530	1.1090	0.3879	+	0.0050	3.3430
0.9577	0.7916	0.5267	+	0.0015	3.6970
0.7120	0.5072	0.2758	+	0.0535	2.1560
0.4765	0.3930	0.5949	-	0.0391	2.3340
0.3208	0.2387	0.4096	-	0.2425	2.8420
0.1942	0.1143	0.2522	+	2.0270	5.2550
0.0904	0.1155	0.2321	-	0.4509	2.6650
-0.0508	-0.0771	0.2876	+	0.1314	2.4540
-0.1793	-0.0767	0.7507	+	3.6710	6.0670
-0.2632	-0.2887	0.3655	-	0.1870	2.7350
-0.3766	-0.4684	0.2314	-	1.4130	4.1730
-0.4976	-0.3350	0.2926	-	0.4744	4.0950
-0.6704	-0.3592	0.7236	+	1.3220	4.7710
-0.8490	-0.7677	0.3252	+	0.1119	2.6510
-1.1200	-0.8693	0.3717	+	0.7981	3.0680
-1.5450	-1.0070	0.4682	+	0.0560	3.4050

INDUSTRY 4 SUBGROUP 2

CLASS MID-PT	MEAN	VARIANCE	SIGN	SKEWNESS	KURTOSIS
1.8450	1.4240	0.4630	-	0.0000	3.1240
1.2340	1.0420	0.4290	+	0.8527	3.7690
0.8834	0.8244	0.4597	-	0.1232	2.8460
0.6319	0.4256	0.4005	-	0.2940	2.8900
0.3661	0.1362	0.7189	-	1.3330	5.0780
0.2014	0.2006	0.4529	-	0.0006	2.6630
0.0367	-0.1355	0.2905	-	0.0126	1.9110
-0.1434	-0.1880	0.4755	+	0.0028	3.4900
-0.2836	-0.2418	0.3095	-	0.0716	3.9110
-0.3838	-0.2268	0.2148	-	0.5838	2.9210
-0.5179	-0.6012	0.1857	+	0.5839	4.6110
-0.6792	-0.4026	0.2016	+	0.1102	3.8870
-0.8180	-0.6062	0.3647	-	0.0317	3.6330
-1.0240	-0.8427	0.4511	-	0.3359	2.4110
-1.5990	-1.0550	0.3918	+	0.6827	5.9350

INDUSTRY 4 SUBGROUP 4

CLASS MID-PT	MEAN	VARIANCE	SIGN	SKEWNESS	KURTOSIS
1.7360	1.5340	0.4932	+	0.0141	2.4230
0.9700	0.9372	0.1691	+	0.0968	2.7800
0.7135	0.3564	0.3880	-	1.0620	4.1790
0.4368	0.4610	0.4605	+	0.2136	3.7820
0.2028	0.1061	0.2331	-	0.3632	3.0440
-0.0599	0.0908	0.2669	-	0.4959	3.3080
-0.4155	-0.5568	0.1911	+	0.0187	2.0660
-0.7213	-0.6514	0.2664	-	0.3326	2.8980
-0.9773	-0.8917	0.1136	-	1.2860	4.9120
-1.4000	-1.0580	0.4307	-	0.9148	4.8110

INDUSTRY 4 SUBGROUP 5

CLASS MID-PT	MEAN	VARIANCE	SIGN	SKEWNESS	KURTOSIS
2.3320	1.6930	0.4937	-	1.0000	5.1160
1.7630	1.2720	0.3579	-	0.1676	2.0980
1.5980	1.2300	0.5356	+	0.0664	3.7860
1.4550	1.2610	0.3333	+	0.1383	2.6300
1.3360	1.0260	0.3001	-	1.3840	5.9870
1.2500	0.9572	0.3150	-	0.1160	3.4340
1.1870	1.0240	0.2212	+	0.4911	3.9450
1.1070	0.9182	0.3113	+	0.0002	3.7010
1.0460	0.8723	0.4390	+	0.0865	3.4450
0.9769	0.8026	0.5340	-	0.0561	2.5860
0.9125	0.7464	0.2001	-	4.4670	9.3130
0.8600	0.6393	0.2290	-	0.2914	3.3370
0.8034	0.5780	0.2901	-	0.0098	3.7600
0.7471	0.4165	0.2454	-	4.6850	10.3400
0.6962	0.6714	0.3920	+	0.4566	3.2410
0.6569	0.5871	0.2529	+	0.0364	2.1860
0.6104	0.6046	0.2725	+	0.3990	2.9020
0.5709	0.5705	0.1395	-	0.5541	4.0520
0.5364	0.4868	0.1102	+	0.0747	3.0230
0.5064	0.5946	0.1814	-	0.5228	4.6270
0.4786	0.4698	0.4582	-	5.1610	10.6600
0.4536	0.2801	0.2679	-	0.9770	4.6390
0.4217	0.2849	0.1277	-	0.0110	3.0630
0.3971	0.2126	0.4863	-	7.2630	12.3100
0.3715	0.1868	0.2589	-	3.3090	6.9190
0.3509	0.4500	0.3658	+	3.4960	8.5210
0.3237	0.3186	0.1091	+	0.0001	3.0080
0.2931	0.3585	0.1818	-	0.4130	4.1280
0.2635	0.1925	0.2026	+	0.1807	5.7780
0.2345	0.2829	0.1243	+	2.4000	6.2620
0.2027	0.3758	0.2823	+	2.4240	5.3210
0.1735	0.1083	0.1588	-	0.7907	4.8920
0.1446	0.0751	0.2467	+	0.1141	5.1230
0.1165	0.1853	0.2204	-	0.0418	2.9450
0.0902	0.1168	0.1863	-	0.9944	5.3800
0.0614	0.0389	0.1715	+	0.6183	3.3210
0.0342	-0.1117	0.2569	-	4.1560	7.7370
0.0119	0.0626	0.1695	-	0.0284	4.7310
-0.0180	-0.0823	0.1733	-	1.5330	3.9450
-0.0477	-0.0316	0.2545	-	1.8130	7.1840
-0.0776	-0.1093	0.1933	-	0.9024	4.0410
-0.1052	-0.1318	0.2639	-	0.2375	3.8580
-0.1342	-0.2715	0.1878	-	0.7438	4.0150
-0.1615	-0.1298	0.1755	+	0.3630	2.7970
-0.1872	-0.1175	0.1418	-	0.2953	2.5300
-0.2140	-0.2045	0.1045	+	0.0087	2.6320
-0.2376	-0.3031	0.1286	-	0.4242	3.2830
-0.2620	-0.2604	0.1609	-	0.6464	3.3000
-0.2936	-0.4339	0.2211	-	3.3460	7.6000
-0.3309	-0.1950	0.1080	+	0.0348	2.0900
-0.3631	-0.3213	0.1118	-	0.0433	2.0150
-0.3985	-0.4450	0.3893	-	1.8510	7.7150

INDUSTRY 4 SUBGROUP 5 (CONTD)

CLASS MID-PT	MEAN	VARIANCE	SIGN	SKEWNESS	KURTOSIS
-0.4333	-0.5344	0.3021	-	2.2990	6.4390
-0.4653	-0.4324	0.1629	-	0.0157	3.1540
-0.4946	-0.5613	0.3037	-	1.4510	4.8890
-0.5255	-0.5489	0.1352	-	0.1569	4.7040
-0.5580	-0.4221	0.1559	-	0.0422	2.9860
-0.6020	-0.5981	0.1165	+	0.3747	3.7100
-0.6549	-0.5949	0.1636	-	3.1870	8.7970
-0.6986	-0.5500	0.1099	-	0.5084	3.3510
-0.7242	-0.7110	0.1383	-	0.0198	5.9310
-0.7553	-0.6970	0.2384	+	0.5180	3.6390
-0.8001	-0.6432	0.3107	+	1.1770	5.6920
-0.8443	-0.7391	0.3716	-	1.6260	7.5280
-0.8850	-0.9378	0.2511	-	1.9430	5.7860
-0.9372	-0.7664	0.1836	+	2.5900	8.3770
-0.9801	-0.7477	0.2954	-	0.0443	4.1760
-1.0510	-0.8881	0.4117	-	0.4459	5.3390
-1.1190	-1.2200	0.4608	-	0.4195	2.7410
-1.2060	-0.9467	0.1833	-	0.0775	2.3330
-1.3320	-1.1040	0.5096	-	0.1575	2.5780
-1.5180	-1.2930	0.3892	-	0.0690	3.4960
-2.1680	-1.4680	0.3733	-	0.3130	2.5540

INDUSTRY 5 SUBGROUP 3

CLASS MID-PT	MEAN	VARIANCE	SIGN	SKEWNESS	KURTOSIS
1.3980	0.9917	0.5957	+	0.0577	2.7750
0.7521	0.5829	0.1400	-	0.5017	2.5080
0.4798	0.3119	0.1377	+	1.6910	4.4090
0.3527	0.2332	0.3654	-	3.2120	7.2650
0.2577	0.1344	0.0744	-	0.1762	2.3150
0.1426	-0.0126	0.2052	-	0.0978	2.8670
0.0487	0.0435	0.1717	-	1.8430	4.5570
-0.1134	-0.2398	0.4122	-	0.5397	3.4160
-0.2302	-0.3216	0.4915	-	5.7360	9.6030
-0.3407	-0.2295	0.1580	-	0.0957	2.4750
-0.5508	-0.4636	0.3258	-	0.0704	2.5150
-0.7945	-0.7057	0.1597	+	0.0589	1.7970
-1.3540	-0.7929	0.5288	-	0.0206	3.2600

INDUSTRY 5 SUBGROUP 4

CLASS MID-PT	MEAN	VARIANCE	SIGN	SKEWNESS	KURTOSIS
2.0410	1.5520	0.7205	-	4.5610	10.8300
1.4630	1.1790	0.2778	-	0.6441	3.4000
1.1810	1.1150	0.2919	-	0.3449	3.8450
0.9352	0.6872	0.3304	+	0.3190	3.2650
0.7056	0.5682	0.2684	+	0.1138	3.0250
0.5410	0.4318	0.3977	-	0.3635	4.3550
0.3929	0.1682	0.2626	-	1.8360	4.8740
0.2444	0.0669	0.2753	-	0.0312	3.5580
0.1340	-0.1548	0.5865	-	3.3410	6.9820
0.0079	-0.0124	0.2400	-	0.1368	4.2900
-0.1146	-0.0858	0.3388	-	0.0430	4.4700
-0.2203	-0.2363	0.3302	+	0.5056	3.5510
-0.2995	-0.4368	0.1646	-	0.6587	5.3030
-0.3914	-0.2903	0.2555	+	0.1367	4.0530
-0.4825	-0.7005	0.3254	-	1.6110	3.6860
-0.5950	-0.4075	0.3238	-	0.0465	3.6190
-0.7521	-0.8267	0.3283	-	0.1721	3.1270
-0.9156	-0.7840	0.3962	-	0.0161	3.0780
-1.0980	-0.9129	0.3553	+	0.1045	5.3460
-1.6600	-0.7491	0.5250	+	1.0240	4.9020

INDUSTRY 6 SUBGROUP 4

CLASS MID-PT	MEAN	VARIANCE	SIGN	SKEWNESS	KURTOSIS
1.8950	1.3350	1.3680	-	2.0620	4.5920
1.2390	1.0230	0.3231	+	0.1058	2.7780
0.9348	0.7431	0.2372	+	0.2018	2.6620
0.7292	0.5514	0.2957	-	1.6630	4.8170
0.6056	0.4094	0.4328	+	0.1952	4.2140
0.4749	0.2301	0.3607	-	0.3520	2.9200
0.3562	0.2386	0.1720	+	0.0815	3.2540
0.2021	0.1862	0.2282	-	0.0225	3.2220
0.0819	-0 0760	0.2613	-	1.1350	3.6830
-0.0052	-0.0161	0.1911	-	0.7488	3.6360
-0.1255	-0.0371	0.3837	-	0.7208	3.0900
-0.2333	-0.2432	0.3024	-	3.3120	7.5720
-0.3883	-0.2044	0.3400	-	1.3270	5.0660
-0.6012	-0.5013	0.2696	-	0.1348	4.1400
-0.8491	-0.7358	0.3842	-	0.1820	3.1460
-1.1640	-1.0010	0.5549	+	0.0873	3.1760
-2.0430	-1.3600	0.9229	+	0.8895	4.5270

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
-0.0912	-0.1352	0.0882	+	0.1003	2.8[illegible]
-0.1242	-0.1327	0.1193	-	0.0149	[illegible]
-0.1519	-0.1621	0.0747	-	0.2038	3.69
-0.1766	-0.1063	0.0690	+	0.2918	4.57
-0.1902	-0.2164	0.1393	-	5.0470	13.04
-0.2327	-0.1035	0.1604	+	0.7069	[illegible]
-0.2595	-0.2033	0.1542	+	[illegible]	[illegible]
-0.2773	-0.2570	[illegible]	+	[illegible]	[illegible]
-0.3003	-0.3016	[illegible]	-	[illegible]	5.60
-0.[illegible]	-0.3540	[illegible]	-	[illegible]	2.70
-0.3633	-0.3734	0.1659	+	[illegible]	4.44
-0.4095	-0.3690	[illegible]	+	0.[illegible]16	4.59
-0.4374	-0.43[illegible]	0.0943	-	0.1619	2.88
-0.4950	[illegible]	0.2130	+	0.1692	4.8[illegible]
-0.[illegible]	-0.6913	0.5137	-	1.2300	4.34
-0.5822	-0.5745	0.1897	-	1.2320	6.2[illegible]
-0.5336	-0.4169	0.2563	+	0.3000	3.2[illegible]
-0.7071	-0.6001	0.3096	+	0.0008	2.7[illegible]
-0.7946	-0.59[illegible]	[illegible]	+	0.0065	3.3[illegible]
-0.8230	-0.6[illegible]	[illegible]	+	0.0128	2.1[illegible]
[illegible]	-0.7185	0.3495	+	0.1296	4.4[illegible]

INDUSTRY 7 SUBGROUP 1

CLASS MID-PT	MEAN	VARIANCE	SIGN	SKEWNESS	KURTOSIS
2.1650	1.7250	0.3431	-	0.0779	2.4410
1.7100	1.4220	0.3164	-	1.0250	2.8630
1.4490	1.2540	0.3734	-	2.1120	6.8420
1.2570	1.0240	0.2726	-	0.3261	3.3090
1.0710	0.9161	0.2555	-	0.3508	3.6110
0.9392	0.6713	0.1406	+	0.0448	2.2610
0.6506	0.6323	0.2824	-	0.6745	4.7890
0.7535	0.6082	0.2599	+	0.0589	3.1910
0.6676	0.6078	0.1952	-	0.2898	4.0250
0.6006	0.3806	0.1298	-	0.5031	3.8400
0.5424	0.3982	0.3337	-	2.5480	8.5700
0.4652	0.2482	0.1901	-	0.1497	2.3060
0.4409	0.3429	0.1068	-	0.2035	2.3720
0.4058	0.3711	0.1100	-	0.1448	3.2360
0.3450	0.3110	0.1105	-	0.6286	2.8700
0.3046	0.0950	0.1072	-	0.1000	1.8780
0.2641	0.3012	0.1016	+	0.0121	2.4330
0.2267	0.0677	0.1140	+	0.0026	2.2330
0.1918	0.2388	0.2041	+	4.2220	7.9110
0.1473	0.1199	0.1384	-	0.0282	3.2080
0.1124	-0.0481	0.1111	-	1.2240	5.0720
0.0679	-0.0337	0.1306	-	0.5859	4.9500
0.0383	-0.1008	0.2106	-	4.6610	7.5860
0.0113	-0.0848	0.0844	+	0.6795	3.4760
-0.0190	-0.0213	0.0906	+	0.3206	3.4090
-0.0549	-0.1414	0.1668	-	0.3939	3.3700
-0.0912	-0.1552	0.0882	+	0.1003	2.8640
-0.1242	-0.1327	0.1193	-	0.0149	3.9240
-0.1519	-0.1821	0.0747	-	0.2058	3.8900
-0.1766	-0.1063	0.0620	+	0.2918	4.6700
-0.1982	-0.2184	0.1393	-	5.8470	13.0400
-0.2327	-0.1035	0.1604	+	0.7669	4.2390
-0.2598	-0.2033	0.1542	+	0.1655	3.4180
-0.2773	-0.2570	0.0925	-	2.8590	8.1630
-0.3003	-0.3016	0.1880	-	0.0194	6.6050
-0.3300	-0.3560	0.1034	-	0.4101	2.7060
-0.3633	-0.3734	0.1658	+	0.2376	4.4480
-0.4055	-0.3690	0.1531	+	0.6316	4.5970
-0.4374	-0.4389	0.0943	-	0.1619	2.8880
-0.4950	-0.3514	0.2138	+	0.1652	4.8650
-0.5455	-0.6913	0.5137	-	1.2300	4.3430
-0.5872	-0.5786	0.1897	-	1.2320	6.2000
-0.6336	-0.4169	0.2363	+	0.3200	3.2230
-0.7071	-0.6001	0.3096	-	0.0006	2.7800
-0.7946	-0.5904	0.1676	-	0.0085	3.3550
-0.8750	-0.6135	0.2539	+	0.0128	2.1360
-0.9705	-0.7185	0.3455	-	0.1256	4.6620
-1.0790	-0.9336	0.2727	-	0.6874	2.6410
-1.2470	-0.8567	0.2157	-	0.2594	4.1680
-1.6500	-1.3290	0.8854	+	0.0593	2.6380

INDUSTRY 7 SUBGROUP 2

CLASS MID-PT	MEAN	VARIANCE	SIGN	SKEWNESS	KURTOSIS
1.9950	1.5590	0.1967	-	0.0191	2.5760
1.4800	1.1000	0.1714	+	0.1491	2.6050
1.3020	1.0880	0.2774	-	0.2974	4.0490
1.1320	0.9823	0.1679	-	0.2853	2.4090
0.9604	0.8910	0.4476	-	0.0236	2.5550
0.8553	0.5947	0.2240	-	0.1979	3.2060
0.7770	0.6499	0.1802	+	0.1708	3.5070
0.6790	0.5957	0.1428	+	0.2024	2.2300
0.5863	0.4821	0.2299	-	0.8961	3.0810
0.4772	0.4946	0.2184	-	0.0409	3.6550
0.3546	0.2473	0.1584	+	1.5860	4.6860
0.2525	0.4593	0.1185	-	0.0229	2.5470
0.1618	0.1691	0.1729	+	1.5280	4.4130
0.0772	0.0922	0.1678	+	2.7820	6.3470
-0.0252	-0.1449	0.2516	-	0.2187	3.5910
-0.1151	-0.0724	0.1870	+	0.7236	5.1740
-0.2341	-0.0247	0.2807	+	0.1338	2.7550
-0.3678	-0.0333	0.1791	+	0.1609	2.6110
-0.5563	-0.3500	0.2193	+	0.1316	3.1690
-1.1530	-0.8143	0.4253	+	0.1011	2.8880

INDUSTRY 8 SUBGROUP 1

CLASS MID-PT	MEAN	VARIANCE	SIGN	SKEWNESS	KURTOSIS
1.7150	1.0990	0.7712	-	0.7968	2.7820
1.1150	0.6383	0.3730	-	0.1696	2.5890
0.7407	0.5458	0.5572	-	0.6127	3.8040
0.5399	0.4268	0.3537	-	0.0266	2.6690
0.3305	0.3540	0.3078	+	0.1978	2.9880
0.1648	0.2466	0.1969	+	0.0266	2.1710
0.0090	0.0035	0.4381	+	2.2140	4.2840
-0.1392	-0.2240	0.8533	-	0.1060	3.6090
-0.2941	-0.3322	0.3989	-	0.4181	2.8720
-0.5003	-0.0567	0.4469	+	0.0578	3.5110
-0.6828	-0.4610	0.2687	-	0.0523	2.9990
-1.3600	-0.6422	0.7148	+	0.0453	2.9450

INDUSTRY 9 SUBGROUP 1

CLASS MID-PT	MEAN	VARIANCE	SIGN	SKEWNESS	KURTOSIS
1.7700	1.3430	0.4383	-	0.9103	3.9650
1.3210	0.9015	0.5173	-	0.3749	3.1780
1.0530	0.4953	0.5740	-	0.4212	2.7560
0.8884	0.7717	0.3779	-	0.1227	3.4520
0.7199	0.4434	0.6250	-	0.8003	3.5800
0.5973	0.3436	0.3654	-	0.8753	3.5040
0.4881	0.4708	0.3317	+	0.0116	2.3140
0.3632	0.0764	0.6707	-	1.4060	4.1520
0.2739	0.2884	0.4293	-	0.2528	3.0060
0.1569	-0.1935	0.4020	+	0.0019	1.9880
0.0466	0.0907	0.4305	+	0.8415	4.5750
-0.0414	0.1006	0.2965	+	0.2564	3.3500
-0.1407	-0.2054	0.5565	-	0.0081	3.7040
-0.2533	-0.2077	0.6373	+	0.0661	2.9770
-0.3725	-0.5685	0.5414	+	0.1100	2.4840
-0.4650	-0.4202	0.4115	-	0.2411	2.1390
-0.5939	-0.4179	0.8100	+	0.0008	3.6730
-0.7463	-0.4627	0.5654	-	0.7221	3.3570
-0.8957	-0.4949	0.1424	+	0.8727	3.3600
-1.1050	-0.6964	0.4205	-	0.3369	3.0190
-1.6840	-0.9653	0.5912	-	0.0273	2.4860

[illegible] 11 SUBGROUP 1

CLASS MID-PT	MEAN	VARIANCE	SIGN	SKEWNESS	KURTOSIS
2.0600	1.2760	0.7311	-	2.3310	6.8400
1.4710	1.1400	0.3454	+	0.0172	3.5570
1.2020	0.9716	0.4382	-	0.3118	3.7280
0.9655	0.9361	0.2393	+	0.0707	2.3440
0.7893	0.7307	0.2522	-	0.1083	3.5860
0.6189	0.5413	0.2529	-	0.1050	3.4540
0.5189	0.3916	0.2370	-	1.9310	6.1020
0.4131	0.3523	0.2484	-	2.4310	7.8520
0.3563	0.2376	0.3505	-	0.7052	4.9470
0.2617	0.1948	0.3358	-	0.1344	4.9070
0.1732	-0.0670	0.0962	-	0.0429	1.9530
0.0793	0.0844	0.1682	-	0.0461	4.1920
0.0082	-0.2702	0.5275	-	4.7220	7.7430
-0.0361	-0.1683	0.2344	-	1.0980	4.1200
-0.1549	-0.3544	0.1820	-	0.0880	2.3330
-0.2380	-0.3926	0.4960	-	0.0693	4.0250
-0.5107	-0.4578	0.5214	-	1.6930	5.2180
-0.4015	-0.4026	0.1530	-	0.0670	3.1210
-0.4927	-0.4023	0.2016	+	0.0405	3.6800
-0.5807	-0.3243	0.2117	+	0.0000	2.6690
-0.7199	-0.6025	0.4038	-	2.0150	4.8420
-0.8652	-0.5332	0.2209	-	0.0115	2.3260
-1.1500	-0.7391	0.3384	-	0.0907	3.5270
-1.9530	-0.9268	1.2400	+	0.5923	4.6510

INDUSTRY 11 SUBGROUP 2

CLASS MID-PT	MEAN	VARIANCE	SIGN	SKEWNESS	KURTOSIS
1.6050	1.4180	0.2905	+	0.6204	3.2530
1.0520	0.9724	0.1777	-	0.0324	4.3200
0.8105	0.6223	0.2310	-	1.1110	4.0160
0.6288	0.5444	0.2986	-	0.0898	2.4800
0.4119	0.3440	0.1138	-	0.1870	2.5360
0.2567	0.0734	0.1502	+	0.0002	2.2660
0.0425	-0.2704	0.2745	-	1.0970	3.4490
-0.1024	-0.0799	0.2290	+	0.0007	3.0860
-0.2407	-0.3143	0.2112	-	0.5911	3.9770
-0.3507	-0.3224	0.3638	+	0.5874	3.4990
-0.5152	-0.6373	0.1687	-	0.1251	2.4850
-0.7550	-0.6215	0.3180	-	0.3006	3.2060
-1.4720	-1.1450	0.4998	-	0.0151	2.5420

INDUSTRY 12 SUBGROUP 2

CLASS MID-PT	MEAN	VARIANCE	SIGN	SKEWNESS	KURTOSIS
1.8570	1.5980	0.3016	-	1.4730	4.4710
1.0520	0.9868	0.3047	+	0.4656	4.4660
0.7795	0.5278	0.3250	-	5.0980	8.0670
0.5533	0.4558	0.4209	-	3.5620	7.4590
0.3468	0.4789	0.1461	-	0.0017	2.2500
0.1661	0.0512	0.1010	-	1.1010	4.7230
0.0538	0.0549	0.1025	-	0.3685	3.8850
-0.0717	-0.0998	0.0949	+	0.4504	2.7650
-0.2236	-0.0915	0.1178	-	0.0606	3.0650
-0.3665	-0.3829	0.0806	+	0.1589	2.1720
-0.4739	-0.4080	0.1546	+	3.1200	7.0230
-0.6114	-0.5842	0.0954	+	1.2200	4.7910
-0.7616	-0.7773	0.1733	-	0.6407	4.2820
-0.9635	-1.0620	0.1038	-	0.0140	2.1940
-1.5620	-1.3160	0.5740	+	0.0109	3.3450

INDUSTRY 12 SUBGROUP 4

CLASS MID-PT	MEAN	VARIANCE	SIGN	SKEWNESS	KURTOSIS
1.5870	1.2530	0.3640	+	0.0479	3.7290
1.0150	0.8318	0.1901	+	0.0621	2.3670
0.7595	0.4677	0.3541	-	0.0444	3.7630
0.5569	0.4761	0.1630	-	0.3326	3.3310
0.4123	0.5247	0.2204	+	1.0090	4.3580
0.2650	0.1169	0.3532	-	2.4420	5.9950
0.1377	0.1528	0.2148	+	0.1052	2.3190
-0.0180	-0.0161	0.3361	-	3.0160	7.2360
-0.2350	-0.1461	0.1456	-	0.4630	2.1520
-0.4544	-0.3637	0.1801	-	0.0150	3.2940
-0.7822	-0.6424	0.2523	-	0.0004	3.0010
-1.4600	-1.3070	0.4024	-	0.0726	3.2710

INDUSTRY 12 SUBGROUP 6

CLASS MID-PT	MEAN	VARIANCE	SIGN	SKEWNESS	KURTOSIS
1.9930	1.3890	0.6278	-	1.5650	4.2270
1.4600	1.1360	0.1721	-	0.5191	2.5610
1.1160	0.9362	0.5326	-	0.2702	3.5620
0.8652	0.7233	0.5961	-	3.9620	7.9580
0.6247	0.3886	0.6694	-	0.5074	2.8910
0.4216	0.4895	0.3208	+	0.9543	4.5470
0.2734	0.3147	0.3414	+	1.2750	4.3090
0.1541	-0.0163	0.0810	-	0.3216	4.4230
0.0291	0.1026	0.2660	+	1.6770	6.4530
-0.1058	-0.0961	0.1583	+	0.0864	2.3030
-0.2096	-0.3025	0.3955	-	2.5490	6.4100
-0.3164	-0.4904	0.1628	-	0.4799	2.6880
-0.4398	-0.3936	0.0989	+	0.0001	3.1320
-0.5490	-0.4974	0.2813	-	0.1262	3.7340
-0.6778	-0.5894	0.0440	+	0.0004	2.5190
-0.8156	-0.4529	0.3774	+	0.0188	2.7470
-1.0620	-0.8368	0.4562	+	1.6320	5.6220
-1.8290	-1.1480	0.7418	-	0.0017	2.4940

INDUSTRY 13 SUBGROUP 1

CLASS MID-PT	MEAN	VARIANCE	SIGN	SKEWNESS	KURTOSIS
2.2110	1.8120	0.4222	-	8.0810	15.0900
1.7520	1.4890	0.1819	-	0.0380	3.9250
1.5660	1.3140	0.1894	-	0.5200	4.9380
1.3690	1.2640	0.1792	-	0.0721	2.2050
1.2160	1.0180	0.4092	-	2.7790	5.9130
1.0710	1.0100	0.3141	-	6.3890	12.7400
0.9643	0.9615	0.0705	+	0.1927	4.2300
0.8747	0.7406	0.1326	+	0.3713	2.4910
0.8149	0.6259	0.5672	-	6.8200	12.9100
0.7461	0.5713	0.2606	-	1.9060	5.1950
0.6702	0.6761	0.1366	+	0.3938	3.5500
0.6039	0.5378	0.2121	+	0.0064	3.6880
0.5572	0.4942	0.2063	-	0.3124	5.4840
0.4887	0.4748	0.1745	+	2.8690	7.6380
0.4399	0.3216	0.1398	-	2.6370	5.9330
0.4007	0.3329	0.1432	-	1.7410	4.4980
0.3569	0.5187	0.2344	+	4.8800	9.5650
0.2973	0.2409	0.0476	+	0.2594	2.9990
0.2555	0.2284	0.0895	+	0.0001	1.9940
0.2225	0.1390	0.3475	-	10.9000	16.7800
0.1829	0.2147	0.0700	+	0.1529	3.2070
0.1484	0.0910	0.1401	+	2.7720	7.7630
0.1186	0.0754	0.1141	+	1.0680	6.5050
0.0820	0.0462	0.0659	-	0.0670	2.6490
0.0427	0.0005	0.2312	+	2.6310	8.2960
0.0081	-0.0225	0.1427	-	0.1227	3.3170
-0.0238	-0.0869	0.2433	-	4.5700	10.9400
-0.0605	-0.0360	0.0865	-	3.5590	9.8500
-0.0961	-0.1029	0.2839	-	3.4100	7.2080
-0.1294	-0.1377	0.0874	-	0.7069	3.4870
-0.1667	-0.1170	0.0841	+	0.2073	3.7360
-0.2093	-0.1838	0.3253	+	5.5340	12.6400
-0.2383	-0.2998	0.1154	-	6.0490	11.6700
-0.2810	-0.2843	0.1092	-	0.4002	3.3190
-0.3212	-0.4561	0.0951	-	0.0120	2.9970
-0.3724	-0.4007	0.2549	+	0.0402	6.2490
-0.4223	-0.4046	0.0781	-	0.6118	3.2500
-0.4669	-0.4234	0.0626	+	0.7886	4.7750
-0.5158	-0.5154	0.2164	-	4.2870	9.8580
-0.5641	-0.5668	0.0648	+	0.0002	2.7170
-0.6132	-0.6368	0.1154	+	0.0046	4.2120
-0.6629	-0.6798	0.1802	-	3.2900	9.5510
-0.7253	-0.6639	0.1103	-	0.3101	3.3410
-0.7741	-0.7677	0.1180	-	0.2524	3.6020
-0.8477	-0.6699	0.2183	+	3.0080	6.0550
-0.9164	-0.8007	0.1183	-	0.[illegible]028	2.6130
-1.0040	-0.8826	0.0991	+	1.2080	4.6720
-1.1120	-1.1020	0.0981	-	0.0501	2.5280
-1.2130	-1.1360	0.2401	+	0.1438	3.7010
-1.2990	-1.1580	0.0703	+	0.4873	2.8180
-1.4350	-1.2170	0.1561	+	0.0405	2.8880
-1.9900	-1.5610	0.2692	+	0.1197	2.8830

INDUSTRY 15 SUBGROUP 1

CLASS MID-PT	MEAN	VARIANCE	SIGN	SKEWNESS	KURTOSIS
1.9770	1.5280	0.6687	-	0.1317	2.3150
1.3340	1.1550	0.2587	-	1.0930	3.9660
1.0480	0.7409	0.4478	-	1.7250	5.3620
0.8654	0.6406	0.3174	-	0.1547	3.4100
0.7095	0.4911	0.3153	+	1.0500	6.4240
0.6212	0.3994	0.3044	-	0.3638	4.9600
0.5159	0.2301	0.5602	-	1.1630	4.0450
0.4277	0.1731	0.4135	-	0.6312	3.1830
0.3527	0.3698	0.2891	+	0.0875	3.5920
0.2645	0.3169	0.1633	+	0.0160	2.2440
0.1596	0.1846	0.1509	-	0.1495	4.0200
0.0528	-0.0039	0.4481	-	0.0933	4.6490
-0.0501	-0.0735	0.2467	-	0.0471	2.5560
-0.1513	-0.2495	0.3659	-	0.0991	2.4570
-0.2786	-0.2813	0.1645	+	0.2259	3.2550
-0.4027	-0.3853	0.5038	-	0.0011	3.1690
-0.5412	-0.4564	0.4589	-	0.0010	3.0750
-0.6814	-0.5763	0.5733	-	0.1266	2.9870
-0.8487	-0.7047	0.4966	-	0.3369	5.4620
-1.0730	-0.7782	0.6402	+	0.0325	1.8820
-1.4120	-0.9811	0.9383	+	1.0780	5.3400
-2.0020	-1.2490	0.6072	+	0.2915	2.8830

INDUSTRY 15 SUBGROUP 2

CLASS MID-PT	MEAN	VARIANCE	SIGN	SKEWNESS	KURTOSIS
1.8630	1.4310	1.0580	-	4.7190	8.7570
1.1600	0.9660	0.1349	-	0.9993	3.5600
0.7631	0.7447	0.1266	+	0.4036	2.1310
0.6167	0.5646	0.1293	-	0.0080	2.8980
0.4481	0.1672	0.1839	-	5.1820	9.0280
0.2871	0.1201	0.3750	-	6.3960	10.6000
0.1399	0.0897	0.0672	-	0.0003	3.0340
0.0011	0.0596	0.1123	-	0.0704	2.9700
-0.1004	-0.2833	0.0815	-	0.8459	4.7340
-0.2649	-0.1574	0.1886	+	1.4970	4.1390
-0.4054	-0.4358	0.1144	+	0.0054	3.3350
-0.5323	-0.4680	0.3289	+	3.6220	8.6500
-0.6965	-0.5401	0.1067	+	0.0004	2.1080
-0.8713	-0.7663	0.2107	+	0.0000	2.8770
-1.0940	-0.9830	0.1312	-	0.4236	3.7590
-1.6580	-1.1030	0.3874	-	0.0108	3.2890

INDUSTRY 15 SUBGROUP 3

CLASS MID-PT	MEAN	VARIANCE	SIGN	SKEWNESS	KURTOSIS
1.9990	1.4060	0.4803	+	0.1730	2.3430
1.3130	0.8434	0.2618	+	0.1227	2.2110
1.0290	1.0740	0.3136	+	0.5233	3.0200
0.8341	0.8726	0.2737	+	0.1763	1.9420
0.6972	0.6294	0.0871	-	0.9612	4.3780
0.5941	0.4320	0.2084	+	0.0006	2.6980
0.5057	0.4761	0.0724	-	0.2654	2.8800
0.4502	0.5259	0.2013	-	0.7174	4.7480
0.3794	0.3440	0.1047	-	0.1904	3.6890
0.3174	0.3989	0.1257	+	0.0012	3.3510
0.2509	0.1208	0.1356	-	0.2625	2.2680
0.1580	0.0335	0.1832	-	0.2630	2.7670
0.0696	-0.0064	0.0672	-	0.4923	4.1740
-0.0030	-0.1431	0.1872	+	0.0559	2.9120
-0.0871	-0.2470	0.4706	-	2.6260	6.3520
-0.1665	-0.2717	0.1368	-	0.0780	2.2800
-0.2564	-0.1876	0.1752	+	0.7282	7.8780
-0.3356	-0.1528	0.1813	-	0.0618	5.0640
-0.4377	-0.4293	0.2746	-	3.1740	7.3550
-0.5618	-0.4880	0.1063	+	0.2209	2.3680
-0.7121	-0.7300	0.3689	+	0.0193	2.0030
-0.8823	-0.9628	0.3397	-	0.1120	3.6740
-1.1270	-0.8996	0.2684	+	0.0026	2.2780
-1.6680	-1.0780	0.7359	+	0.2930	4.7400

INDUSTRY 16 SUBGROUP 1

CLASS MID-PT	MEAN	VARIANCE	SIGN	SKEWNESS	KURTOSIS
1.7660	1.5000	0.4652	-	0.0526	2.6700
1.0830	0.8137	0.3688	+	0.7224	3.5010
0.7471	0.3990	0.5495	+	1.8490	4.1720
0.5178	0.5386	0.1619	+	0.0317	2.1080
0.3816	0.2463	0.1085	-	0.3599	2.6610
0.2669	0.4438	0.3271	+	0.9422	3.3300
0.1688	0.0822	0.0991	+	0.2589	2.3380
0.0533	0.0023	0.3312	-	0.0424	2.9370
-0.0585	-0.2486	0.3876	-	1.7390	4.9380
-0.1764	-0.2354	0.2327	-	0.0682	2.9420
-0.3200	-0.2410	0.0653	+	0.1243	2.1790
-0.4636	-0.3711	0.1245	-	0.3621	2.9750
-0.6973	-0.6946	0.4256	-	0.0542	2.0660
-1.0530	-0.9093	0.4669	-	1.3040	4.4870
-1.6660	-1.1920	0.6176	+	0.9075	4.0030

INDUSTRY 16 SUBGROUP 2

CLASS MID-PT	MEAN	VARIANCE	SIGN	SKEWNESS	KURTOSIS
1.7800	1.1900	0.7074	-	4.8990	9.4420
1.0950	0.9405	0.2792	+	1.5910	4.3370
0.9066	0.4523	0.7214	-	4.5860	9.3390
0.7557	0.6837	0.2249	-	0.1236	2.8230
0.5723	0.3961	0.1082	+	0.7206	4.0100
0.4437	0.3722	0.2114	+	0.0110	2.3710
0.3441	0.1024	0.2474	-	1.0090	3.1770
0.2279	0.3260	0.1486	-	0.0466	2.0260
0.1146	-0.0855	0.2537	+	0.4652	3.9150
0.0042	-0.0671	0.4182	-	1.7090	5.8750
-0.0708	-0.1740	0.2144	+	0.2949	3.6990
-0.1643	-0.1444	0.2168	+	0.1908	2.7240
-0.2536	-0.2263	0.1171	-	0.1061	2.5790
-0.3457	-0.2791	0.3727	-	0.1134	2.0910
-0.4630	-0.4554	0.1846	-	0.1560	3.0790
-0.6074	-0.4852	0.3638	-	0.0156	3.0700
-0.8640	-0.5155	0.4919	+	0.9385	7.3180
-1.4220	-0.8757	0.4417	-	0.8846	3.0930

INDUSTRY 16 SUBGROUP 3

CLASS MID-PT	MEAN	VARIANCE	SIGN	SKEWNESS	KURTOSIS
1.6950	1.0790	0.3354	+	0.1332	2.9880
1.1960	1.0040	0.2401	-	0.0482	2.8880
0.9888	0.7255	0.2163	+	0.0322	2.3000
0.8585	0.7824	0.2524	-	0.0575	2.2540
0.7222	0.6283	0.1675	+	0.0637	2.7030
0.6014	0.4653	0.3091	-	0.4855	2.6110
0.4468	0.3513	0.3316	-	0.7370	3.8170
0.3193	0.3224	0.3139	+	2.7800	6.7240
0.1940	0.2021	0.1710	+	0.0132	2.2590
0.0607	-0.0938	0.1227	-	0.1421	3.1100
-0.0700	-0.0737	0.2684	+	0.0112	2.6560
-0.2061	-0.1614	0.2735	+	0.0327	2.3640
-0.3634	-0.2666	0.2475	-	1.0210	3.8690
-0.4431	-0.4972	0.2266	+	0.0010	2.2170
-0.5322	-0.4496	0.1634	-	0.0073	3.6820
-0.7066	-0.8760	0.3960	-	1.6960	3.9230
-0.9577	-0.6812	0.2542	+	0.4887	3.6110
-1.6660	-1.2280	0.6499	-	0.0000	2.3920

INDUSTRY 16 SUBGROUP 4

CLASS MID-PT	MEAN	VARIANCE	SIGN	SKEWNESS	KURTOSIS
1.8680	1.3040	0.7325	-	0.9332	5.3640
1.1320	0.9681	0.1317	+	0.0894	2.1830
0.8717	0.4076	0.9364	-	0.2148	2.4920
0.6601	0.4573	0.5166	-	0.3168	2.4600
0.4651	0.3462	0.2604	+	0.0382	2.7840
0.3005	0.3327	0.4618	+	0.0172	3.0210
0.1418	0.0242	0.2539	+	0.0738	2.2880
0.0076	-0.1343	0.3304	-	0.1463	1.8370
-0.1017	-0.3117	0.3357	-	0.6699	3.7750
-0.3103	-0.2648	0.2428	+	0.0001	2.5960
-0.4497	-0.2521	0.3036	-	0.0005	1.7500
-0.5715	-0.4794	0.3618	-	0.4862	3.5140
-0.8043	-0.4485	0.4137	-	0.3189	2.2550
-1.0700	-0.7108	0.7927	+	0.2057	2.1940
-1.5970	-0.7652	0.5364	-	0.0043	2.0240

INDUSTRY 16 SUBGROUP 5

CLASS MID-PT	MEAN	VARIANCE	SIGN	SKEWNESS	KURTOSIS
1.8390	1.5470	0.3256	+	0.0085	2.7540
1.1600	0.8682	0.3255	+	0.0486	3.1800
0.8875	0.8210	0.2377	+	0.3077	5.7880
0.6776	0.6147	0.2253	+	0.0000	2.3520
0.5044	0.4990	0.2150	-	0.0571	3.8600
0.3177	0.2207	0.1962	+	0.0000	2.8580
0.1134	-0.0071	0.2656	+	0.0519	3.5870
-0.0138	-0.1019	0.1141	-	0.5528	5.1820
-0.1437	-0.2219	0.1295	+	0.2506	3.3060
-0.2519	-0.2911	0.1320	+	0.1808	3.2540
-0.3657	-0.5096	0.1242	-	3.8790	9.6710
-0.4734	-0.4143	0.2464	+	0.1105	3.5290
-0.5662	-0.6188	0.1273	-	0.9449	4.5590
-0.6857	-0.6283	0.2081	-	1.1430	4.3020
-0.8731	-0.8802	0.2494	+	0.0101	2.9600
-1.4510	-1.0220	0.3571	-	0.3476	2.6770

INDUSTRY 17 SUBGROUP 1

CLASS MID-PT	MEAN	VARIANCE	SIGN	SKEWNESS	KURTOSIS
1.4130	1.4090	0.4374	-	0.9025	6.4170
1.2360	0.8452	0.2760	+	0.0012	2.4150
0.9456	0.9066	0.1495	+	0.0023	3.1640
0.7282	0.5822	0.1331	+	0.3436	3.4640
0.5463	0.3647	0.2350	-	0.0094	2.6740
0.3507	0.2544	0.2108	-	0.6075	4.6610
0.2529	0.3945	0.1724	+	0.0652	3.0540
0.1286	0.0551	0.1290	-	1.6870	5.9900
0.0106	-0.0755	0.1971	-	1.9340	7.1620
-0.0906	0.0102	0.1991	+	1.6080	5.5110
-0.1631	-0.1431	0.2936	+	0.1648	3.3710
-0.2559	-0.2529	0.1040	-	0.0833	2.9390
-0.3519	-0.3703	0.2365	-	0.0565	2.5240
-0.4695	-0.5369	0.3027	-	2.6540	6.3480
-0.6485	-0.4877	0.0921	-	0.0335	2.3550
-0.8760	-0.6753	0.1726	-	0.0784	2.5140
-1.4200	-1.0650	0.7450	+	5.0450	12.6400

INDUSTRY 18 SUBGROUP 1

CLASS MID-PT	MEAN	VARIANCE	SIGN	SKEWNESS	KURTOSIS
2.1770	1.5210	0.6489	-	0.5157	3.1130
1.3440	1.2350	0.3059	+	2.0490	5.0750
1.0820	0.9667	0.1484	+	0.0211	3.9280
0.8744	0.5244	0.5170	+	0.0685	3.5340
0.7363	0.5457	0.2162	+	3.1680	7.1130
0.6361	0.4281	0.1571	-	0.1539	2.5480
0.5500	0.4046	0.2396	+	1.5090	6.1000
0.4613	0.3950	0.1889	-	0.2053	3.0090
0.3626	0.3502	0.1078	-	0.1000	3.4620
0.2875	0.2815	0.2206	-	0.6289	3.3680
0.1857	0.1841	0.1136	-	0.0012	3.4830
0.1248	0.1696	0.0840	+	0.0004	2.0270
0.0477	0.0649	0.2582	-	0.0049	3.7270
-0.0402	-0.0696	0.2645	+	0.0875	3.8260
-0.1089	-0.1514	0.0854	+	0.4216	2.1740
-0.2100	-0.3528	0.1131	-	0.0059	2.0130
-0.3211	-0.3251	0.0762	+	0.1044	2.4620
-0.4150	-0.4199	0.1338	-	2.7620	8.0900
-0.4728	-0.3202	0.1236	+	0.1372	2.8950
-0.5440	-0.5417	0.1116	-	0.0665	2.3970
-0.6546	-0.4721	0.2861	+	0.9561	3.1300
-0.7606	-0.7250	0.3684	+	0.0056	3.9510
-0.8725	-0.8650	0.1230	-	0.5522	2.5750
-1.0440	-0.8992	0.2271	+	0.2448	2.0950
-1.2450	-1.2380	0.3884	-	0.7475	2.8840
-1.8730	-1.3250	0.2229	-	1.6870	5.7140

INDUSTRY 18 SUBGROUP 2

CLASS MID-PT	MEAN	VARIANCE	SIGN	SKEWNESS	KURTOSIS
1.7200	1.2120	0.1819	-	0.0097	1.9860
1.3110	0.9242	0.1637	+	0.1363	2.0440
1.1360	0.7960	0.5107	+	0.2076	3.5010
0.9265	0.5738	0.8219	-	7.7610	11.2400
0.7623	0.5499	0.3699	+	0.2180	2.2890
0.6033	0.6510	0.2326	-	0.2590	2.0540
0.4688	0.4764	0.1583	+	0.2743	2.3060
0.3702	0.3264	0.3821	-	0.2616	5.1200
0.2917	0.1627	0.0453	-	0.2413	2.3300
0.2385	0.1774	0.1391	-	0.0217	3.8340
0.1738	0.1988	0.1044	+	2.0010	4.4460
0.1125	0.1320	0.1856	-	0.0326	2.8870
0.0444	-0.0184	0.4230	+	1.2140	5.7300
-0.0057	-0.2423	0.1926	-	1.0350	3.5720
-0.0669	-0.0516	0.2383	+	1.5730	4.7590
-0.1477	-0.2375	0.3068	-	1.0290	4.3960
-0.2192	-0.3294	0.2834	-	1.8410	4.8180
-0.3129	-0.4390	0.3409	-	0.0211	2.9170
-0.4376	-0.4052	0.0963	+	0.0302	2.4800
-0.5517	-0.5441	0.2641	-	0.4143	2.1340
-0.6618	-0.3825	0.3334	+	1.0400	5.5790
-0.7902	-0.6552	0.1721	+	0.0182	2.2000
-0.9254	-0.7360	0.2201	-	1.5200	4.9720
-1.1700	-0.9397	0.3131	-	0.0208	2.3850
-1.8520	-1.2380	0.7185	-	0.3041	2.4290

INDUSTRY 18 SUBGROUP 3

CLASS MID-PT	MEAN	VARIANCE	SIGN	SKEWNESS	KURTOSIS
2.2970	1.6240	0.5433	-	0.0392	2.3680
1.6830	0.7211	0.6117	-	0.1724	2.7560
1.4430	0.9076	0.7603	-	0.2704	3.8310
1.2840	1.0580	0.5394	-	0.1055	3.7840
1.1360	0.8066	0.3986	-	0.9398	4.2110
1.0210	0.8688	0.2890	+	0.0239	2.1470
0.9291	0.7649	0.6274	-	0.0000	5.0090
0.8367	1.0680	0.3076	+	0.2166	2.5660
0.7720	0.8063	0.2194	-	0.4189	3.2780
0.7000	0.4282	0.2545	+	0.0153	3.2990
0.6532	0.4484	0.2318	-	1.1800	4.8130
0.5838	0.5381	0.1620	+	0.1128	3.6450
0.5193	0.5373	0.1563	-	0.0094	2.6910
0.4557	0.4490	0.2222	+	0.5268	4.5860
0.4092	0.3167	0.2157	+	0.0333	2.8070
0.3662	0.2316	0.1776	-	0.0001	3.7880
0.3171	0.2685	0.4118	-	0.0344	4.3250
0.2601	0.1134	0.1198	+	0.2354	3.3580
0.2092	0.1612	0.3136	+	0.1371	4.6360
0.1735	0.1856	0.2496	+	2.8800	8.0580
0.1383	0.1086	0.1151	+	0.0011	2.1390
0.0716	-0.1252	0.2165	-	0.4791	4.5660
0.0251	0.0772	0.1559	-	0.0462	3.1210
-0.0162	-0.1754	0.4714	-	0.8361	5.1130
-0.0487	-0.2387	0.4577	-	1.7980	6.7480
-0.0850	-0.1334	0.1627	-	0.6069	3.6860
-0.1300	-0.2762	0.4403	-	1.5580	9.3360
-0.1789	-0.2953	0.6476	-	0.2638	4.7120
-0.2182	-0.0972	0.2080	+	0.2483	3.5270
-0.2663	-0.5041	0.5200	-	0.5796	3.3050
-0.3045	-0.2602	0.1497	+	0.0134	1.9770
-0.3375	-0.3985	0.1912	-	0.0190	3.2170
-0.3708	-0.4972	0.2829	-	7.6270	12.6300
-0.4170	-0.2683	0.1843	+	2.8280	6.4040
-0.4601	-0.6050	0.3209	+	0.0006	4.5180
-0.5146	-0.3362	0.3974	-	0.0057	6.5510
-0.5665	-0.4404	0.2589	+	1.7170	5.7080
-0.6205	-0.5706	0.3853	+	0.7133	4.6570
-0.6796	-0.4070	0.2270	+	0.7526	3.3780
-0.7415	-0.5044	0.3121	+	1.4840	5.9810
-0.8044	-0.7247	0.3040	-	2.1070	5.3880
-0.8663	-0.7782	0.2708	-	0.0094	3.7870
-0.9482	-0.7977	0.2331	+	0.3792	5.1370
-1.0550	-0.8971	0.4383	+	1.7510	5.2280
-1.1800	-1.0210	0.4960	-	0.0210	3.7250
-1.4070	-1.1960	0.5025	-	0.2056	2.0920
-2.0260	-0.9532	0.6645	+	3.8660	9.1730

INDUSTRY 19 SUBGROUP 1

CLASS MID-PT	MEAN	VARIANCE	SIGN	SKEWNESS	KURTOSIS
2.0990	1.6260	0.6714	-	0.1888	2.5410
1.2150	0.9665	0.4213	+	1.6960	4.8240
0.9313	0.7713	0.0696	-	0.0268	2.5230
0.7222	0.5599	0.1529	-	0.0443	2.3790
0.5472	0.4870	0.2763	+	0.3553	3.5000
0.4105	0.4453	0.2127	+	0.9435	2.6080
0.2881	0.1639	0.1317	+	0.0114	1.8950
0.1791	0.1587	0.1980	-	0.0311	2.9330
0.0867	-0.0760	0.1883	-	0.3723	3.1740
-0.0004	0.0091	0.1233	-	0.0349	2.0090
-0.1103	-0.0556	0.3293	+	2.7140	6.9660
-0.2119	-0.1664	0.0885	+	0.0544	2.3810
-0.3320	-0.2765	0.0995	+	0.7403	3.8580
-0.4528	-0.4039	0.1729	+	0.7183	4.3450
-0.5729	-0.5607	0.1308	-	0.0633	2.5570
-0.6938	-0.8827	0.1088	-	0.0907	3.5570
-0.8442	-0.7074	0.1285	-	0.8154	2.9350
-1.1830	-1.1200	0.2172	+	0.0002	2.0370
-1.7020	-1.6060	0.2083	-	0.1464	2.8670

INDUSTRY 19 SUBGROUP 2

CLASS MID-PT	MEAN	VARIANCE	SIGN	SKEWNESS	KURTOSIS
2.1420	1.9500	0.4235	+	0.0003	1.9810
1.2400	1.0910	0.1867	-	0.3286	3.5380
0.7938	0.8050	0.1364	+	1.8170	5.4200
0.5380	0.5019	0.0379	+	0.2041	2.6220
0.3433	0.1943	0.0750	-	0.0779	3.3060
0.2461	0.1293	0.0664	-	0.4795	3.2700
0.1204	0.0837	0.0943	-	0.2006	4.6490
0.0264	-0.0263	0.0547	-	0.0233	3.0710
-0.0593	-0.1052	0.0441	+	0.2322	3.7340
-0.1383	-0.1049	0.0537	-	0.3275	2.4120
-0.2304	-0.1942	0.0535	+	2.0780	6.4630
-0.3474	-0.3640	0.0459	-	0.0033	2.5880
-0.4972	-0.5191	0.0628	-	0.5266	3.2910
-0.6520	-0.7131	0.0578	+	0.0609	2.8670
-0.8360	-0.9835	0.3032	-	3.0220	6.2490
-1.5540	-1.3730	0.6809	-	0.0665	2.3130

INDUSTRY 19 SUBGROUP 3

CLASS MID-PT	MEAN	VARIANCE	SIGN	SKEWNESS	KURTOSIS
2.1820	1.6460	0.5311	-	1.9920	5.8100
1.7280	1.3490	0.3488	-	0.4751	3.2810
1.4680	1.1610	0.3258	+	0.1241	3.4230
1.2960	1.2220	0.2627	-	2.0240	7.0930
1.1550	0.8948	0.2219	-	0.8329	4.5580
1.0610	0.8621	0.3635	-	0.1147	2.3130
0.9775	0.8198	0.2492	-	0.0569	2.7860
0.8917	0.7030	0.2300	-	0.9095	3.5490
0.8209	0.6088	0.3220	-	0.2022	2.5640
0.7144	0.6210	0.3925	-	0.4352	3.3900
0.6111	0.6043	0.3477	-	1.6800	5.7740
0.5344	0.4864	0.3351	-	2.5840	8.7510
0.4659	0.4507	0.0969	+	0.0781	4.5440
0.3826	0.4013	0.1633	-	0.1714	2.5180
0.3049	0.2882	0.1261	-	0.2823	3.3670
0.2499	0.0612	0.4429	-	2.3250	6.5520
0.1721	0.1818	0.3623	-	0.6483	4.8760
0.1104	0.2412	0.3568	+	4.0390	7.9430
0.0454	-0.0783	0.2034	-	0.0120	2.8360
-0.0272	0.0213	0.1095	+	0.3725	3.2750
-0.0714	-0.0756	0.2035	-	1.1650	5.1280
-0.1271	-0.1558	0.2120	+	0.0726	2.8090
-0.1883	-0.1977	0.1251	+	0.0013	2.1350
-0.2634	-0.2343	0.2562	+	2.7800	7.5430
-0.3330	-0.3377	0.1726	+	0.5757	5.6170
-0.4189	-0.4212	0.3667	+	0.0458	3.2990
-0.4944	-0.5061	0.1214	+	0.0136	3.0010
-0.5686	-0.5419	0.1836	-	0.2537	2.8190
-0.6277	-0.4668	0.4013	+	1.3190	6.8400
-0.6935	-0.6468	0.1251	+	0.0697	2.8070
-0.7659	-0.6551	0.1360	+	0.0018	2.3870
-0.8366	-0.8735	0.3828	-	0.0124	3.3340
-0.9369	-0.8586	0.2091	-	0.0206	5.1190
-1.0410	-1.0220	0.2710	-	0.0018	3.0770
-1.2100	-1.0480	0.1688	-	0.0053	2.9900
-1.4390	-1.2260	0.6136	+	3.6750	7.1740
-1.9340	-1.3050	0.6276	+	0.5243	3.4160

INDUSTRY 20 SUBGROUP 2

CLASS MID-PT	MEAN	VARIANCE	SIGN	SKEWNESS	KURTOSIS
1.8880	1.4940	0.4266	-	1.1970	3.8580
1.3080	1.0670	0.2317	-	0.3675	2.8160
0.8220	0.5752	0.2200	-	0.0011	3.4590
0.5497	0.5080	0.3330	+	0.0388	2.7050
0.3346	0.0943	0.1642	-	0.0017	2.3300
0.1211	0.1789	0.5944	-	0.0772	3.0890
-0.1065	-0.0085	0.3116	+	0.2324	2.2640
-0.2391	-0.1372	0.0951	-	0.1213	2.9050
-0.4377	-0.2624	0.4691	+	5.1210	8.6760
-0.6383	-0.7042	0.1780	+	0.4176	3.2220
-0.8005	-0.7281	0.4680	-	0.0377	2.8490
-1.0710	-0.9821	0.1861	+	0.2983	3.3860
-1.6110	-1.2290	0.4464	-	0.0607	3.0710

INDUSTRY 20 SUBGROUP 3

CLASS MID-PT	MEAN	VARIANCE	SIGN	SKEWNESS	KURTOSIS
2.3050	1.8710	0.9794	-	1.8920	4.4410
1.3000	1.2720	0.3988	-	0.0091	2.2990
0.9666	0.6789	0.3108	-	1.8160	4.8950
0.7201	0.7586	0.1352	-	0.0713	2.6110
0.5183	0.2989	0.1814	+	0.2375	2.2810
0.3906	0.0991	0.2275	-	1.5620	4.4770
0.2556	0.0673	0.1517	-	0.0613	2.2200
0.1484	0.1056	0.0879	+	0.0240	2.0700
0.0421	-0.0633	0.1028	-	0.3130	4.2120
-0.0360	-0.0674	0.0542	-	0.4432	2.8630
-0.0866	0.0842	0.0779	+	1.8700	4.7880
-0.1530	-0.1207	0.0626	+	0.2647	3.1780
-0.2116	-0.1155	0.1853	-	0.0006	2.2250
-0.2796	-0.3092	0.0518	+	0.0042	2.4250
-0.3579	-0.3267	0.0548	+	0.2566	2.6670
-0.4403	-0.4531	0.1264	+	0.1190	2.5250
-0.4996	-0.5762	0.2298	-	0.9463	3.5400
-0.5668	-0.6728	0.1640	-	0.9774	3.5860
-0.6537	-0.6818	0.0952	+	0.9563	3.5710
-0.7815	-0.5715	0.1288	+	1.4470	4.2840
-0.9002	-0.7676	0.1755	+	0.3252	4.0210
-1.0110	-0.8477	0.1538	+	0.2906	3.0860
-1.3900	-0.9794	0.1367	+	0.0003	2.5700

INDUSTRY 21 SUBGROUP 2

CLASS MID-PT	MEAN	VARIANCE	SIGN	SKEWNESS	KURTOSIS
2.2210	1.6730	1.0190	-	1.6090	4.2600
1.3560	1.2460	0.4175	-	0.4271	3.3400
0.9231	0.9157	0.1444	+	0.1325	2.6480
0.7310	0.6966	0.3235	+	0.4678	4.7270
0.5605	0.5865	0.1138	-	0.0928	2.6150
0.4204	0.4030	0.0723	+	0.0909	2.1150
0.3272	0.2952	0.1902	+	0.0020	3.1640
0.2437	0.0441	0.1475	-	0.9999	3.8010
0.1530	0.0644	0.2478	-	0.0334	2.8860
0.0570	0.0225	0.2083	-	0.1019	2.5390
-0.0279	0.0341	0.1093	+	0.1099	2.4410
-0.1175	-0.1133	0.1044	+	0.0194	2.6000
-0.2002	-0.3525	0.1783	-	1.3390	4.7380
-0.2966	-0.2531	0.2775	-	3.0340	8.2420
-0.3657	-0.2466	0.2544	+	2.4800	7.4550
-0.4457	-0.4801	0.1496	-	0.7462	3.5920
-0.5429	-0.5188	0.1377	-	0.4661	3.4830
-0.6165	-0.6469	0.1230	-	3.3830	7.2590
-0.7222	-0.6927	0.1959	-	0.3254	3.4760
-0.9118	-0.7819	0.2914	-	0.0011	2.8620
-1.1870	-1.2560	0.3595	+	0.0323	3.6310
-1.7890	-1.2570	0.5590	+	0.0025	3.1950

INDUSTRY 21 SUBGROUP 3

CLASS MID-PT	MEAN	VARIANCE	SIGN	SKEWNESS	KURTOSIS
1.7530	1.4460	0.2368	-	0.9568	2.8520
1.2190	1.0280	0.6002	-	2.7270	5.8450
0.8061	0.6058	0.1032	+	0.0778	2.1340
0.4998	0.4055	0.4541	-	0.1052	6.0110
0.2354	0.2953	0.2892	+	0.0044	1.7460
-0.0352	-0.1844	0.1398	+	0.1940	2.2620
-0.1915	-0.2471	0.1604	-	2.0780	5.5040
-0.3686	-0.3697	0.1155	-	1.8860	5.7940
-0.5044	-0.3365	0.0575	+	0.0474	2.6750
-0.6714	-0.5340	0.1488	-	0.0002	4.1560
-0.8818	-0.7663	0.2279	-	0.0148	2.4370
-1.5510	-1.3010	0.6400	+	2.6100	6.7200

INDUSTRY 21 SUBGROUP 4

CLASS MID-PT	MEAN	VARIANCE	SIGN	SKEWNESS	KURTOSIS
1.8000	1.3570	0.3891	-	0.3048	2.4560
1.1350	0.8599	0.5865	-	2.0330	5.4770
0.8001	0.5621	0.4510	-	0.1273	3.4290
0.5215	0.3349	0.6934	+	0.0042	3.2610
0.2669	0.4052	0.3977	+	0.0860	2.8380
0.0547	0.2754	0.5953	+	0.1191	3.5590
-0.1683	-0.2435	0.3592	+	0.0028	2.5350
-0.3504	-0.5812	0.2448	-	0.1136	2.7960
-0.5827	-0.4913	0.2616	-	0.0059	2.6150
-0.8463	-0.7513	0.3989	+	0.4175	2.7280
-1.1150	-0.8548	0.3061	+	0.0461	2.7110
-1.5170	-0.9281	0.2567	+	0.3175	2.4910

INDUSTRY 21 SUBGROUP 5

CLASS MID-PT	MEAN	VARIANCE	SIGN	SKEWNESS	KURTOSIS
1.[illegible]	1.1730	0.4584	+	0.3201	2.4620
0.8162	0.5253	0.1744	-	0.0054	2.0560
0.5643	0.3843	0.2667	+	0.2766	3.3830
0.3682	0.1327	0.2284	-	0.0306	3.1000
0.2207	0.0652	0.1616	-	2.6140	7.2610
0.0871	-0.0817	0.1875	-	0.1846	2.9290
-0.0192	0.0553	0.1565	+	0.0170	2.4040
-0.1311	-0.1941	0.2061	-	0.7592	2.9540
-0.2498	-0.3522	0.1058	-	0.3051	2.6280
-0.3640	-0.3841	0.1071	-	0.0439	2.9360
-0.5146	-0.4679	0.2112	+	0.1604	2.8020
-0.7452	-0.5895	0.3330	-	0.8797	7.6440
-1.2880	-0.8324	0.7979	-	0.0000	3.3280

INDUSTRY 21 SUBGROUP 6

CLASS MID-PT	MEAN	VARIANCE	SIGN	SKEWNESS	KURTOSIS
1.9410	1.4850	0.3604	-	0.5388	3.7750
1.4200	1.1120	0.3713	-	0.3730	2.7990
1.1100	1.2410	0.3895	+	0.4537	4.0040
0.8582	0.8273	0.3356	+	0.0053	4.0550
0.6700	0.6273	0.1546	+	1.3640	4.0110
0.4836	0.4483	0.1172	+	0.2518	3.2240
0.2966	0.2685	0.0955	-	0.0220	2.8470
0.1280	0.1124	0.2899	+	0.3119	3.5960
-0.0416	-0.1962	0.3103	-	0.7028	4.0520
-0.2092	-0.1774	0.1655	+	0.1392	3.3630
-0.3628	-0.3491	0.3757	+	1.1710	4.1140
-0.5305	-0.5701	0.1445	+	0.2123	3.6540
-0.6928	-0.5047	0.0766	+	0.0508	2.6760
-0.6870	-0.9368	0.0927	+	0.0156	3.3830
-1.0050	-0.8278	0.3521	+	1.7110	5.0270
-1.1820	-1.0330	0.0784	+	0.0141	3.9540
-1.6160	-1.4980	0.1777	+	1.0350	3.5030

A P P E N D I X D

THE FITTED EQUATIONS

The results of fitting the power function forms (see Chapter VI Section I) are given for both industries and subgroups.

See Chapter VII for discussion of these results.

Industry 1.

	CONSTANT	CLASSMIDPOINT	$(\text{CLASSMIDPOINT})^3$	R^2	$\bar{R}^2$	DW	NO OF OBSERVATIONS
POSITIVE RANGE	0.0133 (0.517)	0.792 (1.771)		0.946	0.943	1.819	20.
	0.0133 (0.281)	0.807 (1.886)	-0.00686 (-0.163)	0.946	0.939	1.530	20.
NEGATIVE RANGE	-0.0194 (-0.501)	0.901 (1.657)		0.945	0.941	2.377	18.
	-0.0182 (-0.350)	0.904 (7.172)	-0.00208 (-0.0328)	0.945	0.938	2.374	18
FULL RANGE.	-0.0344 (-2.318)	0.863 (4.378)		0.982	0.981	1.813	38.
	-0.0335 (-2.243)	0.892 (2.245)	-0.0228 (-0.365)	0.982	0.981	1.857	38
	-0.0144 (-0.736)	0.884 (2.235)	-0.0120 (-0.445)	0.983	0.982	1.989	38

Industry 4

	CONSTANT	CLASSMIDPOINT	$(\text{CLASSMIDPOINT})^3$	R^2	$\bar{R}^2$	DW	NO OF OBSERVATIONS
POSITIVE RANGE	0.03634 (1.791)	0.760 (3.094)		0.949	0.948	1.762	53
	-0.0191 (0.746)	0.810 (1.599)	-0.0176. (-1.113)	0.951	0.949	1.812	53
NEGATIVE RANGE	-0.0664 (-3.201)	0.776 (2.618)		0.933	0.932	1.582	51
	-0.0444 (-1.647)	0.859 (1.508)	-0.0437 (-1.691)	0.937	0.934	1.685	51
FULL RANGE	-0.0221 (-2.446)	0.822 (6.983)		0.980	0.979	1.481	104
	-0.0182 (2.118)	0.881 (4.447)	-0.0375 (-3.625)	0.982	0.982	1.686	104
	-0.0223 (2.030)	0.884 (4.846)	-0.0405 (-3.526)	0.982	0.981	1.693	104

INDUSTRY 5

	CONSTANT	CLASSMIDPOINT	(CLASSMIDPOINT)^3	R^2	$\bar{R}^2$	D.W.	NO OF OBSERVATIONS
POSITIVE RANGE	−0·0652	0·871		0·965	0·966	2·628	20.
	(−2·109)	(23·185)					
	−0·0952	0·973	(−0·0311	0·971	0·968	2·945	20.
	(−2·632)	(12·492)	(−1·482)				
NEGATIVE RANGE FM	−0·0999	0·743		0·944	0·941	1·776	20
	(−3·486)	(617·382					
	−0·0524	0·898	−0·0904	0·955	0·950	2·063	20.
	(−1·505)	(10·662)	(−2·053)				
FULL RANGE	−0·0452	0·835		0·984	0·984	2·049	40.
	(−3·503)	(48·597					
	−0·0422	0·865	−0·0193	0·985	0·984	2·098	40
	(−3·217)	(27·930	−1·163				
	−0·0700	0·890	−0·0484	0·988	0·987	2·570	40.
	(−4·652)	(30·459)	(−2·701)				

INDUSTRY 6

	CONSTANT	CLASSMIDPOINT	(CLASSMIDPOINT)^3	R^2	$\bar{R}^2$	DW.	NO OF OBSERVATIONS
POSITIVE RANGE	0·0260	0·710		0·917	0·911	2·356	16
	(0·621)	(12·427)					
	0·0332	0·685	0·0124	0·917	0·904	2·329	16
	(0·614)	(5·444)	(0·223)				
NEGATIVE RANGE	6 −0·0393	0·705		0·852	0·831	1·563	12
	(−0·625)	(7·580)					
	0·0754	1·113	−0·269	0·915	0·896	2·720	12
	(1·125)	(6·366)	(−2·579)				
FULL RANGE.	−0·00382	0·745		0·964	0·962	1·906	28
	(−0·189)	(26·220)					
	0·00194	0·801	−0·0466	0·966	0·963	2·084	28
	(−0·0969)	(1·1464)	(−1·200)				
	−0·0164	0·814	−0·0625	0·966	0·962	2·135	28
	(−0·605)	(14·217)	(−1·429)				

INDUSTRY 7

	CONSTANT	CLASSMIDPOINT	$(CLASSMIDPOINT)^3$	R^2	$\bar{R}^2$	DW	NO OF OBSERVATIONS
POSITIVE RANGE	-0.0517 (-2.548)	0.551 (30.253)		0.970	0.969	2.339	30
	-0.0581 (3.246)	0.572 (14.989)	-0.00922 (-0.408)	0.970	0.968	2.324	30
NEGATIVE RANGE	-0.0379 (-1.511)	0.769 (17.931)		0.917	0.914	2.233	31
	-0.0375 (-1.157)	0.760 (8.292)	-0.000853 (-0.0156)	0.917	0.911	2.233	31
FULL RANGE	-0.0209 (-2.079)	0.503 (52.575)		0.979	0.979	2.128	61
	-0.0219 (-2.142)	0.789 (28.940)	0.0111 (0.647)	0.979	0.979	2.159	61
	-0.0344 (-2.759)	0.801 (25.787)	-0.00564 (-0.259)	0.980	0.979	2.260	61

INDUSTRY 8

	CONSTANT	CLASSMIDPOINT	$(CLASSMIDPOINT)^3$	R^2	$\bar{R}^2$	DW	NO OF OBSERVATIONS
POSITIVE RANGE	0.0229 (0.291)	0.629 (5.071)		0.866	0.832	2.718	6
	0.0440 (0.397	0.536 (1.652)	0.0768 (0.3223)	0.5870	0.783	2.924	6
NEGATIVE RANGE	-0.0541 (-0.862)	0.578 (7.669)		0.951	0.935	2.134	5
	-0.156 (-2.785)	0.266 (1.994)	0.116 (2.482)	0.988	0.976	2.691	5
FULL RANGE	0.00375 (0.133)	0.642 (16.634)		0.969	0.965	2.682	11
	0.00512 (0.164)	0.631 (7.695	0.00736 (0.149)	0.969	0.961	2.653	11
	-0.0104 (-0.249)	0.605 (6.288)	0.0659 (0.509)	0.970	0.957	2.842	11

INDUSTRY 9

	CONSTANT	CLASS MIDPOINT	(CLASS MIDPOINT)^3	R^2	$\bar{R}^2$	DW	NO. OF OBSERVATIONS
POSITIVE RANGE	-0.0386 (-0.523)	0.706 (7.639)		0.855	0.841	2.227	12.
	-0.0144 (-0.160)	0.632 (2.925)	0.0393 (0.387)	0.858	0.826	2.232	12
NEGATIVE RANGE	-0.190 (-3.101)	0.439 (4.781)		0.741	0.708	3.094	10
	-0.166 (-1.937)	0.520 (2.319)	-0.0534 (-0.402)	0.747	0.674	3.185	10
FULL RANGE	-0.0386 (-1.223)	0.677 (16.460)		0.931	0.928	2.079	22
	-0.0347 (-1.156)	0.699 (8.133)	-0.0189 -0.297)	0.932	0.924	2.097	22
	-0.0820 (-2.206)	0.732 (8.916)	-0.0648 (-1.010)	0.943	0.934	2.511	22.

INDUSTRY 11

	CONSTANT	CLASS MIDPOINT	(CLASS MIDPOINT)^3	R^2	$\bar{R}^2$	DW	NO. OF OBSERVATIONS
POSITIVE RANGE	-0.0344 (-1.125)	0.843 (20.174)		0.964	0.962	2.355	17
	-0.731 (-2.035	0.978 (1.141	-0.0664 (-1.779)	0.971	0.967	2.766	17.
NEGATIVE RANGE	-0.172 (-3.595)	0.551 (7.277		0.815	.799	2.312	14
	-0.202 (-3.493)	0.428 (3.563)	0.0903 (0.823)	0.826	0.794	2.469	14
FULL RANGE	-0.0307 (-1.588)	0.807 (27.958)		0.964	0.963	1.532	31.
	-0.0287 (-1.463)	0.843 (15.437	-0.0300 (-0.739	0.965	0.963	1.545	31
	-0.0685 (-3.109)	0.879 (17.598)	-0.0894 (-2.278)	0.973	0.971	2.045	31.

Industry 9.12

	CONSTANT	CLASSMIDPOINT	$(\text{CLASSMIDPOINT})^3$	R^2	$\bar{R}^2$	DW	NO. OF OBSERVATIONS
POSITIVE RANGE	0·0388 (1·388)	0·751 (0·223)		0·963	0·961	2·277	21
	0·0201 (0·569)	0·805 (11·186)	−0·0154 (−0·840)	0·965	0·961	2·186	21
NEGATIVE RANGE	−0·0223 (−0·801)	0·869 (22·513)		0·967	0·965	1·759	20
	0·00351 (0·102)	0·957 (12·079)	0·0449 (−1·289)	0·969	0·966	1·918	20
FULL RANGE	−0·0292 (−2·290)	0·836 (51·242		0·985	0·985	1·733	41
	−0·0258 (−2·157)	0·895 (32·223)	−0·0376 (−2·672)	0·988	0·987	1·828	41
	−0·0134 (0·887)	0·889 (31·165)	−0·0288 (−1·861)	0·988	0·987	1·914	41.

INDUSTRY 13

	CONSTANT	CLASSMIDPOINT	$(\text{CLASSMIDPOINT})^3$	R^2	$\bar{R}^2$	DW	NO. of OBSERVATIONS
POSITIVE RANGE	0·0223 (0·320)	0·836 (24·250		0·961	0·959	1·352	26
	−0·0109 (−0·339)	0·942 (13·682)	−0·0379 (−1·786)	0·965	0·962	1·529	26
NEGATIVE RANGE	−0·0524 (−2·274)	0·884 (24·066)		0·954	0·952	2·391	30
	−0·0682 (−2·325)	−0·823 (10·045)	0·0424 (0·876)	0·955	0·952	2·441	30.
FULL RANGE	−0·0311 (−2·784)	0·898 (56·746		0·984	0·983	1·702	56
	−0·246 (−2·266)	0·956 (36·965)	−0·0379 (−2·742)	0·986	0·985	1·936	56.
	−0·0218 (−1·598)	0·952 (34·369)	−0·0342 (−1·930)	0·986	0·985	1·937	56.

INDUSTRY [illegible]

	CONSTANT	CLASSMIDPOINT	(CLASSMIDPOINT)^3	R^2	$\bar{R}^2$	DW	NO OF OBSERVATIONS
POSITIVE RANGE	0.000880 (0.0232)	0.749 (1479)		0.905	0.901	1.636	25
	-0.0414 (-0.901)	0.880 (8.732)	-0.0594 (-1.533)	0.914	0.906	1.666	25
NEGATIVE RANGE	-0.0760 (-2.249)	0.638 (1.395)		0.901	0.902	2.591	22
	-0.0756 (-1.732)	0.639 (6.653)	-0.000495 (-0.00132)	0.907	0.897	2.591	22
FULL RANGE	-0.00312 (-0.238)	0.737 (34.537)		0.964	0.963	1.698	47
	-0.00359 (-0.251)	0.795 (20.453	-0.0386 (-1.769)	0.966	0.965	1.549	47
	-0.0167 (-0.860)	0.797 (20.520)	-0.0405 (-1.851)	0.967	0.965	1.896	47

INDUSTRY 16

	CONSTANT	CLASSMIDPOINT	(CLASSMIDPOINT)^3	R^2	$\bar{R}^2$	DW	NO OF OBSERVATIONS
POSITIVE RANGE	-0.0530 (-2.441)	0.872 (21.417)		0.941	0.938	1.782	31
	-0.101 (-2.351)	0.923 (10.956)	-0.0185 (-0.700)	0.942	0.937	1.828	31
NEGATIVE RANGE	-0.0461 (-1.389)	0.757 (15.747)		0.902	0.898	0.979	29
	0.0279 (0.800)	1.016 (12.113)	-0.133 (-3.519)	0.933	0.928	1.869	29
FULL RANGE	-0.0291 (-1.993)	0.802 (64.230		0.969	0.968	1.524	60
	-0.0282 (-1.914)	0.820 (23.700	[illegible] (-0.609)	0.969	0.968	1.541	60
	-0.0568 (-3.201	0.838 (34.952)	-0.0307 (-1.683	0.972	0.971	1.736	61

INDUSTRY 17

	CONSTANT	CLASSMIDPOINT	(CLASSMIDPOINT)^3	R^2	$\bar{R}^2$	DW	NO OF OBSERVATIONS
POSITIVE RANGE	-0.0166 (-0.109)	0.844 (8.246)		0.919	0.905	2.932	8
	0.0264 (0.138)	0.745 (2.645)	0.0669 (0.385)	0.921	0.890	3.079	
NEGATIVE RANGE	-0.0192 (-0.381)	0.850 (9.073)		0.922	0.910	3.019	9
	-0.0688 (-1.152)	0.595 (2.882)	0.255 (1.351)	0.940	0.920	3.348	
FULL RANGE	-0.0186 (-0.161	0.855 (23.385)		0.973	0.972	2.967	17
	-0.0182 (-0.793)	0.805 (9.915)	0.0585 (0.697)	0.974	0.971	3.029	
	-0.00994 (-0.317)	0.798 (9.339)	0.0716 (0.775)	0.975	0.969	3.038	

INDUSTRY 18

	CONSTANT	CLASSMIDPOINT	(CLASSMIDPOINT)^3	R^2	$\bar{R}^2$	DW	NO OF OBSERVATIONS
POSITIVE RANGE	0.00870 (0.332)	0.758 (24.243)		0.933	0.932	1.413	44
	-0.0566 (-2.042)	0.938 (17.994)	-0.0550 (-4.025)	0.952	0.950	1.961	
NEGATIVE RANGE	-0.107 (-3.772)	0.705 (17.433		0.886	0.883	1.954	41
	-0.0950 (-2.578)	0.746 (8.941)	-0.0197 (0.563)	0.887	0.881	1.967	
FULL RANGE	-0.0352 (-2.851)	0.795 (5.063		0.969	0.968	1.526	85
	-0.0296 (-2.6[illegible])	0.877 (36.461)	-0.0448 (-[illegible])	0.974	0.974	1.837	
	-0.0446 (-3.234)	0.888 (36.884)	-0.0559 (-4.616)	0.975	0.974	1.915	

INDUSTRY 19

	CONSTANT	CLASSMIDPOINT	$(\text{CLASSMIDPOINT})^3$	R^2	$\bar{R}^2$	DW	NO. OF OBSERVATIONS
POSITIVE RANGE	-0.0150 (-0.094)	0.974 (36.513		0.979	0.979	1.993	30
	-0.0387 (-1.434)	0.940 (18.238)	-0.0219 (-1.429)	0.981	0.979	1.938.	
NEGATIVE RANGE	-0.00583 (-0.332)	0.939 (28.327)		0.968	0.966	2.162	29
	-0.00637 (-0.213)	0.947 (13.382	-0.00461 (-0.133)	0.967	0.965	2.169	
FULL RANGE	-0.0323 (-3.483)	0.897 (78.493)		0.991	0.991	1.905	59
	-0.0296 (-3.176)	0.924 (43.273)	-0.0159 (-1.511)	0.991	0.991	1.994	
	-0.0211 (-1.759)	0.918 (42.084)	-0.00835 (-0.672)	0.991	0.991	2.025.	

INDUSTRY 20

	CONSTANT	CLASSMIDPOINT	$(\text{CLASSMIDPOINT})^3$	R^2	$\bar{R}^2$	DW	NO. OF OBSERVATIONS
POSITIVE RANGE	-0.097 (-1.697)	0.913 (13.589)		0.953	0.948	2.284	11
	-0.0502 (-0.447)	0.784 (4.810)	0.0490 (0.902)	0.958	0.947	2.294	
NEGATIVE RANGE	-0.0119 (-0.445)	0.562 (21.014)		0.969	0.967	1.903.	16.
	0.0873 (0.256)	0.941 (10.301)	-0.0565 (-0.964)	0.971	0.961	2.083	
FULL RANGE	-0.0316 (-1.936)	0.847 (38.207)		0.983	0.982	2.049	27
	-0.0403 (-2.456)	0.785 (19.410)	0.0433 (1.776)	0.985	0.984	2.316.	
	-0.0432 (-2.023)	0.789 (19.919)	0.0394 (1.302)	0.955	0.983	2.142	

INDUSTRY 21

	CONSTANT	CLASSMIDPOINT	$(\text{CLASSMIDPOINT})^3$	R^2 $\bar{R}^2$	DW	NO OF OBSERVATIONS
POSITIVE RANGE	-0.0409 (-1.618)	0.883 (32.088)		0.972 0.971	1.883	32.
	-0.0423 (-1.336)	0.881 (1.470)	-0.00104 (-0.0739)	0.972 0.970	1.887	
NEGATIVE RANGE	-0.0423 (-2.130)	0.875 (28.693)		0.955 0.954	1.930	41.
	-0.0405 (-1.542)	0.881 (14.088)	-0.0310 (-0.104)	0.955 0.952	1.937	
FULL RANGE	-0.0394 (-4.177)	0.881 (12.808)		0.987 0.987	1.916	73.
	-0.0393 (-3.983)	0.881 (42.330	-0.000147 (-0.0181)	0.987 0.986	1.915	
	-0.0405 (-3.366)	0.882 (4.031)	-0.00134. (-0.124)	0.987 0.986	1.919	

Industry 1/2

	CONSTANT	CLASSMIDPOINT	$(CLASSMIDPOINT)^3$	R^2	$\bar{R}^2$	DW	no. of OBSERVATIONS
POSITIVE RANGE	0.00689 (0.103)	0.798 (9.101)		0.883	0.872	2.337	13
	0.00720 (0.0829)	0.796 (3.934)	0.000937 (0.00962)	0.883	0.859	2.336	
NEGATIVE RANGE	0.0185 (0.407)	0.916 (13.434)		0.952	0.947	2.705	11
	0.0101 (0.156)	0.886 (50.814)	0.0223 (0.193)	0.953	0.941	2.730	
FULL RANGE	-0.0217 (-0.947)	0.843 (26.044)		0.969	0.967	2.350	24
	-0.0210 (-0.888)	0.866 (12.709)	-0.0107 (-0.207)	0.969	0.966	2.365	

Industry 1/3.

	CONSTANT	CLASSMIDPOINT	$(CLASSMIDPOINT)^3$	R^2	$\bar{R}^2$	DW	no. of OBSERVATIONS
FULL RANGE	-0.0734 (-1.782)	-0.912 (14.897)		0.969	0.965	1.462	9
	-0.827 (-2.302)	0.757 (5.846)	0.267 (1.837)	0.980	0.974	1.910	

Industry 4/1

	CONSTANT	CLASSMIDPOINT	$(CLASSMIDPOINT)^3$	R^2	$\bar{R}^2$	DW	no of observations
FULL RANGE	0.00194 (0.0845)	0.812 (22.929		0.976	0.974	2.180	15
	-0.00189 (-0.0807)	0.747 (9.419)	0.0685 (0.923)	0.977	0.974	2.309	

Industry 412.

	CONSTANT	CLASSMIDPOINT	$(\text{CLASSMIDPOINT})^2$	R^2	$\bar{R}^2$	DW	NO OF OBSERVATIONS
FULL RANGE.	-0.00579 (-0.172)	0.759 (17.172)		0.961	0.958	2.159	14
	-0.00740 (-0.221)	0.835 (10.104)	-0.0541 (-1.087)	0.965	0.958	2.174	

Industry 414

	CONSTANT	CLASSMIDPOINT	$(\text{CLASSMIDPOINT})^2$	R^2	$\bar{R}^2$	DW	no of observations
FULL RANGE	-0.0351 (-0.649)	0.888 (10.595)		0.949	0.941	3.266	8
	-0.0343 (-0.578)	0.849 (3.393)	0.0540 (0.167)	0.950	0.929	3.250	

Industry 415.

	CONSTANT	CLASSMIDPOINT	$(\text{CLASSMIDPOINT})^2$	R^2	$\bar{R}^2$	DW	no of observations
POSITIVE RANGE	0.0438 (1.664)	0.761 (22.386)		0.935	0.933	1.623	37
	0.0198 (0.592)	0.835 (11.462)	-0.0317 (-1.157)	0.937	0.933	1.667	
NEGATIVE RANGE	-0.0609 (-2.307)	0.819 (21.451)		0.935	0.933	2.404	34
	-0.0486 (-1.441)	0.861 (10.701)	-0.0242 (-0.591)	0.936	0.932	2.437	
FULL RANGE	-0.0266 (-2.321)	0.855 (54.182)		0.977	0.977	1.731	71
	-0.0229 (-2.101)	0.917 (33.089)	-0.0525 (-3.067)	0.980	0.979	1.956	

Industry 5/3

	CONSTANT	CLASSMIDPOINT	$(CLASSMIDPOINT)^3$	R^2	$\bar{R}^2$	DW	no of obs.
FULL RANGE	-0.0609 (-3.162)	0.800 (18.256)		0.974	0.971	2.368	11
	-0.0595 (-2.952	0.746 (7.292)	0.128 (0.589)	0.975	0.969	2.374	

Industry 5/4

	CONSTANT	(CLASSMIDPOINT	$(CLASSMIDPOINT)^3$	R^2	$\bar{R}^2$	DW	NO OF OBS.
POSITIVE RANGE	-0.146 (-2.605)	0.957 (13.284)		0.962	0.956	2.692	9
	-0.163 (-2.183)	1.018 (5.639)	-0.0314 (-0.376)	0.963	0.950	2.685	
NEGATIVE RANGE	-0.0855 (-0.927)	0.803 (5.436)		0.808	0.781	3.385	9
	-0.000651 (-0.00457)	1.102 (2.724)	-0.236 (-0.797)	0.827	0.769	3.700	
FULL RANGE	-0.0701 (-2.484)	0.858 (21.425)		0.966	0.964	2.776	18
	-0.0732 (-2.419)	0.831 (9.819)	0.0235 (0.364)	0.967	0.962	2.830	

Industry 6/1

	CONSTANT	CLASSMIDPOINT	$(CLASSMIDPOINT)^3$	R^2	$\bar{R}^2$	DW	NO OF OBS
FULL RANGE	-0.0294 (-1.573)	0.802 (27.924)		0.984	0.982	1.988	15
	-0.0280 (-1.687)	0.696 (12.489)	0.111 (2.149)	0.988	0.986	2.764	

Industry 7/1

	CONSTANT	CLASSMIOPT	$(CLASSMIOPT)^3$	R^2	$\bar{R}^2$	DW	No OF OBS.
POSITIVE RANGE	-0.0698 (-2.777)	0.881 (25.339)		0.968	0.967	2.503	23
	-0.0691 (-2.142)	0.879 (11.608	0.00107 (0.0365)	0.968	0.965	2.504	
NEGATIVE RANGE	-0.0657 (-2.410)	0.709 (14.374)		0.900	0.895	2.076	25
	-0.0361 -1.007	0.835 (-1.007)	-0.100 (-1.311)	0.907	0.899	2.168	
FULL RANGE	-0.0249 (-2.056)	0.808 (42.741)		0.975	0.975	1.938	48
	-0.0272 (-2.190)	0.782 (23.488)	0.0196 (0.900)	0.976	0.975	1.988	

Industry 7/2

	CONSTANT	CLASSMIOPT	$(CLASSMIOPT)^3$	R^2	$\bar{R}^2$	DW	no of obs.
FULL RANGE	0.0820 (2.709)	0.737 (17.383)		0.950	0.947	2.083	18
	0.0818 (2.610)	0.743 (9.497)	-0.00515 (-0.103)	0.950	0.943	2.078.	

Industry 8/1.

	CONSTANT	CLASSMIOPT	$(CLASSMIOPT)^3$	R^2	$\bar{R}^2$	DW	no of obs
FULL RANGE	0.0325 (0.715)	0.636 (7.716)		0.882	0.867	1.996	10
	0.0454 (0.989)	0.786 (5.139)	-0.212 (-1.155)	0.900	0.872	2.259	

Industry 9111

	CONSTANT	CLASSMIOPT	$(\text{CLASSMIOPT})^2$	R^2	$\bar{R}^2$	DW	NO OF OBS
POSITIVE RANGE	-0.0464 (-0.481)	0.703 (5.147)		0.768	0.739	3.340	10
	-0.0707 (-0.525)	0.787 (2.341)	-0.0515 (-0.278)	0.771	0.705	3.425	
NEGATIVE RANGE	-0.0893 (-1.047)	0.557 (3.999)		0.696	0.652	1.535	9
	-0.0185 (-0.166)	0.854 (2.582)	-0.255 (-0.989)	0.738	0.651	1.851	
FULL RANGE	-0.0287 (-0.838)	0.665 (12.880)		0.907	0.902	2.560	19
	-0.0263 (-0.746)	0.715 (6.483)	-0.0529 (-0.520)	0.909	0.897	2.644	

Industry 1111.

	CONSTANT	CLASSMIOPT	$(\text{CLASSMIOPT})^2$	R^2	$\bar{R}^2$	DW	NO OF OBS
POSITIVE RANGE	-0.0988 (-1.927)	0.933 (13.132)		0.945	0.940	1.929	12
	-0.185 (-3.7[illegible]8)	1.248 (10.101)	(-0.165) (-2.836)	0.971	0.965	3.239	
NEGATIVE RANGE	-0.238 (-4.875)	0.401 (4.868)		0.748	0.716	2.110	10
	-0.259 (-3.723)	0.320 (1.606)	0.0644 (0.453)	0.755	0.685	2.129	
FULL RANGE	-0.0303 (-1.022)	0.799 (17.953)		0.942	0.939	0.946	22
	-0.0276 (-0.899)	0.839 (9.607)	-0.0351 (-0.528)	0.942	0.936	0.938	

11/2

	CONSTANT	CLASSMIDPT	$(CLASSMIDPT)^3$	R^2	$\bar{R}^2$	DW	NO OF OBS
FULL RANGE	-0.0739 (-2.097)	0.907 (14.366)		0.958	0.954	2.291	11
	-0.0813 (-2.452)	0.822 (5.982)	0.133 (0.703)	0.961	0.951	2.447	

12/2

	CONSTANT	CLASSMIDPT	$(CLASSMIDPT)^3$	R^2	$\bar{R}^2$	DW	NO OF OBS
FULL RANGE	-0.0278 (-0.969)	0.939 (19.229)		0.971	0.968	2.183	13
	-0.0328 (-1.114)	0.846 (7.316)	0.134 (0.899)	0.973	0.968	2.158	

12/4

	CONSTANT	CLASSMIDPT	$(CLASSMIDPT)^3$	R^2	$\bar{R}^2$	DW	NO OF OBS.
FULL RANGE	0.00867 (0.278)	0.794 (14.029)		0.961	0.956	2.684	10
	0.00918 (0.275)	0.821 (6.439)	-0.0432 (-0.242)	0.961	0.950	2.770	

12/6

	CONSTANT	CLASSMIDPT	$(CLASSMIDPT)^3$	R^2	$\bar{R}^2$	DW	no of obs
FULL RANGE	-0.0127 (-0.433)	0.807 18.984		0.962	0.960	1.914	16
	-0.00682 (-0.216)	0.854 (9.820)	-0.0418 (-0.634)	0.964	0.958	1.978	

13|1

	CONSTANT	CLASSMIDPT	$(CLASSMIDPT)^3$	R^2	$\bar{R}^2$	DW	no of obs.
POSITIVE RANGE	0.000176 (0.00772)	0.876 (29.791)		0.975	0.974	2.150	25
	-0.0208 (-0.733)	0.944 (15.029)	-0.0281 (-1.225)	0.976	0.974	2.274	
NEGATIVE RANGE	-0.0481 (-2.390)	0.866 (30.034)		0.976	0.975	1.605	25
	-0.0255 (-0.999)	0.946 (14.846)	-0.0467 (-1.398)	0.978	0.976	1.721	
FULL RANGE	-0.0213 (-2.329)	0.897 (72.752)		0.991	0.991	1.847	50
	-0.0184 (-2.082)	0.942 (41.136)	-0.0312 (-2.296)	0.919	0.916	2.027	

15|1.

	CONSTANT	CLASSMIDPT	$(CLASSMIDPT)^3$	R^2	$\bar{R}^2$	DW	no of obs.
POSITIVE RANGE	-0.0256 (-0.420)	0.784 8.842		0.897	0.885	1.169	11
	0.0727 (1.039)	0.460 (2.667)	0.194 (2.096)	0.933	0.917	1.478	
NEGATIVE RANGE	-0.113 (-4.707)	0.684 (19.647)		0.982	0.980	1.878	9
	-0.0808 (-3.051)	0.747 (11.735)	-0.0579 (-1.894)	0.989	0.985	2.835	
FULL RANGE	-0.0241 (-1.188)	0.760 (26.585)		0.975	0.974	1.061	20
	-0.0248 (-1.178)	0.773 (12.688)	-0.0108 -0.236	0.975	0.972	1.075	

15/2

	CONSTANT	CLASSMIOPT	$(CLASSMIOPT)^3$	R^2	$\bar{R}^2$	DW	NO OF OBS
FULL RANGE	-0.0337 (-1.281)	0.850 (20.436)		0.972	0.970	2.405	14
	-0.0350 (-1.292)	0.798 (8.425)	0.0626 (0.622)	0.973	0.968	2.544	

15/3

	CONSTANT	CLASSMIOPT	$(CLASSMIOPT)^3$	R^2	$\bar{R}^2$	DW	NO OF OBS
POSITIVE RANGE	0.0169 (0.219)	0.839 (7.085)		0.834	0.817	1.680	12
	-0.156 (-1.967)	1.404 (6.996)	-0.344 (-3.118)	0.920	0.902	1.928	
NEGATIVE RANGE	-0.0859 (-1.394)	0.799 (7.423)		0.873	0.857	1.520	10
	-0.0873 (-1.060)	0.793 (3.041)	0.00568 (0.00276)	0.873	0.837	1.530	
FULL RANGE	-0.0261 (-0.931)	0.890 (19.598)		0.951	0.948	1.599	22
	-0.0249 (-0.985)	1.054 (13.157)	-0.178 (-2.375)	0.962	0.958	1.563	

16/1

	CONSTANT	CLASSMIOPT	$(CLASSMIOPT)^3$	R^2	$\bar{R}^2$	DW	NO OF OBS
FULL RANGE	-0.418 (-1.220)	0.823 13.625		0.944	0.939	2.370	13
	-0.0246 (-1.221)	0.904 (6.672)	-0.104 (-0.679)	0.947	0.936	2.545	

16/2

	CONSTANT	CLASSMIDPT	(CLASSMIDPT)^3	R^2	$\bar{R}^2$	DW	NO OF OBS.
FULL RANGE	-0.0269 (-0.884)	0.760 (13.546)		0.929	0.924	2.854	16
	-0.0276 (-0.858)	0.738 (6.119)	0.0179 (0.115)	0.929	0.918	2.848	

16/3

	CONSTANT	CLASSMIDPT	(CLASSMIDPT)^3	R^2	$\bar{R}^2$	DW	No OF OBS.
FULL RANGE	-0.0269 (-1.039)	0.859 (21.077)		0.969	0.967	2.713	16
	-0.0223 (-0.840)	0.929 (10.662	-0.0880 (-0.909)	0.971	0.967	2.804	

16/4

	CONSTANT	CLASSMIDPT	(CLASSMIDPT)^3	R^2	$\bar{R}^2$	DW	NO OF OBS
FULL RANGE	-0.0232 (-0.655)	0.689 (12.545)		0.935	0.929	1.893	13
	-0.0252 (-0.685)	0.631 (4.943)	0.0678 (0.515)	0.936	0.924	1.789	

16/5

	CONSTANT	CLASSMIDPT	(CLASSMIDPT)^3	R^2	$\bar{R}^2$	DW	NO OF OBS
FULL RANGE	-0.0651 -3.333	0.914 (27.824)		0.985	0.983	2.165	14
	-0.521 (-2.858)	1.029 (16.826	-0.155 (-2.127)	0.989	0.987	2.492	

17||

	CONSTANT	CLASSMOPT	$(CLASSMOPT)^3$	R^2	$\bar{R}^2$	DW	No OF OBS.
FULL RANGE	-0·0101 (-3·869)	0·802 (18·036)		0·962	0·959	2·361	15
	0·000747 -0·0286	0·903 (10·672)	-0·122 (-1·384)	0·967	0·961	2·418.	

18||

	CONSTANT	CLASSMOPT	$(CLASSMOPT)^3$	R^2	$\bar{R}^2$	DW	No OF OBS
POSITIVE RANGE	0·00686 0 141	0·819 (11·411)		0·929	0·922	1·298	12
	0·102 (2·212)	0·487 (4·173)	0·203 3·187	0·966	0·959	2·468	
NEGATIVE RANGE	-0·0379 (-0·825)	0·886 (12·739)		0·942	0·936	2·316	12
	-0·0943 (-1·676)	0·679 (4·609)	0·145 1·555	0·954	0·944	2·759	
FULL RANGE	-0·0339 -1·881	0·880 (32·666)		0·980	0·979	1·674	24
	-0·0356 (-2·049)	-0·803 (15·028)	0·0777 (1·661)	0·982	0·980	1·773.	

|8|2

	CONSTANT	CLASSMIOPT	CLASSMIOPT	R^2	$\bar{R}^2$	DW	NO OF OBS
POSITIVE RANGE	0.0496 (1.143)	0.676 10.404		0.915	0.907	1.272	12
	0.00789 (0.133)	0.841 (5.236)	-0.104 -1.121	0.925	0.909	1.515	
NEGATIVE RANGE	-0.147 (-3.19[illegible])	0.682 (8.106)		0.880	0.866	2.400	11
	-0.1717 (-2.942)	0.517 2.938	0.0975 0.731	0.887	0.859	2.496	
FULL RANGE	-0.0395 (-1.779)	0.780 (22.321		0.960	0.958	1.366	23
	-0.0355 -1.685	0.899 (12.682)	-0.121 (-1.896)	0.966	0.962	1.672	

|8|3

	CONSTANT	CLASSMIOPT	$(CLASSMIOPT)^2$	R^2	$\bar{R}^2$	DW	NO OF OBS
POSITIVE RANGE	0.0786 (1.187)	0.644 (7.579)		0.742	0.729	1.095	22
	-0.102 (-1.767)	1.193 (9.568)	-0.239 (-4.962)	0.888	0.816	1.884	
NEGATIVE RANGE	-0.1185 (-2.954)	0.712 (11.513)		0.863	0.857	2.594	23
	-0.166 (-3.395)	0.536 (4.285)	0.112 (1.594)	0.879	0.867	2.937	
FULL RANGE	-0.0461 (-1.968)	0.787 (2.402)		0.931	0.929	1.340	45
	-0.0329 (-1.665)	0.960 (19.119)	-0.149 (-4.459	0.953	0.951	1.791	

19/1

	CONSTANT	CLASSMIDPT	$(CLASSMIDPT)^3$	R^2	$\bar{R}^2$	DW	no of obs
FULL RANGE	-0.0393 (-1.832)	0.887 (26.032)		0.978	0.977	2.241	17
	-0.0385 (-1.749)	0.925 (12.894)	-0.0413 -0.579	0.979	0.976	2.319	

19/2

	CONSTANT	CLASSMIDPT	$(CLASSMIDPT)^3$	R^2	$\bar{R}^2$	DW	no of obs
FULL RANGE	-0.0529 (-2.995)	0.980 (30.418)		0.987	0.986	1.254	14
	-0.0508 (-2.674)	1.003 15.906	-0.0272 (-0.429)	0.987	0.985	1.153	

19/3

	CONSTANT	CLASSMIDPT	$(CLASSMIDPT)^3$	R^2	$\bar{R}^2$	DW	no of obs
POSITIVE RANGE	0.0305 (0.815)	0.794 (18.343)		0.955	0.952	2.189	18
	0.00431 (0.00887)	0.867 (9.042)	-0.0290 (-0.857)	0.957	0.951	2.265	
NEGATIVE RANGE	-0.0235 (-0.948)	0.881 (23.339)		0.977	0.976	2.005	17
	0.00516 (0.174)	0.979 (13.996	-0.0578 (-16.018	0.981	0.978	2.267	
FULL RANGE	-0.0262 (-2.014)	0.859 (52.491		0.988	0.988	2.039	35
	-0.00220 (-1.781)	0.921 (30.667)	-0.0428 (-2.378)	0.990	0.989	2.347	

20/2

	CONSTANT	CLASSMIOPI	$(\text{CLASSMIOPI})^3$	R^2	$\bar{R}^2$	DW	no of obs
FULL RANGE	-0.0242 (-0.725)	0.840 (17.399)		0.971	0.968	2.233	11
	-0.0273 (-0.281)	0.807 (7.324)	0.0322 (0.340)	0.972	0.964	2.219	

20/3

	CONSTANT	CLASSMIOPI	$(\text{CLASSMIOPI})^3$	R^2	$\bar{R}^2$	DW	no of obs
POSITIVE RANGE	-0.156 -1.966	1.029 8.755		0.927	0.915	2.598	8
	-0.0978 (-0.932)	0.802 2.800	0.140 0.872	0.937	0.912	2.701	
NEGATIVE RANGE	-0.00248 (-0.0479)	0.902 (9.581)		0.893	0.883	1.372	13
	0.0842 (1.462)	1.302 6.845	-0.421 (-2.314)	0.903	0.916	2.139	
FULL RANGE	-0.0375 (-1.435)	0.868 (19.892)		0.956	0.952	1.700	21
	-0.0494 (-1.919)	0.765 (8.692)	0.150 (1.333)	0.958	0.954	1.722	

21/2

	CONSTANT	CLASSMIOPT	$(CLASSMIOPT)^3$	R^2	$\bar{R}^2$	DW	NO OF OBS
POSITIVE RANGE	-0.0618 (-1.543)	1.011 (16.643)		0.975	0.972	1.679	9
	-0.112 (-2.306)	1.192 (9.317)	-0.102 (-1.564)	0.982	0.977	1.990	
NEGATIVE RANGE	0.0104 (0.224)	0.998 (12.824)		0.948	0.942	2.321	11
	-0.0194 (-0.313	0.881 (5.051)	0.0905 (0.750)	0.952	0.939	2.263	
FULL RANGE	-0.0202 (-1.146)	0.958 (34.021)		0.985	0.984	2.000	20.
	-0.0213 (-1.166)	0.939 (16.729)	0.0182 (0.378	0.985	0.983	2.018	

21/3

	CONSTANT	CLASSMIOPT	$(CLASSMIOPT)^3$	R^2	$\bar{R}^2$	DW	NO OF OBS
FULL RANGE	0.006390 (0.0135)	0.871 (19.339)		0.979	0.976	2.180	10
	0.00540 (0.164)	0.908 (8.873)	-0.0417 (-0.401)	0.980	0.974	2.105.	

21/4

	CONSTANT	CLASSMIOPT	$(CLASSMIOPT)^3$	R^2	$\bar{R}^2$	DW	no of obs
FULL RANGE	-0.0254 (-0.497)	0.812 (10.930)		0.937	0.929	1.548	10.
	-0.0220 (-0.439)	1.005 (5.550)	-0.210 (-1.165)	0.947	0.932	1.882	

21/5

	CONSTANT	CLASSMIDPT	$(CLASSMIDPT)^3$	R^2	$\bar{R}^2$	DW	no of obs
FULL RANGE	-0.0847 (-4.036)	0.741 (1.583)		0.965	0.961	2.358	11
	-0.0836 (-3.741)	0.774 (6.817)	-0.0763 (0.326)	0.966	0.957	2.343	

21/6

	CONSTANT	CLASSMIDPT	$(CLASSMIDPT)^3$	R^2	$\bar{R}^2$	DW	no of obs
FULL RANGE	-0.000591 (-0.0204)	0.910 (24.219)		0.978	0.977	2.583	15
	0.0075 0.264	1.015 12.409	-0.0907 -1.431	0.981	0.978	2.646	

A P P E N D I X   E

MEASURES OF THE DECAY OF PROFITABILITY

The rates of decay are given for each range and each equation form at both industry and subgroup level.

See Chapter VIII Sections I and 2 for discussion of these results.

Industry Level Decay Measures

Industry No	Positive Range: Linear ($1D^+$)	Positive Range: Linear Cubic (LCD^+)	Negative Range: Linear ($1D^-$)	Negative Range: Linear Cubic ($1CD^-$)	Full Range: Linear ($1D^f$)	Full Range: Linear Cubic ($1CD^f$)	Full Range: Cubic (CD^f)
1	0.792	0.798	0.901	0.902	0.863	0.862	0.868
4	0.760	0.786	0.776	0.801	0.822	0.835	0.830
5	0.871	0.923	0.743	0.777	0.835	0.840	0.825
6	0.710	0.702	0.705	0.755	0.745	0.739	0.731
7	0.851	0.860	0.759	0.759	0.803	0.803	0.794
8	0.630	0.638	0.578	0.422	0.642	0.641	0.653
9	0.706	0.684	0.439	0.449	0.677	0.674	0.646
11	0.843	0.890	0.551	0.549	0.807	0.803	0.761
12	0.751	0.780	0.870	0.898	0.836	0.848	0.851
13	0.836	0.892	0.884	0.879	0.898	0.905	0.907
15	0.750	0.807	0.638	0.639	0.737	0.744	0.743
16	0.872	0.899	0.757	0.838	0.803	0.806	0.797
17	0.844	0.834	0.850	0.935	0.855	0.883	0.893
18	0.758	0.865	0.705	0.720	0.795	0.817	0.813
19	0.874	0.911	0.939	0.941	0.897	0.903	0.907
20	0.918	0.850	0.862	0.865	0.847	0.843	0.842
21	0.883	0.885	0.875	0.877	0.881	0.881	0.880

Subgroup level Decay Measures

Industry No.	Subgroup No	Positive Range: Linear ($1D^+$)	Positive Range: Linear Cubic ($1CD^+$)	Negative Range: Linear ($1D^-$)	Negative Range: Linear Cubic ($1CD^-$)
1	2	0.798	0.797	0.916	0.916
4	5	0.761	0.793	0.819	0.829
5	4	0.957	0.977	0.803	0.788
7	1	0.881	0.880	0.709	0.701
9	1	0.703	0.718	0.557	0.513
11	1	0.933	1.029	0.401	0.406
13	1	0.876	0.907	0.866	0.884
15	1	0.784	0.718	0.638	0.670
15	3	0.840	0.945	0.799	0.801
18	1	0.820	0.758	0.886	0.873
18	2	0.676	0.703	0.632	0.647
18	3	0.644	0.875	0.712	0.687
19	3	0.794	0.828	0.881	0.903
20	3	1.029	0.989	0.902	0.740
21	2	1.011	0.850	0.998	1.002

Full Range Decay Measures

Industry No.	Subgroup No.	Linear ($1D^+$)	Linear Cubic ($1cD^f$)
1	2	0.843	0.841
	3	0.972	1.100
4	1	0.812	0.838
	2	0.759	0.763
	4	0.888	0.921
	5	0.845	0.847
5	3	0.800	0.916
	4	0.858	0.862
6	4	0.802	0.843
7	1	0.808	0.809
	2	0.737	0.737
8	1	0.636	0.503
9	1	0.665	0.645
11	1	0.800	0.792
	2	0.907	0.999
12	2	0.940	1.025
	4	0.794	0.763
	6	0.807	0.799
13	1	0.897	0.901
15	1	0.760	0.758
	2	0.850	0.881
	3	0.890	0.816
16	1	0.823	0.766
	2	0.750	0.762
	3	0.859	0.822
	4	0.690	0.721
	5	0.914	0.823
17	1	0.802	0.740
18	1	0.880	0.906
	2	0.780	0.739
	3	0.787	0.781
19	1	0.887	0.870
	2	0.980	0.967
	3	0.860	0.864
20	2	0.840	1.055
	3	0.868	0.966
21	2	0.958	0.964
	3	0.871	0.852
	4	0.812	0.725
	5	0.741	0.672
	6	0.910	0.894

APPENDIX F

MEASURES OF INDUSTRY STRUCTURE AND PERFORMANCE

Structural Measures

Sawyer's 4-firm Concentration Ratio

Four-firm Employment Concentration ratios for Minimum List Heading industries for 1958 are given by Sawyer in his article "Concentration in British Manufacturing Industry", Oxford Economic Papers Vol 23 1971, pp 352-383. These have been combined by averaging weighted by employment to give concentration ratios for the subgroups and industries employed in this study. Definitions of the subgroups in terms of MLH's are given in Table 4.4. The employment figures used as weights are from 1958 Census of Production Summary Tables pt 133, Table 1, column 13. Where Sawyer gives maximum and minimum ratios, their average has been used. This affects Industry 4 subgroup 5, 7 subgroup 1 and 13 subgroups 2 and 3. Where a subgroup involves some non-manufacturing activities, these have been disregarded in calculating the concentration ratio. Cases of this are: Industry 1 subgroup 2, Industry 6, Industry 11 subgroup 2 and Industry 13 subgroup 1. In a number of cases, the subgroup definitions involve the disaggregation of MLH's. In these, the whole MLH is included wherever a component of it is called for: Industry 4 subgroups 4 and 5, Industry 7 subgroup 1 and industry 16 subgroup 5.

Finally, Sawyer does not give a figure for Construction but, using the method he describes in Appendix III of his article and data from the 1958 Census of Production Pt 133, Table 4, maximum and minimum values were calculated.

Whittington's Concentration Ratio

The values are given in "The Prediction of Profitability" Table 3A1. The ratio is defined as "the ratio of the sum of the net assets of large companies to the sum of the net assets of all quoted companies in the relevant industry". Only companies which continued from 1954 to 1960 are included and 'large' is defined as having net assets of greater than £4 million in 1954. It is only available at the industry level.

Variance of Logarithm of Size, Variance of Size and Average size

These three measures all used net assets as the measure of size and all are calculated for quoted companies only. The logarithms in the first are Napierian.

Industry Level Measures of Structure

Industry No.	Sawyer's 4-firm Concentration Ratio	Whittington's Concentration Ratio	Variance of Logarithm of Size	Variance of size	Average Size
1	29.0	66.8	1.55	1.64×10^7	1546
4	25.4	61.4	1.48	2.63×10^7	2043
5	42.6	86.2	2.20	1.01×10^8	4148
6	46.7	81.2	2.67	9.46×10^7	4238
7	19.5	60.9	1.33	2.84×10^7	1491
8	16.8	68.8	0.74	3.04×10^6	1003
9	10.6	37.1	0.84	8.42×10^6	1424
11	14.3	39.9	1.28	5.96×10^6	1150
12	34.3	84.6	2.08	3.75×10^7	2553
13	25.1	75.2	1.39	8.59×10^7	3490
15	20.3	70.9	2.02	3.86×10^7	2502
16	20.9	56.0	1.12	3.54×10^7	1267
17	5.6	26.5	1.55	3.20×10^6	1158
18	*	42.5	1.16	8.61×10^6	1330
19	*	76.2	1.94	4.37×10^7	2305
20	*	72.5	2.22	3.06×10^7	1340
21	*	62.3	1.95	1.17×10^7	1329

Subgroup Level Measures of Structure

Industry No.	Subgroup No.	Sawyer's 4-firm Concentration Ratio	Variance of Logarithms of Size	Variance of Size	Average Size
1	2	21.5	1.56	3.85×10^6	1191
	3	14.5	0.75	5.78×10^5	881
4	1	34.2	1.48	1.95×10^7	3010
	2	17.5	0.93	4.50×10^6	1061
	4	20.5	0.58	4.16×10^5	779
	5	22.6	1.43	2.70×10^7	2123
5	3	40.1	2.04	1.64×10^7	3431
	4	38.2	1.59	1.72×10^7	2057
6	4	44.4	1.25	3.79×10^6	1357
7	1	18.7	1.30	3.13×10^7	1442
	2	24.3	1.32	6.19×10^6	1682
8	1	24.0	0.68	2.61×10^6	915
9	1	10.6	0.81	5.75×10^6	1389
11	1	14.3	1.15	4.83×10^7	953
	2	14.4	1.25	3.82×10^6	1651
12	2	28.6	1.61	8.88×10^6	1482
	4	38.9	1.73	5.79×10^7	3152
	6	31.9	2.19	1.74×10^7	2083
13	1	19.1	1.29	2.18×10^7	3146
15	1	27.4	2.13	5.21×10^7	2907
	2	29.3	1.48	2.83×10^7	3973
	3	7.8	1.43	1.06×10^7	903
16	1	36.1	2.30	1.89×10^8	4008
	2	7.6	0.67	2.82×10^5	602
	3	16.7	0.69	4.36×10^5	568
	4	24.8	0.57	2.76×10^5	603
	5	23.4	1.20	2.77×10^6	1030
17	1	5.6	1.62	1.89×10^6	1125
18	1	*	1.02	5.83×10^6	1310
	2	*	1.29	1.59×10^7	1255
	3	*	1.14	4.23×10^6	1362
19	1	*	1.51	2.13×10^7	1881
	2	*	2.70	1.06×10^8	5544
	3	*	1.69	2.58×10^7	1521
20	2	*	1.18	1.89×10^5	317
	3	*	1.98	4.96×10^6	732
21	2	*	1.26	7.11×10^5	608
	3	*	1.18	3.91×10^5	536
	4	*	2.49	3.64×10^7	2197
	5	*	1.83	2.87×10^7	2841
	6	*	1.84	2.74×10^5	388

Performance Measures

Average Rate of Return on Net Assets

This is calculated as the average of the rates of return of companies for each of the years 1948-1960.

Growth Rate of Net Assets

Taken from Whittington's "Prediction of Profitability" Table 2.4. It is the compound annual rate calculated after adjustments have been made for asset revaluations and changes of accounting date. These figures are based on continuing companies only.

Measures of the Variability of Industry Average Rate of Return

For each industry, the annual average rates of return were calculated. Then each industry series was regressed on a linear time trend. The coefficient of time in that equation is referred to as "the Trend".

Industry Level Measures of Performance

Industry No.	Average Rate of Return on Net Assets (%)	Growth Rate of Net Assets (% p.a.)	Trend in the Average Rate of Return (% pts. p.a.)	Standard Deviation of the Average Rate of Return (% pts.)	Standard Deviation of Errors about the Trend in Average Rate of Return
1	15.7	7.1	0.13	1.4	1.2
4	19.5	9.3	-0.66	2.5	1.1
5	20.0	10.8	-0.20	1.6	1.5
6	17.4	7.9	-0.92	3.8	2.0
7	19.1	8.4	-0.47	2.3	1.6
8	13.0	5.9	-0.22	9.6	6.4
9	16.7	6.5	-0.15	6.2	3.3
11	15.0	4.5	-0.52	4.0	3.5
12	16.6	7.1	-0.41	1.5	1.0
13	11.9	4.6	-0.27	1.1	0.5
15	16.6	7.5	-0.35	3.9	3.2
16	14.4	5.6	-0.38	2.5	2.1
17	17.3	7.9	-0.07	1.9	1.9
18	14.1	5.2	-0.43	2.4	1.9
19	16.6	7.5	-0.04	2.4	1.0
20	12.9	1.3	0.09	1.5	1.4
21	11.8	4.3	0.44	1.7	0.6

Subgroup Level Measures of Performance

Industry No.	Subgroup No.	Average Rate of Return on Net Assets (%)	Trend in Average Rate of Return (% pts. p.a.)	Standard Deviation of Average Rate of Return (% pts.)	Standard Deviation of Errors about the Trend of Average Rate of Return
1	2	15.5	0.32	1.6	0.8
	3	15.7	-0.56	3.0	2.6
4	1	16.3	-0.41	1.9	1.1
	2	22.0	-0.92	4.3	2.7
	4	17.1	-0.87	4.0	3.1
	5	19.9	-0.60	2.3	0.4
5	3	19.0	-0.23	2.1	2.0
	4	20.3	-0.03	1.6	1.3
6	4	20.5	-0.68	2.9	1.5
7	1	20.7	-0.53	2.8	1.1
	2	15.1	-0.06	1.6	1.3
8	1	13.7	-2.10	9.5	6.4
9	1	16.5	-1.50	6.1	2.5
11	1	14.3	-0.59	4.6	3.0
	2	15.5	-0.34	2.8	2.6
12	2	17.9	-0.70	2.8	1.3
	4	19.9	-1.20	6.3	4.9
	6	15.7	0.05	1.0	0.8
13	1	11.2	0.25	1.0	0.2
15	1	18.3	-0.54	5.8	4.1
	2	17.0	0.19	1.6	1.3
	3	13.9	-0.32	2.3	1.5
16	1	15.8	-0.48	3.5	2.8
	2	12.3	-0.05	2.9	2.4
	3	13.8	-0.05	3.4	2.9
	4	11.7	-0.16	6.8	3.6
	5	16.5	-0.08	2.4	2.1
17	1	17.2	-0.13	1.8	1.5
18	1	14.5	-0.15	0.9	0.5
	2	14.2	-0.10	1.7	1.2
	3	13.6	-0.66	3.5	1.4
19	1	14.6	0.20	1.3	0.9
	2	13.6	0.20	1.4	1.1
	3	18.0	-0.20	1.5	0.7
20	2	15.5	0.05	2.4	2.4
	3	11.7	0.03	1.5	1.1
21	2	11.4	0.46	1.8	0.7
	3	15.4	-0.42	2.2	1.7
	4	13.1	0.07	0.6	0.6
	5	11.3	0.32	1.8	1.4
	6	12.9	0.21	1.1	0.6