"On the International Diversification of Production"

P. A. Geroski

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Acknowledgements

This thesis was commenced in September 1975 under the supervision of Professor John Williamson and was planned as an extension of my M.A. thesis on the Product Cycle and Direct Investment. As I began probing more deeply into the nature and operations of multinational firms, I became aware that Trade Theory provides much less help in opening these black boxes than Industrial Organization Theory, and, with the assistance of John Cubbin and Professor Keith Cowling, I began to move in this direction. With the departure of Professor Williamson in January, 1977, the informal supervision of Professor Cowling intensified and he formally took over as my supervisor.

During my two years as a research student at Warwick and my one year at the University of Southampton, I have been particularly fortunate in having colleagues willing to devote time to re-organizing my thinking on many little and big problems. At Warwick, Professor John Williamson, Paul Stoneman, Paul Weller, Norman Ireland, Dennis Leach and John Cubbin all contributed inputs at various stages of my work and proved ingenious at smoothing out my programming problems. At Southampton, Professor David Rowan, Alan Hamlin, Saul Estrin, George McKenzie and Chris Chapman all displayed much interest and gave ungrudgingly of their time. Portions of this thesis have been presented to seminars at Warwick (S.S.R.C. Study Group in Industrial Economics and Warwick Industrial Economics Study Group), the L.S.E. and Reading and with each presentation and subsequent discussion my ideas sharpened and my exposition improved. In particular, the assistance of Alan Rugman and Mark Casson at Reading during the

construction of the model and later during the assessment of the results must be gratefully noted. Finally, thanks must be given to Fiona Savory and Frances Edwards for carefully typing and proof-reading the finished product.

Above all, however, the evolution of this thesis has relied upon the encouragement, friendliness and incisive comments of Keith Cowling. More importantly, my own evolution over these three years from an enthusiastic but inexperienced M.A. student to an (Industrial) economist with the same enthusiasm but more experience and judgement is the product of many discussions and continuing friendly encouragement. It is the latter contribution which I particularly value.

Summary

This thesis is concerned with rigorously formalizing and testing a particular model of foreign investment, the so-called 'portfolio model'. As such, it is an exercise in positive economics - rigorous model specification coupled with direct empirical testing. The exercise can be conceptually separated into four stages. In the first place, consideration must be given to the reasons for using the model and the limitation on its applicability. This is the principal subject matter of the first chapter. Having cleared this ground, the model must be formulated and tested. It is here that previous attempts to test the model have been most disappointing. In Chapter II, we shall set out the model rigorously and generate an estimating technique to deal with the simultaneous equations system the model generates. The third step in our examination of the portfolio model is the assessment of the results and this merges with the final step of taking these results and using them for further explorations on multinational firms. As it turns out, the model does not command support from the data and the process of assessing the reasons for failure involve the last three chapters. However, an alternative model emerges directly from examination of the portfolio model and some attention is paid to this evolution and the close links between the models. Thus, in a sense, the thesis results are a purely negative affair - i.e. after a reasonably close examination, the portfolio model is put on one side. The reasons for failure and the beginnings of an alternative model are the positive results which emerge but, in the end, we are not left with a full blown rigorous model which we can put some confidence in. While not glorious and exhilarating, it is still progress.

Chapter I

Investment and the Diversified Firm

(i) Introduction

The task which we set ourselves in this thesis is relatively straightforward and easily described. We wish to predict the investment flows directed by multinational firms to various host countries. Two interrelated problems are involved: to predict the firm's global investment total and, intertwined with this, to predict the allocation of that global total amongst the host countries involved. For reasons which will be developed in Chapter II, we shall concentrate here on predicting the allocation of investments by multinational firms.

The need for such an investigation is self-evident and, as it has been the subject of many inquiries, one wonders why yet more work is needed on the topic*. Three reasons can be given for the rethinking and reworking presented here. The first is that much has passed as germane to "the theory of direct investment" and there is a need to be precise about what in particular one is concentrating on. In Section (ii) below, we shall distinguish new from expansionary investment and these two form (what we shall come to call) characteristics analysis. This three part distinction will assist us in nailing down precisely what we want to predict and what variables are relevant to the problem.

A second reason for reworking the subject matter is that not enough attention has been paid to the type of firm whose behaviour is

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* I do not intend to develop this polemic in the text. Our argument will be set out and developed on its own merits. In the first Appendix to this Chapter, the important empirical work done on predicting direct investment will be briefly surveyed and a mild polemic developed there.

being investigated. In particular, the fact that a multinational firm is a diversified firm operating interdependent subsidiaries located in different host nations has not been fully appreciated. In Section (iii), we shall briefly discuss the operations of such a firm and show why its diversification of production activities makes a difference. The implications of this discussion go a long way towards explaining the particular model we intend to employ in this study.

Finally, very few investment models explicitly acknowledge uncertainty and, clearly, it is of no little importance to build this into whatever model is being considered if possible. Whether or not one believes that home investment is riskless, international investment is clearly a rather risky business if only because of the unfamiliar environment decision-makers find themselves in. In Section (iv), we shall briefly discuss the nature of the risks of international investment and its role in the initial diversification as well as subsequent expansion of multinational firms. The principal empirical results of our study centre (perhaps somewhat controversially) around the role of risk in the international investment decision.

These three strands of the argument are brought together in Section (v). Our discussion will lead to the adoption of a particular model (to be developed in detail in Chapter II) which corresponds to a precise set of hypotheses about the determinants of the allocation of international investment. In Section (v) we shall state this hypothesis and consider the null hypothesis in some detail. This examination is doubly necessary because rejection of the null hypothesis (should it occur) does not imply return to the sort of investment models surveyed in the first Appendix. Rather, it involves examination of the internal workings of firms unable to control and effectively co-ordinate their multifarious activities.

(ii) Notes on Investment

It appears to be the case that many theories have come under the rubric of "the theory of direct investment" and frequently one does not know quite what phenomena is under discussion*. It will be helpful to use a three part distinction in considering this literature and our place in it; we intend to concentrate solely on one of the three types of analysis. Thus we shall distinguish expansionary investment analysis, new investment analysis and characteristics analysis.

Quite often one encounters a discussion of the types of firm which go abroad, the motive for internationalization, and the ability of the firm to 'go international'. This is 'characteristics analysis'. It commences properly with a discussion of the motives for diversification and provides sufficient conditions on the types of firm which go, the reasons why, and so on. The method of analysis is to deduce these characteristics from a discussion of the conditions under which international diversification will be profitable. It is a long way, however, from profitability to investment flows (which involve the construction of plant and equipment), the size of such construction, its timing, location and so on. Here we distinguish characteristics analysis from investment, and, within the latter, new from expansionary investment. The former concerns a once over flow, centring attention on timing and specific location and somewhat less on size. Expansionary

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* For example, compare Casson's use of the term "theory of direct investment" with our use which refers to expansionary investment flows; Casson (1977).

investment is concerned with a continuing flow, the size of which is of more interest than location or timing; location is given by past new investment decisions, while timing is embedded in the time unit over which the flow is calculated. It should be apparent that the three types of exercise concern themselves with rather different dependent variables and hence require distinct sets of independent variables and perhaps empirical techniques. The remainder of this section briefly considers each in turn.

The principal lynchpin in characteristics analysis is a consideration of the barriers to entry into foreign markets facing the would be multinational*. Chief amongst these is the unfamiliarity with the new market and the lack of reliable information which decision-makers can use. Such ignorance and uncertainty arise from not only the usual market uncertainties but, more importantly, from the fact that the firm is not familiar with the means available in this foreign market to aid it in reducing the problem. That is, it is not so much the uncertainty and ignorance per se, but, as it were, the uncertainty surrounding (and ignorance of) instruments available for hedging.

Given this disadvantage, it is clear that the firm must have some compensating assets or advantages with which to meet the competitive advantage of indigenous firms. Such assets must be easily transportable, preferably at low internal opportunity cost (that is, they must take on the character of a public good within the firm), and not available to native firms. Of the many possibilities which present themselves, product differentiation advantages stand

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* Caves (1971; 1974a). Appendix II contains a more detailed discussion of such diversification and a summary of the principal empirical studies of characteristics analysis. Casson (1977) and Casson and Buckley (1976) present a similar analysis centring on internalization of intermediate product markets by the firm which complements our analysis here.

out head and shoulders above the rest (Caves, 1971). It is these assets which are the subject of characteristics analysis; the firms which have or can obtain them are the relevant subset of firms potentially or actually abroad; and, the markets most receptive to them or in which they can be most profitably exploited, the presumed destinations of these firms. In short, characteristics analysis seeks the conditions for profitable operation (and expansion) in markets in which the firms suffers relative to competitors in knowledge and information about the market.

Such a method of analysis is undoubtedly interesting and valuable, yet is is limited in two important respects. On the one hand, it establishes only sufficient conditions for profitability; and, on the other, it makes no statement about the extent of commitment to a foreign market, if any. It is therefore no more than a very necessary complement to investment analysis. New investment analysis supplies the first deficiency, for it concerns itself with the reasons for the firm initially undertaking a foreign commitment; expansionary investment, as we remarked earlier, concentrates on the size of the continuing commitment.

The distinction between new and expansionary investment is old and familiar and, unfortunately, seldom mentioned (exceptions in the foreign investment literature are Stevens, 1969a; Richardson, 1971a and b) and rarely empirically utilized (typically because of data inadequacies). Building on the bed of characteristics analysis and retaining our interpretation of it as providing sufficient conditions for profitability, it is clear that new investment theory must concern itself with the specific factors which transform potential entry into

actual entry. This amounts to identifying the particular signal which ultimately impels the firm into motion.

A number of such signals are relevant and interesting and some empirical work has established their importance. One signal is a change in government policy; in particular, for a firm hitherto exporting to the ultimate host nation, the imposition or tightening of tariffs or other trade barriers signals the end of profitable exporting and the existance of a protected market. Another particularly interesting signal is the actions of rivals and competitors*. A movement abroad from one of them not only provides information to other competitors on a new market, but raises the threat that the initiating firm may develop competitive advantages in the new market which can be profitably transplanted back to disturb the home market oligopolistic equilibrium. The world-wide scramble of the oil companies, as well as other resource extractive industries put this phenomena into excellent relief (Vernon, 1974). There are of course a number of other signals impelling action and much depends on the firms strategy (Ansoff, 1965), internal resources and opportunity sets (Penrose, 1959) and information gathering procedures (e.g. Aharoni, 1966).

When once a firm is established in a market, its expansion and continuing growth is the subject matter of expansionary investment theory. In rather familiar ways, this depends not so much on the current levels of various variables but their expected future movement and the extent to which such developments depend on current and near

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* Classic works in this respect are Vernon (1974) and Knickerbocker (1973); the empirical findings of the latter are discussed in Appendix I.

future expansionary decisions by the firm. What is relevant is not so much a set of attributes possessed by the firm, nor a set of signals indicating a large, once over change in market circumstances, but rather a time series of principally endogenous indices of profitability linked in known ways to current expansionary decisions.

It is perhaps worth summarizing this discussion and three part distinction by considering a number of independent variables frequently encountered in the empirical literature and allocating them to their appropriate dependent variable*. One variable which has gained some popularity is the 'size of the market' (Scaperlanda and Mauer, 1969), as typically measured by the GNP of the host nation. This is relevant to characteristics analysis inasfar as the exploitation of some particular asset is subject to increasing returns and may create a favourable environment for the reception of a signal which will induce new investment. It is, however, inappropriate for expansionary investment. What is relevant there is the change in the size of that market the firm controls, and principally the change which can be induced by a combination of marketing initiatives and plant expansion (see Goldberg's comments on Scaperlanda and Mauer, 1972, for a discussion of this point). Another variable encountered is the change in tariffs (e.g. as resulted from the formation of the EEC and EFTA) considered, for example, in studies by Scaperlanda and Mauer (1969), Scaperlanda (1967), Bandera and Lucken (1972) and many others (see the discussion

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* It will be evident in the course of Appendix I that our allocation of these variables to dependent variables occasionally differs from the allocations of the writers cited.

in Appendix I). This, as mentioned, properly pertains to new investment for it acts as a signal*; the level of tariffs (e.g. Caves, 1974c; Horst, 1972b) pertains to characteristics analysis, for it forms a crucial part of the environment in which sufficient conditions for profitability must be established.

The listing of such variables can be indefinitely continued (as it is, to some extent, in Appendix I) but the basic principles should be clear. Our principal interest here is in expansionary investment; as such, we take the set of existing production locations and facilities as given (to be explained if necessary by a backwards appeal to new investment theories). Furthermore, the conditions of profitability - current levels and to some extent their future movements - are also taken as given; again, some explanation can be achieved by appeal to characteristics analysis. What cannot be taken as given is the overall firm profitability which results from pursuing an optimum investment programme. The determinants of that programme and its carefully calculated effect on current and future profitability are the crux of the problem.

(iii) The Multinational as a Diversified Firm

A diversified firm is one which controls profit generating activities in a number of markets, activities involving either the production or sale of goods and services**. However, this definition

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* Kindleberger (1969), remarks that the formation of the EEC acted as a signal to American foreign investors and that the tariff walls were of secondary importance.

** Familiar models such as multi-plant firms (e.g. Henderson and Quandt, 1972) and multiproduct firms (e.g. Dhrymes, 1964) isolate two polar possibilities.

while hardly controversial, is particularly unhelpful, for it is plagued by the definitional problems of identifying markets (see, for example, the discussion in Penrose, 1959, pp. 110 passim). Markets, of course, are defined by product and location (given a temporal setting) but this merely pushes the problem back one step. This unfortunate difficulty has plagued the investigation of diversified firms; as Penrose (1959, pp. 108) has noted: "...because of the ambiguity and non-comparability of product classes, one cannot appraise the significance of the comparative diversification of different firms". In addition, one cannot appraise the breadth of diversification of any given firm and this makes the admirable work by Berry (1974), Utton (1977) and others on the prevalence of conglomerate diversification and Schumpeterian competition amongst giant firms difficult to interpret.

Fortunately, we can make adequate progress without extensive probing of this definitional mire. The important distinction we need to make concerns the difference between the operations of a single activity firm and those of a diversified firm which controls several activities. This feature of control implies that the individual plants are operated towards a common purpose and their activities correspondingly integrated. One particular manifestation of this is the existence of inter-market intra-firms flows of goods which is typical especially of vertically integrated structures*. Such flows predominate in vertical structures because the linkage between vertical markets concerns successive development or distribution of

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* Some implications of this argument are developed and applied to labour markets in Geroski and Knight (1977). The particularly interesting implication is the identification of an important causal link between types of firm merger and different patterns of union merger.

a particular good. In horizontal structures, such intra-firm flows may be implicit; that is, there may exist an equilibrium in which no flows occur but which, when disturbed, occasions such flows as the firm performs arbitraging activities.

This integration of plants and possible intra-firm trade can be a profitable activity. Not only are arbitrage profits appropriated by the firm (perhaps in part), but the firm can price discriminate (Henderson and Quandt, 1972; Clemens, 1951), cross-subsidize activities to support predatory activities (e.g. Blair, 1974), or otherwise manipulate the prices of goods flowing between markets (transfer pricing). All of these practices depend on control; ownership is not sufficient. Diversification of firms in and out of an industry can thus have potentially important effects on industry performance and must play a role in the explanation of such profitability (e.g. Rhoades, 1973; Miller, 1969).

It is easiest to conceptualize the interdependencies between plants controlled by a diversified firm by the (potential or actual) intra-firm, inter-market flows of goods, technology, finance capital, and managerial services. By concentrating on goods flows we can make a richer set of distinctions between types of diversification. Thus, a horizontally diversified firm controls the flows of a good to different locations and similar goods to the same or different locations. This can be further sub-classified into geographical or product horizontal diversity depending on whether significant differences in geographical arbitrage and arbitrage over goods space affects the particular problem at hand (e.g. Geroski and Knight, 1977). Vertical diversification is somewhat different; rather than

keying on a basic good, the goods flows are related to the production process (including distribution), and different goods flow to markets, each being used to produce the next. One particularly interesting aspect of this relationship is that the firm faces itself, as it were, as buyer and seller in each market and the erection of a vertically integrated structure has been closely related to market failure (Williamson, 1971, 1975). Conglomerates, in pure form, have absolutely no potential or actual goods flows, for their various activities are in markets which cannot be spanned by either goods or geographical arbitrage.

An interesting subset of diversified firms relates to those who control intermarket flows of goods or services which cross national boundaries; i.e. multinational firms*. They can be further classified as primarily either vertical or horizontal (see immediately below); the interesting topic of analysis is the international intra-firm flow of goods. While Hymer (1960) was the first economist to bring an Industrial Organization perspective to the analysis of multinational firms, Caves (1971, 1974a) is responsible for a relatively full development of the analysis. He argues that: "...the overwhelming portion (by value) of direct investments involve either horizontal expansion to produce the same or similar good abroad or vertical integration.....production diversification across national boundaries is almost unknown...; (and).....the international corporations' plans to make vertical and horizontal investment abroad are directly comparable

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* Some evidence by Bradshaw (1969) indicates the importance of intra-firm international transactions. He found that 330 U.S. multinational corporations with 3579 affiliates were responsible for a full third of U.S. exports, 60% of which were channelled through foreign affiliates. Studies by Cohen (1975), Helleiner (1973) and Reuber et al (1973) show a growing reliance by some host countries (e.g. South Korea, Singapore and Taiwan) on intra-firm trade for boosting their exports of industrial products.

to business decisions opting for familiar forms of domestic expansion",* (1971, pp. 268). It is worth explicitly endorsing Caves' view that such diversification decisions are similar to purely domestic diversification decisions; we shall argue that this is the case with expansionary investment and the models which can be used to describe it are similar.

Let us turn to consider the investment behaviour of such diversified firms. One's instinctive feeling is to employ familiar models determining optimal capital stock (Jorgenson, 1963), specify an adjustment function and estimate plant and equipment expenditures for each subsidiary, or the flows of capital finance from the parent to each subsidiary (e.g. Stevens, 1969a; Kwack, 1973; and so on, discussed in more detail in Appendix I). A moment's reflection suggests that this cannot be right. The distinctive and important feature of the operations of diversified firms is the control they exert over subsidiaries located in different markets and the profitability of co-ordinating these diverse activities. When the firm makes an investment decision for one plant, it surely considers the alternative and interdependent possibilities presented by the other plants it controls. The point is simply that the Jorgenson model must, if it is to be used, be extended to simultaneously determine all investment in all plants.

Let us consider the proposition that expansionary investment decisions are made by scanning over the activities of all existing

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* See also Stopford and Wells (1974). The evidence of Stopford and Wells and Vernon (1971, Chapter 3) suggests (weakly) the possibility that this may be becoming less true over time.

plants*, and, in effect, solving a set of simultaneous equations. What is crucial here is firm structure and in particular the location of the investment decision. Should investment decisions be located in plants or subsidiaries, there would be no problem in applying the simple investment models. Scanning might occur in the higher echelons, but subsidiaries who lack a global perspective are free to act independently. Although decentralization of decisions within the firm is widespread and subject to sophisticated analysis, there is no evidence to suggest that strategic decisions such as investment have been so delegated, and this is not surprising. The factors which give this common-sense good foundations is that financial constraints and interdependencies link these decisions in a way no profit maximizing firm can ignore.

Centralization of the investment decision implies that investment decisions for various plants will be part of one overall firm wide decision; it underlies the importance of explicitly including scanning mechanisms in one's model; and it suggests that rather than predicting the investment in each plant separately, one should predict

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* Were the firm to scan over all existing plants and possible new projects, it would face an immensely complicated problem known as the 'wharehouse problem' (Baumol and Wolfe, 1958; Cooper, 1963). The problem is complicated because, given the current size and activity of existing plants, a new plant must not only be located, but its size chosen, but then all existing plants must be altered in size. The computational difficulties are formidable. This aside, there is a further reason for suspecting that new investment is essentially a separate decision; the time horizon (life of plant rather than life of machine) and various strategic considerations (emphasized by Richardson, 1971a and b) differ between the two.

the pattern of investment in all plants simultaneously*. To reinforce this point, consider how the centralization of a distribution network within the firm weakens the link between optimum capital stock in a particular plant and the change in sales in a particular market - the key relation in single equation, single plant models. The weakening comes about because the supply network between plants and sales outlets gives the firm an extra degree of freedom of choice. When circumstances change so that, say, demand increases 'permanently' in one market, the plants principally involved in supplying that market can expand production (and expand in different proportions), or supply networks can be rearranged so that output from another plant is called forth. In the extreme, if there is surplus capacity in this second plant, no investment may occur anywhere at all.

The absence of any overall constraints or interdependencies between plants would make the case for centralized decision-making rather weak. There is one overall constraint of importance and three important sources of subsidiary interdependence.

The overall constraint is clearly financial; whether or not it is binding depends on whether the investment policy of the firm is independent of firm financial structure. It is quite common in investment studies to appeal to the Modgliani-Miller Theorem

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* A rather interesting illustration of the principles of our argument occurred in Chile in 1955, when the so called "Nuero Trato" mining legislation in effect gave the large U.S. copper producers a windfall gain in profits. This was expected to increase local investment- instead, it was siphoned off and invested by the firms elsewhere in the world. It is important to note that this occurred well before nationalization and expropriation became real concerns for the firms and so cannot be explained away by risk aversion. It is the global perspective of the firms and the lack of independence of local investment decisions (see Moran, 1974, Chapter 4).

(Modgliani and Miller, 1958) to banish financial variables (e.g. Jorgenson, 1971). However, the evidence is against it (Meuller and Grabowski, 1972) and even Jorgenson admits that 'outside' financial variables make an impact on investment decisions. The evidence from direct investment studies surveyed in Appendix I confirms these suggestions. However, the financial constraint may take many forms - subsidiaries may be financed solely out of retained earnings (Penrose, 1956), the home market may be given "the first bite of the cherry" and so on. None of these theories (most of which postulate a separation of domestic and foreign investment decisions) appears to have found support (Stevens, 1974). The precise nature of the constraint depends rather crucially on the sources of funds to the multinational and the conditions under which finance is obtained. Little hard knowledge has emerged despite several intensive investigations (Robbins and Stobaugh, 1974). An interesting case study which illustrates the problems (and our ignorance) is the response of U.S. multinationals to the U.S. Restraint Programme in the late 1960's (Severn, 1972; Stevens, 1972; Brimmer, 1966; Willey, 1970; Shapiro and Deastlov, 1970; and so on). What appears to have occurred is that the restriction on outflow of funds did not impede plant and equipment expenditure by U.S. multinationals, it merely shifted their financing abroad, principally to national capital markets in Europe and the Eurodollar market.

The principal interdependencies (the first two of which induce the sort of intra-firm flows of goods remarked upon earlier) between plants are three. First, for plants supplying each other with intermediate goods or supplying similar markets with complementary

goods, a link is formed which makes investments in these plants complementary. The reverse is true for plants supplying overlapping sets of markets with the same or similar goods, for then expansion of one is at the expense of another plant. Supply networks and new investment projects are important ceteris paribus features of these functional relations. Finally, pooling of risk arising from relations between the "shocks" occurring in various markets allow for the possibility of risk pooling by careful choice of an 'expansion portfolio'.

In an important sense, covariances* may reflect all three types of interdependencies. Any relation between the stochastic forces operating in various markets will, of course, be picked up by a covariance, but one may expect that substitutability and complementarity may also be reflected. This is most clearly seen if we suppose a pair of plants and investment possibilities which raise the rate of return which we assume would otherwise decline. If the plants are complementary, the investment will occur in both and both rates of return will rise; if they are substitutes, then the rate of return in one plant will fall while that in the expanded plant will rise. Thus, both economic and stochastic factors will enter the covariance between the two plants' rates of return.

To sum up this discussion, we have argued that the salient characteristic of a diversified firm (which a multinational is) is the control over the interdependent activities of its subsidiaries.

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* For the moment consider this to be covariances between the rates of return earned in various markets.

In planning an investment programme, this implies that the firm will solve a 'simultaneous equation problem' in determining investment allocations amongst plants. When we have discussed the effect of uncertainty on investment in the next section, we shall move on to modelling these ideas into a specific, testable hypothesis in Section (v). The model based upon this discussion and hypothesis is the subject of Chapter II.

(iv) Risk and Uncertainty in Foreign Operations

It will be recalled that the third reason the reader was enticed into this thesis is that we argued that risk and uncertainty play a large role in expansion of foreign operations and must be explicitly included in whatever model of such expansion is being proposed. As Helliwell has remarked: "...the influence of uncertainty is likely to remain far larger in the world of affairs than it is in the specification of .... investment equations", (1976, pp.16). We should like to remedy this sad state to some (perhaps limited) extent, and so must spend some effort considering just precisely what the risks of foreign operation are and how they might differ from the risks involved in domestic operations.

We mentioned the risk of foreign operation earlier in our discussion of characteristics analysis, such risk and the consequent uncertainty forming a crucial step in that argument. Risk arising from unfamiliarity of the workings of a new market obviously is most acutely felt upon initial entry. Over time, as the firm operates in the new market, it gains the knowledge needed to cope with situations

and the confidence to face unexpected reverses and stumbling blocks with relatively more equanimity. It learns not only the character and extent of demand in the new market, but how best to estimate this; it develops relations with suppliers of raw materials, intermediate products and ancilliary services and learns the full possibilities open to it; the nature of competition and the particular methods of collusion and co-ordination amongst rivals are slowly revealed*; and, finally, it develops a working relationship with the host government, slowly mastering the nuances of the laws and regulations and how they may be effectively 'dealt with'. Nevertheless, this knowledge is only slowly and painfully gained and evidently the assets of the firm which ensure successful initial entry must be counted upon to sustain competitiveness in the 'foreign' environment for some time. At some point in its operations in the foreign host, the firm may become 'native' and, using primarily native managers, come to feel 'at home'. This possibility can only be realized, however, after a long, intensive learning period.

Let us consider specifically the risks of expansionary investment in a domestic environment and then, using these principles, extend that discussion to deal with the risks of expansion in a foreign country. The most conceptually straightforward means of approaching this subject is to imagine (not implausibly) that the firm formulates an expected return from an expansion of a given size, expressed as a rate of return. The risk of that expansion is clearly the probability of

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* Caves (1974b) speculates that the multinational will, nevertheless, remain a force disrupting these collusive patterns and that international oligopolistic co-ordination is still very much of the future.

various deviations from that expected return, conveniently expressed as a variance*. Any number of factors can be expected to create such a deviation: a poor guess, the reaction of rivals, unanticipated policy changes by the government, and so on. However, these factors create only the possibility of a deviation, for the firm has some limited means of reacting to each and rectifying the situation. Thus, suppose that the expansion involves extending the facilities of a plant producing green toothpaste and the expected return is 10%. Unanticipated expansion by a rival may lower this by 5% if the firm cannot react. If, say, it can switch the new facilities towards producing red toothpaste, it may achieve a rate of return of 9%, a net deviation of expected returns of 1%. Thus, the risk of expansion is the probability of each possible disturbing element times the net disturbances (expressed as a deviation from the expected return); the net deviation being the total disturbance less the correction achieved by the firm.

For a firm with several plants, the variance of each is modified by the joint covariances. This arises because the inter-dependencies between the plants controlled by the firm allow the joint resources of both plants to be applied to a problem in either. Furthermore, the factors creating disturbances in markets may be related, reinforcing each other or cancelling out to some extent across the system.

It is important to stress that this view of variances (and covariances) as measures of risk is "ex post" in the sense that the potential effect of any given disturbance is modified or exacerbated

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* Another measure might be the semi-variance, in this case the sum of squared deviations below the mean. See Markowitz (1959).

by the reactions by the firm. Faced with the probability of any given disturbance, the firm asks first, what that disturbance will do to the expected return; second, what the firm can do; and then deduces the net effect. It should be pretty evident by now what the problem with foreign investment is. In the first place, because of ignorance about the market it is involved in, the firm has a much less clear idea of precisely what probability is to be attached to particular disturbances and the gross deviation likely to be induced by each. It can of course either under- or over-estimate each of these components but it would appear likely that it would over-estimate both the probability of an event with a negative deviation and the gross extent of that deviation. This would follow if the firm was risk averse, for risk aversion entering into the decision of what probability to use for each event would imply over-estimation*. This follows from the fact that the risk averse fear the risk of 'overdoing it'; that risk, in the problem of choosing what probability to weight a given gross deviation with, is the risk of understating the true objective probability of the event if that event creates a negative deviation, or overstating the probability if the deviation is expected to be positive.

However, the crucial element entering the risk of foreign expansion is the adjustment problem identified earlier. Given the probabilities eventually chosen and the gross deviations expected, the adjustment problems facing the foreign firm result in a larger

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* This rather self-evident proposition appears to play no role in the uncertainty literature in which subjective probabilities are given and not analysed. See Arrow (1971).

expected net deviation, ceteris paribus*. The lack of knowledge of the environment means that the firm will be less sure in its response, less effective and perhaps in the limit, completely unable to react. It faces an uphill struggle in modifying potential gross deviations.

To sum up, let us ask what we are to make of a given estimated variance to expansion in a foreign as compared to a domestic environment. Evidently, the variance the firm attaches to a given foreign expansion will be less accurate and it will be less confident of it than in the domestic situation. The probabilities used and gross deviations applied are calculated amidst relatively more ignorance; the net deviations are larger and their precise magnitude less certain because the conditions and methods of adjustment are less clear to the firm, ceteris paribus. Looking at the other side of the coin, a given ex post variance of returns over past operations (say, the variance calculated from the rate of return earned over the past ten years) is an achievement involving relatively greater effort in the foreign country; effort expended in guessing, worrying and adjusting. Clearly, it cannot be regarded in the same light as the same variance calculated from past home market activities.

These observations are rather important, for the measure of risk we shall be forced to adopt (for reasons eventually to be made clear) is an ex post calculation of risk. Such ex poste calculations will have to be used as proxies for the ex ante variances used by the firm in making decisions, but the same problem exists with both.

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* There is, of course, one final element of risk which is the fact that a number of events may take the firm completely by surprise and one might expect that this will be relatively higher for the foreign firm. However, cutting aginst this is the vigilance of the foreigner acutely aware of his inadequacies.

That is, the variance conceals the very real ignorance and adjustment difficulties facing a firm abroad. Not only must the variance quite properly appear in the investment function, but some provision must be made for the asymmetry between home and foreign variances, not to mention the asymmetries between the individual foreign variances themselves. This is a subject which will move to the forefront of Chapter IV and we shall have a number of interesting empirical results casting information on the matter.

(v) The Hypothesis

The time has come to sum up our arguments and form them into a precise hypothesis to test. This hypothesis will be cast in terms of the specific model we intend to adopt and so before presenting the hypothesis, it is worth sketching the transition between the three strands of argument in this chapter and the model of the next. Finally, the arguments of this chapter not only imply a particular hypothesis to test but also lead to a set of alternatives and we shall briefly point to the path we envisage should be taken.

The discussion and classification of investment models enables us to proceed more confidently on our task of estimating and predicting expansionary direct investment. Coupled with the points made about scanning over a number of interdependent activities, it implies that our model will scan over the expansion possiblities of a given set of existing plants. The inclusion of risk and expected return in the model of expansionary investment will be facilitated because we

will be able to use past plant performance to extrapolate future performance*; with new investment, there is no past performance to extrapolate from. The fact that we are dealing with a diversified firm emphasizes the scanning over a number of joint expansion possibilities and demands the inclusion of plant interdependencies. It is the centralized decision-making arising from the single control over these interdependent activities which causes us to focus on scanning and inter-relations between activities. Finally, the explicit inclusion of uncertainty suggests that the firm will be investing in combinations of interdependent risky activities and that some sort of portfolio choice is involved. An important point of this portfolio choice is the evaluation of foreign risk.

This portfolio model we will come to use will be constructed to predict the investments that the firm makes in each of its 'N' plants around the world. Our concern is consequently with the pattern or allocation of investment as much as with global total investment (which we will not, in fact, model). The precise hypothesis we propose to test is the following:

> The multinational firm pursues an integrated global expansionary investment policy, reflecting interdependencies between the activities of its plants; and, that this centralised decision is made on the basis of a portfolio model, or may be so described. Such a portfolio model is used to maximise the risk adjusted expected rate of return of global investment.

To bring this hypothesis into sharper focus and direct attention to the crucial arguments it is founded upon, it is worth considering

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* This will be discussed more fully below. It is obviously only one of a number of ways of overcoming the problem that we cannot observe precisely what the firm had in mind when it made its decision.

in some detail the alternative hypotheses. There are two:
(a) that centralized decision-making is not effectively occurring;
(b) that it is occurring, but not by use of a portfolio model*.
Let us briefly consider each in turn.

The factors which bring about a situation in which the firm cannot take account of interdependencies and optimise are those which create information problems for and overloading of peak co-ordinators within the firm. Of these, two stand out in importance. Sheer size increases information processing and evaluating requirements and allows control loss to develop, isolating, overloading and attenuating the power peak co-ordinators have to impose their will on middle and lower management (Williamson, 1970). Hand in hand with this is the possibility that firm structure has not adapted to firm strategy (Chandler, 1962) diversification having proceeded to such an extent that required information and control fails to diffuse within the firm from peak co-ordinators down and operating divisions across to other divisions and up to the head office.

In their study of firm financial policy, Stobaugh and Robbins (1974) divided up the firms they studi d into three size classes - small, medium and large. In considering the financial policies typically followed by firms in each size class, a number of interesting differences emerged. Small firms tended to neglect their international operations, leaving them by and large to run themselves,

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* There is a third possibility which is that interdependencies are trivial and hence do not give rise to centralization of such decisions. I find this particularly implausible on a priori grounds, and certainly the variance-covariance matrix presented in Appendix VII as well as the evidence on intra-firm international trade cast doubt empirically on it, albeit indirectly and imperfectly.

the reason being that such operations are too small and the firm was too inexperienced in manageing subsidiaries abroad to make it economically worthwhile to co-ordinate. Large firms, on the other hand, tended to apply rules of thumb; despite their superior knowledge and experience of international affairs, there is simply too large an administrative task involved in attempting to optimise. Medium sized firms were found by Stobach and Robbins to approach the optimum financial policy most closely.

Similar performance effects were found for roughly the same sample of firms by Stopford and Wells (1974) when firms were 'mis-structured'. They traced the evolution of multinational structures from one-off foreign activities to international divisions, from thence to world-wide product or area divisions and finally into recent 'mixed grid' systems combining product and area divisionaliz-ation. An important empirical finding of theirs was that 'misstructured firms' suffered a deterioration in growth and (less noticeably) profitability relative to firms more appropriately structured.

Firm size and diversity would thus appear to be the biggest stumbling blocks to optimisation and are thus starting points in the exploration of why firms fail to perform with all the efficiency of a maximizer. One suspects that these paths will lead through problems of control loss, subgoal pursuit and so on, into the realms of rule of thumb decision-making. Hopefully, such exploration will be rich enough to generate light on the choice of the particular manifestations of the problems outlined here.

It is of course possible that firms optimise, make decisions centrally taking into account interdependencies and so on, but do

not use the portfolio model we shall outline in a moment. While it is possible, it is highly unlikely. Quite simply, there is no alternative model which describes the choice of risky, inter-dependent assets. What is more likely is that particular specifications of the portfolio model may incorrectly describe the behaviour in question. Rather than forming a null hypothesis, this suggestion should guide further research; in other words, our use of the portfolio model should be concerned with the extensions which might be needed to make the model perform adequately as much as with the question of whether 'the model' finds significant support in the data. One suspects that the principal extensions needed will concern the treatment of risk and foreign risk in particular.

Chapter II

A Portfolio Model of Direct Investment

(i) Introduction

After isolating and identifying expansionary investment as the subject of our interest in Chapter I, we went on to develop two themes which we argued should be at the forefront of model building. These were the explicit view of the multinational firm as a diversified firm, implying centralized strategic decision making and cognizance of the interdependence between activities; and, secondly, the question of risk. On the latter score, we developed our discussion by conceptualizing the variance of returns expected from a given expansion relative to the expected return as a measure of expected risk, and most of our efforts were made to develop the precise implications of such a measure in the context of foreign activity.

This discussion leads us to the 'portfolio' model and our concern in this chapter is to expound the model formally, and prepare it for empirical work. It will prove convenient to proceed in four steps. In section (ii) below, we shall set out the basic model and discuss one or two simplifications we have had to impose on it. The discussion there springs immediately from the prior work done in section (iii) of the previous chapter. Unfortunately, the model involves 'N' simultaneous equations, a number of tedious non-linearities and an unknown parameter on which information must be generated before estimation can proceed. While our methods are the conceptually familiar ones of OLS, the procedure used initially and generalised in later chapters is not well known and requires some elaboration. This will be the subject of section (iii).

The discussion of section (ii) in the previous chapter served to distinguish and identify expansionary investment from new investment and characteristics analysis. New and expansionary investment are investment

in real assets (characteristics analysis, we emphasized, contains no prediction about investment at all) and while economists have been long familiar with the differences between real investment and equity investment (i.e. investment in shares and bonds), the need for re-emphasizing this distinction arises here. The reason for this is that the model we shall employ to predict real investment turns out to be deceptively similar to that frequently used in discussions of international equity investment. Consequently, a digression in section (iv) is necessary to remind us precisely what we are about. This will be rather useful, for it will enable us to avoid certain specification errors which have plagued previous work in this area.*

One final topic must be discussed before we can proceed in Chapter III and commence empirical investigation, and it harkens back to our discussion of risk in the previous chapter. Our model works with ex ante variables such as expected return and the variance anticipated and attached to this expected return. Such data are not available to us and we must explicitly approximate them from past data, a task made easier because of our concern with expansionary investment. However, a number of tricky problems and interesting issues arise in such an approximation procedure and they relate immediately to the problems of risk in foreign environments. In section (iv), we shall discuss this matter explicitly. Both sections (iii) and (iv) represent something of a digression on the main argument; however, they are necessary preliminaries to meaningful work and, indeed, will prove rather helpful in illustrating both the strengths and weaknesses of the portfolio model and in suggesting its proper specification.

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* There have been one or two previous studies employing the portfolio model to predict real investment; these are surveyed in Appendix III.

(ii) The Model

We shall assume that the firm maximizes expected returns subject to 'an allowance' for risk. The investment decision takes the form of allocating a fixed global total of funds amongst the interdependent activities of the firm in 'N' countries. The whole problem is set in the context of uncertainty about the precise return to be gained from a given expansion.

Let us commence with the objective function. We take management to be concerned with the rate of return (which, as global total investment is fixed, is equivalent to profit maximization) which is a natural starting point for most problems.* This should not be taken as precluding the study of alternative motivations; the Solow (1971) argument that alternative motivations lead to only quantitative and not qualitative differences in performance, however, reinforce one's inclination to start with profits.

Perhaps somewhat more controversial and certainly more important is the assumption that firms maximize expected returns subject to 'an allowance' for risk. As we shall formulate this, it implicitly involves solving an expected utility problem and then imposing a quadratic functional form on the utility function. There are good theoretical reasons for being cautious about such a procedure (Feldstein, 1969; Rothschild and Stiglitz, 1970), the problem being that the quadratic utility function is

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* Quite frequently appeal is made to the Williamson (1970) proposition that, in an M-form firm, control procedures based on profitability of divisions will ensure the absence of sub-goal pursuit. This, however, does not imply profit maximization, for top managers might pursue alternatives unimpaired by these devices. Furthermore, the argument is a little simple. The great problem with such profit centres is that the allocation of overheads and the setting of intra-firm transfer prices makes them rather arbitrary accounting yardsticks. The furthest one can comfortably go is to argue that they make divisional managers cost conscious and hence lead to cost minimization which is compatible with most other objectives (J. Williamson, 1966).

not monotonically increasing throughout. Nevertheless, this form has particularly helpful properties which aid the estimation procedure immensely; the only other alternative is to impose another functional form (say logs) and this seems equally arbitrary. The position taken here has been to simplify empirical work at some sacrifice of theoretical considerations.

Thus, the firm maximizes expected returns (rate of return to expansion of plant and equipment), subject to some appropriate discounting for risk. This mean-variance criterion can be written as:

$$(1) \qquad Z = p^{o} - hp^{*}$$

where p^{o} is expected overall firm rate of return and p^{*} is total firm-wide variance of such returns. The particular uncertainty of not being able to predict accurately and confidently leads to a discounting of a factor proportionate to risk from expected returns; h, the marginal rate of substitution between expected return and risk, is the factor of proportionality and is taken to be constant and positive.

The discounting factor, h, is worth dwelling upon for it will assume some importance in later discussions. In slightly more general models, h comes to equal one-half the coefficient of absolute risk aversion of decision makers within the firm. To see this*, consider the following argument:

We seek a risk premium, r, such that $(p^{o}-r)$ is equivalent to the random return, p, in some sense. Thus, let r be a number such that:

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* This derivation is quite common in the literature; see Malinvaud (1972, pp. 290-92), for example.

(2) $$U(p^o - r) = E\{U(p)\}$$

and write p as: $p = p^o + e$, where e is a random number such that $E(e) = 0$ and $E(e^2) = p^*$. Expanding both sides of (2) about $e = 0$ and $r = 0$ in a Maclaurian series, we have, for small e, the following local approximation:

(3) $$r = \tfrac{1}{2}U''p^*/U'$$

which is positive for risk averters (Arrow, 1971, Chapter III). Clearly, our $h = r/p^*$.* The important point to be gathered from this discussion is that h, which bears a close relation to absolute risk aversion, can be expected to depend, inter alia, on total investor wealth. Because we have taken global investment to be given, h can then be taken to be constant. We shall come back to this point in a moment.

To be helpful, the model must relate the individual markets where investment occurs to these overall firm aggregates. We have assumed a fixed total of investment funds which we shall denote as F^o, and, with this simplification, it is particularly easy to work with the shares, λ_i, allocated to each of the 'N' markets (where each market is indexed by subscript i). It is then straightforward to rewrite (1) as:

(4) $$Z = \sum \lambda_i p^o{}_i - h\left\{\sum \lambda_i^2 p^*{}_{ii} + \sum_{j,i} \lambda_i \lambda_j p^*{}_{ij}\right\}$$

and the problem the firm faces is to maximize (4) by choice of the N

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* If the utility function was defined on total profits, then h would turn out to be one-half the coefficient of relative risk aversion.

investment shares, subject to the constraint that the shares sum to unity*:

$$(5) \qquad \sum_i \lambda_i = 1$$

This then is the basic model. Its solution is straightforward and before we come to the detailed formal analysis it is worth discussing two simplifying assumptions which have been imposed. These are the assumption (already noted) of taking F^o as constant and the assumption we shall shortly adopt of stochastic constant returns.

The constraint on the allocation of funds for investment around the world is that the shares, λ_i, sum to unity; denoting the total funds allocated to market i as F^i, the constraint is readily rewritten as:

$$(6) \qquad \sum_i F^i = F^o$$

Conceptually, extension of the model so that it determines both the allocation of shares to each market and total global investment jointly is quite straightforward. Two sets of considerations determine the choice of global funds. On the one side, a cost of funds schedule is needed to be set against Z. On the other, the effect of F^o on Z and

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* It would also be natural to constrain the shares to be positive. As it turns out, most of the data we shall use in the forthcoming empirical investigations is not plant and equipment expenditures but flows of funds and these latter can be negative, reflecting an outflow from the host rather than an inflow. The sceptical reader is advised to await the next chapter.

hence on optimum shares needs to be specified. This latter is slightly complicated, for in this particular model there is no separation (Cass & Stiglitz, 1970)*, so that optimum shares will, in general, vary with F^o. The mechanism determining this relation is the effect F^o has on h, the marginal rate of substitution between overall expected return and overall risk. Should this decline with increases in F^o so that increases in total investment modify the compensation (in terms of expected returns) demanded for shouldering extra risk, then shares will increase in those countries which contribute relatively more to overall risk, and vice versa should h increase with F^o. With Z then a function of F^o, calculations can proceed by comparing Z with the cost of funds schedule and predictions of the N shares and F^o can be jointly obtained.

Our real interest is with the allocation of funds and taking F^o to be constant (which amounts empirically to taking F^o to be the actually observed global total investment) is a considerable simplification. This is more so with multinational firms whose sources of supply of funds extends around the world. The U.S. Voluntary Restraint Program (Brimmer, 1966) demonstrated the flexibility of such firms in seeking the funds they need for their expansion and the ease with which they can do so without seriously affecting real investment plans (Stevens, 1972; Willey, 1970; Shapiro and Deastlov, 1970). It is a complicated problem to which justice cannot be done here.

The assumption of F^o constant is not particularly serious. For each level of F^o which the firm could conceivably generate, it would solve an allocation problem such as we have suggested here. Using a cost of funds schedule, it would then select that F^o together with the appropriate shares which would be its' optimum. Constancy of F^o merely implies that

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* Essentially because there is no riskless asset. The concept of a worldwide riskless asset is rather nebulous in any case; see Rugman (1976).

we are considering that problem to have been solved and the correct F^o to have been chosen. We then describe the shares which helped to determine that F^o. A far more damaging assumption would have been to determine the global F^o without consideration of shares, implicitly holding them constant.

A second point about the model worth remarking upon is precisely how interdependencies enter and the related question of dealing with stochastic returns to scale. The later question involves the derivative of the random return (in particular its first two moments) with respect to the investment shares sent to that market; interdependencies involve the cross derivative between the returns in market i and the shares allocated to any j. Should two plants be complementary in, say, serving a particular market, then this cross derivative will be positive; should the plants be substitute sources of supply, then the derivative will be negative. The issue is complicated by the fact that returns are random and that progress can only come after the full specification of the joint density function over all returns as functions of all shares is determined.

For familiar reasons, we can only take derivatives of expected returns (and variances), not of the random return itself (Feller, 1950). Intuitive reasonings suggest that expected returns will fall when investment rises, but for risk no obvious a priori guides emerge. Thus, there is a sense in which stochastic constant returns is the natural course to take short of fully specifying returns schedules in each market. However, in empirical investigation, the data do not contain enough richness for investigation of diminishing returns, much less interdependencies as reflected in cross derivatives. The problem is the familiar one that one observation of a point on a return schedule (or any other schedule for that matter) does not provide sufficient information to deduce its slope.

It is germane at this point to ask just how far it is reasonable to pursue marginal analysis in problems such as this. To fully investigate interdependencies and stochastic returns to scale, the full joint distribution of the returns, p_i, in all markets i are needed. This is quite a staggering informational problem and it is not unreasonable to suggest that economic decision makers will economize by adopting simplifications. The natural one to make in such circumstances is stochastic constant returns, coupled perhaps with some ad hoc adjustment for decreasing expected returns from increases in the scale of plant. A similar adjustment procedure may extend to interdependencies. However, in this case, it is possible that co-variances will pick up many more important economic forces at work (see Chapter I). By so doing, decision makers are not necessarily being irrational or anti-marginalist.

(iii) Empirical Application of the Model

It is now high time that we set down the details of the model, and prepare for empirical testing. Recall that the problem is to choose the N shares, λ_i, to maximize:

$$(7) \qquad Z = \sum_i \lambda_i p^o_i - h \left\{ \sum_i \lambda_i^2 p^*_{ii} + \sum_i \sum_{j \neq 1} \lambda_i \lambda_j p^*_{ij} \right\}$$

where λ_i is the share of total investment F^o allocated to market i; p^o_i is the expected return per unit of funds invested in market i; $p^*_{ij} = p^*_{ji}$ is the variance/co-variance of returns between markets i and j; and h is a constant greater than zero. Z is maximized subject to the constraint that:

$$(8) \qquad \sum_i \lambda_i = 1$$

To solve this problem, form the Lagrangian:

$$(9) \qquad \ell = Z + \psi\left[1 - \sum_i \lambda_i\right]$$

where ψ, the Lagrangian multiplier, bears the interpretation of the shadow cost of funds and the dimension of an interest rate. To ensure that the first order conditions are sufficient for a maximum, we require that the bordered Hessian:

$$(10) \qquad |\bar{H}| = \begin{vmatrix} 0 & -1 & \cdots & -1 \\ -1 & p^*_{11} & \cdots & p^*_{N1} \\ \vdots & \vdots & & \vdots \\ -1 & p^*_{1N} & \cdots & p^*_{NN} \end{vmatrix}$$

must be such that the last (N-1) principal minors are all negative; i.e. that the Hessian of Z is negative definite subject to (8). No particularly interesting insights emerge from this condition.

The first order conditions solve for the λ_i and ψ and are the (N+1) equations:

$$(11) \qquad \frac{\partial Z}{\partial \lambda_i} = \psi \quad i=1, \ldots, N$$

$$\sum_i \lambda_i = 1$$

One equation from (11) may be eliminated by eliminating ψ, and we can consequently write N equations in the N shares; we can solve explicitly for these N variables if (11) is sign definite (as opposed to semi-definite) for this guarantees that the Jacobian of the system (12) below is

non-zero in the region of the maximum. Thus:

$$(12) \qquad \frac{\partial Z}{\partial \lambda_i} = \frac{\partial Z}{\partial \lambda_N} \qquad i=1, \ldots, N-1$$

$$\sum_i \lambda_i = 1$$

where the elimination has been done by using $\partial Z/\partial \lambda_N$ for notational convenience. Writing out fully:

$$(13) \qquad 2\lambda_N p^*_{NN} - 2\lambda_i p^*_{ii} + 2 \sum_{j \neq N} \lambda_j p^*_{Nj} - 2 \sum_{j \neq i} \lambda_j p^*_{ij} = \frac{p^o_N - p^o_1}{h} \qquad i=1, \ldots, N-1$$

$$\sum_i \lambda_i = 1$$

It will also prove convenient to express the system in matrix notation:

$$(14) \qquad \Lambda = \Omega^{-1} \Phi$$

where

$$\Lambda = \begin{bmatrix} \lambda_1 \\ \vdots \\ \lambda_N \end{bmatrix} \qquad \Phi = \begin{bmatrix} \frac{p^o_N - p^o_1}{h} \\ \vdots \\ 1 \end{bmatrix}$$

$$(15) \qquad \Omega = \begin{bmatrix} p^*_{N1} - p^*_{11} & \cdots & p^*_{NN} - p^*_{1N} \\ \vdots & & \\ p^*_{N1} - p^*_{1,N-1} & \cdots & p^*_{NN} - p^*_{N,N-1} \\ 1 & \cdots & 1 \end{bmatrix}$$

Equations (12), (13) and (14) all equivalently show the equilibrium λ_i expressed as functions of the unknown h and the known variables, ρ_i^o, and ρ_{ij}^*. Actually observed shares will henceforth be denoted as λ_i; estimated shares defined by these equations will be denoted $\hat{\lambda}_i$. Clearly, to test the model, two steps must be followed. First, to construct $\hat{\lambda}_i$ we need to know h; and, second, the estimates $\hat{\lambda}_i$ must be compared with the actually observed shares λ_i to check that the model predicts correctly.* The first step involves $\hat{\lambda}_i$ and requires that we generate a value for h. We assume that the firm is allocating optimally according to (7) and (8), so that observed shares are derived from (14). Then, using these observed shares, we extrapolate what h must have been if these λ_i were so generated. That is, we seek the h which maximizes the likelihood of finding $\hat{\lambda}_i$ from the population for which λ_i is the mean - the maximum likelihood estimate of h.

Denote the ijth element of Ω^{-1} as e_{ij}, and expand the ith row of (14) as:

$$(16) \qquad \hat{\lambda}_i = \epsilon_{i1} \frac{[\rho_N^o - \rho_1^o]}{2h} + \ldots + \epsilon_{iN} \quad i=1, \ldots, N$$

which simplifies to:

$$(17) \qquad \hat{\lambda}_i = \frac{\Gamma_i}{2h} + \epsilon_{iN} \quad i=1, \ldots, N$$

where:

$$(18) \qquad \Gamma_i = \sum_j^{N-1} \epsilon_{ij} [\rho_N^o - \rho_j^o] .$$

Fortunately, the $\hat{\lambda}_i$ are linear in h^{-1}. Writing:

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* After the vast bulk of the empirical work was complete an alternate, equivalent estimating technique was suggested to me by Dennis Leech. The details are sketched in Appendix IV.

(19) $\lambda_i = \hat{\lambda}_i + \mu_i \quad i=1, \ldots, N-1$

and assuming that

(20) $\mu \sim N(0, \sigma_\mu^2)$,

then the likelihood function, f(h), is:

(21) $$f(h) = \frac{1}{(2\pi\sigma^2)^{N/2}} \cdot \exp\left\{ \sum_i (\hat{\lambda}_i - \lambda_i)^2 \left| \frac{1}{2\sigma_\mu^2} \right| \right\}$$

which we seek to maximize by choosing h. Assumptions (19) and (20) are natural to make in the circumstances, but hide some difficulties. The error term in (19) should be seen as arising from minor errors of allocation by the firm and minor constraints in the allocation which we have ignored. As $\sum_i \lambda_i = 1$, (19) applies only to (N-1) of the shares and the last is determined as a residual. If (19) applied to all N shares, then the error terms u_i would not be independent and the use of the likelihood criterion would involve a mis-specification.*

Taking the log of (21), converting to a minimum problem by multiplying through by (-1) and ridding ourselves of inessential terms, we seek to minimize L(h):

(22) $$L(h) = \sum_i (\hat{\lambda}_i - \lambda_i)^2$$

At the minimum, h must satisfy:

(23) $$\frac{\partial L}{\partial h} = 0 = \sum_i \left\{ \frac{2\lambda_i \Gamma_i}{h^2} - \frac{2h\Gamma_i^2}{h^4} - \frac{2\epsilon_{iN}\Gamma_i}{h^2} \right\} = 0$$

and so:

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* I am obliged to Dennis Leech for this observation.

$$(24) \qquad \frac{1}{h} = \sum_i \frac{(\lambda_i - \epsilon_{iN})r_i}{\sum_i r_i^2}$$

which is the maximum likelihood estimate of h and, as such, is both a sufficient and an aysmototically minimum variance estimate (Freund, 1972, pp. 267-70).

Having generated the best possible h, we must check that the model predicts correctly or, in this case, that the model is internally consistent in the sense that the estimates of h using actual shares result in estimated shares sufficiently close to these actual shares. If these λ_i are, as hypothesized, generated from (7) - (8), then by estimating h and calculating the $\hat{\lambda}_i$'s from (23), we should generate a set of $\hat{\lambda}_i$'s which are close (in some sense) to the λ_i. If they are close, we can then say that the data support the model and accept the hypothesis of Chapter I.

Our final problem, then, is to develop a criteria for closeness. Suppose we estimate:

$$(25) \qquad \lambda_i = \alpha + \beta\hat{\lambda}_i \qquad i=1,\ldots,N-1$$

for (N-1) of the N linearly dependent shares*; clearly we would want $\alpha = 0$ and $\beta = 1$ to find support for the model.

However, since the OLS line goes through the point $(\bar{\lambda}_i, \bar{\hat{\lambda}}_i)$**, estimates of α and β will not be independent. Consider Figure I.

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* Linear dependence follows from the constraint $\sum_i \lambda_i = 1$.

** That is, mean actual and estimated shares.

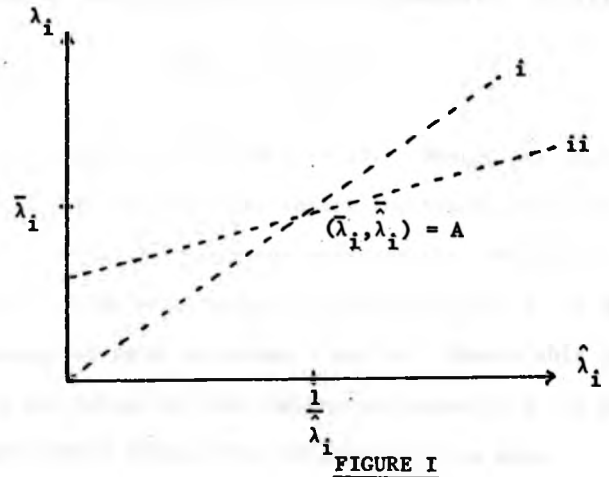

FIGURE I

Given that the OLS line goes through point A, inspection of lines i and ii shows clearly that the higher the estimated α the lower will be the estimated β. Consequently, simply testing that α is insignificantly different from zero and β from unity is incorrect, for it fails to note that the co-variance of α and β is negative. Consequently, the confidence limits are inappropriately large and we must construct a joint test.

Following Theil (1971, pp.138-9), we shall compare the sum of square of the residuals implied by the hypothesis $\alpha = 0$ and $\beta = 1$:*

$$(26) \qquad SS_o = \sum_{i=1}^{N-1} (\lambda_i - \hat{\lambda}_i)^2$$

with the OLS sum of squares:

$$(27) \qquad SS_1 = \sum_{i=1}^{N-1} (\lambda_i - \hat{\alpha} - \hat{\beta}\hat{\lambda}_i)^2$$

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* The omitted observation is the N^{th} for notational convenience.

where $\hat{\alpha}$ and $\hat{\beta}$ are the OLS estimates of the two parameters. It can be shown that SS_o and SS_1 are independent χ^2 variates so that:

$$(28) \qquad \theta = \frac{[SS_o - SS_1](N-3)}{2(SS_1)}$$

is distributed as $F(2,(N-1) - 2)$. Should the computed F exceed the critical F, then we must reject the hypothesis that $\alpha = 0$ and $\beta = 1$. Intuitively, the numerator measures the improvement to explanation gained by relinquishing the assumption that $\alpha = 0$ and $\beta = 1$, and letting the data determine $\hat{\alpha}$ and $\hat{\beta}$. Should this improvement, expressed as a percentage of the explanatory power of $\alpha = 0$ and $\beta = 1$ be sufficiently large, then relinquish it we must.

(iv) Direct and Equity Investment

Portfolio models have usually been applied to equity investment, whether it be to describe and predict investment choices in a domestic stock market or international 'portfolio' investment. Rather than testing the model directly, early researchers contented themselves with measuring the possible gains to diversification, and these were usually found to be considerable (Grubel, 1968; Levy & Sarnat, 1970 & 1975). Rather more positive testing has accompanied the development of the model into a full fledged general equilibrium description of the capital asset market - the so-called Capital Asset Pricing Model (Cf. Jenkins, 1973). This capital market model has been applied internationally with somewhat less success (Rugman, 1976; Solnik, 1973 & 1974; Lessard, 1974 & 1976). Lacking data on individual investors and their activities in capital markets, researchers have been forced into testing a theory centering not so much on the behaviour of the individual investor, but on the behaviour of large numbers of such investors in the capital asset market.

The first apparent difference between this work on international (and domestic) capital markets and our model here is that we concentrate on the individual investor (or a number of them together) and shall empirically test a hypothesis about individual behaviour, not market behaviour. The second important difference between these equity investment models and a direct investment model is that the latter seeks to predict investment in real assets or machines. Despite many formal similarities in the two types of model, these two considerations serve to mark the differences between the two models in a strong and unambiguous manner.

The identity of the investors being described in direct and equity investment models is quite different; equity investment is performed by individuals and various financial institutions whereas direct investment is done by non-financial multinational corporations (Leanor & Stern, 1972; Ragazzi, 1973)*. In the terminology of Leanor and Stern (but contrary to their assertions), direct investment models are "activity" models in which the activity can be attributed to a relatively small class of "transactors" who are distinct from the transactors relevant to equity investment models. This very close link between transactors and activities removes many of the criticisms lodged by Learmer and Stern against activity models relating to direct investment and allows further development of direct investment portfolio models not possible in the case of equity investment.

The first and most obvious extension involves exploring the implications of alternative maximands which managers may adopt, and testing them. This is a topic we have touched upon before, and we need not labour it here. The important point to note is that there is no reason to limit analysis to maximization of returns although this

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* Characteristics analysis can, of course, make this distinction far more fine by considering the motivations and abilities of the two types of investors.

is the only tenable assumption which can be made in an equity investment model.

The identity of the investor being unambiguously resolved in direct investment models serves to emphasize the particular nature of the activity being pursued; i.e. investment in real assets. This may be contrasted with equity investment in which funds are allocated to the purchase of shares and bonds. Evidently, rather different sets of variables will guide the two different allocation decisions. Investment in fixed assets flows to where the rate of return on manufacturing activities is highest; equity investment is guided by the rate of return on equities and bonds - that is, fixed interest payments, dividends and capital gains. The most obvious example of how these two sets of variables lead to different flows is the case of the U.S. which receives large inflows of equity capital (principally from Europe) and exports massive outflows of direct investment (a large share of which goes to Europe).

This raises the question of whether there is any need for corporations to diversify; whether all the gains from diversification come to individual investors diversifying their holdings of stocks and bonds, obviating the need for firms to do so. Some recent evidence suggests that there are gains to "real" diversification by corporations, especially international diversification (Rugman, 1977) and this is not surprising. Capital markets are hardly perfect (especially internationally) and the information problems of an individual investor (even a large financial institution) scanning around the world are awesome. In contrast to this, the large multinational firm typically engages in an industry-specific scan (Caves, 1971; Stopford & Wells, 1974) in industries characterized by production and distribution conditions not completely unrelated to the firms current (domestic) activities. This

superior edge in information provides a gain for investors, saving them the need to diversify on the basis of less complete stocks of knowledge. Furthermore, whatever gains there may be to controlling and co-ordinating plants (see Chapter I) can accrue to individual investors (however indirectly) only when firm diversification occurs. This is, of course, the basis of the famous proposition by Kindleberger (1969, pp.13) that: "... in a world of perfect competition for goods and factors, direct investment cannot exist".

Finally, the fact that direct investment is diversification by large firms investing in manufacturing (or distribution) activities suggests a rather different dependent variable to be used in the model. Direct investment is investment in plant and equipment and is irreversible. An equity investor faces a well-functioning market in which he can buy and share assets relatively easily and his wealth is sufficiently liquid to be reallocated completely each period. A firm whose wealth is in the form of machines cannot easily dispose of its holdings for second hand markets in used machines are weak, if not non-existent.

This observation carries two implications for the difference between equity investment models and direct investment models. On the one hand, the time horizon for the two models differs. A one period model may not be a bad approximation for equity investment, but it is definitely much more serious for direct investment. Although a model can be constructed to allow a firm to reallocate some of its assets (Pfouts, 1961; Dhrymes, 1964), the longer life of machines really does require some intertemporal consideration. On the other hand, the fixity of assets implies that the wealth variable (that which is being allocated)

differs as between the two models. For equity investment where it is conceivable that the investor can switch all assets from period to period, total wealth is clearly appropriate. For direct investment, where such capital assets are immobile, the funds that can be allocated in each period are marginal increments to wealth; i.e. investment funds. The firm invests these funds in fixed assets, given the location of past investments, where they prove most profitable.

In short, there are important differences between portfolio models describing equity and direct investment. The identity of the investor and the particular activity he engages in dictate differences in the objective function used, the independent variables which guide his decisions, and the wealth (or part of it) which he can allocate. The formal similiarities of the two models hide important and real differences of both theoretical and empirical importance.

While we are on the subject of risk reduction through diversification and the use of equity investment models to describe firm behaviour, it is worth digressing somewhat to comment on the premise of diversification of risk through merger (Geroski, 1978). It has often been observed that control of several activities each yielding streams of risk returns less than perfectly positively correlated leads to a reduction in variance as compared with an "equivalently sized" control over one activity alone. Some writers have seen this risk reduction as an important if not a primary cause for diversification by merger. Fisher (1963), for example, constructed a model to investigate the impact of uncertainty in competitive situations where the firm faces a financial constraint. Using a mean-variance model, he showed varying circumstances under which diversification would occur, concluding (pp.309) that the: "... choice between diversification and specialization depends on the utility function", or, more precisely, the degree of risk aversion.

A moments thought should suggest, however, that this cannot be completely correct. Diversification involves buying or building new plant and equipment, or controlling new outlets for distribution; the important aspect of this is control. Control, however, is neither necessary nor sufficient for diversification away of risk; in fact, it leads to inefficient diversification, for large chunks of funds are tied up in relatively few holdings. Portfolio investment, ownership of firms through share (but not 100%) purchase on the stock market, dominates firm diversification through merger as a method of reducing risk. The key to merger lies in the advantages of control and while risk reduction is obviously important (see also the discussion in Penrose, 1959, pp. 131-9), it is not crucial. It is undoubtedly true that diversification reduces the variability of firm profits (although its empirical importance has yet to be established; Cf. Meuller, 1977 and Cable, 1977) and certainly an element of risk aversion enters the decision to diversify. In our view, this factor makes its presence felt at an earlier stage in the decision, at a time when the firm adopts a strategy leading to diversification and before it considers the particular possibilities open to it. Risk makes a firm look for opportunities to diversify; the particular new investments it undertakes are determined by the more familiar complementaries between operating them and the possibilities of enhancing monopoly power through control.

What can be said though (and is in fact hypothesized here) is that expansion of facilities already in operation may be dictated by risk aversion. That is, the allocation of expansionary investment funds is made to reduce the risks of operation, to balance the advantages of profitable opportunity with risk. When once a firm is set up producing and selling in a number of markets risk aversion should determine expansion of these markets; the particular markets which a firm happens to operate

in are affected, however, by risk aversion only inasfar as it has predisposed the firm to diversify. The advantages of control dictate the particular choices.

(v) Ex Ante Variable Approximation

One final set of remarks is worth making before we proceed to the empirical testing of the model we have just outlined. The independent variables which determine investment shares are expected returns and the expected variance of possible outcomes around these expected returns. The expected returns and variances relevant to the problem are those the firm's decision makers have in mind when they make the investment decision and are, unfortunately, unobservable. To the researcher, the only option open is to try to generate these figures from past data, from the past performance of the firm. It may well be that this is how decision makers within the firm generate the variables they use but there is, of course, no guarantee of this. This extrapolation procedure forced upon us is subject to several problems and, in this section, we should like to outline these particular problems and limitations.

Ex ante variable approximation is, in my opinion, the most serious problem that one faces in applying the models;* it shall form the basis of the extensions we shall make in Chapters III and IV. The usual measure of expected returns is the simple arithmetic mean over a number of past observations of the variable in question, but we shall argue in the next

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* More serious than, for example, the assumption of stochastic returns because as argued, the firm probably makes that assumption itself. Ex ante variables are where the information gap between researchers and firms is largest.

Chapter that this is by no means a theoretically acceptable procedure. There are, however, some reasonable ad hoc manipulations which alleviate the problems to some extent. Variances and covariances turn out to be more crucial and these are rather intractable. Again, the obvious first start is to compute the usual variance-covariance matrix using a series of past observations of the data in question, but this also involves a number of theoretical problems. Ad hoc adjustment cannot take us too far in this case and additional information on risk may be required.

The directions this will take us are, as far as I can tell, largely unexplored.* Recall our discussion in section (iv) of the last Chapter. There we argued that the variance the firm expects depends, ceteris paribus, on the amount of adjustment it is able to make in the face of a given disturbance in a particular market. This is the crucial element involved in the risk of foreign operations; it is not deviations from expected returns so much as it was the ability of the firm to correct such movements. This factor is liable to enter into the calculation of risk explicitly per se - it hangs over the entire decision and while it enters the calculation of variances, its importance is sufficiently large to justify separate inclusion. In Chapter IV we shall come to discuss this problem somewhat more fully and will empirically test this particular hypothesis.

There is an additional problem with extrapolating ex ante variables from ex post data. Let us presume that such an extrapolation is precisely how the firm approaches the problem so that our procedure is

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* Stevens (1969) and Prachowny (1972) have done some work in this area; see Appendix III.

completely correct in this regard. Let us also assume that the rates of return which it uses are those earned on its past operations in the country in question (we shall come back to this in a moment). The problem is that the reported rates of return (which we have access to) may differ from the actual rates of return (which decision makers use). This problem is particularly relevant to multinational firms who can (and do - see Vaitsos, 1974) minimize tax loss by transferring profits between various countries by transfer prices (Lall, 1973 and others). Such behaviour does not affect the principles of the model - the ex ante rates of return still form the basis of decisions by managers and they are unaffected by a transfer of profits through accounting devices. The problem is that ex post data will be distorted away from ex ante values by the transfer prices. Thus, use of reported data may be subject to serious distortion, the rates of return reported for various countries being unwarrantedly high or low.

Nevertheless there are reasons to believe that such distortions may cancel out in our study. This is because our study will be an aggregate study, covering the investment of all firms in all industries in the U.K. (and the U.S.) which invest abroad (see next Chapter for a fuller discussion) and transfer prices are subject to important firm and industry specific factors. The desirability of a particular transfer price depends not only on taxes, but tariffs, fears of repatriation, the desire to hide profits from competitors, labour, partners and so on. With the exception of profits taxes (to the extent that these are not manipulated for particular firms as incentives), these factors are all industry and firm specific. Thus, there is no reason to expect transference of profits by firms between two or more countries to take the same pattern between industries and quite possibly within industries. Thus, some cancelling out may occur when

we take all firms as a whole and that distortions may be reasonably small and involve only minor distortion.

There is one final problem. Let us suppose that firms do construct expected returns and variance-covariance matrices as we have initially suggested and that we can get any profits data we choose without serious distortion. The question now is which rate of return series should we use to construct our ex ante proxies; that is, will it be the past history of the firm (as we have suggested a number of times thus far) or the past history of native firms in the host country on the principle that these are what signal and attract the firm to diversify into the country. The proper answer is, I think, that we want to use the past history of the firm and the reason for this recalls our discussion of new and expansionary investment in Chapter I.

For expansionary investment, the firm is expanding from a base and from a (admittedly limited) knowledge about the market. Given its existing operations and their profitability, working out what will happen with an incremental expansion is relatively easy and relies on the knowledge and experience embedded in past operations. What is happening to local competitors may signal to the firm that the market is profitable and that expansion is called for, but the profitability it expects from such expansion depends crucially on current and recent past operations. For new investment, the firm has no base of knowledge or operation and it explicitly seeks a signal to induce it to enter a particular market. In this situation, native firms and would-be-competitors performance clearly is relevant and probably quite important.

Let us briefly pull together these three threads. Our model relies on ex ante variables unobtainable from published data sources. This raises three particular problems - how to approximate these

variables, which data to use, and the worth of that data. We have, on the basis of this discussion, come to a set of starting points. We intend to use past performance by firms to calculate, in straightforward ways, means and a variance-covariance matrix and we have judged that this may not be too distorted. We have also suggested that there may be objections to such a procedure (without specifying precisely the alternatives open to us); such objections will be the concern of the next two chapters. One final point requires mention.

Our concern here is with the allocation of investment and this is necessarily a cross-section problem. At a given time, we calculate means and a variance-covariance matrix (subject to the qualifications just suggested) and compute optimal shares across countries which we compare to the shares we have actually observed. A question which we shall not discuss but which is worth identifying is the appropriate method of updating such ex ante variables so that the model can be used year after year, accounting for variations, over time, of the shares allocated across countries.

In the calculation of means and the variance-covariance matrix, we shall use rates of return (as it happens) over the past seven years. Should we repeat the exercise in the following year, we would of course have one more observation to use in such calculations. However, as we accumulate information over time, year after year, the ex ante variables are going to become rather insensitive to the weight of additional variables. In other words, we must face the problem of updating means and the variance-covariance matrix (especially the latter). Keeping strictly within the framework of the model, this amounts to truncating the rate of return series so that the variance-covariance matrix is computed using a rate of return series over the past X years. The

choice of X obviously becomes an extremely important consideration. However, we have also suggested that we may need to add additional information on risk relating to the adjustment problems of the firm, and it may be that the particular costs of adjustment and deviations the firm expects can be precisely enough specified on a year to year basis to account (in part) for year to year variations in shares.

As we have said, this is not a problem which will concern us here. We shall concentrate on predicting shares for a particular year that will turn out to be work enough as it is. Nevertheless, when we come back to discuss risk empirically, we shall have more to say about updating our ex ante variables. It is a problem worth keeping track of, for it limits the extension of the model to time series problems.

Chapter III

An Empirical Investigation of the Portfolio Model of Foreign Investment

(i) Introduction

This chapter is the first of two in which we will concentrate on a detailed discussion of the empirical results gained from application of the portfolio model. Chapter IV following deals with the extensions of the model centering around the (by now familiar) problem of foreign (and domestic) risk; the results presented in this chapter are gathered from testing the model in a 'pure' or 'naive' form. As we shall see, both theoretical and empirical considerations suggest that such a 'pure' or 'naive' model is of limited interest; having established this proposition, we can move on to Chapter IV and consider appropriate extensions and necessary modifications of the model.

The argument of this chapter is structured in three steps. In Section (ii) immediately below, the samples are briefly described*. As we shall be constrained to aggregate investment flows (e.g. investment by all U.K. or U.S. firms in various host countries), this must be supplemented by a discussion of aggregation bias and the link between the theory as already set out and the aggregate estimating equations.

In Section (iii), the first tests are reported and commented upon. The particular problem considered there is the application of the portfolio model to foreign investment alone (i.e. excluding

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* In Appendix V the data sources and samples are scrutinized in some detail. Appendix VI is devoted to closer examination of the dependent variable - shares - while Appendix VII considers expected returns and the variance covariance matrices for the samples, both comparatively and historically.

domestic investment); this for reasons bound up in the problem of foreign risk which will be made plain as we continue. The particular hypothesis corresponding to this test is slightly different to that stated in Chapter II, but it is of interest on its own. The restricted sample will also enable us to clear up a number of issues concerning the data. One particular issue of some interest is the appropriate approximation of ex ante variables which proves convenient to discuss within the confines of this slightly restricted sample. This is the subject matter of Section (iv).

(ii) Sample Characteristics and Aggregation

There are three samples which we shall be using in the next two chapters, one U.K. sample and two U.S. samples. In all three cases, we shall be predicting the total share of the investment by all U.K. (U.S.) firms sent to a set of host countries. We shall be predicting shares for 1971 for the U.K. sample and for 1972 for the two U.S. samples.

The investment data for the U.K. sample (which involves nineteen foreign countries) is net capital outflow from the U.K. to a given host (hereafter NKO) which is not quite the same as plant and equipment expenditures*; the nineteen countries in the sample accounted for about 95% of total net capital outflows in 1971. NKO is defined as unremitted profits, intra-firm trade credit and share

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* Plant and equipment expenditures were unavailable for the U.K. sample.

and bond acquisitions by the parent from the subsidiary. The principal difference between this figure and plant and equipment expenditures (hereafter PE) is local borrowing. For the U.S., both PE and NKO figures were available and this forms the difference between the two U.S. samples. The hope is that by comparison or results, some inferences may be made about the relative merits of these two similar specifications of the dependent variable. Both U.S. samples cover twenty-six foreign countries. The U.S. and U.K. samples overlap more in the set of developed than developing countries much as one would expect, and both yield distinctly different sets of share allocations from noticeably different means and variance-covariance matrices.

The independent variables for the U.K. sample (as well as the other two) are means, variances and covariances and these have been generated from a series of seven observations of annual average post-tax rates of return earned by U.K. multinationals in the host. A similar series of post-tax annual average rates of return were constructed and manipulated for the U.S. samples and both U.S. samples are guided by the same rates of return series.

The model to be tested relates to the individual firm and at this point as are forced to make something of conceptual leap, for testing is constrained (by data unavailability*) to the highest level of aggregation. This is a familiar sort of problem and these

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* The constraint is the result of unavailability of rates of return data below this aggregate level. For the U.K. investment data can be gathered at Order Level; for the U.S. investment data can be gathered for Manufacturing, Mining and Petroleum.

difficulties plague demand estimation, estimation of aggregate production functions and so on. Unfortunately, it is rather difficult to detect and evaluate aggregation biases, and this applies particularly to our model.

The individual firms within these samples are guided by rather different rates of return (and hence means, variances and covariances) - rates of return which have important inter-industry and perhaps inter-firm differences. If one were to use average expected returns as the sole dependent variable, it might turn out to be a good predictor for the aggregate of investment by these multifarious firms in a given host; those firms whose rate of return is higher than average are implicitly underestimated but this would be compensated by those firms whose rate of return is below average and who are thus implicitly underestimated in the aggregate predition. Variances and covariances are more difficult however. How an aggregate variance, calculated from a series of annual <u>average</u> rates of returns over all firms relates to the individual firm variances (much less covariances) is not at all clear. It is therefore very hard to gauge how the aggregate performance relates to the individual choices made by firms. In particular, there is no guarantee that if all individual firms behave exactly as hypothesized then the aggregate will behave according to the same model- confirmation of the model on the aggregate level, by the same token, cannot rigorously be extended back to infer that behaviour on the individual level is as hypothesised.

We must thus explicitly argue on an <u>as if</u> basis; that is, we shall hypothesise that the aggregate behaves <u>as if</u> it were a single individual firm. One can possibly imagine this to arise because the

hypothesis 'is true' at the individual level, but one cannot rigorously (or at least I cannot) confirm (or deny) this. As a check, in Appendix VIII we shall use a fourth sample based upon data supplied confidentially by a particular U.K. firm, rerunning some of our equations to at least compensate for our ignorance of the aggregation bias.

(iii) The Allocation of Foreign Investment

For reasons which will become evident shortly, the first testing of the model to be done on U.S. and U.K. investment will consist of looking at the allocation of foreign investment alone, without domestic or home investment. This corresponds to a weaker version of our hypothesis and implies that a dual decision is made in the allocation of funds; first, home and total foreign investment shares are chosen, and, then, the foreign share is allocated according to our model. Such a distinction between home and foreign investment is not new to the literature (Barlow and Wender, 1955; Penrose, 1956). The Barlow and Wender "gambler's earnings" hypothesis has enjoyed some popularity but has failed to find empirical support (Stevens, 1974). Their hypothesis is that firms view foreign income as essentially transitory and plough it back, whether necessary or not, to the subsidiary. Penrose argues along similar lines, but stresses the independence of subsidiaries from parents: "... once established, a new subsidiary has a life of its own and its growth will continue in response to the development of its own internal resources..." (1956, pp. 251).

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Our argument in support of the dual decision hypothesis is that uncertainty produces an asymmetry between domestic and all foreign activities and this produces an attitude on the part of the firm which leads to a separation between home and foreign expansion. This is a rather extreme assumption and, as it turns out, will not find support in the data. At the beginning of Chapter IV a weaker version of this hypothesis is used rather more successfully.

Table I shows the results of applying the model to nineteen foreign countries alone for the U.K. sample. There are a couple of reasonable estimates*; however, the underestimates of Australia, the U.S. and Germany together with the overestimates of South Africa, Canada and the West Indies are rather serious. (Curiously, the estimates for South Africa and Germany are rather near their average shares for 1967-71). That is, the model views South Africa, Canada and the West Indies more favourably than U.K. investors and conversely with the U.S., Germany and Australia. With the exception of Canada, this can possibly be traced back to the inadequacy of measured risk discussed in Appendix VII. That is, one intuitively expects that as both South Africa and certain parts of the West Indies are undergoing fundamental political change, the measurement of risk that we have used is proving rather poor. The rank correlation between actual and estimated shares is R = .0298 which is low because of the large ranking changes induced by these wilder estimates.

Table II shows the results of the regressions:

$$\lambda_i = \alpha + \beta\hat{\lambda}_i$$

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* A negative NKO share implies a net outflow from the host.

for (N-1) countries. We have chosen to exclude countries (since one country must be excluded in any case) strategically in order to gain maximum information. The troublesome estimates are Australia, the U.S., Germany, South Africa, Canada and the West Indies. Somewhat arbitrarily, South and Central America was chosen from among the remaining countries as an index upon which to base comparisons and the results for the exclusion of South/Central America are shown in equation (i).

Table I

Actual and Estimated Shares of U.K. Foreign Investment in Nineteen Foreign Countries

Country	actual shares λ_i	estimated shares $\hat{\lambda}_i$
Australia	.1971 (2)	.1200 (4)
Irish Republic	.0349(11)	.0489 (7)
New Zealand	.0031(17)	.0125(12)
South Africa	.0367(10)	.2715 (1)
Africa	.0417 (8)	.0234 (9)
West Indies	-.0541(19)	.1576 (3)
Hong Kong	.0031(16)	-.0016(18)
India	.0151(14)	.0512 (6)
Malaysia	.0155(13)	.0015(17)
Canada	.0458 (7)	.1596 (2)
United States	.2152 (1)	.0367 (8)
Denmark	.0056(15)	.0147(10)
Switzerland	-.0191(18)	.0082(13)
Belgium	.0958 (4)	.0080(14)
France	.0553 (6)	.0129(11)
Italy	.0218(12)	.0044(15)
Netherlands	.0837 (5)	-.0018(19)
Germany	.1633 (3)	.0026(16)
South/Central America	.0398 (9)	.0690 (5)

Numbers in parentheses are rankings.

Table II

Regression results for the U.K. samples of Nineteen Foreign Countries

Regression	α	β	R^2	F(.)	Countries Excluded
(i)	.0554 (.0216)	-.0413 (.2401)	.0019	.0296 (1,16)	South/Central America
(ii)	.0540 (.0225)	-.0128 (.3443)	.0001	.0013 (1,16)	South Africa
(iii)	.0444 (.0182)	-.0159 (.2001)	.0004	.0063 (1,16)	United States
(iv)	.0317 (.0196)	.1166 (.3385)	.009	.1187 (1,13)	South Africa, Canada, United States, Germany

Numbers in parentheses below the estimated co-efficients are standard errors; those below the F-statistics give degrees of freedom.

The estimates of the constant is high and, tested on its own, is significantly different from zero. The slope co-efficient is correspondingly low (and remains so when the constant is excluded) and the overall explanatory power is weak. Progressive elimination of some of the troublesome countries yields the results shown in equations (ii) - (iv). No particularly interesting conclusions emerge; (iv) is the strongest estimated equation, but is not worth dwelling upon.

These descriptions lead strightforwardly to our formal significance tests. Recall that, θ, the proportionate reduction in explained sum of squares from using OLS estimates of α and β rather than assuming that $\alpha = 0$ and $\beta = 1$ is distributed as $F(2,(n-1)-2)$:

$$\theta = \frac{(N-3)(SS_o - SS_1)}{2SS_1}$$

where:

$$SS_1 = \sum_{i}^{N-1} (\lambda_i - \hat{\alpha} - \hat{\beta}_i)^2$$

$$SS_o = \Sigma (\lambda_i - \hat{\lambda})^2$$

Should θ exceed the critical F, then we must reject the hypothesis that $\alpha = 0$ and $\beta = 1$. The calculated and computed statistics are shown below.

Table III

Calculated and Critical F-Statistics for the U.K. Sample

Equation	θ	F	SS_1	SS_o
(i)	3.60	3.63	.1355	.1966
(ii)	9.436	3.63	.0902	.1966
(iii)	25.06	3.63	.0627	.1966
(iv)	17.48	3.81	.0442	.1631

Clearly, for all but equation (i), we must reject the hypothesis that $\alpha = 0$ and $\beta = 1$. Acceptance of (i) can only be the result of the very poor OLS estimates which could hardly be worse; progressive and selective elimination of troublesome countries has little effect on SS_o, absolutely and relatively to SS_1, indicating that the OLS estimates do improve markedly but in the end appear not to converge on the values of α and β hypothesised.

Let us turn to the sample containing foreign investment in twenty-six foreign countries by all U.S. multinational firms. Recall that in this case we have two specifications of the dependent variable.

Table IV

Actual and Estimated Shares of U.S. Foreign Investment in Twenty-six Foreign Countries as Measured by Net Capital Outflow and Plant and Equipment Shares

	NKO Shares		PE Shares	
Country	Actual	Estimated	Actual	Estimated
Canada	.1501 (3)	.2965 (1)	.2870 (1)	.3499 (1)
Mexico	.0145(13)	.0968 (4)	.0157(12)	.1073 (3)
Panama	.0000(21)	.1375 (2)	.0022(24)	.1082 (2)
Argentina	.0025(18)	-.0029(23)	.0120(13)	-.0032(23)
Brazil	.0954 (5)	.0718 (5)	.0477 (7)	.0590 (6)
Chile	-.0008(22)	.0006(22)	.0014(25)	.0016(20)
Columbia	-.0072(24)	.0026(19)	.0068(20)	.0035(17)
Peru	.0197(10)	.0028(16)	.0088(18)	.0020(19)
Venezuela	-.0027(23)	.1282 (3)	.0218(10)	.0906 (4)
Belgium	.0325 (9)	-.0052(24)	.0374 (8)	-.0069(25)
France	.1084 (4)	-.0056(25)	.0826 (4)	-.0058(24)
Germany	.2455 (1)	.0027(18)	.1236 (3)	.0003(21)
Italy	.0517 (7)	.0181(12)	.0568 (5)	.0258 (9)
Netherlands	.0331 (8)	.0245(10)	.0307 (9)	.0217(11)
Denmark	.0139(14)	.0038(20)	.0052(21)	.0060(16)
Norway	.0178(11)	-.0167(26)	.0095(16)	-.0070(26)
Spain	-.0092(25)	.0072(15)	.0172(11)	.0084(15)
Sweden	.0175(12)	.0649 (6)	.0091(17)	.0843 (5)
Switzerland	.0556 (6)	.0468 (7)	.0117(14)	.0329 (8)
United Kingdom	.2383 (2)	.0164(14)	.1246 (2)	.0162(13)
Liberia	.0042(17)	.0378 (8)	.0011(26)	.0439 (7)
Libya	.0092(16)	.0011(21)	.0079(19)	.00009(22)
South Africa	.0701(26)	.0289 (9)	.0113(15)	.0237(10)
India	.0017(20)	.0026(17)	.0036(23)	.0025(18)
Philippines	.0110(15)	.0204(11)	.0040(22)	.0204(12
Australia	.0019(19)	.0165(13)	.0603 (5)	.0139(14)

Numbers in parentheses are rankings

Table IV shows actual and estimated shares for the two specifications. The first two columns show actual and estimated shares for net capital outflows. Again, there are some good and some bad estimates. Of somewhat dubious accuracy are the estimates of Canada, Panama, France, Germany and the U.K. Canada is inexplicably overestimated -

as with the U.S. and the U.K. on the one hand and South Africa on the other, one would expect Canadian risk to be overestimated leading to an underestimated share. The rank correlation between estimated and actual shares is higher than in the U.K. sample: R = .4503. Notice that both the U.K. and the U.S. samples have trouble with the same set of countries: Germany, Canada, Australia, the U.S./U.K. and one or two of the developing countries. This would suggest that some systematic error of ex ante variable measurement has crept into the construction of means, variances and covariances for these countries.

Turning to the second two columns of Table IV, we find the comparison between actual and estimated shares for plant and equipment expenditures. In many ways, they are quite similar to the predictions (and errors thereof) found in the first two columns. In fact, in nineteen of the twenty-six countries, the model either underestimates both NKO and PE shares, or overestimates both. Canada and Mexico are overestimated in the PE shares sample while France and the U.K. are underestimated to name only the most obvious errors. The rank correlation between these last two columns of Table IV is R = .0646, remarkably lower than for the NKO shares.

Consider first the regression results for NKO shares, presented on Table V. Inspection of Table IV reveals that Canada, Germany, the U.K., Panama and France are the worst estimates. Selecting India from the remainder to use as an index as a country to be excluded in the first regression, the results are much as before. α is marginally insignificant from zero (when tested alone) and β is rather closer to zero than unity (suppression of α doubled estimates of β but,

Table V

Regression Results for NKO shares of U.S. Foreign Investment to Twenty-Six Foreign Countries

Regression	α	β	R^2	F(.)	Countries Excluded
(i)	.0338 (.0177)	.1529 (.3796)	.018	.4404 (1,23)	India
(ii)	.0421 (.0176)	-.2895 (.3573)	.027	.656 (1,23)	Canada
(iii)	.0099 (.0100)	.2841 (.1274	.184	4.97 (1,22)	Germany, United Kingdom
(iv)	.0184 (.0096)	-.0864 (.1881)	.009	.210 (1,21)	Canada, Germany, United Kingdom
(v)	.0110 (.0090	.0459 (.2023)	.002	.021 (1,20)	Canada, Panama, France, Germany, United Kingdom

Standard errors are in parentheses below estimated co-efficients; numbers below F-statistics give degrees of freedom.

nevertheless, β remained insignificantly different from zero). Experimentation with the exclusion of the various troublesome countries failed to improve the results much above the level of equation (i) although the F-statistic was significant at the 5% level in (iii). The formal significance tests in Table VI below reflect these insights. Table VII shows the regression results for PE shares. Consideration of Table IV suggests that Germany, the U.K., France, Mexico, Panama, Venezuela and Canada are troublesome, and from the remainder Peru was selected as an index of comparison. Progressive elimination of Mexico, Panama, Venezuela and Canada complete the list of equations shown. Until (v), the

Table VI

Calculated and Critical F-Statistics for the U.S. NKO Sample

Equation	θ	F	SS_1	SS_o
(i)	.2959	3.42	.1282	.2039
(ii)	6.8048	3.42	.1179	.2039
(iii)	52.39	3.44	.6353	.2038
(iv)	65.65	3.47	.0281	.2038
(v)	146.4	3.49	.0124	.1940

results are quite strong, with F-statistics significant at the 1% level. This is a rather new result compared with the last two sets of results, and while one would like to believe that the model has unambiguously proved itself, inspection of the last equation suggests a slightly different answer. The only difference between (IV) and (V)

Table VII

Regression Results for PE shares of U.S. Foreign Investment to Twenty-Six Foreign Countries

Regression	α	β	R^2	F(.)	Countries Excluded
(i)	.0175 (.0108)	.5612 (.1320)	.440	18.07 (1,23)	Peru
(ii)	.0059 (.0085)	.6182 (.1013)	.628	37.18 (1,22)	Germany, United Kingdom
(iii)	.0090 (.0073)	.6956 (.0955)	.746	59 (1,20)	Mexico, Panama, Germany, United Kingdom
(iv)	.0082 (.0601)	.7752 (.0601)	.907	165.8 (1,18)	Mexico, Panama, Venezuela, France, Germany, United Kingdom
(v)	.0161 (.0052)	.1838 (2134)	.041	.742 (1,18)	Mexico, Panama, Canada, France, Germany, United Kingdom

is the replacement of Venezuela by Canada on the list of exclusions, and this causes a noticeable deterioration of the results. The Canadian observation so dominates the rest that the ability to predict it even with such a large error provides an immense advantage.

Finally, on Table VIII the formal significance test results are presented.

Table VIII

Calculated and Critical F-Statistics for the U.S. PE Sample

Equation	θ	F	SS_1	SS_o
(i)	5.378	3.42	.0512	.0752
(ii)	19.51	3.44	.0270	.0750
(iii)	34.42	3.47	.0175	.0750
(iv)	84.67	3.55	.0070	.0729
(v)	173.2	3.55	.0036	.0729

Again, in every case, we must reject the hypothesis that $\alpha = 0$ and $\beta = 1$. What appears to have happened is that these results improve our predictive ability and that strategic elimination enhances this accuracy. The share estimates are, in some sense, as accurate as before, but their relation to actual shares are far more systematic. Hence, we find improved OLS estimates and a corresponding move towards the hypothesis being confirmed.

The improved OLS estimates presented in Table VII appear to conflict with the low rank correlation of R = .0646 mentioned earlier between actual and estimated PE shares. How can one reconcile these differing results? The clue lies on Table IV. The last two columns -

PE shares - show particularly large rank changes for Panama, France, Germany, Liberia and, less spectacularly, Mexico, Argentina, Belgium and the Phillipines. These are mirrored in similar rank changes in the first two columns. When estimating NKO shares, large estimation errors for the U.K. and Canada are associated with minor rank differences; for PE shares, similar rank divergences are coupled with much lower estimating errors. Furthermore, the estimates of Germany and France are rather more accurate in the second two columns. This higher concentration of smaller PE shares than NKO shares induce these relatively large rank changes, this despite the relatively more accurate set of estimates.

Before we proceed, it will be as well to tie together what we have thus far discovered, and in particular assess the differences between the PE and NKO U.S. samples. The purpose of introducing the two U.S. samples is to look at the possible differences that local borrowing makes to the allocation process being described. On the basis of the results thus far presented, we have found that although neither sample passes the significance tests, the specification using PE shares is more nearly correct in predicting actual shares. The rank correlation between NKO and PE actual shares is R = .6130 so that large PE and large NKO shares go hand in hand by and large. Recall now the differences between the two: NKO is net capital outflow which is retained earnings plus intra-firm credit while PE adds to this local borrowing but excludes those funds from NKO not used for plant and equipment expenditures. Retained earnings and the important component common to both, local borrowing the important difference. The rank correlation suggests that local borrowing supplements NKO

although one must be careful for, by and large, investment occurs largely in developed countries with well-developed capital markets and it may be that funds borrowed there are shipped elsewhere. Thus, we can only say that inasfar as NKO goes to developed countries the bias in not using PE is low for it is in these countries that local borrowing is heaviest. NKO complements local borrowing in these countries, and supplements it elsewhere and a correspondence exists because multinational firms tend to operate more in developed countries than developing.

Which variable is theoretically appropriate? Recall that the model centres around a large, well-spread firm centrally controlling and co-ordinating investment decisions in a number of plants. Of the components of NKO, intercompany credits is clearly likely to be so allocated for it is near in principle to portfolio investment. Retained earnings are controlled through dividend decisions from parent to subsidiaries (and thence to shareholders of the parent); the control over local borrowing is much weaker and occurs through gearing limits. The decision facing managers of the subsidiary, given NKO from the parent and an absolute limit to borrowing, is how much to finance of what percentage of the projects under consideration. To the extent that gearing limits are not binding and not set in line with the portfolio model, the model becomes relatively inaccurate in predicting PE shares. Our results here suggest that the PE specification performs somewhat better and so this, following the previous argument, <u>might</u> imply that local borrowing limits are binding. The weakness in prediction would then arise from measurement errors plus gearing limits not set in accord with the model.

This is, of course, generalizing on rather thin evidence of a highly indirect nature and one is not inclined to push it too far. We shall proceed using PE shares in the U.S. sample because the estimates are more accurate and are more compatible with the home investment data. There do seem to be reasons to suggest that this is the correct path to take.

What have we gathered from studying the weak version of the model that all foreign investment is allocated by a portfolio model? The clearest and most direct answer is that the model doesn't work and that this weak version of the hypothesis must be emphatically rejected. About the only achievement of the model is to predict shares which are fractions, which is rather small comfort. However, it can (and will be) argued that the model as yet cannot be expected to perform well. In particular, it is not clear that the specification of the independent variables is correct; their empirical construction is weak and lacking theoretically convincing foundations. Further, the weak version of the hypothesis that there is dual decision between home and foreign investment is rather unconvincing. For a firm hypothesised to be sufficiently rational and calculating to use our model, it is very difficult to posit behaviour such as this split between home and foreign investment decisions.

We shall now proceed to develop the model in more satisfactory ways, working both with the specification of ex ante variables and the inclusion of home investment. It turns our, however, that we can turn our attention primarily to the specification of risk variables - that expected returns don't appear to make much of a difference. This rather surprising finding is the subject of the next section of

this chapter. Chapter IV continues the story, developing the measurement of risk and the distinction between home and foreign investment.

(vi) The Approximation of Ex Ante Expected Returns

The difficulty with ex ante variable approximation is the following: we seek the joint distribution of $p_i(T)$, $i = 1,\ldots,N$ for year T or, at least, sufficient information to generate means, variances and covariances. The only information we have is a set of observations $p_i(T-j)$, $i + 1,\ldots, N$ and $j = 0,\ldots,T$. We face the problem that one observation $p_i(T-1)$ does not give sufficient information to generate the entire distribution of p_i in T, nor the first two moments. We must push back J years in the past, and assume that returns over time are related and use the past observations to extrapolate the distribution in T.

These difficulties are common to all portfolio model testing and the following tale is usually (implicitly) told. First, the firm concentrates on forming estimates of means, variances, and covariances rather than attempting to estimate the entire distribution. This is harmless, for it is all the information needed for the model and all that one can plausibly imagine being used. Second, the first two moments are extrapolated from past data - a necessary procedure as we have seen. What is crucial is the method of extrapolation and what it implies. What is usually done is that the data $p_i(T-j)$ $j = 0,\ldots,T$ is used straightforwardly to calculate means, variances

and covariances. One must be careful with this however, for it presumes that the distribution of the p_i has remained stable over time. The problem is that the process of successively approximating and reacting to a stable distribution implies that year to year variations in investment result not from changing circumstances but from acquisition by the firm of information on that stable distribution. Ultimately investment will settle down to an unchanging equilibrium flow. This is hardly an interesting tale to tell. Circumstances do change, partly endogenously (which our constant returns has ruled out) and partly from exogenous factors (which is what that tale ignores). We can certainly improve on this.

The difficulty with means is that they are slow to react to recent events and trends, being weighed down by the dead hand of the past. Some sort of adaptive mechanism must be added if they are to achieve real plausibility. Two other measures present themselves as alternatives. Instead of calculating means from all T past years observations, we can use some recent sub-set of these to incorporate the effect of new events more quickly. Such a mean has been calculated here by using the past three years. We shall refer to it as MA. The extreme version of this approach is to use the naive predictor; e.g. the observed value for T-1 as a proxy for the expected value in T. This we denote as M71 and together with MA and MEAN, we have three starting points.

These three measures do not, however, efficiently use all the information available to us and it is worth our while to explicitly add in trends in the $p_i(t)$ over the J years of our sample. If for example, $p_i(T)$ were rising sharply, we might expect (ceteris

paribus) higher expectations - i.e. some adjsutment being made to MEAN, M71 or MA. M71 will not reflect such trends at all; MA only poorly; and MEAN sluggishly. In any case, it is worth some experimentation in this direction. In the first place, a time series of the form:

$$p_i(t) = a_i + b_i t$$

was run to isolate the time trend in the data. b_i, the estimated marginal increase in the rate of return per annum is, when statistically significant, clearly one measure of the direction of shift in the p_i's. We consider only statistically significant b_i's on the presumption that only these are large enough to be 'perceived' and 'believed' by the firm. Note that a b_i significantly different from zero (say positive) does not necessarily imply that the distribution of the p_i has been shifting out over time; the set of $p_i(t)$ may have been generated by movements along a stable distribution over time in the direction of larger p_i. A correction of this sort - adding b_i to MEAN, M71, and MA corresponds to the following story. The firm still concerns itself with the first two moments of the distribution and it assumes that the shape of the distribution has not altered. It does, on the basis of information about these trends, relocate this stable distribution. The relocation occurs partly through trends picked up by MEAN, but most directly through b_i. While such a measure will be inaccurate inasfar as the shape of the distribution alters and inasfar as b_i picks up movements along the distribution, it has some intuitive appeal.

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We can, of course, consider alternatives to b_i. Rather than working solely with statistically significant marginal changes, we can use average changes:

$$\Delta p_i(t) = p_i(t) - p_i(t-1)$$

Two in particular - $\Delta P71$, the most recent average change, and $\Delta\overline{P}$, the "average" average change - have some intuitive appeal. Combinations of MEAN, M71, MA, b, $\Delta\overline{P}$ and $\Delta P71$ produced, in total, the following ten proxies:

MEAN	M71	MA
MEAN + b	M71 + b	MA + b
MEAN + $\Delta\overline{P}$	M71 + $\Delta\overline{P}$	
MEAN + $\Delta P71$	M71 + $\Delta P71$	

The constituent elements of these proxies are shown on Tables IX and X for the U.K. and U.S. samples respectively. Inspection of these two tables shows clearly that the difficulties observed in earlier tests cannot be laid at this door. On Table IX, South Africa clearly shows a recent fall in return and this may account for the overestimation in the U.K. sample as it may not be acted upon as quickly in our model as by investors. However, the U.S. also shows recent deterioration, but was underestimated in the model. Similarly, on Table X, Mexico shows recent deterioration as does Libya, but the model overestimates the first and understates the second, In fact, several countries with large recent changes in returns such as the Irish Republic, Africa, Malysia, Italy and the Netherlands in the U.K. sample and Chile, Peru, Denmark and Libya in the U.S. sample are not amongst the extreme problem countries.

Table IX

Proxy Expected Returns for the U.K. Sample

	Country	MEAN	M71	MA
1.	Australia	7.43	7.5	7.8
2.	Irish Republic	9.23	11.2	9.8
3.	New Zealand	6.98	5.8	6.8
4.	South Africa	12.06	11	11.6
5.	Africa	9.63	10.6	11.1
6.	West Indies	5.1	4.3	4.8
7.	Hong Kong	18.85	20.5	20.4
8.	India	7.36	7.9	7.8
9.	Malaysia	14.86	17.4	17.3
10.	Canada	5.77	5.5	5.1
11.	United States	11	7.5	9.3
12.	Denmark	.52	3.2	.9
13.	Switzerland	14.57	19.8	18.6
14.	Belgium	7.61	10.9	11.2
15.	France	5.26	9.1	7.9
16.	Italy	5.52	6.4	8.5
17.	Netherlands	8.32	14.3	13.9
18.	Germany	12.47	14.5	1 .8
19.	South/Central America	10.36	10.5	11

	Country	B	$\Delta\bar{P}$	$\Delta P71$
1.	Australia	0	-.02	0
2.	Irish Republic	0	.22	2.5
3.	New Zealand	0	-.22	-.6
4.	South Africa	-.1821	-.15	-.8
5.	Africa	.4678	.3	-2.0
6.	West Indies	0	-.02	-.2
7.	Hong Kong	0	-.12	.6
8.	India	0	.05	-1.0
9.	Malaysia	0	-7.15	-2.1
10.	Canada	-.2166	-.11	.8
11.	United States	-.4928	-.51	-1.6
12.	Denmark	0	.53	.1
13.	Switzerland	1.3404	1.14	-.9
14.	Belgium	1.7464	1.38	.8
15.	France	.9988	.92	.20
16.	Italy	.9809	.55	-3.3
17.	Netherlands	1.8333	1.37	-3.9
18.	Germany	1.119	.71	-1.9
19.	South/Central America	.4130	.31	-.9

Table X

Proxy Expected Returns for the U.S. Sample

Country	MEAN	M71	MA	β	$\Delta\bar{P}$	ΔP71
1. Canada	8.12	8.67	8.10	0	.0967	1.07
2. Mexico	8.35	6.42	7.69	-.3314	-.4250	-1.53
3. Panama	11.44	11.10	11.83	0	.0317	-.81
4. Argentina	10.19	6.21	8.68	-.9803	-1.2667	-1.99
5. Brazil	9.62	10.55	10.12	0	.1450	-.17
6. Chile	11.54	-.69	7.82	0	-1.8433	-6.3
7. Columbia	5.07	8.74	6.72	0	.6967	2.29
8. Peru	14.85	5.93	11.11	-2.0714	-1.9883	-4.79
9. Venezuela	17.82	18.33	17.14	0	.0633	2.58
10. Belgium/ Luxembourg	9.04	11.74	11.23	.8367	.5300	.75
11. France	6.59	10.34	9.80	1.1857	.9567	.80
12. Germany	9.05	11.44	12.03	1.0567	.5900	-1.68
13. Italy	3.58	3.47	4.82	.6367	.6633	-2.47
14. Netherlands	7.76	11.20	9.43	.8014	.6767	-.74
15. Denmark	2.39	-.84	3.04	0	-.8067	-6.92
16. Norway	1.57	1.37	2.69	0	-.4300	-.87
17. Spain	5.06	4.37	4.20	0	-.7867	-.24
18. Sweden	4.80	5.81	5.54	0	.1217	-.16
19. Switzerland	15.74	16.68	17.32	.6100	.4583	-.54
20. United Kingdom	7.68	8.80	7.66	0	-.1767	1.32
21. Liberia	9.78	8.72	9.25	0	.0167	.16
22. Libya	62.51	38.71	57.40	0	-2.66	-17.02
23. South Africa	15.85	10.88	13.79	-1.1775	-1.18	-3.98
24. India	6.72	10.64	9.21	0	.0733	1.79
25. Philippines	7.25	7.24	7.52	0	.3033	.54
26. Australia	7.89	10.03	9.81	0	.4400	-.02

This suggests an interesting line of thought. When people attempt informally to allow for uncertainty, they proceed along the line of: 'firms invest where expected returns are highest, subject to an allowance for risk'. It seems that such might not be the case. Consider Table XI where correlations between MEAN and the other measures are presented, together with correlations between shares estimated with MEAN and shares estimates using the other measures. For both samples, all the measures of expected returns are highly positively correlated, with MEAN permutations being rather closer and M71 permutations somewhat more distant; all were no lower than .85 bar one. These various measures were each used to predict shares and the correlations between these are shown on the bottom half of the Table. As can be seem, almost no difference in estimated shares was produced by the different proxies - even in the M71 + ΔP71 case in the U.S. sample.

Thus, it appears that expected returns provide little explanation (or a small percentage of what little explanation we have so far achieved) of the allocation of investment by multinational firms in our samples. This suggests that it <u>may</u> turn out that the argument that these firms 'adjust expected returns for risk' will be reversed; that is, such firms may allocate investment 'to minimize risk subject to an allowance for expected returns'. This line of inquiry will be pursued in the next chapter.

Table XI

Correlations between Various Proxies

of Expected Returns with MEAN

U.K. Sample	Proxy	U.S. Sample
.9867	MEAN+B	.9982
.8848	M71	.8779
.8356	M71+B	.8523
.9272	MA71	.9870
.8766	MA71+B	.9766
.9401	MEAN+DP71	.9538
.9056	MEAN+DP	.9975
.7719	M71+DP	.8163
.8540	M71+DP71	.5170

Correlations Between Shares Estimated Using MEAN and

Shares Estimated Using Various Proxies

Proxy	U.K. Sample	U.S. NKO Sample	U.S. PE Sample
MEAN+B	.9999	.9998	.9999
M71	.9950	.9998	.9999
M71+B	.9956	.9996	.9998
MA71	.9989	.9999	.9999
MA71+B	.9992	.9997	.9999
MEAN+DP71	.9981	.9987	.9997
MEAN+DP	.9988	.9999	.9999
M71+DP	.9972	.9997	.9999
M71+DP71	.9898	.9982	.9723

(v) Summary

We have come some way in this chapter and, as it is apparent that much work lies ahead of us, it is worth pausing and taking stock of just what we have done and where we should be heading.

The first substantive point is that the dual decision hypothesis evidentally finds no support in the data. Initial estimates of the portfolio model when applied to foreign investment alone were poor and about the only remarkable feature is that the estimated shares were fractions. This applied for all three samples. The second feature of note was that some but not very much difference was found between shares based on NKO and those based on PE for the U.S. sample. Finally, it was discovered that expected returns had very little impact on estimated shares; most of what little explanation was achieved came from the risk terms.

The directions these results point to lie in the further consideration of risk. This is hardly surprising for as early as Chapter I we have had some misgivings about the quantification of this variable; evidentally it requires more work than we have thus far given it. In addition, home investment must be introduced to the sample for this is an important part of our initial hypothesis about multinationals' investment policies. These two points are, however, closely intertwined and must be considered simultaneously. This we now proceed to do.

Chapter IV

Risk and Foreign Investment

(i) Introduction

The empirical work of the last chapter left us on a relatively well defined path and it is left for us here to follow it as long as possible. Two issues in particular were left open. The first is the role of home investment and the interrelations between home and foreign investment. We have found the dual decision hypothesis untenable and, as it turns out, in order for home investment to be successfully predicted some major extensions of the model are required. The reason is that home investment is fundamentally safer (without being riskless) than all foreign investment, or at least is perceived as being so. This question is tackled in Section (ii).

The measurement of risk is the other issue left over from the last chapter. We found reason to suspect that whatever explanation of shares was being provided was arising from the risk terms; expected returns appear to have played only a small role. It seems then that the measurement of risk is the area of importance to which attention must be directed to make the model serviceable. We shall do this by generating additional information on risk in Section (iii) and using it to accurately predict shares. Such additional information will enable us to measure 'total perceived risk' in the various markets the firm operates in. Such total perceived risk must, of course, be explained if possible and Section (iv) considers this problem. In Sections (v) and (vi), we shall come to an assessment of the portfolio model and consider its usefulness as a predictor of foreign investment.

(ii) Home and Foreign Investment

There is an important sense in which home investment is "safer" than all foreign investment. This is, of course, the converse of the argument discussed in Chapter I relating to the uncertainty of expansion into new foreign markets by the firm. As Caves (1974b, pp. 11) has remarked in a similar context: "... why should the we/they distinction fail to guide the hand of the entrepreneur when its power over other human relations is carved so deeply upon the records of history?" It is the notion of a 'home base' which is crucial to the argument.

Clearly, home operations are risky and, even if the firm is sufficiently diversified at home, such operations are subject to "systematic risk" (Sharpe, 1964, pp. 440-442) arising from such forces as macroeconomic fluctuations. Such national systematic risk can be diversified away in part by international operations (Solnik, 1974; Rugman, 1976; and so on) and such risks as remain are captured in our measures. Nevertheless, this is not the whole story. U.K. multinationals in the U.K. (the same applies, mutatis mutandi, to U.S. multinationals in the U.S.) are in a familiar environment, are familiar with competitors, suppliers, consumers, unions and government ministers and their outlook on policy. To some extent they can anticipate (if not postpone) disruptive developments; more importantly, they believe that they can adopt more readily to them, mitigating the adverse effects of such disturbances. The belief and confidence in their ability to "do something about it" is justified, quite naturally, by their intimate ties with the home

base and (at a second order) by cultural (etc.) ties. That is, their attitudes to whatever measure of risk they use as an index are liable to differ quite markedly as between home and all foreign investment, even those with precisely the same measured risk.

Recall Appendix VII where, using Risk (ii), the U.K. had a very similar risk to South Africa. No one in his/her right mind would suggest that U.K. investors found them equally risky; South Africa must be considered far more risky. South Africa is in the process of massive political change; it is not clear what will occur, nor to what extent, nor the attitude of the new rulers to U.K. multinationals and their policies. That change is on the books is clear - what it will entail and how to minimize its effects are not. In the U.K. change is also due with the forthcoming elections. It is not clear when exactly they will occur nor who will win, but firms in the U.K. do know the attitudes of a Tory or Labour government and their likely policies and how to circumvent them. Even a Liberal government's attitudes are known despite the fact that a Liberal victory would be unexpected.

This principle can be extended to countries within the foreign sample. Our risk measures suggest that Columbia is less risky than the U.K. for U.S. investors. No-one in their right mind would accept this. Since 1867 when Singer set up in Glasgow (Tugendhat, 1971, pp. 33), or 1914 when Ford produced 25% of the cars made in the U.K., the U.S. presence in Britain has been large enough for public comment (pp. 35-9), despite the host government's attitudes (Gillespie, 1972; Dunning, 1958). U.S. presence in Columbia, as in the rest of South America, has been of some long standing, but limited in form and accompanied by much tension. "During the 1970's...among

Latin American countries, Chile, Mexico and Peru would probably be related a little higher on the tension scale than Columbia, but not by much; Columbia would, in turn, be rated higher than Argentina or Brazil... In the advanced world, there would be very little hesitation in placing Japan near the top of the scale, France somewhat below, Britain much lower and Belgium lower still". (Vernon, 1971, pp. 189-90). According to our measures Brazil and Argentina are rated much more risky for U.S. investors than the U.K.

The simple (and by now familiar) point that we are trying to establish is that our measure of risk is, of necessity, quite imperfect and that it is important to recognize that attitudes to a given measured risk in a pair of countries with equal measured risk may differ quite markedly due to differences in 'investment climate'; such attitudes are not likely to find their way into ex post returns.

Here we shall first consider the simplest version of this hypothesis; that is, that home investment is very much safer than all foreign investment. Let us commence by testing the model without this assumption. Table I sets actual and estimated shares (denoted Estimated Share (i)) for the U.K. sample and Table II gives the same information for the U.S. PE sample. On Table I it can be seen that these estimates are rather poor - poorer than before; the rank correlation coefficient between estimated and actual shares is $R = .0496$. Most importantly, home investment is under-estimated by 72 percentage points; South Africa over-estimated by 24 percentage points; the West Indies by 16; Canada 14; Australia 7; and so on - all not surprising given that the U.K. is so badly over-estimated. What effect has adding the U.K. to the list of countries in our sample had

Table I

Actual and Estimated Shares for U.K. Investment to Nineteen Foreign Countries and Home Investment

Country	Actual Shares	Estimated Shares(i)	Estimated Shares(ii)
Australia	.0487 (3)	.1142 (4)	.0258 (5)
Irish Republic	.0086(11)	.0515 (6)	.0126 (7)
New Zealand	.0007(17)	.0168(11)	.0035(12)
South Africa	.0090(10)	.2543 (1)	.0633 (2)
Africa	.0010(10)	.0236(10)	.0057(10)
West Indies	-.0133(20)	.1557 (2)	.0342 (4)
Hong Kong	.0007(18)	-.0015(20)	.00002(19)
India	.0037(14)	.0500 (7)	.0119 (8)
Malaysia	.0038(13)	.0044(16)	.0012(16)
Canada	.0113 (8)	.1498 (3)	.0342 (3)
United States	.0532 (2)	.0284 (9)	.0070 (9)
Denmark	.0014(15)	.0163(12)	.0036(11)
Switzerland	-.0047(19)	.0095(14)	.0023(14)
Belgium	.0236 (5)	.0071(15)	.0016(15)
France	.0136 (7)	.0149(13)	.0033(13)
Italy	.0054(12)	.0043(17)	.0007(17)
Netherlands	.0207 (6)	-.0012(19)	-.0002(20)
Germany	.0403 (4)	.0018(18)	.0004(18)
South/Central America	.0096 (9)	.0627 (5)	.0151 (6)
United Kingdom	.7527 (1)	.0366 (8)	.7747 (1)

Numbers in parentheses are rankings.

on the rest of the estimates (aside from the slight movement towards over-estimation)? The rank correlation between actual and estimated shares in nineteen foreign countries is: R = .0150 the rank correlation between these remaining nineteen countries and the estimates of the last chapter when the U.K. was excluded is: R = .9842. The introduction of the U.K. (home investment) has not altered the ranking of foreign investment shares predicted by the model; indeed, except for the slight upward bias, it has not altered the estimates very much at all.

Table II

Actual and Estimated Shares (PE) for U.S. Investment in Twenty-Six "Foreign" Countries and Home Investment

Country	Actual Shares	Estimated Shares(i)	Estimated Shares(ii)
1. Canada	.0982 (2)	.3697 (1)	.1421 (2)
2. Mexico	.0054(13)	.0781 (5)	.0344 (5)
3. Panama	.0008(25)	.1876 (2)	.0095 (9)
4. Argentina	.0041(14)	-.0042(23)	-.0068(25)
5. Brazil	.0163 (7)	.0908 (3)	.0078(10)
6. Chile	.0005(26)	-.0014(21)	.0014(17)
7. Columbia	.0023(21)	.0014(20)	.0048(15)
8. Peru	.0030(19)	.0024(18)	-.0040(22)
9. Venezuela	.0075(11)	.0162(14)	-.0024(20)
10. Bolivia	.0128 (8)	-.0015(22)	.0056(14)
11. France	.0283 (5)	-.0079(24)	.0063(11)
12. Germany	.0423 (4)	.0023(19)	.0058(13)
13. Italy	.0194 (9)	-.0095(25)	.0387 (4)
14. Netherlands	.0105(10)	.0275 (9)	.0062(12)
15. Denmark	.0018(22)	-.0190(26)	.0132 (8)
16. Norway	.0033(17)	-.0333(27)	.0161 (7)
17. Spain	.0059(12)	.0039(16)	-.0062(24)
18. Sweden	.0031(18)	.0262(11)	.0691 (3)
19. Switzerland	.0040(15)	.0809 (4)	-.0050(23)
20. United Kingdom	.0426 (3)	.0311 (8)	-.0111(26)
21. Liberia	.0004(27)	.0383 (6)	.0192 (6)
22. Libya	.0027(20)	.0025(17)	-.0015(19)
23. South Africa	.0039(16)	.0370 (7)	-.0114(27)
24. India	.0012(24)	.0078(15)	.0009(18)
25. Philippines	.0014(23)	.0267(10)	-.0039(21)
26. Australia	-.0207 (6)	.0199(13)	.0046(16)
27. United States	.6577 (1)	.0259(12)	.6664 (1)

Numbers in parentheses are rankings.

Turning to Table II, the same state of affairs appears to hold for the U.S. PE shares. Home investment is under-estimated by 63 percentage points. Correspondingly, Canada and Panama are quite heavily over-estimated and the rest (barring a few such as Argentina and Chile) are over-estimated. In fact, the rank correlation between actual and estimated shares including the U.S. is: R = -.0104.

Removing the U.S., the rank correlation between actual and estimated shares for the remaining twenty-six countries is: R = .0607 and between these and those estimated in the last chapter: R = .7997.

Running the regression for the U.S. Sample (those for the U.K. are similar and are suppressed for brevity), the results presented on Table III confirm our observations. Germany, Canada and the U.S. are troublemakers* and India is our bench mark; the results are relatively indistinguishable as between the various exclusions and are uniformly poor. Excluding the U.S. is the best result, but this is hardly surprising.

Table III

Regressions of the Form $\lambda_i = \alpha + \beta\hat{\lambda}_i$ for the U.S. (PE) Sample

Equation	α	β	R^{-2}	F(.)	Countries Excluded
(i)	.0316 (.0295)	.1279 (.3294)	.006	.1507 (1,23)	Germany, United Kingdom
(ii)	.0105 (.0028)	-.0308 (.0554)	.013	.3100 (1,23)	Canada
(iii)	.0068 (.0035)	.1689 (.0402)	.423	17.65 (1,24)	United States
(iv)	.0338 (.0283)	.1195 (.3217)	.005	.1380 (1,24)	India

* Curiously, the U.S. in the U.K. sample and the U.K. in the U.S. sample are predicted rather accurately.

These results clearly bring us back to the hypothesis that domestic investment is safer, somehow, than all foreign investment, and fundamentally so. The tests described above were based on the premise that, for equal levels of measured risk, countries are judged equally risky. To isolate the possibility of different attitudes to a given measured risk, we have pursued the following hypothesis: we continue to use one overall risk premium, h, but we alter the measured risk of the U.K. Since, in our objective function, the risk premium enters multiplicatively with measured risk, this is equivalent to estimating a second risk premium which relates only to home measured risk. In altering measured risk, not only must we alter the variance of home investment but the various co-variances between home and all other countries must be adjusted. For given interrelations between two countries, those which include a safe country with which one is familiar are more sure than those those between two foreign countries which is liable to be quite tenuous - this for obvious reasons. Partly, lines of comunication between home country corporate headquarters and subsidiaries taken separately are stronger than between two foreign subsidiaries, and partly because as the home country is familiar, the knowledge of its interactions with various countries taken together has an added element of surety - one half of the relationship is on familiar grounds. Consequently, risk is reduced not only by reduction of measured risk for the home country but by the knowledge of the relations between home countries and all others.

Formally, the model is as follows. Let the nth country be the home country and, for all t, write $p_n(t)$ as $cp_n(t)$ for some constant c. Consequently, the variance of p_n over t is $c^2 p_n^*$ and the

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co-variance with any j is cp_{nj}^*. The objective function Z( ) then becomes:

$$(1) \quad Z(.) = N\sum_i \rho_i^o \lambda_i - h\left\{\sum_i^{N-1} \lambda_i^2 \rho_{ii}^* + \sum_{j\neq i,N}^{N-1} \lambda_i\lambda_j\rho_{ij}^* + \lambda N^2 c^2 \rho_{NN}^* + 2c \sum_{j\neq N} \lambda_N\lambda_j \rho_{Nj}^*\right\}$$

Using methods similar to those employed above, the first order conditions for a maximum require the $N\hat{\lambda}_i$ to satisfy the N equations:

$$(2) \quad \frac{\partial Z}{\partial \lambda_i} = \frac{\partial Z}{\partial \lambda N} \qquad i = 1, \ldots, N-1$$

$$\Sigma\lambda_i = 1.$$

which can be written in matrix notation as:

$$(3) \quad \hat{\Lambda} = \pi^{-1}\Phi$$

where

$$(4) \quad \hat{\Lambda} = \begin{bmatrix} \hat{\lambda}_1 \\ \vdots \\ \hat{\lambda}_N \end{bmatrix} \qquad \Phi = \begin{bmatrix} \dfrac{\rho_N^o - \rho_1^o}{h} \\ \vdots \\ 1 \end{bmatrix}$$

$$\pi \begin{bmatrix} (2c\rho_{1N}^* - 2\rho_{11}^*) & (c\rho_{2N}^* - \rho_{12}^*) & \ldots\ldots & (2c^2\rho_{NN}^* - c\rho_{1N}^*) \\ 1 & 1 & \ldots\ldots & 1 \end{bmatrix}$$

Thus, $\hat{\lambda}_i$ is a function of h and c, linear in h^{-1} and quadratic in c. The likelihood function is:

$$(5) \quad L(h,c) = \sum_i^N \{\hat{\lambda}_i(h,c) - \lambda_i\}^2$$

which involves, inter alia, terms in h^{-2} and c^4. To choose the minimizing values of h and c, we must solve:

$$(6) \quad \frac{\partial 1}{\partial h} = \sum_i \left(\frac{\partial \lambda_i}{\partial h}\right) \left[\hat{\lambda}_i(h,c) - \lambda_i\right]^2 = 0$$

$$\frac{\partial L}{\partial c} = \sum_i \left(\frac{\partial \lambda i}{\partial c}\right) \left[\hat{\lambda}_i(h,c) - \lambda_i\right]^1 = 0$$

There is, however, a short cut which obviates the need for obtaining an analytic solution. This is that c is strictly bounded by zero and unity; i.e. $0 < c < 1$. A negative c will give rise to negative co-variances (if they were positive and visa versa) and makes no economic sense; c in excess of unity gives rise to more risk than before, and $c = 0$ eliminates risk altogether. Thus the most straightforward procedure is to scan over the open interval (0,1), using each c to calculate h as given above, and find the minimum of L(h,c). Tables IV and V show the results for the U.K. and U.S. samples respectively.

On Table IV, there does not appear to be a minimum. L(h,c) falls rather substantially as c falls from unity to 0.1, and then slowly levels off to a value of L(h,c) = .0115 shortly after c = .01. On Table V, a simpler situation prevails. L(h,c) falls monotonically as c falls until c = .08 and then rises rather slowly. The value of L(h,c) at the minima of the two samples differs by about .003.

Having computed h and c, what predictions do we get about foreign investment flows? On Tables I and II, estimated shares (Estimated Share (ii)) computed using c = .01 and c = .080 for the two samples respectively*. Consider Table I first. The most apparent difference with the previous estimated shares is that home investment is exactly right. However, the allocation of the remainder of the shares (i.e. to all foreign countries) does not show any increased accuracy. The rank correlation between actual and estimated shares (including the U.K.) is R = .1573; the correlation between Estimated Shares (i) (when c = 1) and actual shares was .0496 - a marginal improvement. Between Estimated Share (i) and Estimated Share (ii), the rank correlation is R = .0530, or R = .9947 when the U.K. is excluded. What appears to be happening is that using c = .01 reallocates shares more or less proportionately from everywhere - especially from Australia, Canada, South Africa and the West Indies. The provision made for the 'relative risklessness' of home investment has not improved the predictions of individual foreign shares although the foreign total is accurately predicted.

Let us consider the regression results for the U.K. sample when we assume c = .01. These are presented on Table VI. South and Central America is our benchmark but the results are the same regardless of whether South and Central America or the U.S. or South Africa (and so on) are excluded. What is happening is that the correctness of the U.K. estimates is dominating the whole regression and this is confirmed by the first two regressions in which the U.K. is

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* The value of c = .01 chosen for the U.K. sample was chosen because further decreases in c have only marginal effects on shares and the likelihood function.

Table IV

Values of c and the likelihood function for the U.K. Sample

c	L(h,c)	c	L(h,c)
1	.6358	.06	.01231
.9	.61820	.05	.01202
.8	.61715	.04	.01182
.7	.60003	.03	.01169
.6	.56965	.02	.01160
.5	.5092	.01	.0115
.4	.3879	.009	.0115396
.3	.2016	.008	.0115345
.2	.05748	.007	.0115296
.19	.04937	.006	.0115249
.18	.04235	.005	.0115202
.17	.03634	.004	.0115157
.16	.03126	.003	.0115113
.15	.02702	.002	.0115069
.14	.02352	.001	.0115027
.13	.02067	.0005	.0115002
.12	.01836	.0001	.0115990
.11	.01658	.00005	.0114988
.1	.01518	.00001	.0114986
.09	.01411	.000009	.0114986
.08	.01331	.000001	.0114986
.07	.01272		

Table V

Values of c and the likelihood function for the U.S. Sample

c	L(h,c)	c	L(h,c)
1	.4980	.086	.00871
.9	.4945	.085	.008712
.8	.4890	.084	.008707
.7	.4794	.083	.008703
.6	.4604	.082	.008700
.5	.4184	.081	.00869927
.4	.3245	→ .080	.0086989 ←
.3	.1644	.079	.008699
.2	.0379	.078	.008701
.19	.03148	.077	.008704
.18	.02604	.070	.008708
.17	.02156	.075	.008716
.16	.01796	.074	.008719
.15	.01512	.073	.00872
.14	.01295	.072	.00873
.13	.01134	.071	.00874
.12	.01020	.07	.00875
.11	.00944	.06	.00887
.1	.00899	.05	.00902
.09	.00876	.04	.00918
.089	.00874	.03	.00933
.088	.00873	.02	.00944
.087	.00872	.01	.00952

eliminated. There the relation appears negative because of the large over-estimation of several countries, principally Australia. The formal significance tests reflect these presumptions.

Table VI

Regressions of the form $\lambda_i = \alpha + \beta\hat{\lambda}_i$

for the U.K. Sample of Twenty Countries

Regression	α	β	R^2	F(.)	Countries Excluded
(i)	.0130 (.0052)	-.0496 (.2606)	.002	.0363 (1,17)	United Kingdom
(ii)	.0041 (.0050)	.9626 (.0285)	.985	1139 (1,17)	South Africa
(iii)	-.0011 (.0053)	.9649 (.0301)	.983	1026 (1,17)	United States
(iv)	.0039 (.0053)	.9598 (.0299)	.983	1028 (1,17)	West Indies
(v)	.0017 (.0060)	.9609 (.0335)	.979	819.2 (1,17)	South/Central America

Standard errors are in parentheses below estimated co-efficients; numbers below F-statistics are degrees of freedom.

Clearly the hypothesis that $\alpha = 0$ and $\beta = 1$ is supported when we use the accurate estimate of the U.K. in our tests (with the exception of (ii), where it is marginal).

Turning briefly to the U.S. sample, a similar pattern emerges. Again, domestic investment is quite close while the rest remain rather inaccurate. The rank correlation between Estimated Share (ii) and actual shares is: $R = .1453$ which falls to $R = .0626$ when we remove the U.S. from both ranks. Again, the presumption to over-estimate disappears, with large reallocations from Canada, Panama and Switzerland

Table VII

Calculated and Critical F-Statistics

Equation	θ	F(.)	SS_1	SS_o
(i)	7.9079	3.59 (2,17)	.0057	.0110
(ii)	3.7132	3.59 (2,17)	.0076	.0110
(iii)	2.5182	3.59 (3,17)	.0085	.0110
(iv)	2.5784	3.59 (2,17)	.0084	.0110
(v)	.3509	3.59 (2,17)	.0106	.0110

to the U.S. in the new estimates. However, the two sets of estimated shares bear only a weak relation to each other: R = .0433 and R = .1679 with and without the U.S. included in the rankings.

Turning to the regression on Table VIII, the same patterns emerge as before. Eliminating Canada, Germany, the U.K., or the benchmark India, all produce good results. Eliminating the U.S., however, causes some deterioration, but not as much as before. The formal significance tests show the same pattern of confirmation as with the U.K. sample.

Table VIII

Regressions for the U.S. Sample of Twenty-Seven Countries

Equation	α	β	R^2	F(.)	Countries Excluded
(i)	.0061 (.0033)	.5724 (.1192)	.498	23.03 (1,24)	United States
(ii)	.0025 (.0036)	.9461 (.0269)	.981	1262.35 (1,24)	Canada
(iii)	.0002 (.0034)	.9544 (.0250)	.983	1455.57 (1,24)	Germany
(iv)	.0001 (.0033)	.9546 (.0247)	.984	1481.89 (1,24)	United Kingdom
(v)	.0019 (.0037)	.9512 (.0276)	.980	1185.22 (1,24)	India

Numbers below estimated co-efficients are standard errors; degrees of freedom are given below the F-statistics.

Table IX

Calculated and Critical F-Statistics

Equation	θ	F(.)	SS_1	SS_o
(i)	2.8197	3.40 (2,24)	.01132	.01398
(ii)	12.8906	3.40 (2,24)	.00674	.01398
(iii)	2.66	3.40 (2,24)	.01144	.01398
(iv)	4.83	3.40 (2,24)	.00996	.01398
(v)	1.1615	3.40 (2,24)	.01274	.01398

As can be seen at a glance, the hypothesis is confirmed for all but the regressions excluding Canada and the U.K.

Thus, we have found reason to suspect that home investment is relatively safer than all foreign investment, and by means of a simple exercise, have demonstrated the proposition. The clear course open now is to extend this procedure to all countries.

(iii) Attitudes to Risk*

In the model we are using, risk and 'attitudes to risk' enter multiplicatively and we shall seek to generate further information on these attitudes to improve the model's performance. In the previous exercise, we did this to home investment by altering measured risk. Here we shall attempt to extend this by generating information on the attitudes to risk in each country, using this information to

* For brevity, we continue now with only the U.K. sample

improve prediction. This turns the model on its head, for we are using observed behaviour (observed investment shares) to generate the attitudes to risk which, for the most part, determine the actions of our economic actors, and hence the observed shares.

Formally, the problem is the following. Choose λ_i, $i = 1, \ldots, N$ to maximize:

$$(7) \quad \mathcal{Z} = \sum_i \lambda_i \rho_i^o - \sum_i h_i \{\lambda_i^2 \rho_{ii}^* + \sum_{j \neq i} \lambda_i \lambda_j \rho_{ij}^*\}$$

subject to

$$(8) \quad \sum_i \lambda_i = 1.$$

The optimum $\hat{\lambda}_i$ satisfy:

$$(9) \quad \begin{cases} \dfrac{\partial \mathcal{Z}}{\partial \lambda_i} = \psi & i = 1, \ldots, N \\ \sum_i \lambda_i = 1 \end{cases}$$

where

$$(10) \quad \frac{\partial \mathcal{Z}}{\partial \lambda_i} = \rho_i^o - h_i 2\lambda_i \rho_{ii}^* - h_i \sum_{j \neq i} \lambda_j \rho_{ij}^* - \sum_{j \neq i} \lambda_j h_i \rho_{ij}^* = \psi$$

These form (N+1) equations in the N λ_i, the N h_i and ψ - evidentally an over-determined system. Knowledge of the λ_i's or h_i's will, of course, set things to rights. There are two approaches to solving this problem.

As a first approach, we can solve the first order conditions for the $\hat{\lambda}_i$'s as functions of the h_i's and choose these latter to maximize the likelihood function.

$$(11) \quad L = \sum_i (\hat{\lambda}_i - \lambda_i)^2.$$

After eliminating ψ as before, we can write:

$$(12) \quad \theta\hat{\Lambda} = \beta$$

where:

$$(13) \quad \hat{\Lambda} = \begin{bmatrix} \hat{\lambda}_1 \\ \vdots \\ \hat{\lambda}_N \end{bmatrix} \qquad \beta = \begin{bmatrix} \rho_N^o - \rho_1^o \\ \vdots \\ 1 \end{bmatrix}$$

$$\theta = \begin{bmatrix} \rho^*_{Ni}(h_i + h_N) - \rho^*_{ii}(h_i + h_i) \cdots\cdots \rho^*_{NN}(h_N + h_N) - \rho^*_{iN}(h_i + h_N) \\ \vdots \\ 1 \qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad 1 \end{bmatrix}$$

The likelihood function is then:

$$(15) \quad L = (\Lambda - \theta^{-1}\beta)^T(\Lambda - \theta\beta)$$

Only θ^{-1} has terms in the h_i; β and $\hat{\Lambda}$ are known and calculable. The first of the N first order conditions for a minimum is:

$$(16)\quad \frac{\partial L}{\partial h_i} = \left[-2\,\frac{\partial \theta^{-1}}{\partial h_i}\,\beta\right]\left[\Lambda - \theta^{-1}\beta\right] = 0$$

but, as:

$$(17)\quad \frac{\partial \theta^{-1}}{\partial h_i} = -\theta^{-1}\,\frac{\partial \theta}{\partial h_i}\,\theta^{-1}$$

we arrive at:

$$(18)\quad \frac{\partial L}{\partial h_i} = \left[2\theta^{-1}\,\frac{\partial \theta}{\partial h_i}\,\theta^{-1}\,\beta\right]\left[\Lambda - \theta^{-1}\beta\right]$$

and similarly for the remaining (N-1) conditions. The trouble with these conditions - and this approach - is only too obvious. The inverse θ^{-1} which contains all the terms in h_i make only numerical approximation methods feasible for solution. In view of these computational difficulties a second, short cut approach has been adopted.

What we do is to set $\hat{\lambda}_i = \lambda_i$ for all i. This eliminates the $\hat{\lambda}_i$ as unknowns altogether and provides an easy means to solve the original first order conditions. This would generate the same answer if the:

$$(19)\quad \text{Min } L = \sum_i (\hat{\lambda}_i - \lambda_i)^2 = 0.$$

The $(n+1)^{st}$ equation, $\sum_i \lambda_i = 1$, is now redundant and we are left with N equations in the N h_i's and ψ - again over-determined. To overcome this, we set:

$$(20)\quad \psi = \bar{\psi}$$

$$(16)\quad \frac{\partial L}{\partial h_i} = \left(-2\,\frac{\partial \theta^{-1}}{\partial h_i}\,\beta\right)\left(\Lambda - \theta^{-1}\beta\right) = 0$$

but, as:

$$(17)\quad \frac{\partial \theta^{-1}}{\partial h_i} = -\theta^{-1}\,\frac{\partial \theta}{\partial h_i}\,\theta^{-1}$$

we arrive at:

$$(18)\quad \frac{\partial L}{\partial h_i} = \left(2\theta^{-1}\,\frac{\partial \theta}{\partial h_i}\,\theta^{-1}\,\beta\right)\left(\Lambda - \theta^{-1}\beta\right)$$

and similarly for the remaining (N-1) conditions. The trouble with these conditions - and this approach - is only too obvious. The inverse θ^{-1} which contains all the terms in h_i make only numerical approximation methods feasible for solution. In view of these computational difficulties a second, short cut approach has been adopted.

What we do is to set $\hat{\lambda}_i = \lambda_i$ for all i. This eliminates the $\hat{\lambda}_i$ as unknowns altogether and provides an easy means to solve the original first order conditions. This would generate the same answer if the:

$$(19)\quad \text{Min } L = \sum_i (\hat{\lambda}_i - \lambda_i)^2 = 0.$$

The $(n+1)^{st}$ equation, $\sum_i \lambda_i = 1$, is now redundant and we are left with N equations in the N h_i's and ψ - again over-determined. To overcome this, we set:

$$(20)\quad \psi = \bar{\psi}$$

and rearrange the system to solve:

$$(21) \quad \Phi = \beta - \bar{\psi}$$

where

$$(22) \quad \underline{h} = \begin{bmatrix} h_i \\ \vdots \\ h_N \end{bmatrix} \qquad \Phi = \begin{bmatrix} \lambda_1\rho^*_{1\cdot} + \Sigma\, \lambda_i\rho^*_{ii} & \cdots\cdots\cdots\cdots & \lambda_N\rho^*_{1N} \\ \vdots & & \\ \lambda_1\rho^*_{1N} & \cdots\cdots\cdots\cdots & \lambda_N\rho^*_{NN} + \Sigma\, \lambda_i\rho^*_{Ni} \end{bmatrix}$$

For chosen values of $\bar{\psi}$ this can easily be solved for $\underline{h}$.

What is involved in setting $\psi = \bar{\psi}$? Recall that ψ bears the dimension of an interest rate and is a shadow price on funds. It is, in principle, knowable by adding a supply of funds schedule - i.e. determining F^o. This is, however, beyond our scope and our plan is to search for that $\bar{\psi}$ which will minimize (11).

From the system above, we know h. To calculate $\hat{\lambda}_i$ and hence h we insert the h_i's into θ and solve:

$$(24) \quad \hat{\Lambda} = \theta^{-1}\beta \, .$$

Table X presents these results. The first column is actual shares, the second is the estimated shares generated by this procedure and the third contains a variable RISK. The i^{th} observation of RISK is:

$$(25) \quad RISK_i = h_i \left(\hat{\lambda}_i\rho^*_{ii} + \sum_{j \neq i} \hat{\lambda}_i\hat{\lambda}_i\rho^*_{ij} \right)$$

Table X

Actual and Estimated Shares for the U.K. Sample

Country	Actual Share	Estimated Share	h_i	RISK
Australia	.0487	.0535	62.0114	-.2918
Irish Republic	.0086	-.0003	8.9786	-.0399
New Zealand	.0007	.0098	-8.1859	-.0034
South Africa	.0090	.0072	-1.0375	-.0019
Africa	.0010	-.0015	7.1722	-.0035
West Indies	-.0133	-.0125	36.381	.1046
Hong Kong	.0007	.0045	-2.6011	.0015
India	.0037	-.0059	13.9566	-.0232
Malaysia	.0038	.0089	.5431	-.0035
Canada	.0113	.0143	-46.286	-.0717
United States	.0532	.0625	.3314	.0191
Denmark	.0014	.0063	10.9198	-.0174
Switzerland	-.0047	.0016	.9021	.0089
Belgium	.0236	.0298	-1.6948	-.0307
France	.0136	.0103	7.0283	-.1130
Italy	.0054	.0024	29.8124	-.0423
Netherlands	.0207	.0197	3.3978	-.1645
Germany	.0403	.0344	-14.238	.0133
South America	.0096	.0052	-1.6137	-.0057
United Kingdom	.7527	.7490	-1.0315	-.8819

which is the attitude to risk in the ith country times the ith country's contribution to total firmwide risk. Comparing the first two columns of the table, the differences between actual and estimated shares are (not surprisingly) rather small. The U.K. total (i.e. the home-foreign investment split) is predicted quite accurately while India and Switzerland are under and over-estimated respectively and these appear to be the worst estimates. The method we used to generate these shares is an approximation to the full likelihood method; ideally, the estimated shares should be such that the likelihood function $L = 0$ and in this case L is of the order of about 10^{-4} which is quite close and accounts for the minor deviations between actual and estimated shares.

This exercise has turned the model on its head and it is important to be quite clear methodogically about precisely what we have done. Our dissatisfaction with the measure of risk and the performance of the model using that measure has inclined us towards developing further information on risk. The particular step taken here has been to (roughly) fill in the gaps between actual and estimated shares by use of the dummies, h_i. That is, we have (in effect) asked what the h_i's (and hence, total risk) must be to generate accurate predictions of the shares allocated to the countries in the sample. This merely postpones the exercise back one step, for as the terms RISK now fully explain and determine shares, we must, to explain share allocation, explain RISK. This problem we take up next in the next section.

(iv) Explaining RISK

We have determined the h_i, terming them attitudes to risk and they are hypothesized to represent some subjective reassessment of the measured risk made by the firm to account for the difficulties of adjusting to disturbances in the host, foreign market. Thus, the h_i are contingent on the measured risk terms and it would thus seem appropriate to explain the two jointly; i.e. explain RISK.

The choice of variables to explain RISK is subject to a number of difficulties, the most important of which is lack of data. Many variables which we would wish to put in are simply unavailable and many others are available only as rather crude summary measures. There are really three sets of variables one would like to use. In

the first place, much of what an executive feels about a country he has little experience in is based on crude, casual empiricism and the opinions (however informed) of colleagues and associates. There may be a good deal of truth in the proposition that the risk an executive feels making an investment decision depends on what he has read the morning before in the Financial Times on the ride in from Hertfordshire. Such transitory, probably ill-expressed prejudices and feelings are completely unquantifiable.

A second set of variables are, shall we say, socio-political variables reflecting the state of society in the host, its political situation and potential changes in both. Such variables may create the transitory feelings and prejudices referred to above but they may also reflect fundamental social and political change which is germane to the firm and its operations in the host country. Such variables can occasionally be obtained and we have managed to isolate a few. As such a study has interest in its own right (c.f. the efforts of Stevens, 1969), we postpone it to the next chapter and consider it in a somewhat broader perspective.

Finally, there are a set of economic indicators of the host's economic performance and potential which are directly germane to the expansion decision of the firm. Ideally, one would expect decision makers to concentrate (at least consciously) on these and so they will form the subject of the empirical study in this section. As the investment decision spans a horizon of a number of years, committing the firm to relatively illiquid plant and equipment assets in the host, one would expect to commence one's search with longer run, 'fundamental' economic indicators rather than short run deviations, isolated incidents and so on.

Given the data on these variables and given the further problem that the variables used must be available for the rather wide spectrum of countries represented in our sample, the measurement of these indicators will be really rather crude. In what follows, we shall constrain our discussion so as to limit data choices to variables actually available.

The first and most obvious data choice harks back to our earlier discussion of risk and the familiarity the firm feels for the host country environment it operates in. The more extensive are the firm's operations in the country in question and the longer have such operations been going on, the more 'native' the firm will be and feel; consequently, the less adjustment constraints it will feel that it faces and the lower its perceived risk. An obvious empirical proxy for this variable is the cumulative value of direct investment in plant and equipment in the country in question. Such a variable reflects both time and, more importantly, extent of commitment in the host; we denote it as VALDI. Such a measure has been obtained for 1970 (the year previous to the share estimates) for all twenty countries in the sample from the Business Monitor; a comparable home investment figure measuring the book value of capital assets in the U.K. was obtained from the Census of Production*.

A second variable of some importance will obviously be exchange rate variation (e.g. Aliber, 1976). Exchange rate variations affect the sterling value of repatriated funds and, given the locations of

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* This home investment figure will obviously dominate the rest and we shall have to carefully consider the results when the U.K. observations are omitted to ensure that the results are not dominated by that figure.

the firm's funds throughout the world, the firm's net worth. One would expect that this variable will be positively associated with RISK. Denoted EXVAR, we have approximated it by the coefficient of variation of mid-point yearly observations of the exchange rate from 1967 to 1971 from the U.N. Statistical Yearbook. It should be noted that the earnings data used to make up means and variances-covariances of rates of return are already expressed in sterling so that exchange rate variations have already made their impact felt in our measure of risk. Hence the lack of significance of EXVAR (should it come to pass) cannot be taken to imply that exchange rate variation has no effect on risk; rather, this variable corresponds to the hypothesis that exchange rate variation per se affects risk in addition to the impact it makes on earnings streams when converted into sterling. EXVAR is available for all countries except Africa and South and Central America; the West Indies has been proxied by the Jamaican exchange rate.

A third set of variables worth considering are those reflecting inflationary conditions in the host country. Inflation complicates business forecasting, cost accounting (and hence profitability depending on whether historic or current cost accounting is used) and so on. To a certain extent such complications may be reflected in the rate of return data and in exchange rate movements but it is worth considering inflation as an independent force in its own right. From the U.N. Statistical Yearbook it proved possible to gather data for all countries except Africa and South America (the West Indies is again proxied by Jamaica) on both wholesale and consumer price indices. For each measure, two permutations of the data were developed:

first differences between the index in 1971 and 1970 (denoted WP71 and CP71) and average first difference between 1965 and 1971 (WPBAR and CPBAR).

Finally, a fourth set of variables were tried relating to the development and growth of the host country. The argument here is perhaps somewhat weaker than those which have gone before. A less developed country may be considered risky simply because it is less developed; the lesser stage of development may imply a lack of various ancilliary services which the firm needs access to on a contingency basis. This absence restricts the firm's degrees of freedom in reacting to disturbances. Similarly, a lack of dynamism or growth in an economy may mean a lack of profitable alternatives to a firm seeking to diversify within the host to offset risk. The index of development used is per capita income (PERCAP), 1970, obtained from the U.N. Statistical Yearbook for all countries excluding Africa and South and Central America. Two growth variables were used: GI71 and GIBAR, being respectively the first difference of the index of industrial production between 1971 and 1970 and over the interval 1967-1971 for the host country in question. The data were unavailable for Africa, the West Indies, Hong Kong, Malyasia, and South and Central America.

Thus, the following variables: VALDI, EXVAR, WP71, CP71, WPBAR, CPBAR, PERCAP, GI71 and GIBAR are hypothesised to be possible determinants of RISK. Without any guidance on the possible functional forms relevant, regressions were run on simple linear combinations of these variables; for EXVAR, WP71, CP71, WPBAR and CPBAR we expect, a priori, a positive coefficient. Table VI presents correlation matrices for the variables for the several sample sizes.

Table XI

Correlation Matrices for the Various Hypothesized Determinants of RISK for various sample sizes

(i) For Full Sample of Twenty

	VALDI
RISK	-.9249

(ii) For Sample Excluding Africa and South and Central America

	RISK	VALDI	EXVAR	PERCAP	CP71
RISK	1				
VALDI	-.9252	1			
EXVAR	.2308	-.3987	1		
PERCAP	-.1103	.0219	.3881	1	
CP71	-.3607	.3471	-.1592	.0982	1
CPBAR	.2116	-.1127	.1157	.0735	.1937

(iii) For Sample Excluding Africa, the West Indies, Hong Kong, Malaysia and South and Central America

	RISK	PERCAP	GI71	GIBAR	VALDI	EXVAR	WP71	CP71	WPBAR
RISK	1								
PERCAP	.0396	1							
GI71	.3018	.2422	1						
GIBAR	.4144	-.0814	.6364	1					
VALDI	-.9376	-.0522	-.3296	-.5034	1				
EXVAR	.3520	.3364	.5903	.6176	-.4601	1			
WP71	-.3552	-.5477	-.2834	-.4860	-.4747	-.5864	1		
CP71	-.3784	-.1476	.1057	-.0315	.3614	-.1876	.3564	1	
WPBAR	-.1940	-.2479	-.0937	-.0198	.2153	-.4698	.4285	.3735	1
CPBAR	.2866	-.0651	-.1247	-.2941	-.1431	.0656	.1270	-.2756	-.0931

Table XI (continued)

(iv) For Sample Excluding Africa, the West Indies, Hong Kong, Malaysia, South and Central America and the U.K.

	RISK	VALDI
VALDI	-.4674	1
EXVAR	-.2472	-.0550

Scanning Table XI, one thing is apparent above all else and that is the close negative relation between RISK and VALDI. It is important to realize that this is not just the naive predictor: VALDI is the book value of assets in the host in 1970 while RISK explains NKO. VALDI is not even the integral of NKO over the past years for NKO is not plant and equipment expenditures however close PE and NKO may be. Notice however, that a fair amount of this strong negative relation between VALDI and RISK is provided by the outlying observation of the U.K.; the partial correlation between the two drops from -.9 to just under -.5. The other variables are all relatively weak. EXVAR appears positively correlated to RISK, as are GI71, GIBAR and CPBAR; CP71, WP71, and WPBAR tend to be negatively related. In Tables XII and XIII regressions are presented although the results involving CPBAR and WPBAR are suppressed as they appear little different from results using GP71 and WP71. The difference between the two tables is that the latter contains equations without a constant.

The first ten estimated equations on both tables strongly reflect the information generated in the correlation matrices. The sole and dominant explanation of RISK is VALDI and that explanation is quite

good; it is strong and robust enough to survive sample size changes, constants and the additional explanatory variables. Variations in VALDI explain about 85% of the variations in RISK. None of the other explanatory variables contribute and all are insignificant except for EXVAR in Equation 3 of Table XIII and GIBAR in Equation 8 of the same table; EXVAR is negatively signed which is against a priori expectations). Equation 11 in both tables contains an estimated equation with the U.K. excluded as well as several other countries. The interest in this particular equation is that explanation is reduced but not so terribly dramatically for the R^2 remains above .5 but, in addition, CP71 takes on significance in Table XIII when the constant is supressed. The extreme outlying observation of home capital stock clearly makes a difference to the results as Equation 11 shows; nevertheless, the importance of VALDI is apparent and is sustained albeit at a less dramatic level.

It thus appears that VALDI is the prime and important determinant of risk, of that risk a firm feels when it allocates investment shares to particular host countries. VALDI represents the familiarity a firm feels in a market which is gained by prolonged and intensive experience in operating in that host market and this is very much what we expect.

This testing of the determinants of risk and hence of investment shares has been, admittedly, rather rough and ready for the data available to us are poor on a cross country basis. While we have found good empirical support for the arguments we have been making about the risk of foreign operation a residual of dissatisfaction must remain. What we have shown is that share allocations tend - for good reasons associated with risk - to be made favouring countries where

Table XII

Regression Results Explaining VALDI with Constant

	c	VALDI	CP71	EXVAR	PERCAP	GIBAR	GI71	WP71	R^2	Countries Excluded
1	-.0320 (-1.55)	-.000020 (-9.75)							.856	Africa, South/ Central America
2	-.009 (-.1572)	-.000020 (-8.76)	-.4190 (-.4337)						.857	"
3	-.0287 (.6971)	-.000021 (-10.10)		-1.501 (-1.673)					.878	"
4	.0543 (.8160)	-.000021 (-9.19)	-.4555 (-.4973)	-1.512 (-1.642)					.880	"
5	.5759 (.8187)	-.000021 (-8.71)	-.4289 (-.4490)	-1.403 (-1.324)	-.000004 (-.2341)				.881	"
6	-.0285 (-1.53)	-.00002 (-10.32)							.855	None
7	-.0471 (-2.11)	-.00002 (-9.728)							.879	Africa, Hong Kong, Malaysia, West Indies, South/Central America

Continued.....

Table XII Continued

	c	VALDI	CP71	EXVAR	PERCAP	GIBAR	GI71	WP71	R^2	Countries Excluded
8	.0168 (.1732)	-.00002 (-8.569)				-1.1738 (-.6776)			.883	Africa, Hong Kong, Malaysia, West Indies, South/Central America
9	-.0448 (-1.158)	-.00002 (-8.851)					-.0752 (-.0770)		.879	"
10	-.0056 (-.1118)	-.00002 (-9.11)						.9048 (1.065)	.887	"
11	.0884 (.8173)	-.00018 (-2.837)	.0041 (1.8194)			-1.8889 (-1.1312)			.542	" plus United Kingdom

t-values in parentheses.

Table XIII Continued

	VALDI	CP71	EXVAR	PERCAP	GIBAR	GI71	WP71	R^2	Countries Excluded
8	-.00002 (-10.52)				-.8821 (-2.26)			.883	Africa, Hong Kong, Malaysia, West Indies, South/ Central America
9	-.00002 (-10.19)					-.9809 (-1.655)		.865	"
10	-.00002 (-7.863)						-.5448 (-.9500)	.848	"
11	-.00015 (-2.95)	.0049 (2.43)			-.5659 (-1.40)			.5117	" plus United Kingdom

t-values in parentheses.

Table XII Continued

	c	VALDI	CP71	EXVAR	PERCAP	GIBAR	GI71	WP71	R^2	Countries Excluded
8	.0168 (.1732)	-.00002 (-8.569)				-1.1738 (-.6776)			.883	Africa, Hong Kong, Malaysia, West Indies, South/Central America
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10	-.0056 (-.1118)	-.00002 (-9.11)						.9048 (1.065)	.887	"
11	.0884 (.8173)	-.00018 (-2.837)	.0041 (1.8194)			-1.8889 (-1.1312)			.542	" plus United Kingdom

t-values in parentheses.

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Table XIII Continued

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11	-.00015 (-2.95)	.0049 (2.43)			-.5659 (-1.40)			.5117	" plus United Kingdom

t-values in parentheses.

the firm's commitments are already rather extensive. Clearly, at a somewhat removed level, the determinants of investment lie in these long years of steadily expanding operations in hosts; years of failure and success and, more important, years of patient information gathering and confidence-building. Somehow, the investigation must be pushed back even further and one must hope to gather perhaps even more fundamental information on RISK, VALDI and consequently, share of investment allocated to particular countries. This is a subject we shall briefly develop in the next chapter.

(v) The Portfolio Model of International Investment: An Assessment

We have come quite some way in the last two chapters and, while some very interesting paths remain to be illuminated, it is important to stop and evaluate what we have done. More precisely, we must evaluate the hypothesis we set out to examine and draw our conclusions about the usefulness of this portfolio model of investment.

The hypothesis was that firms make a centralized decision on the allocation of funds for direct investment under conditions of uncertainty as described by a portfolio model. To test this proposition a sample was constructed in order to predict the aggregate investment of all U.K. (and U.S.) multinational firms to 19 (26) foreign countries plus home investment. Despite explicit recognition of possible aggregation biases, such a sample was taken up to use to test the hypothesis. A number of simplifying assumptions were made in order to render the model testable: global investment totals were not determined but taken as given and stochastic constant returns was

imposed upon our functions. No explicit correction was made for data distortions, especially those arising from transfer pricing for this was felt to have but a small impact on aggregate data. Finally, the independent variables, means, variances and covariances, were calculated in straightforward ways from a series of ex poste rates of return earned by all U.K. (U.S.) firms in the host over the past seven or eight years.

At face level, the model cannot be said to have found support in the data. Initial testing on foreign investment alone and foreign and domestic investment using the model exactly as originally specified generated uniformly poor results. The tests including home investment produced particularly shocking results, for home investment was notoriously under-estimated. As a predictive tool, the simple portfolio model must be rejected out of hand and our hypothesis must be resoundingly denied.

Nevertheless, throughout the testing, doubt was raised about the appropriate approximation of ex ante variables. The means used are theoretically the return the firm expects to gain for a particular expansion of a plant, and the variance-covariance matrix reflects the net distortions and deviations for this predicted rate of return which the firm expects. It is not clear firstly that these variables can properly be approximated from past data reflecting ex post returns from years previous and secondly, given that we must do this, it is not clear what is the appropriate way to use such ex post data to approximate the ex ante variables. This latter question is the really important one for one is unable to observe the expected parameters the firm uses in making its decisions.

Investigation of this line of thought proved rather productive and generated the interesting empirical results of this study. The easier variable to deal with is means, for there are a number of plausible ad hoc manipulations one can make to generate alternative approximations. A number of these were tried with rather surprising results. Various proxies had no impact on share estimates. That is, the model remained insensitive to various possible specifications of expected returns. From this emerged the conclusion that foreign investment might be guided primarily by risk and that expected returns might play but a minor role in the international allocation of direct investment.

Interest accordingly switched to the specification of the risk variables. Conceptually, the variance was used as a measure of such risk. The firm was taken to construct an expected value of rate of return and then consider possible disturbances from that rate of return. For each disturbance, a probability was constructed, a gross deviation from the expected return was estimated and then the firm considered the possible adjustments that it could make in the face of this disturbance. This calculation conceptually leads to a net deviation from the expected return and the expected value of the square of these net deviations then measures risk and its possible expected consequences to the firm. The principal problem with foreign operation was identified to be the adjustment by the firm to adverse circumstances. That is, foreign markets are subject to stochastic disturbances much as the home market is and there is no reason to single out particular countries as more or less subject to such shocks. What is really important is not so much the shock but what the firm feels that it can do about it; i.e. the correction to gross deviations it can make.

This hypothesis about foreign risk ultimately found quite good support in the data and constitutes the principal and important empirical result of the study. It, however, took some time to reach this finding, and it is valuable to trace the path followed somewhat closely for at one, well-defined point, we left off testing the hypothesis directly and, as it were, stood the model on its head.

Faced with the problem of measuring risk, a number of difficulties made themselves apparent. The principal problem was that ad hoc manipulations, while being straightforward and familiar for means, are difficult to perform with variances. A number of possibilities such as the semi-variance are open to the researcher in these matters; our path, however, took us the first steps away from the model. Rather than manipulate the variance-covariance matrix blindly hoping to be fortunate enough to stumble upon something which worked, we chose to introduce additional information into the model. Such additional information came from manipulating the risk terms multiplicatively - essentially adding dummies in a rather peculiar fashion.

The first efforts were rather modest. Home investment was posited to be fundamentally safer than <u>all</u> foreign investment and a search was made for a scalar <u>fraction</u> to be used to modify the home investment risk terms. This turned out to be rather successful - fractions were found which enabled us to accurately separate out home from all foreign investment and predict the split between the two rather accurately. Thus, emboldened, a full scale experiment was tried. Concentrating on the U.K. sample alone (to minimize costs of calculation), a set of twenty dummies was added to the model, each pertaining to the risk measured for each country. The product of

the dummy and the risk term - so called RISK - proved to be powerful and complete determinants of shares. That is, the twenty dummies (not entirely surprisingly) enabled us to predict the allocation of investment as accurately as we cared to approximate the estimation of the dummies.

It is important to be clear about the precise methodological implications of this step. At this point in the testing, we were no longer testing the model so much as doing as much as we could to make it work. Put slightly differently, the use of the dummies specified our ignorance and the failure of the model. The RISK terms are the variables which we needed to have found in the first place to make the model work and to find support for it in the data. The next step, obviously, was to try to explain these variables. In some sense, investment is being made on the basis of information or decision rules which the simple portfolio model reflects only imperfectly if at all; RISK quantifies this information and its explanation is clearly crucial to an understanding of the decision rules actually being used.

Explanation of RISK proved to be highly successful and this explanation illuminates very clearly just what might be underlying the allocation of foreign investment. It turned out that familiarity with the host market (as measured by the book value of assets in the host country) explained total risk rather well. Including the U.K. observation, roughly 85% of the variation is RISK was explained by VALDI. This difference or reduced explanation is not really as important as it might seem on face value. The U.K. book value of assets figure reflects the book value of the assets of <u>all</u> (not just

multinational) U.K. firms and undoubtedly is far larger than the book value of home assets of the firms in our sample. On that account the U.K. observation should be excluded as its dominance clearly dramatically improves the results. On the other hand, home markets are relatively safe vis-a-vis all foreign markets, and the artificial expansion of the U.K. figure resulting from the inclusion of non-multinationals is really a step in the right direction emphasizing this relative risklessness. In short, the explanation of RISK by VALDI is large and important despite some data problems involved in the test.

This is rather a rich catch. In terms of our hypothesis and the alternative hypothesis suggested, it enables us to say a number of interesting things. The important point to see, I think, is that our findings that firms allocate shares to areas where they have a large presence and in which they are familiar with the environment can be equally well explained by the following rule of thumb: allocate investment shares in proportion to existing presence (as measured, say, by the book value of assets) and then make small, minor modifications to allow for relatively high or low expected returns and perhaps some unusual risks (such as expropriation or something similarly drastic). Our empirical results cannot discriminate between such a rule of thumb hypothesis and the extensions of the portfolio model we have described in the last two chapters. This is crucially important, for it enables us to assess the hypothesis we started with and come to a firm set of conclusions about investment behaviour.

The hypothesis underlying the model must be rejected. One is a little reluctant to be emphatic about it given the data problems and the ex ante variable problems we faced, but these empirical problems do really weigh against the possibility of the model ever being used to predict (on a cross-section basis) share allocations. Having made the rejection, we turn to the alternative hypothesis that the firm cannot optimize and that it must construct some rule of thumb to co-ordinate its activities within the vast empire it owns and controls. The rule of thumb it clearly adopts is that stated just above: allocate and expand where presence is largest, subject to an allowance for unusual and startling changes of circumstances.

But, this is not really the whole story. Such a rule of thumb could well have been adopted in the beginning and its importance celebrated now. This is where our model has some considerable value. The point is simple. Satisficing behaviour and rules of thumb are not particularly compelling hypotheses to commence a study with. Any number of them, each as superficially plausible as the next, can be taken as starting points and the real interest is not so much the implications of using such a rule (as these are usually pretty self-evident from the start) but why such a rule is interesting. I think our work with the portfolio model suggests a good answer and justification for the particular rule of thumb we have suggested and found support for.

The answer evidentally lies in the risk of foreign operation. The costs of adjusting abroad are great and, in particular, the firm faces the problem of reacting to and adjusting to the effects of disturbances. What is more, such adjustment must and can be made

by co-ordinating the activities of plants owned and controlled. Adjustment is easier in those markets where the firm's presence is large and important and, quite naturally, it expands in these markets more readily and quickly than elsewhere.

While this is an interesting and perhaps important set of results and further hypotheses, one must feel that the story is only just beginning. Valuable groundwork has been made and some real foundations have been laid in the understanding of the foreign expansionary investment decision process, but the plot is beginning to thicken and is worth further speculations and explorations to see how the story will run and perhaps how it will ultimately turn out.

(vi) A Brief Exploration of the Alternative Hypothesis

Our hypothesis is that firms expand in markets they are familiar with, by and large leaving aside considerations of expected returns. Such familiarity we have measured by a variable reflecting both time spent in the market and depth of commitment; i.e. VALDI. There are thus two issues to explore: why such risk averse behaviour, and why is VALDI a good variable to use to capture such phenomena?

The risk of operating in foreign markets is, we suggested (Chapter I), the problems of adjustment the firm faces to given disturbances. There are any number of events, anticipated with some degree of confidence or totally unanticipated, which can disrupt production plans or distribution policies and networks. It may be that particular economies and particular markets experience more of

such events than others, but there is no reason to believe that across the advanced countries in any given product market substantial variations exist, and similarly across less developed countries. It is hard to see such a substantial inter-country variation in random shocks as would explain the relatively high inter-country variation in investment, sales or any other measure of 'presence' by multi-national firms. The crucial inter-country variation is that the structure (political and economic) of such economies differs and, consequently, firms must seek out information on these details and learn to adapt to their environment.

It is thus not the shocks per se, nor the frequency which account for inter-country variation in presence, but the ability, confidence and speed of reactions to these shocks by firms operating in these markets. Such information and confidence of action comes, of course, after a long learning period. The speed of such learning can be taken to depend on three factors: length of time of operation, extent of operation and diversity of operations. Length of time is obvious, but needs to be qualified immediately by considerations of the extent of commitment. Partly, firms with small commitments may not notice or pay close attention to developments in the market and partly small operations may have the flexibility to avoid problems without dealing in depth with them. A large operation, however, involves an important commitment by the firm and events affecting them are liable to be noticed and acted upon. Thus, long standing operations of large size should lead to relatively quick learning and consequently, less expected risk. Diversity of operation reduces that risk somewhat by the usual pooling of risks inherent in a diversified enterprise.

Furthermore, a diversified firm may experience the same shock in a number of different markets, getting a better perspective of both the problem and the required adjustment. In any event, time, size and diversity all determine learning and an accessable and obvious proxy is VALDI.

The observation that large investment goes to areas with large extant book values of assets might perhaps be explained by replacement investment which might follow that pattern if depreciation was roughly proportional (across countries) to the value of assets. This competing hypothesis also finds support from the data; it is, however, theoretically unacceptable and this is for two reasons.

In the first place, the notion of replacement investment does not lie easily in a world of continuing technical advance. As a machine wears down, parts begin to deteriorate, requiring replacement or servicing to keep the machine at peak efficiency. Presumably, at some point the machine becomes so worn down that purchasing a new machine becomes more economic. A steady flow of 'replacement investment' is thus required to pay off the machine and then maintain it at peak efficiency. In a world of technical advance, however, such a simple story is not really very accurate. Such a world is characterized by new and better machines and maintaining existing productive capacity is not simply a matter of maintaining a machine until it is too worn out to make it worth continuing. Rather, the introduction of new machines speeds up economic obsolescence. For a firm growing, replacement investment is part and parcel of expansionary investment, for both maintenance of existing capacity and expansion of that capacity involve the introduction of new machines. It is

neither conceptually nor empirically possible to separate out the two flows.

Supposing, however, technology and growth are stagnant so that the concept of replacement investment has some meaning. It is not entirely clear (a) that it should be some proportion of existing stock, nor (b) that the firm should actually maintain capacity in a particular market. Point (a) follows from the simple observation that depreciation (and hence replacement) varies both with utilization rates and types of machine; the proportionality assumption is merely one of convenience. Point (b) is rather more important. Consider again that we are dealing with a diversified firm and that such a firm controls and co-ordinates activities between markets, expanding and contracting in particular markets to maintain overall profitability.

The amount of replacement investment is thus subject to the same kind of economic forces as expansionary investment (see also Feldstein and Rothschild, 1974) and it is implausible, a priori, that the optimal policy is simply to maintain capacity at each plant. Rather, profit maximizing strategies (even under uncertainty) can be expected to lead to expansion in some areas (i.e. replacement investment plus positive net investment) and run down in others, exploiting the advantages of unbalanced plant expansion (Beckinstein, 1976). Thus, replacement investment should be subject to essentially the same forces as expansionary investment and these, we have argued, are risk aversion and differential risk - in short, the hypothesis we have maintained.

Before running a few regressions confirming the hypothesis, it is worth examining the VALDI - shares relation in the context of

the model explored in this chapter. To recount, we developed a set of dummy variables - the h_i's - and an associated measure of RISK which completely explained shares. RISK, in turn, was explained by VALDI. On Table XIV the correlation coefficients between these variables are set out, both with and without the U.K. observations. The relations between VALDI and shares is over .9900 with the U.K. included, dropping to about .7000 when the latter is excluded. This is the fundamental relation of importance and it is robust enough to survive the sample re-specification more or less intact. It is important to notice from both tables that the h's are not simply dummy variables which thereby fill in the difference between estimated and actual shares; nor is there any strong relation between errors of estimation and shares (the large negative relation in Part i of the table between λ_i and $(\hat{\lambda}_i - \lambda_i)$ is due to the gross under-estimate of the U.K. share). Finally, it is worth noticing that the relation between VALDI and shares is stronger than the two relations between VALDI and RISK and RISK and shares. This is prima facie support for our view that RISK is a reflection of the underlying relation between VALDI and shares.

The hypothesis that VALDI and not expected return explain shares should by now be well established, but for the sake of completeness we include Tables XV and XVI which show the formal regression with and without the U.K. On Table XV, the observations run over all shares, only N-1 of which are independent. Consequently, one observation is superfluous reducing the degrees of freedom and increasing standard errors. Consequently, the t-statistics as shown are biased upwards. As this cannot conceivably affect the results (as can be seen by inspection), no attempt was made to correct this.

Table XIV

Correlation Co-efficients between: H, λ_i, $(\lambda_i - \hat{\lambda}_i)$, VALDI, RISK and MEAN

(i) For Full Sample of Twenty Countries

	h	λ_i	$(\hat{\lambda}_i - \lambda_i)$	VALDI	RISK
h	1				
λ_i	-.0503	1			
$(\hat{\lambda}_i - \lambda_i)$	.0696	-.8967	1		
VALDI	-.0646	.9969	-.9150	1	
RISK	-.0675	-.9385	.8114	-.9250	1
MEAN	-.2388	.0097	.0227	.0124	.0716

(ii) For Sample excluding United Kingdom

	h	λ_i	$(\hat{\lambda}_i - \lambda_i)$	VALDI	RISK
h	1				
λ_i	.2002	1			
$(\hat{\lambda}_i - \lambda_i)$	.0144	.2334	1		
VALDI	.1741	.6904	-.4113	1	
RISK	-.3372	-.6024	-.1609	-.4557	1
MEAN	-.2385	-.0437	.0857	-.0522	.2155

In no case do any of the three proxies for expected returns make an impact on the high explanation of shares by VALDI. Together with an insignificant constant, variation in VALDI explains 99% and 45% of the variation in shares. All of the other proxies tried earlier for expected returns were tried but none made any impact and frequently the sign was incorrect.

The conclusion is that our alternate hypothesis is not rejected. The results on Table XVI must be considered somewhat more satisfactory as they do not include the extreme observation of the U.K. which is subject to upward measurement error of VALDI. Contemplating that table, it is clear that this proportionality rule cannot be considered fixed - only 45% of the variation of shares is explained. Nevertheless, it is also clear that our hypothesis has an important basis in reality.

Table XV

O.L.S. Regressions Explaining Shares for Full Sample

CONSTANT	VALDI	MEAN	M70	MA70	$\bar{R}^2$
.0049 (1.592)	.0000178 (53.732)				.9935
.0059 (.7708)	.0000178 (52.246)	-.000106 (.1389)			.9931
	.0000178 (53.302)	.000432 (1.368)			.9933
.0068 (.9019)	.0000178 (51.4040)		-.000177 (.2712)		.9931
	.0000179 (54.147)		.000357 (1.3017)		.9932
.0052 (1.6018)	.0000178 (52.332)			-.0000026 (.3885)	.9931
	.00000179 (55.713)			.000000084 (.0131)	.9935

Table XVI

O.L.S. Regressions Explaining Shares for Sample Excluding U.K.

CONSTANT	VALDI	MEAN	M71	MA70	$\bar{R}^2$
-.00160 (.3850)	.0000393 (3.9346)				.4458
-.00132 (.1691)	.0000393 (3.8099)	-.0000299 (.0424)			.4113
	.0000385 (4.2997)	-.000129 (.3458)			.4452
-.00441 (.5058)	.0000405 (3.7548)		.000232 (.3690)		.4162
	.0000372 (4.4808)		-.0000449 (.1487)		.4437
-.00163 (.3597)	.0000393 (3.7333)			.00000018 (.0184)	.4112
	.0000365 (5.3880)			.00000062 (.1054)	.4453

Chapter V

Risk and the Political Structure of Host Countries

(i) Introduction

Our study of direct investment has yielded a reasonably consistent picture of the foreign investment behaviour of firms. Multinational firms (and, in particular, U.K. based multinationls) appear to display a certain amount of inertia in their foreign expansion policies, investing and growing in economies where their operations are already well established. Expected returns appear not to play a large role in such allocation decisions, and the obvious implication is that risk plays a dominating role in the foreign investment decision. This is a matter worth further exploration and in the final chapter of this thesis we hope to make some small start down this path, identifying some of the salient characteristics of the economies which host well-established U.K. multinationals. That is, we shall isolate some of the characteristics of host countries which appear conducive to the establishment and growth of large U.K. multinational subsidiaries.

The extent of integration of foreign firms into a host market depends on a complex of factors not easily measured nor often consciously in the minds of decision makers themselves. The problem of adjustment to disturbances is as much a matter of the limited information of decision makers as it is a matter of their confidence, and these are not easily explored on either a theoretical or empirical plane. To make a start, we must limit the domain of our enquiry, concentrating attention on one particular class or subset or variables. We propose to classify possible characteristics into one of two groups: variables pertaining to host economic structure and those pertaining to the

political structure of the host country. This distinction is made and explored in Section (ii) below.

In this limited exploration, we shall concentrate on those elements of political structure which we believe to be germane. In Section (ii), we shall argue that such political variables operate by affecting (a) the stability of the host government; (b) external relations between the host and all other countries especially the parent country; and (c) domestic order within the host. In the last of these, domestic order, both outbreaks of domestic disorder as well as the government measures taken to limit them must be considered. A number of variables have been collected which belong to these various classes, and, in Section (iii), they are presented and discussed. These particular variables will add considerable richness to the initial analysis of Section (ii), and we shall be able to make some firm a priori predictions concerning the joint impact of these political variables.

These two theoretical sections lead, finally, to full scale multivariate testing of the role of political factors on multinational presence in the various hosts. Section (iv) will present the results we have obtained and lead us to some conclusions in Section (v) about the role of host political structures on the perceived risk and hence the international expansion of U.K. multinational firms.

(ii) Economic and Political Structures

The extent of the commitment to a particular host by any multinational firm depends on the expected risk it perceives, and hence on

its confidence in its ability to adjust to the changing circumstances of that market. Such adjustment evidentally depends on the particular skills, goals and structure of the firm; however, it also depends on the characteristics of the environment itself. Two avenues are thus open for research. On the one hand, one can inquire into the characteristics of the firms who happen to prefer a particular host, matching them to the characteristics of that particular market. On the other hand, one can ask what are the characteristics of hosts which multinational firms, on average, appear to prefer.

Our investigation here will concentrate on the latter, i.e. on identifying host country characteristics which U.K. firms on average appear attracted to. Evidentally, such markets will be populated with relatively large numbers of U.K. firms, at least some of whom will have extensive commitments there. Thus, preferred characteristics will be revealed by using some measure of foreign presence. Any number of characteristics of host markets present themselves for consideration, and we shall class them into two broad categories - those parts of the economic structure of the host and those pertaining to its political structure.

The firm's principal purpose in operating in a particular market is production and distribution, and by economic structure we refer to the network of interaction between the firm and consumers, rivals, suppliers, and the government. Such relationships take on particular forms depending on the institutional context in which they occur, but they all have the common element of direct interaction between two (or more) parties, one of which is the firm. For example, interaction with the government involves paying of taxes, sale or purchase of goods, regulations in which other transactions occur, and

so on. Interactions with rivals involve competition or collusion in certain transactions with other parties, such as consumers or suppliers.

The precise role played by elements of the host political structure is rather different from such transactional variables. Political variables are primarily outside the control of the firm (although perhaps not outside its influence) and so do not reveal themselves immediately in the course of transactions. Rather, they form the context within which such transactions are conducted, remaining in the background and adding additional costs to every interaction and aggravating the informational problem of the firm. They are, in some sense, a cost penalty for operating somewhere other than in the U.K. All diversified firms face the problem of entering into market transactions outside their home market base; multinational firms have the additional penalty of doing so outside of the home country as well.

We shall centre our attention on these political variables. This reflects no a priori judgements concerning relative importance, nor even on separability. Rather, it is a recognition that in such a large, unexplored territory some partial analysis is necessary, and that political factors have been the subject of less analysis than economic factors. There are numerous case studies and hypotheses about the effects of particular economic environments on particular types of firms; political factors, on the other hand, have often been thought important but just as often left neglected.

We commence by dividing the elements of political structure germane to the problem into four groups: stability of government, instruments of law enforcement, domestic disorder, and external

relations*. Of course, each of the variables in these groups interact with those of other groups and particular variables may be classed in more than one group; nevertheless, the variables pertaining to each group have their own characteristics impact. After dealing with each singly in turn, we shall consider the interactions between groups.

Stability of government operation affects firms directly through its effect on the continuity of economic policy. Economic policy itself we have classed as an element of the economic structure of the host, but continuity is definitely political by our definitions. The important point to grasp here is that firms will be indifferent between having policy A or B (or policy A or B under the same set of government ministers) provided they can have either consistently. That is, while A may be preferred to B, B may be preferred to continually switching between A, B, C and D. Rapid turnover of ministers (regular or irregular) may bring into office a stream of officials, each differing in his/her views about policy, degree of corruptability, degree of competence, and political power base. Such a stream of redirection involves continual planning and costly information gathering which inhibits the construction of long range plans**. Irregardless of particular policies, instability of government increases transactions costs, inflates adjustment problems and increases perceived risk.

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* Instruments of law enforcement and domestic disorder are evidentally very closely related, but must nevertheless initially be distinguished. This arises because the signal sent by extensive resort to law enforcement is fundamentally ambiguous, whereas that sent by observed public disorder is not (see below).

** Nickell (1977) analyses a formal model which captures some of the spirit of this analysis. He finds that continual policy change inhibits the size and growth of optimal capital stock.

Domestic order is the second class of variables affecting risk and it contains two groups of variables - instruments of enforcement and domestic disorder. Let us consider each in turn and then both together.

Instruments of enforcement reflect the need and willingness of authority to intervene, overtly coercing subjects to follow acceptable or peacefull behaviour patterns. Their impact on decision makers within the firm is ambiguous and this is the familiar 'Dictator Problem'; i.e. are dictators good or bad for business? On the one hand, a government forced to resort to extensive (physical) coercion of subjects is evidently not riding a wave of popularity, not governing with the free consent of the masses. Its life is therefore, ceteris paribus, expected to be somewhat shorter and somewhat less pleasant. Expected discontinuity of rule is perhaps less attractive than actual discontinuity, for not only are there transactions costs from instability, but, in addition, there is the problem of determining when these additional costs will be incurred. On the other hand, active and wholehearted use of coercive tools evinces a desire to rule 'come what may' and a desire to rule with little interruption and, provided it is not optimism hopelessly misplaced, this cannot be a bad sign. If a government can survive and govern decisively, it provides the security and stability of rule needed to reduce the firm's perceived risk*.

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* In addition, it is possible that a well established dictatorship will give the firm some bargaining power inasfar as the firm can be used to sustain the tenure of the dictators. This may yield appreciable short term benefits but (for reasons to be developed shortly in the text) may yield undesirable long run consequences; that is, the firm's local existence may come to depend completely on the existence of the dictator.

Domestic disorder is the outward manifestation of citizens' dissatisfaction with current aims and methods of rule, reflecting the strength and durability of the fabric of the social and political structure of the host. Such disorder affects consumers and workers (or subsets of these groups), and so may enhance the unpredictability of transactions entered into by the firm. In addition, in a clash between governed and authority, the firm may be forced to take sides or may be given the appearance of having done so. Sitting on fences, let alone coming down on one side or the other of them, complicates ordinary transactions, and puts the firm directly into the arena of of domestic political activity. It is of some importance for the firm to operate in an environment of stability and maintain aloofness, for foreign firms are just too easy a target. Host countries exhibiting substantial disorder therefore discourage presence.

The net effect, domestic order, of instruments of enforcement and citizen dissatisfaction thus contains a certain ambiguity arising from the Dictators Problem. Obviously, countries suffering from substantial disorder are unfavourable to operate in; nevertheless, those governments which persuade the firm that they are in full control, may well succeed in attracting multinationals. Thus, we hypothesise that, for given levels of observed disorder, the adoption of effective instruments of enforcement increase the likelihood of multinational presence; for given levels of enforcement, the lower the level of observed disorder, the less overt conflict exists between rulers and ruled and the higher is the efficiency of enforcement, and so the greater is the likelihood of foreign presence.

This brings us, finally, to external relations between the host government and all others (especially the parent country of the firm).

Extensive external relations have three effects on the transactions the firm engages in. In the first place, external relations which are weak or hostile lead to the possibility of external intervention (armed or otherwise), disrupting the continuity of government and perhaps leading to widespread destruction of property and so on. Secondly, good external relations facilitate trading relations between the host and other countries; such trade is the life blood of intra-firm co-ordination and control, enhancing its ability to react everywhere. Finally, good external relations, especially with the parent country and other capitalist powers, provides some shelter for the firm. Such relations give such outside powers channels through which to pressure the host, protecting the firm (to some extent) from aggressive and unfavourable policy initiatives by the host.

Thus, stability, domestic order and external relations all singly and independently affect the risk of foreign operation. How do they jointly operate on perceived risk? Perhaps the simplest approach to answering this question is to illustrate the principles by means of simple illustrative scenarios. Consider a country with a certain amount of domestic disorder, (i.e. frequent violent political demonstrations) and a past history of relatively frequent changes in government. Such a country, on the face of it, is not a particularly attractive location for foreign investment*. Suppose,

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* The discussion in this chapter by and large ignores the special case where a host country may have some particularly unique advantages to the investor, for example, a scarce natural resource. In this event, investment will probably occur, but its size will be minimized and the firm will extensively monitor and probably try to control and internal politcal structure of the host to minimize possible disruption.

however, that the ruling junta runs a relatively tight political state, suppressing all but a limited amount of political disorder and forcing most of that underground. Furthermore, suppose (possibly as a result of a successful policy of this type) that the junta maintains good relations with nearby powerful nations and the parent country. These constitute powerful counterveiling considerations and may encourage foreign presence. If, on the other hand, internal security forces were clearly incompetent, inefficient or otherwise particularly disagreeable and poor relations between the host and parent countries existed, external intervention by neighbours and weak influence by the parent on the host conjoin with the strong possibility of discontinuity of rule to discourage foreign presence. Similarly, a well run country with poor external relations with major capitalist powers is a mixed blessing. If that country maintained strict internal control inhibiting foreign infiltration and if the government and citizens were in close accord, then external intervention and discontinuity is less likely and the country more attractive.

Without proliferating examples, it should be clear how these general groups of variables singly and jointly make an impact on the risk of foreign operation, and hence affect the presence of foreign firms. Such broad groups of variables illustrate the general principles of the argument, but within each group are a number of variables representing particular facets of the general group, and further progress cannot really be made without considering these in detail. This is the task we take up in the next section.

(iii) Some Characteristics of Host Political Structures

It is time to flesh out the skeleton of the argument and begin concentrating our attention on empirical work. We have succeeded in collecting a number of variables reflecting facets of host political structure for a wide range of countries (43) in which U.K. firms operate. We must group them in accord with our previous classification, evaluate their precise single and joint impacts and, finally, select an appropriate dependent variable.

VALDI (book value of assets controlled by U.K. multinationals in the host country, 1970) is the obvious choice of dependent variable, following from the work of previous chapters. This proxy, reflecting both time spent in the host and extensiveness of operations, is an ex poste reflection of the risk felt by U.K. decision makers involved in operating in a particular host and is thus a natural starting point. There is, however, a slight difficulty which might be illustrated by the following simple example. Suppose that (say) Hong Kong and the U.S. were exactly equally desirable in all respects for U.K. multinationals. Would we then expect equal levels of VALDI? Hardly. A presence of twenty million pounds in Hong Kong represents a dominating position in that market whereas it is merely a drop in the ocean in the U.S. A pattern of investment of twenty million pounds in each country would thus show, ex post, a high risk for the U.S. (hence the low presence relatively) which contradicts the premise that they are equally risky. What we evidently need is a measure of commitment relative to the size of the host; i.e. relative to the maximum commitment that can be made in the host. We have

therefore chosen to scale VALDI by the GNP of the host, generating:

$$\text{VALGNP} = \frac{\text{VALDI}}{\text{GNP}} \quad .$$

Let us turn to the independent variables reflecting host government stability*. Four variables have been collected: IET (irregular executive transfers), RET (regular executive transfers), ET (= RET + IET, total executive transfers), and PF (an index of party fractionalization). The first three variables directly reflect instability. Significance of total executive transfers implies indifference to the method of transfer; significance of regular and/or irregular transfers reflect both instability and sources. Together, regular transfer and party fractionalization imply a weakness in the structure of domestic political parties, with no one party strong enough to dominate the legislative branch much less to ensure stability or long-standing tenure in the executive. This weakness manifests itself in small majorities or minority governments and coalitions leading to high executive turnover, continual compromise and discontinuity in rule. Irregular transfers are indicative of power passing to parties outside the existing structure and is presumably often accompanied by violent upheaval. Thus, a priori, irregular transfers should bear a larger negative relation to

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* Full presentation of the data and descriptions of the variables can be found in Appendix IX. In the text we shall content ourselves with rough descriptions of the variables. In general, the dependent variables relate to 1970 and the independent variables to the middle or late 1960's.

VALGNP than regular transfers. Party fractionalization and regular transfers should be positively related and perhaps jointly explain more than either singly, as they are, to an extent simultaneously determined. The relative impact of total transfers (while negatively related to VALGNP as with the other three) will be larger the stronger the feeling against instability per se and the weaker the attitudes to its source.

On Table I, the zero order correlation matrix is presented between VALGNP and these four independent variables.

Table I

Government Stability Variables: Correlations

	VALGNP	IET	RET	ET
VALGNP	1			
IET	-.1261	1		
RET	-.0775	.0660	1	
ET	-.0980	.2436	.9838	1
PF	-.2004	.0547	.2177	.2162

These coefficients confirm a priori expectations concerning the single (as opposed to multivariate) impact of these variables; correlations between the independent variables are low*.

Four variables were obtained which reflect the mechanisms of enforcement: IS (internal security forces per 1000 of the population),

* As ET = RET + IET and as RET tends to be much larger than IET (see Appendix IX), the correlation of .9838 between RET and ET is not surprising.

MM (military manpower per 1000), GS (number of government sanctions to neutralize threats to the government) and PRF (an index of press freedom). The problem with these variables, it will be recalled, is the Dictators Problem; nevertheless, these four reflect a range of facets of the enforcement mechanism and may allow us some joint sign prediction. Military manpower is considered in this group as it is just as frequently a tool of internal enforcement as it is of external protection and is perhaps a less than accurate indicator of the latter as it does not take account of the technological and capital intensive aspects of modern warfare. On the face of it, it would appear that both internal security forces and military manpower would take the same sign (positive or negative) as both types of force appear to play the same role. However, this is only superficially convincing. The extensive use of military manpower involves, inter alia, an economy dominated by and geared to the military and this limits severely the scope open to private enterprise. Internal security forces show no such obvious bias in national economic goals. Further, extensive use of military manpower suggests strong representation of the military in government and it is not clear that the military mind is completely compatible with business. Internal security forces are far more neutral in this respect. One is therefore inclined to suspect that internal security forces will be positively related to VALGNP reflecting both their neutral character as well as the fact that they are enforcement tools typically employed in advanced capitalist nations; military manpower should accordingly bear a negative relation to VALGNP.

Consider now the variables GS and PRF. Both are government actions directly suppressing the activity of citizens and, as such, are

different from internal security forces and military manpower which reflect potential action as much as actual action by the government. One might then speculate that a combination of high security forces, low sanctions and high press freedom is preferable to any other combination of the three. The reason is that high security forces reflect potential action which can effectively halt any disturbance which might errupt and the low levels of sanctions and high press freedom indicate that merely the threat is enough to generate domestic peace. Low security forces with low sanctions and high press freedom appears desirable but the government has no enforcement tools to fall back on should trouble appear. Thus, high security forces, press freedom, low sanctions and low military manpower appear conducive to high VALGNP. On Table II, the zero order correlation coefficients support this view.

Table II

Internal Security Variables: Correlations

	VALGNP	IS	MM	GS
VALGNP	1			
IS	.2356			
MM	-.2473	-.0332	1	
GS	-.1720	.2787	-.0920	1
PRF	-.1712	-.0836	.2455	-.0864

Domestic order is unambiguously desirable from the point of view of foreign firms and, following from previous arguments, low levels of observed disorder together with low levels of government

sanctions, high press freedom, and high levels of internal security forces, represent a good combination from the point of view of the foreign firm. Four variables were collected which represent very similar types of domestic disorder; PD (political demonstrations 1948-1967), DV (deaths from domestic violence, same years), R (riots, same period) and RPD (= PD + R = total domestic public disturbances).

Of the four, political demonstrations should be most negatively correlated with VALGNP, for these are clearly relatively direct threats to the existing order of authority and rule. Riots, to the extent that they are directed at the government and manifestations of its particular policies, should work along the same lines. Indeed, riots and political demonstrations should be highly correlated and the variable RPD may prove stronger than either. Levels of domestic violence is a much less straightforward variable. It may, of course, move in the same manner as the other three, reflecting general political discontent and, hence, strains in the existing social order. On the other hand, many advanced Western Capitalist countries have severe urban problems, one of whose manifestations is extensive street violence and murder - political expressions of an obscure and indirect type. Therefore, it is possible that domestic violence may not have a strong negative sign, or indeed be positively related. Such a relation would be essentially spurious. That is, such violence happens (for other reasons) to attract a good deal of U.K. investment. Such domestic violence in this case probably has no real impact on the foreign investment decision and should be ignored. As it turns out (see Table III), this appears to be the case*.

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* As RPD = PD + R, the two correlations of .9632 and .9272 between RPD and PD and R respectively together with the correlation of .7923 between PD and R show that there is little to choose between these three variables.

Table III

Domestic Order Variables: Correlations

	VALGNP	PD	DV	R
VALGNP	1			
PD	-.2299	1		
DV	.3264	-.0633	1	
R	-.1990	.7923	.1562	1
RPD	-.2288	.9632	.0300	.9272

Domestic violence will hereafter be ignored. Of the remaining three, it is evident that they measure essentially the same phenomena and are all negatively related to VALGNP, hereafter, we shall concentrate on PD alone.

This brings us finally to the external relations variables and there are seven to be considered: AA (armed attacks on the host, 1948-1967), EI (external interventions, same years), TUSA, TSA (total U.S. and Soviet Aid respectively), AID (total aid, = TUSA + TSA) and DR, DS (diplomats received and sent respectively). The two to be immediately singled out for attention are external interventions and armed attacks which should have similar but by no means identical implications for foreign investors. Frequent armed attacks bring disruption and destruction and, whatever the beneficial aspects of such an intervention, these must be weighed against it. Frequent external interventions may be desirable depending on precisely who intervenes and why. Intervention by the U.K. to protect U.K. interests is clearly desirable while Cuban intervention is probably not. Thus, external interventions (and to some extent armed attacks) is a

rather unsatisfactory variable without further specification (which we are unable to give)*.

Soviet and U.S. aid are rather peculiar in their effects as well. Aid by the U.S. which serves to prop up the government and which leads to lucrative contracts for U.K. companies is rather helpful; tied aid benefitting U.S. corporations only is not. Soviet aid has, in addition, implications of coming from what might be an unfriendly and unsympathetic donor whose local activity might be harmful to the firm's interests. If both U.S. and Soviet aid are tied, then total aid (AID) should assume a significance larger than each, especially if the two are highly correlated.

Exchange of diplomats should, we have argued, bespeak an openess in foreign policy favourable to the multinational leading to fewer external interventions, more trade and the possibility of intervention by the parent. However, former colonial possessions may have few external links in addition to those with the U.K. and these are desirable investment locations, fewness of links strengthening to impact of U.K. intervention on behalf of her multinationals operating locally.

The external relations variables remain somewhat unsatisfactory, for very much depends on precisely which countries the host maintains links with and precisely who intervenes, and we are unable to gather information on these points. The correlation matrix on Table IV shows that this is a problem.

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* The role of these external relations variables will be intertwined with the links of older colonial ties; we shall return to this point later.

Table IV

External Relations Variables: Correlations

	VALGNP	AA	EI	TUSA	TSA	DR	DS
VALGNP	1						
AA	.2889	1					
EI	.3592	.0591	1				
TUSA	-.3098	.0678	-.1085	1			
TSA	-.0878	.1495	-.0337	.8535	1		
DR	-.5556	-.0037	-.2104	.2172	.1227	1	
DS	-.3659	.0156	-.1669	.0467	.0400	.9113	1
AID	-.2814	.0823	-.0990	.9962	.8802	.2070	.0467

External interventions, armed attacks and both diplomat variables have signs which indicate the difficulties facing us, the first two being positively related to VALGNP and the latter two negatively related. These, by our previous arguments, suggest that much will depend precisely who it was who intervened and who maintains relations with the host. One expects that this constellation suggests that a desirable host is one which has proved accessable to the external manipulations by the U.K. and other major capitalist powers and who maintains few external links except with these countries*. The three aid variables are all negatively related to VALGNP (and highly inter-related) suggesting that aid is used politically by the two super-powers to the detriment of U.K. interests.

* As we shall see, these signs persist in multivariate testing.

(iv) Multivariate Results

Thus far we have made a number of partial and joint predictions within classes of political variables. A necessary prelude to joint testing is a joint hypothesis. Having enunciated such a hypothesis, we must take a methodological degression into the complexities of testing such a wide range of variables upon the basis of relatively loose hypotheses, partial and joint. After examining the results, we shall be able to comment on the joint hypothesis and come to some qualified conclusions about the effects of political structures on foreign investment.

The ideal host country will evidently exhibit some combination of potential strength, actual peace, and a tradition or recent history of government stability. From what has passed thus far, we have some clues about the details of these political structures. One expects to observe a low level of irregular (and perhaps regular) executive transfers, a recent history free of riots, political demonstrations or both, low levels of government sanctions and, perhaps, high levels of internal security enforcement. Such a mix reflects ample strength to maintain order with a good record of having done so in the past. Upon the basic domestic combination, the structure of external relations fills out the political structure. External interventions (armed or not) and diplomatic relations all add important dimensions to political structure, although much depends on the precise outside countries relations exist with.

As it turned out, these basic reflections provided a good start for multivariate testing. The problem with these initial reflections

is, of course, that they are based upon inspection of zero order correlation coefficients which are poor guides to joint, multivariate relations. Given our initial expectations, regressions were run with these initial variables, dropping insignificant variables and replacing them with others. In addition, more arbitrary combinations of these nineteen independent variables were used as a starting point, again with progressive elimination and substitution. In all cases, it soon became apparent that the same five variables turned up as the principal explanatory variables no matter what the starting point and these were: IS (internal security forces), MM (military manpower), EI (external interventions), DR (diplomats received) and AA (armed attacks). The correlation matrix between these five is presented on Table V.

Table V

Correlations Between Principal Explanatory Variables

	VALGNP	IS	MM	AA	EI
VALGNP	1				
IS	.2592	1			
MM	-.2471	-.0471	1		
AA	.2829	.1828	-.0764	1	
EI	.3522	-.0851	-.1011	.0547	1
DR	-.5572	.0617	.1209	-.0001	-.2068

* Because some data were not available for all countries, seven countries were usually eliminated in the multivariate testing: Hong Kong, Argentina, Rhodesia, Zambia, Mozambique, Singapore and Malawi. Differences between these correlation coefficients and those presented on earlier tables are due to these slight sample differences as earlier figures relied on the maximum number of observations possible for the group in which the variable appeared.

Our initial starting point was the IS-GS-R-IET relations, and the investigation was quickly extended to cover MM, AID and other variables excluding EI, AA and DR whose specification was not as complete as desired. In the event, it turned out that we could not make much progress without any of these three and the best result prior to their exclusion is Equation 1 on Table V. All four variables - IS, GS, MM and AID - have the same sign as their zero order correlation coefficients but the overall explanation is weak.

Both the partial coefficients and preliminary explorations indicated that EI and DR would play a large role and, in Equations 2 and 3, the former is introduced. In 3, the substitution of EI for AID brings the explanatory power of the independent variables up remarkably and both EI and IS are now significant. The substitution of AID for GS in 2 has little effect other than to reduce the significance of IS. In Equation 4, DR is introduced to Equation 3 and explanation increases by a third. IS, EI and DR are all significant, GS marginally so and MM somewhat less.

Equations 5 to 10 contain variations of this basic combination with the addition of AA as an independent variable. IS remains positive and significant, as does EI; DR is negative and significant; MM negative and usually insignificant; AA positive and significant; and GS insignificant and of varying sign. In all cases, well over 45% of the variation in VALGNP is explained by all or some combination of these basic six variables.

Throughout this testing, experimentation was made with the other variables introduced into the study, but in no case did any of them exhibit significant explanatory power. Two examples (IET and PRF)

Table VI

Regressions Explaining Political Determinants of VALDI

EQUATION	CONSTANT	IS	AA	GS	EI	DR	MM	OTHERS	$\bar{R}^2$
1	.0215 (2.636)	.00412 (1.719)		-.0000185 (1.267)			-.000227 (1.858)	AID -.0000061 (1.754)	.163
2	.0219 (1.698)	.00371 (1.788)			.000894 (2.997)		-.000171 (1.537)	AID -.0000068 (1.887)	.3177
3	.0121 (1.626)	.00503 (2.341)		-.000025 (1.963)	.000981 (3.338)		-.000161 (1.462)		.3234
4	.0137 (1.912)	.00493 (2.440)		-.0000030 (.168)	.000679 (2.605)	-.000031 (2.154)	-.000082 (.911)		.4587
5	.0127 (1.801)	.00483 (2.399)		.00000028 (.015)	.000687 (2.643)	-.000033 (2.391)			.4621
6	.0127 (1.948)	.00485 (2.912)			.000688 (2.833)	-.000033 (3.452)			.4813

Continued.....

Table VI Continued

EQUATION	CONSTANT	IS	AA	GS	EI	DR	MM	OTHERS	$\bar{R}^2$
7	.0131 (2.141)	.00415 (2.619)	.0000038 (2.241)		.000657 (2.888)	-.000038 (2.241)			.546
8	.0210 (3.043)	.00310 (1.488)	.00000403 (2.043)	-.0000104 (.578)		-.000044 (3.125)	-.000076 (.805)		.4118
9	.0139 (2.060)	.00426 (2.215)	.0000037 (2.124)	-.0000028 (.167)	.000652 (2.659)	-.0000312 (2.288)	-.000069 (.821)		.5231
10	.0142 (2.258)	.00409 (2.560)	.0000037 (2.166)		.000640 (2.782)	-.000032 (3.559)	-.000067 (.820)		.5409
11	.0148 (1.969)	.00452 (2.198)		.0000032 (.181)	.000669 (2.553)	-.000035 (2.484)		IET -.00261 (.852)	.4566
12	.00831 (1.089)	.00515 (3.110)			.000762 (3.077)	-.000036 (3.673)	-.000103 (1.195)	PRF .00365 (1.498)	.5012

Table VI Continued

EQUATION	CONSTANT	IS	AA	GS	EI	DR	MM	OTHERS	$\bar{R}^2$
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are given in Equations 11 and 12. It appears that the basic six variables together contribute to a large explanation of VALGNP and, in the final section to this chapter, we shall attempt to wrap this testing up with some conclusions and assessments of these findings.

(v) Some Conclusions

We have found that about 45% of the variation in VALGNP can be jointly explained by the level of internal security forces in the host, external interventions and armed attacks, diplomats received, military manpower levels and government sanctions, and that no other variables make a statistically significant impact at any stage in the testing. From one point of view this is a rather good find, for we have narrowed our search down from nineteen possible independent variables to be left with six of some importance. What is more, these six yield a pretty consistent picture of the typically attractive host. What is a bit disheartening is that some of the external relations are not as completely specified as one would like.

Economies favoured by U.K. multinationals might be characterised as follows: such countries have high levels of internal security forces and low military manpower per 1000 of the population. They are thus police states to some extent, with the important characteristics that authority and rule is not based upon the military. The cause or consequence of such low military manpower is a high level of external intervention, including armed attacks. Such economies are not notable for either instability of government from internal

forces nor domestic disorder. Low levels of government sanctions and high levels of internal security forces together with the absence of any significant domestic disorder variables suggest that such firms are allowed to maintain an aloofness and an appearance of neutrality towards host citizens. There is, of course, instability of government in such favoured nations, but the interesting characteristic is that it is the result of external intervention. Such economies are therefore tightly controlled internally but probably diffident and subject to much pressure in external relations with neighbours, major powers and the parent country.

Closer inspection of the Tables in Appendix IX yields a few insights into the causes of the external variables signs. Eight countries of the forty-three receive less than one hundred diplomats: the Irish Republic, New Zealand, South Africa, Kenya, Jamaica, Trinidad, Sierra Leone and Uganda. Of these, the U.K. has large stakes in the Irish Republic, New Zealand, and South Africa and slightly smaller but still substantial stakes in Kenya. Such a pattern suggests the such countries lean diplomatically on the U.K. and that the lack of diplomatic representation with the outside is of little import to U.K. firms as the parent country will have easy access and a large role in affecting internal affairs in these hosts. India and Malaysia both have large stocks of U.K. owned assets and both are subject to an astonishing number of armed interventions. The U.S., South Africa, Kenya and Nigeria also host large stocks of foreign investment from the U.K. and are subject to armed attacks. Few countries are subject to external interventions, but Kenya in particular and Rhodesia have both suffered in this regard and in both

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cases it is clear that these are U.K.-initiated to a large extent. Thus, with the exception of the U.S. and its surprisingly large number of armed attacks (which presumably has little effect on U.K. investment decisions), former colonial ties cut across most of the findings about external relations. Other countries with high levels of external intervention such as Spain, Portugal and Mozambique, with high levels of armed attacks such as France, Argentina and Venezuela and relatively low levels of diplomatic representation such as Jordan, Portugal and Venezuela are all shunned (relatively) by U.K. investors.

Thus, outside of internal security forces, government sanction and military manpower levels, the important block of explanatory variables are those in the external relations class. It appears that in the U.K. the close web of colonial ties cuts across these variables so that while typical U.K. hosts are subject to large external pressures, these pressures are probably initiated by the U.K. parent government. Other countries subject to such external pressure (especially the South American countries) which do not appear to be U.K. initiated are shunned and do not host substantial U.K. owned subsidaries.

Appendix I

A Survey of Empirical Studies of Foreign Investment

In this appendix, we shall briefly review some of the more important empirical studies of investment by multinational firms, gathering what insight we can into the problem as well as showing (by way of contrast) some alternative approaches to predicting investment to our own. Three characteristics stand out in common with all the work to be reviewed: they are aggregate studies, they ignore uncertainty and none utilizes Industrial Organization theory.

Let us first consider Severn's (1972) study. He commences by considering three competing uses for the funds of multinational firms: domestic investment, foreign investment and dividends. The 'model' proceeds by balancing the marginal efficiency against the marginal cost of funds and this leads to linear equations containing ten, eleven and ten independent variables respectively. There is no identification of optimal capital stock, adjustment or a detailed treatment of sources of funds, and it is consequently difficult to evaluate the results. Correcting for size of firm, Severn estimates these equations simultaneously on aggregate data consolidating all foreign countries into one 'Rest of the World' country. A typical result is:*

$$I^f = \underset{(4.699)}{.254}\, dS_{-1} + \underset{(1.613)}{.146}Y^f - \underset{(-2.96)}{.136}L_{-1} + \underset{(1.572)}{.179}\, P + \underset{(1.113)}{.122}F$$

$$\bar{R}^2 = .461$$

---

* Throughout this appendix, t-values are given in parentheses under the estimated co-efficients.

where: I^f = foreign investment in fixed assets; dS_{-1} = lagged change in foreign sales; Y^f_{-1} = foreign income lagged; L_{-1} = lagged debt - equity ratio; P = price of the firm's stock; F = net outflow to the Rest of the World*.

He searched for but found very little substitutability between foreign and domestic investment, as reflected in an insignificant co-efficient on foreign investment in the domestic investment equation (not included here), but suggested that domestic investment and the use of U.S. controlled funds to finance foreign investment may be linked (i.e. the significant co-efficient on L_{-1} and P in the equation shown and in the domestic investment equation). While, on the face of it, this latter result suggests an overall financial constraint and no interdependencies, one must be careful for the model is not explicit enough to be clear about just what is happening. The significance of dS_{-1} in the foreign investment equation indicates that, at base, domestic investment models are probably readily applicable to foreign investment. Whether Severn's model is the appropriate one to use for both foreign and domestic investment is another question altogether.

Stevens' first study (1969a) is somewhat more firmly based on an explicit model and its similarities with the results of Severn's study allow one to go some way towards pinning down the importance of finance and financial constraints on global investment. He uses a modified Jorgenson-type model (1963) to explain expansionary

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U.S. investment subject to a financial constraint. The size of the financial constraint is given exogenously however. An additional curiosity is that the resulting equation uses levels rather than first differences of sales as dependent variables (see below). However, his results are quite good and suggest that direct investment is a positive function of demand in the host country, total firm financial flow and a negative function of demand elsewhere. This second result adds strength to the somewhat incomplete finding of Severn on substitutability between plants in countries*.

The second Stevens study (1972) is concerned with the flow of direct investment that enters the balance of payments rather than direct investment in plant and equipment expenditures. This involves extending the direct investment equations to include repatriated earnings and foreign borrowing. Commencing with an accounting identity - the change in current and net fixed assets is identically equal to the flow of direct investment and change in liabilities to foreigners - he proceeds to estimate the determinants of each component. The first two are determined through simple Jorgenson models while the last is determined by the minimization of exchange risk. The estimates are then inserted into the identity to estimate the flow of direct investment. The final results are not too bad. Ultimately, the flow of direct investment is positively related to changes in total assets (dA) and negatively related to earnings in the host (E). Denoting the flow of direct investment by F, he found:

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* It is possible that Severn's earnings variables are picking these effects up.

$$F = 290.3 + .46\ dA - 1.80E$$
$$\qquad\quad (5.05) \quad (3.61)$$

$$\bar{R}^2 = .91$$

The model is then used to examine the impact of the U.S. Balance of Payments Programme 1965-68 and his findings suggest that the main impact on the programme was not on plant and equipment expenditure so much as on financing those expenditures (see also Willey, 1970 and Shapiro and Deastlov, 1970).

Kwack's (1973) study of direct investment flows postulates an independent subsidiary which determines its optimal capital stock subject to an overall financial constraint which is given. There are no competing uses of funds, but there are alternate sources and the composition between foreign and domestic borrowing is determined by the minimization of exchange risks. A rather strange aspect of the model is that the real cost of capital at home and abroad is alleged to be equalized, but they appear to be independent of the firm's decisions and hence equalization appears fortuitous. Furthermore, in minimizing risk (over a rather short time horizon), covariances between the cost of funds in the U.S. and the Rest of the World are ignored. Adjustment of desired to actual capital is specified in an ad hoc manner by inserting a few lags and a domestic cash flow variable. In view of the financial interdependencies issues, interpretation of this variable is exceedingly difficult. Nevertheless, the estimated equation (one of them) is:

$$I = \underset{(2.267)}{-.655} + \underset{(3.305)}{.122C} + \underset{(2.516)}{.023}\left(\frac{PQ}{r-g^*}\right) - \underset{(2.150)}{.096A} + \underset{(5.012)}{2.246DMY} + \underset{(1.10)}{.386VRP}$$

$$\bar{R}^2 = .863$$

where I = the flow of U.S. direct investment; C = cash flow of U.S. non-financial corporations; r = long term U.S. government bond rate; g* = rate of change of U.S. GNP price deflator; VRP = dummy for the years of the U.S. Voluntary restraint programme; PQ = sales; A = cumulative value of U.S. direct investment abroad; DMY = dummy reflecting direct investment in anticipation of the Voluntary Restraint Programme. As can be seen, the results show a positive relation between foreign investment and sales, U.S. cash flow and a negative relation to the cumulative value of U.S. direct investment abroad thus complementing some of the earlier results.

These first four studies are the most satisfactory of those which we shall discuss here and it is worth some further discussion of their common features before we move on to the rest. All are formulated on a U.S.-Rest of the World basis and while some evidence on financial constraints and other interdependencies emerges from these, they must be considered to rest on somewhat shaky foundations. In particular, they implicitly impose a homogeneity on all foreign operations so that the principal distinction the firm makes is between home and all foreign investment; relations amongst the hosts and amongst each host and the parent, home corporation are ignored. One of the prime determinants of total foreign investment must be the proposed allocation amongst foreign hosts of the foreign total for

this crucially affects the profitability of total foreign investment. As we have argued in Chapter I, it may only be the small internationally immature multinational that distinguishes home and all foreign investment; the mature, well spread firm must surely consider each country on its merits, taking into account the interdependence between each of all the rest. This is precisely what our own model is aimed at.

The remaining four studies we shall look at here are somewhat less satisfactory and I cannot accept that the results support the conclusions advanced by the writers. In particular, there appears to me to be a strong confusion between new and expansionary investment variables and their appropriate uses.

Scaperlanda and Mauer (1969) have produced an ad hoc equation which they claim tests and discriminates between various "important" hypotheses about foreign investment. Direct investment is asserted to be a linear function of host country characteristics, (market size in particular), market growth and tariffs. These are represented by sales, various change of sales measures and a tariff measure (see the exchange between Goldberg, 1972 and Scaperlanda and Mauer, 1972). In looking at U.S. direct investment in the E.E.C., they found that only the size of market variable was significant. The argument underlying this variable is that the market must be large enough to absorb economies of scale. However, (see also Goldberg, 1972) it is not clear why this should determine the magnitude of investment. What this variable really points to is a threshold size of market influencing the new investment decision. Only the change in sales variable has any meaning in an expansionary investment model

and two of the three specifications of this variable do not seem to be based on any model known to me. Anticipating a discussion below on sales levels and changes in levels as dependent variables in investment studies, it is hard to accept the Scaperlanda and Mauer findings.

Bandera and White's study (1968) is rather similar to the one just discussed although it is more comprehensive inasfar as it tests a similar model for various sectors (manufacturing, petroleum and trade) for each of seven E.E.C. countries. They tried various values of U.S. direct investment and GNP in the host country and concluded that linear in levels combinations were superior and most stable. Two other variables, earnings and liquidity, failed to make an impact.

Goldberg (1972) attempted an answer to and reworking of Scaperlanda and Mauer. He estimated the same equation without size of market variables but with changes in sales (first differences) and a modified tariff variable. The tariff variable was of no value in this study either, but the change in sales variable proved quite strong. This conflict of findings is worth a short digression because it holds implications for the first four studies we discussed as well.

As we have seen, some studies have levels of sales (Stevens and Kwack) and some first differences (Severn) as independent variables and separately both perform well. If one considers the full lag distribution of an investment model, one can write the resulting equation with the independent variables as a sum of lagged sales terms with geometrically declining co-efficients or a sum of lagged

changes in sales terms also with declining co-efficients. Both forms result from the simple adjustment mechanism of the simple Jorgenson model and the conversion between them is assured by the fact that the lag distributions generate an infinite number of terms. Since the model does not force a choice between them, choice must be made on simple econometric grounds and, because of multicollinearity problems in the levels of sales formulation, choice must really fall on the changes in sales form. The difference between Scaperlanda and Mauer and Goldberg can be looked at in these terms. Scaperlanda and Mauer claim to be testing some sort of market size hypothesis whereas they are really testing a peculiar mis-specified optimal capital stock model with no lags of adjustment. Goldberg sees more clearly the optimal capital stock basis of his test but fails to perceive that it is on this point that Scaperlanda and Mauer falter.

A final study - that of Krainer (1967) - is worth mentioning in passing. This is, in many ways, a rather curious study which starts from the Heckscher-Ohlin premise that the resource endowment of a country influences the industry composition of its long term foreign investments. Comparing the U.S. with the U.K., he suggests that this will ultimately lead to complementarity between domestic and foreign operations in the U.K. and the reverse (or no relation) will hold for the U.S. He finds support for this proposition (although see Severn, 1967), finding U.K. home and foreign investment to be complementary.

These expansionary investment studies can, I think, be looked at as only a beginning of serious modelling and testing. Evidence is accumulating about financial constraints and interdependencies, but only in tantalizing form. It can be expected that more attention to

modelling and the economic content of such models will lead to further important contributions.

Let us briefly turn to new investment studies. Recalling our discussion of Chapter I, we seek signals to firms which attract their attention to profitable market opportunities and may ultimately lead to new investment (possibly after a stage of exporting to the market has been tried).

Despite clear statements of the distinction between new and expansionary investment (e.g. Penrose, 1956, Stevens, 1969, Richardson, 1971 a and b), little empirical work has been done and there are not many reliable clues to go on. Aharoni's book (1966) contains probably the best and most comprehensive study of the decision making process, stressing the importance of defensive movements when markets are threatened and the role of government policy. Some results from a number of survey investigations surveyed by Dunning (1973) supplement this view. The factors which appear most important to new investment are: the host government's attitude to foreign investment, political stability, prospects of market growth and marketing factors generally. Only a minority of firms surveyed stressed lower costs or other traditional economic variables.

Two sets of signals have been investigated in the literature and we shall review them here. These are the actions of rivals and government policy, principally commercial policy.

One of the principal causes of large industry investment totals may be oligopoly (short for mutual awareness and interdependence amongst rivals). Evidence to be reviewed shortly shows important links between oligopoly and foreign investment and many theoretical

links explain these findings (see Appendix II). Oligopoly encourages two types of movement. On the one hand, oligopolists facing each other in different markets may invest in each other's market to exchange threats in an effort to achieve market stability. Grahm (1975) reviewed evidence relating to three particular firms which can plausibly be explained by this hypothesis. On the other hand, oligopolists in the same market may follow each other into new markets both to forestall competitive advantages that rivals may develop there, and because movement by rivals generates information about market possibilities. This second proposition has been extensively tested by Knickerbocker (1973) in an ingenious fashion. He constructs an entry concentration index as a quantitative measure of oligopolistic reaction and compares it with various characteristics of the home market such as concentration, industry stability and so on. The findings are all quite strong, showing oligopoly to have an important impact on new investment.

The principal work on the effects of government policy on new investment has been concentrated on calculating the effects of tariffs and their changes. This work is not entirely satisfactory, if only because of the multiplicity of findings and one must conclude that tariffs may only have a secondary impact (Ragazzi, 1973). Findings by Bandera and Luchen (1972), Caves (1974a), Scaperlanda and Mauer (1969), Goldberg (1972), Orr (1975) and Scaperlanda (1967) all showed no impact. Horst's (1972b) findings that nominal tariffs (not effective) affect the decision between exporting or producing in Canada failed to appear at a more disaggregated level (Orr, 1975) and Horst himself (1975) noted that the issue was far from resolved. Scaperlanda (1967) found that the formation of the E.E.C. had no effect in shifting U.S. direct investment from non-E.E.C. countries

was challenged by Wallis (1968) who, while showing a dramatic shift between 1951-58 and 1959-64 in the share of U.S. investment going to the E.E.C., failed to show that this was significantly different to a simultaneous shift to E.F.T.A. (Scaperlanda, 1968). D'Arbge (1969) followed this exchange up with an explicit customs union model and found a shift toward E.F.T.A. but not to the E.E.C.!!! Schmitz (1970), however, found a significant E.E.C. effect.

Equally important if somewhat less visible are non-tariff barriers. Franko (1975) has shown (pp. 83-4) that continental multinational enterprises have spread themselves throughout the E.E.C. in response to such barriers as preferential buying behaviour. Studies by Gillespie (1972) on French, English and German official attitudes to direct investment complement what we know about Japan (Hufbauer, 1975) and emphasize that non-tariff barriers may have an important impact on flows.

Appendix II

Characteristics Analysis

Characteristics analysis, as mentioned in Chapter I, seeks conditions for the profitable operation of firms in particular markets; in particular, it looks at those assets of firms which enable them to scale barriers to entry and operate profitably and competitively even when they face a number of ongoing disadvantages in the host market. Evidently, characteristics analysis is rather closely related to the theory of the diversification of the firm. In this appendix we shall give a rather fuller sketch of this body of theory and discuss some of the empirical results which have been generated in a number of studies. In terms of the model presented in the main text, this is something of a digression into background material; one might conveniently view it as a cursory discussion of the principal determinants of the rate of return actually earned by multinationals abroad.

The obvious starting point to make in theorizing about diversification is to observe that either firms may be pushed out of markets or pulled into markets. A firm can be pushed out of existing markets because the market is declining in size or growth or because competitors are increasing shares at the expense of the firm. More familiarly, diminishing returns (in a static sense) may limit the size of the firm. The important point to note is that the firm will not be inclined to leave unless aspiration levels are unfulfilled; that is, neither diminishing returns nor declining market share will force a maximizing firm out of a market. This is an important source of

difficulty in attempts to give a maximization framework to firm models of diversification; for a maximizing firm, aspiration levels are simply the achievement of the maximum, whatever that level is (as long as it exceeds the opportunity cost of operating in that market). For maximizers, what is required for diversification is pull from other markets which attracts the firm (essentially) by raising the opportunity cost of continued operation*.

This suggests that it is the attractions of other markets which induces diversification (especially for maximizers). Satisfied or not, the firm cannot move without specifying where. However, in order to operate in these secondary markets, the firm must scale various barriers to entry and compete (on a continuing basis) with established or indigenous firms. In these circumstances, the firm must have some sort of competitive advantage or special asset which enables it to compete with indigenous firms (Caves, 1971; Kindleberger, 1969; Caves, 1974a; Hymer, 1960). To explain diversification and the pull of other markets (net of these barriers) we must thus concentrate on these assets, how they enable the firm to scale barriers, how firms get then and how the firm matches asset to potential market.

This is the essence of characteristics analysis - it seeks those special assets or advantages which enable the firm to diversify. The nature of this asset differs slightly between domestically and inter-

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* This point can be illustrated by the model of Sutton (1973). His diversifying firm has a discretionary fund which deteriorates whenever market circumstances (for whatever reason) turn against the firm. This sharpens the motive to diversify, for managerial utility depends on the level of the fund. It is hard to see a maximizer generating this result.

nationally diversified firms, but its existance (and importance) is common to both. The characteristics of this asset are (Caves, 1971; 1974a): (i) it must not be available to indigenous firms (else it would convey no advantages to the invader); (ii) it must be transportable to the new market and partake of the character of a public good within the firm in the sense that it can be applied in new circumstances at zero or low costs.

Consider domestic diversification first. Such factors as marketing ability and technical ability are clear candidates for consideration (and have been empirically verified; see Gort, 1962; Hassid, 1975 and others); they are in the form of knowledge and clearly satisfy both criteria. Similar principles apply to management technique (or the existence of a uniquely skilled entrepreneur within the firm) and access to critical factors of production. Indeed, these factors - long familiiar as sources of barriers to entry in markets - are precisely those needed to scale the barriers by firms contemplating diversification (see also Caves and Porter, 1977, whose argument is similar in content and spirit to some of this argument)*.

International diversification involves similar principles with a slightly different emphasis on various factors. The most important barrier to international expansion is lack of information on opportunities and the details of operation in host markets.

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* The obvious implication is that after entry by a diversified firm, barriers to further entry may be higher. It is possible that Bain's distinction between 'immediate' and 'general'

Furthermore, the breadth of operations which international operations involves eliminates access to critical factors and managerial superiority from the list of candidates. This latter is especially true because of the environment of uncertainty and unfamiliarity which confronts management. The skills multinationals firms rely upon centre on product differentiation and research (Caves, 1971; 1974a). In point of fact, this important link with technical skill has led to a number of welfare analyses based on the premise that the multinationals carry useful technology abroad (Johnson, 1970; Magee, 1974; Buckley and Casson, 1976; Casson, 1977). My own opinion (see also Hymer, 1970) is that while this is true in part, it overstates the case. The importance of product differentiation or marketing skills has been amply demonstrated (Geroski, 1976; see also Horst's fascinating study of the American Food Process Industry Abroad, 1974); and the value of much industrial R and D can be doubted (Mansfield, 1968). Nevertheless, marketing and technical skills, applied to host markets and developed in the course of domestic operations (Stopford and Wells, 1974) show that products typically are first developed in the home market and are then taken abroad; see also Vernon, 1966 and 1971, Chapter 3, for a similar theory based on the product life cycle) are the principle tool in the arsenal of internationally diversifying firms used to overcome barriers to entry and operation in uncertain and unfamiliar environments.

The origin of these skills are familiar to many students of industrial economics and are easily described. In fact, there are two interacting threads to the argument. These skills are developed

in the course of domestic competition, particularly in oligopolistic markets*. The vulnerability of narrow product lines (see Penrose, 1959, pp. 137-8) as well as the inducement to non-price competition encourages firms to develop marketing and technical skills. Indeed, the possession of such skills by the management team has often been seen as the reason for diversification, arising from internal pressures (Penrose, 1959; Sutton, 1973). Furthermore, diversification is a tactic which affects competition in the home market leading other firms to improve skills and continue diversifying (e.g. Knickerbocker, 1973; Vernon, 1974).

Thus, to wrap up, we have argued that diversification is taken for positive reasons, firms being attracted to possibilities in other markets. Perception and ability to enter such markets often go hand in hand, relying on certain skills in the firm's possession. This is true for both multinational and domestically diversified firms. Such skills are the subject matter of what we have called characteristics analysis.

Let us turn now to empirical studies of the characteristics of multinational firms. The first and perhaps most comprehensive is that of Caves (1974c). To measure multinationality, he used shares of sales held by foreign firms in Canadian and U.K. markets. To explain: "... the substantial inter-industry variance in the prevalence of multinational operations" (pp. 279), he considered the following sets of variables: 'intangible capital variables', 'multiplant advantages', and 'entrepreneurial variables'. Intangible capital variables used

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* This accounts for the familiar finding that most multinationals and domestically diversified firms come from highly concentrated markets; see below.

were: advertising as a percent of sales (AD), R and D as a percent of sales (RD), a size of firm measure (e.g. DS = shipments in the U.S. market accounted for by firms with assets of a million dollars or more). In addition, various scale measures were used to represent barriers to entry. For multiplant enterprise advantages, he used the percent of shipments in the U.S. accounted for by multiplant firms (MP). Entrepreneurial resources were proxied by skill ratios within the firm and earnings data. Several tariff variables were used, as were royalty receipts (NR) and the average value of shipments per plant in the U.S. divided by the same for Canada (DS). In all, a comprehensive list of possible factors which could enhance foreign profitability.

For the Canadian market, RD was always significant and positive, AD occasionally significant, firm size (DS and DS/EC where EC is the average value of shipments per plant of the largest plants accounting for 50% of Canadian shipments divided by the total) was positive and significant as was MP. DS is occasionally significant but other entry barrier variables did not perform well. Entrepreneurial resource variables and tariffs also failed to make an impact. A typical result is*:

$$D = \underset{(-1.53)}{-.215} + \underset{(3.78)}{.642MP} + \underset{(.958)}{1.24AD} + \underset{(2.89)}{8.13RD} - \underset{(-.065)}{.006DS} + \underset{(.368)}{.311\frac{EC}{DS}} + \underset{(1.20)}{.002RW}$$

$$\bar{R}^2 = .459$$

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* RW is payroll per worker in the U.S. divided by the same for Canada. This variable together with tariffs were used to get at the trade offs between investment and exporting. t-values are given in parentheses below estimated co-efficients in this appendix.

The U.K. sample produced, in general, similar results. AD and RD are both highly significant with the former having more explanatory power than in the Canadian sample; NR was relatively insignificant and MP generally significant. A typical result was:

$$D = \underset{(-4.81)}{-.412} + \underset{(.376)}{.042MP} + \underset{(3.78)}{.205AD} + \underset{(4.98)}{6.32RD} + \underset{(7.17)}{.348DS} - \underset{(-1.43)}{.025NR}$$

$$\bar{R}^2 = .895$$

In conclusion, Caves argued that intangible assets - principally advertising and research - are significant determinants of multinationality. Multiplant economies work rather better for Canada than the U.K. but entrepreneurial resources fail to make an impact in either sample.

The study by Geroski (1976) restricts itself to fewer variables but generates slightly different results to Caves' for a sample of U.K. multinationals. Measuring multinationality by the flow of U.K. net outward investment in 1968 at Order Level, he hypothesised that advertising intensity (A), research intensity (R), concentration (H) and domestic activity were positively related to multinationality after deflating for size of industry. Domestic activity was proxied by domestic investment (C) and growth. The principal finding was:

$$D = \underset{(-4.06)}{-.0032} + \underset{(7.171)}{.069H} + \underset{(3.96)}{.0966C} + \underset{(19.59)}{.0052A} - \underset{(-3.99)}{.0003R}$$

$$R^2 = .976$$

Advertising dominates the results, but concentration and domestic investment are also significantly and positively related to multinationality. Growth failed to make any impact at all. The most curious finding is that research is significantly negatively related to multinationality (in other tests this variable occasionally turned up insignificant but never positive). This set of results stands in contrast to the Caves findings and leads to the suggestion that there may be differences in the skills used by multinational firms of different national origins.

Horst (1972a) considered the size of firm characteristic, explicitly seeking to separate out inter-industry from intra-industry characteristics. Considering first the differences between investors and non-investors within the same industry, he concluded (without reporting specific results) that: "... once inter-industry differences are washed out, the only influence of any separate significance is firm size" (pp. 261). Looking then at firms of a given size in different industries (and using as a dependent variable a ranking reflecting the percentage of firms in an industry which invested abroad), he tried to explain multinationality by research intensity (R), a dummy reflecting resource extraction (RE), and an estimate of minimum efficient scale (MES). A typical result was:

$$D = \underset{}{.13} + \underset{(2.1)}{4.95R} - \underset{(-.2)}{.0058MES} + \underset{(.5)}{.05RE}$$

$$R^2 = .50$$

Clearly, both research and minimum efficient scale perform well.

Turning to patterns of foreign control in Canadian industry (D* is the share of Canadian industry sales by foreign firms), he estimated:

$$D^* = .11 + \underset{(4.7)}{13.9}R - \underset{(-1.7)}{.38}REH + \underset{(4.2)}{.020}MES$$

$$R^2 = .72$$

This suggests that technologically-intensive industries capture a larger and resource intensive industries a smaller share of the Canadian market. Together, the two estimated equations suggest that: "... industries in which economies of scale are important tend to have fewer foreign investors controlling a larger share of the foreign market" (pp. 264).

A second study by Horst (1972b) extended the subject matter of characteristics analysis by considering different forms of diversification patterns. In particular, he was interested in the characteristics of exporting firms and investing firms. He found that technical intensity of a U.S. industry is more closely related to the sum of that industry's exports and subsidiaries' sales to the Canadian market (as a percent of total sales) than it is to either taken separately. He also investigated the effects of tariffs, finding that they did affect the decision between exporting and investment.

In a somewhat similar vein to the studies just discussed are firm level characteristics studies. As a whole, such studies must be viewed with some suspicion. They look only at firm characteristics, ignoring inter-industry variations. Theoretical arguments can be

mustered building on Horst's results to suggest that these studies are picking up unnecessary noise from such inter-industry variations in the independent variables (Geroski, 1976).

By far and away the most comprehensive analysis is that of Vernon (1971, Chapter 1) who worked with data for 187 of the 500 U.S. firms topping the Fortune list which have six or more subsidiaries. They tended to be larger, more profitable, technically more sophisticated, more diversified and more advertising intensive (Vernon does

Table I

Characteristics of U.S. Multinationals

Characteristic	187 firms in sample	Other 313 firms in Fortune list	U.S. Manufacturing firms not on Fortune list	All U.S. Manufacturing
Sales per enterprise 1964 (1000)	927.3	283.2	1	2.4
Employees per enterprise 1964 (1000)	35,800	11,500	38	93
Plants per enterprise 1964 (1000)	76	34	1.5	1.6
After tax earnings as a percent of sales, 1964	7.2	5.9	3.1	5.2
After tax earnings as a percent of investment, 1964	13.3	11.1	9.1	11.6
Corporate funded R and D as percent of sales, 1964	2.48	1.85	-	1.29
Scientists and Engineers as a percent of employment, 1962	6.72	5.15	-	3.64
Scientists and Engineers in R and D as a percent of employment, 1962	2.33	1.89	-	1.33
Advertising as a per cent of sales, 1965	2.57	2.39	-	1.46

not test these statistically). The table upon which his analysis is based is reproduced above as Table I (Source: Vernon (1971), Chapter I).

Dunning (1973) presented evidence generated by Vaupal which by and large corroborates these findings (pp. 317). Looking at the 419 largest U.S. companies, he uses a three-part distinction between domestically oriented firms, those which produce in less than six foreign countries, and those which produce in more than six. This is something of a minor improvement on the Vernon two-part classification, but there is still an arbitrariness in these rankings. Vaupal found, by and large, that the more multinational a firm was, the larger were its size, research intensity, advertising, profits, export sales ratio, diversification and annual wages. In a study of U.S. affiliates in the U.K. (reported in Dunning, 1973, pp. 317-323), Dunning found that such affiliates were concentrated in faster growing export industries which were technologically advanced and advertising intensive.

Finally, Buckley and Casson (1976) looked at the largest 500 U.S. firms and 300 largest non-U.S. firms on the Fortune list, ultimately reducing the numbers to 264 and 170. They noted the "paramount" importance of country specific factors and "importance" of industry specific factors, but concentrated on firm specific factors assuming that variations in these latter will tend to average out across countries and industries. They found that in high research intensive firms, there was a positive association between multinationality, growth and profitability, and that this relation is stronger than in lower research intensive firms. This does not, however, affirm that multinationals firms are more research intensive than non-multinationals.

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One often finds, in addition to these relatively formal studies, hints and short discussions of the characteristics of multinational firms in various case studies, host country studies and so on. However, all tend to converge to much the same results as the several papers examined in more detail here. Industry characteristics relating to research and advertising intensity appear to lead the field of distinguishing characteristics for multinationals. The minor conflicts between various studies in the effects of these variables is, I suspect, relatively sensitive to sample specifications; clearly research and advertising are (or can be) alternate routes to international expansion. Comparison of the international spread of the Heinz Company and I.B.M. makes this abundantly clear. Other industry characteristics that might deserve closer studies are multiplant economies and the extent of purely domestic diversification. Behind all of these characteristics lie industry structure.

On the firm or intra-industry level, the Horst results stand out, clearly indicating the important role played by firm size. This finding really forces us to talk of multinational industries rather than firms, for with the exception of firm size, no intra-industry effects worthy of mention appear as characteristics of multinational firms. Again, this suggests that industry structure and conduct patterns may well play a large part in the international expansion of these firms.

Appendix III

Some Previous Studies

There have, in fact, been a few studies of direct investment using the portfolio model and it will prove instructive to review them in some detail. We shall argue that lack of attention to theoretical specification mitigates their usefulness.

Prachowny's (1972) study is the only published one. In point of fact, I cannot find a model which actually predicts his estimating equation - he presents none nor pays attention to his specification. The estimating equation is linear (with an unjustifed constant); the dependent variable is the stock of U.S. corporate stock expressed as a percentage of the market value of U.S. corporate stock (D) while the independent variables are the ratio of the rate of returns on investment abroad to the U.S. rate of return $\left(\frac{Rf}{Rh}\right)$, the ratio of the variances of the two $\left(\frac{Vf}{Vh}\right)$, the co-variance between them (Cfh) and the U.S. balance of payments of the year before (B)* and the results are

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* The inclusion of the lagged balance of payments term is justified by Prachowny as "external risk" (pp. 451 and footnote 11, same page) and he hypothesised that repatriation of earnings, devaluation and so forth are all 'external risk variables' which influence the dependent variable directly, rather than through rates of return and their variances. The balance of payments term is meant to cover these factors, for it signals tightening or easing of controls likely to affect the profitability of the firm's operations. The empirical performance of this proxy is poor; nevertheless, it appears unclear on a theoretical level where the distinction between "external risk" and (as we shall call it) "endogenous risk" which affects investment through rates of return, is. For example, restrictions on repatriation of earnings does not affect the profitability of serving a market, merely the allocation of funds, and should it be a short term control (which is what the variable suggests) there are any number of ways of getting around the restriction such as transfer pricing.

Continued.....

rather weak. A typical result is (t-statistic in parentheses):

$$D = \underset{(1.55)}{.031} + \underset{(1.69)}{.032\frac{Rf}{Rh}} + \underset{(.23)}{.001\frac{Vf}{Vh}} + \underset{(.33)}{.001Cfh} + \underset{(.59)}{.001B}$$

$$\bar{R}^2 = .13$$

As can be seen, only the return variable is significant and Prachowny concludes (pp. 454) that: "... all risk variables fail to pass the test... ". In subsequent testing, he tried a composite risk/return variable,

$$RR = \frac{Rh-Vh}{Rf-Vf}$$

and estimated:

$$D = \underset{(2.71)}{.043} + \underset{(2.46)}{.025RR} + \underset{(.36)}{.001B}$$

$$\bar{R}^2 = .39$$

While RR turns out to be significant it is hard to evaluate the results; with no model and no clear hypothesis, it is hard to

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(Footnote continued from previous page) Similarly, devaluation has large and systematic effects on returns and inter-firm transactions (Levy and Sarnat, 1975 show an empirical simulation of this effect, applying it to equity investment). Surely this shift will dominate any allocative difficulties involved in moving funds. The concept of risk, in short, is difficult to measure and use empirically; I suspect that Prachowny's concept of external risk does not alleviate the problem much.

determine just what the significance of RR implies about investment behaviour, let alone the counter intuitive result that risk does not matter suggested by the first equation. Two further difficulties must be noted in addition to the lack of a model. It is a 'portfolio model' but there are only two assets or activities to invest in (the U.S. and the Rest of the World) which hardly leaves room for any diversification at all! And, secondly, the wealth variable used is total corporate assets which we have already argued is untenable.

My own opinion is that not much can be gained from this study. The empirical results are not particularly meaningful in the absence of a model. The portfolio model leads to precise predictions and functional forms; simply to linearly list the relevant variables and to test each one's significance is hardly an acceptable or convincing test of the model.

Stevens (1969b) has produced a somewhat more satisfactory study utilizing the portfolio model. He used an equation derived by Tobin (1958, pp. 8) relating the ratio of the capital stock (K) in two countries, i and j, to rates of return (R) and their variances (V) precisely.

$$\frac{K_i}{K_j} = \frac{(R_i - R^*)V_j}{(R_j - R^*)V_i}$$

where R* is the riskless rate of interest. The difficulty with this is that co-variances are not taken account of; in the empirical work i is Latin America and j is Canada and the dubious absence of co-variances allows these two countries to be estimated independently from the rest. Taking logs and estimating, he found:

$$\log\left(\frac{K_i}{K_j}\right) = \underset{}{-1.41} + \underset{(4.46)}{.26 \log (R_i - R^*)} - \underset{(3.87)}{.46 \log(R_j - R^*)}$$

$$- \underset{(2.09)}{.24 \log V_i} + \underset{(.017)}{.0017 \log V_j}$$

$$R^2 = .94$$

All the estimated co-efficients are significantly different from zero except that for $\log V_j$; however, they are not significantly different in absolute value from unity which is what is predicted by the equation given above. Thus, the data do not support the model under consideration.

As total corporate wealth is being allocated in this model, subsequent work by Stevens (quite rightly) was undertaken to allow for lags in the adjustment of stock; for a number of technical reasons, this proved rather unsatisfactory.

Finally, some work by Paxson (1973) and Mellors (1973; see also the discussion in Hufbauer, 1975) needs to be noted in passing. Paxson, rather than testing a model, used the portfolio model to calculate optimal shares for the geographical distribution of U.S. and U.K. total foreign assets and showed reasons to suggest that where the difference between actual and optimal shares were largest, the percentage growth in assets is highest, the implication being that some adjustment from actual to these optimal shares was occurring. It appeared from this work that while optimal allocation of total corporate wealth was not occurring, diversification by multinationals did reduce risk and raise returns. Mellors looked

at the effects of taxes on the location of multinational firms and found that firm allocations are more closely related to the predictions of a portfolio model using post-tax returns than one using pre-tax returns. Both studies are largely illustrative, but unlike the Prachowny and Stevens results, do seem to suggest a role for a portfolio model in the analysis of foreign investment behaviour.

These four studies do not, I think, predispose one towards the portfolio model on the face of it. The model fails to find support in the data and while interesting exercises and simulations can be performed using the model, these exercises lose a good deal of interest in the failure of the model to survive direct testing. However, there are good reasons to feel that the model has not yet been given a reasonable test. The mis-specification of the dependent variable is one point we have already noted. In addition, approximation of ex ante variables from ex post data and attention to the crucial role of risk are crucial to the performance of the model.

Appendix IV

An Alternative Estimating Technique*

An alternative estimation procedure may be outlined along the following lines. We maximize Z and try to rearrange the resulting equations to isolate h as a co-efficient to be estimated in a simple linear regression. Denoting the vector of means as P^o and the various co-variance matrix as P* with I as a vector of unit values we have (superscripts T indicates a transpose):

$$\text{max:} \qquad Z = P^{oT}\Lambda - h\Lambda^T P^*\Lambda$$

$$\text{subject to} \quad I^T\Lambda = 1$$

The first order conditions are:

$$\frac{\partial Z}{\partial \Lambda} = \psi I$$

$$I^T\Lambda = 1$$

where:

$$\frac{\partial Z}{\partial \Lambda} = P^o - 2hP^*\Lambda$$

Thus:

$$\Lambda = \frac{P^{*-1}}{2h}(P^o - \psi I)$$

---

* This was suggested by Dennis Leech.

and:

$$I^T\Lambda = I^T\frac{P^{*-1}(P^o - \psi I)}{2h} = 1$$

from the constraint. Evidently:

$$I^TP^{*-1}P^o - I^TP^{*-1}I = 2h$$

and:

$$\psi = \frac{I^TP^{*}y_{P^o} - 2h}{I^TP^{*-1}I} = R - \frac{2h}{a}$$

where:

$$a = I^TP^{*-1}I, \qquad R = \frac{I^TP^{*-1}P^o}{a} .$$

Writing:

$$\Lambda = \frac{1}{2h}P^{*-1}(P^o - RI + \frac{2h}{a}I)$$

i.e.:

$$\Lambda = \frac{1}{2h}P^{*-1}(P^o - RI) + \frac{1}{a}P^{*-1}I ,$$

we can estimate h from the equation:

$$\Lambda - \frac{1}{a}P^{*-1}I = \frac{1}{2h}P^{*-1}(P^o - RI) .$$

Our own procedure presented in the text is more cumbersome but generalizes more easily. In any case, the two techniques are equivalent.

Appendix V

The Data

Empirical application of the model consists of three studies using slightly different samples:

(i) Total foreign investment by all U.K. firms in 1971 for a sample of nineteen foreign countries.

(ii) Total foreign investment by all U.S. firms in 1972 for a sample of twenty-six foreign countries.

(iii) The same U.S. sample with a slightly different dependent variable specification.

For each study essentially two sets of data are required and thus two sets of data constraints determined the countries included in the samples. In all three cases, roughly 90-95% of total investment flows were accounted for by the countries chosen. The data required are investment shares and the rate of return on capital used to proxy expected returns and variances.

For Study (i) dealing with U.K. miltinational firms, investment shares are derived from figures on the net outward flow of investment for all U.K. industries excluding oil. To get an idea of the composition of this data by industry, shares of total investment to all countries in the sample were calculated on an industry basis for 1971 and 1972 and are shown on Table I.

These are, of course, Order level listings; 'Other Manufacturing' includes Textiles, Timber and Paper while the last item includes Insurance and Banking. Clearly, manufacturing dominates the shares

Table I

Shares of Investment to All Countries in the U.K.

Sample by Industry

Industry	1971 Share	1970 Share
Agriculture	.0005	.0000
Mining	.0207	.0044
Engineering	.0240	.0732
Vehicles	.0041	.0183
Other Manufacturing	.5532	.4195
Construction	.0135	.0647
Distribution	.1880	.1636
Transportation	.0147	.0568
Shipping	.0090	.0004
Other	.1717	.1986

(3rd, 4th, 5th and 9th items) but nonetheless, services (especially Distribution) do constitute an important component of the total*. This inter-industry breakdown is of course the subject matter of characteristics analysis and these inter-industry variations have been explained quite well, primarily by inter-industry variations in advertising (Geroski, 1976). One point which emerges more clearly with a longer inspection of the data series is that while most direct investment is accounted for by the same few large industries, there is considerable variation in precise share values year by year and rankings amongst the smaller industries do change.

The data for U.K. investment was collected from appropriate issues of the Business Monitor M4 Series and is net outward investment expressed in sterling. This is defined as the sum of unremitted profits, the change in intra-company indebtedness and net

* Franks (1976) has observed the importance of non-manufacturing direct investment by Continental firms as well.

acquisitions by the parent of share and loan capital from the subsidiary. A breakdown of the components of net outward investment by all U.K. firms to all countries (including several not in the sample) is given on Table II.

Table II

The Breakdown of U.K. Net Outward Investment into Three Components

Item	1971	1970	1969	1968	1967	1966
Unremitted Profits	49%	59%	58%	68%	68%	66%
Change in indebted-ness	17%	5%	33%	18%	16%	15%
Net Acquisitions	34%	36%	19%	14%	16%	19%

Unremitted profits clearly dominate these flows, accounting for about two-thirds on average, with the other two items fluctuating somewhat between themselves in accounting for the last third. As these profits are those reported for tax reasons and given to shareholders in annual reports, they can be considered as net of any deductions which might be allocated to managerial goals such as staff and emoluments; hence, they are clearly earmarked for investment in the particular country. The remitted portion of such profits comprise those funds allocated to shareholders through dividends or sent to other countries in which the firm operates, being transmitted thence through share acquisition, loan capital or trade credit.

These net capital outflows are not, of course, the same as plant and equipment expenditures (which were unavailable) for they do

not include the important component of local borrowings. While it is hard to get a precise idea of the role of local borrowing in financing plant and equipment expenditure, it is probably rather important in a number of (primarily developed) countries (one would suspect)*, especially in times of exchange controls (which do exist on U.K. outward investment). However, unremitted profits and the other items are large and important intra-firm flows of funds and can be expected to be allocated as we have hypothesised.

Investment shares were obtained by summing the total investment flows to each country included in the sample and dividing each flow by this sum; i.e. they were calculated so as to fulfil the constraint that they sum to unity. This is not a serious distortion as the nineteen countries included accounted for about 95% of total net outward investment by all U.K. firms barring the oil companies. Several shares turned out to be negative and this reflects a net outflow from the host, presumably in accord with a policy of non-expansion or very marginal expansion in that country.

At a later stage in the testing, we shall include domestic (i.e. U.K. home) investment, figures for which were obtained from the 1973 Blue Book. This data is manufacturing plant and equipment expenditures for all (multinational or not) U.K. firms. Being plant and equipment expenditures for all U.K. firms, it does not match the data on foreign investment. One might suspect that the firms in our foreign investment

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* Again, I refer the reader to the studies of the U.S. Voluntary Exchange Restrictions; e.g. Stevens (1972); Brimmer (1966); Willey (1970) and Shapiro and Deastlov (1970).

sample account for between 50-60% of the home investment figure used (see Vernon, 1971, Chapter One), but it is almost impossible to be exactly sure what the correct figure is. While we have almost certainly over-estimated the share of home investment, it will soon be apparent the precise magnitude of the home investment share is not too big a problem. A stylized argument that rationalizes the data choice might be that the risk of foreign operations is considered too great by all those firms who do not invest abroad, and their allocation of all funds to purely domestic activities represents a choice consistent with the basic workings of the model.

Profits data for the U.K. sample was also culled from the Business Monitor and is a yearly average aggregate post-tax rate of return on capital assets. For each country there are eight observations - seven mid-year observations from 1965 to 1971, with an end year 1964. These will be used to predict 1971 investment shares. Mid-year profits for 1971 were included in the prediction of 1971 shares on the principle that much of the information contained in mid-year returns would be available for the firm to use in making investment allocations throughout the year. Rates of return for U.K. ("home") investment were calculated by dividing net profits by gross capital stock at replacement cost, figures being obtained from the 1973 Blue Book once again. The particular choice of this set of data will be discussed more fully in Appendix VII.

For the two U.S. samples, data from the Survey of Current Business provided both net capital outflows data and data on plant and equipment expenditures. Each of these two sets of dependent variables forms the basis of a separate sample, henceforth referred

to as the NKO and PE samples respectively. These two sets of data are rather a bonus and were an important factor in running a test on U.S. data to compare with the U.K. sample. By comparing the performance of both samples (which will use the same rate of return data) we can check on the possible bias due to the exclusion of local borrowing. (The U.K. sample is retained because this bias does not appear particularly strong, but that is getting ahead of the story). The breakdown of plant and equipment expenditures by various U.S. industries for the twenty-six foreign countries in both the U.S. samples is given in Table III and may be compared with Table I, illustrating the greater importance of manufacturing direct investment in U.S. totals.

Table III

Shares of U.S. Plant and Equipment Expenditures for all countries in both U.S. Samples by Industry

Industry	1972 Share	1971 Share
Mining	.0976	.1186
Petroleum	.2370	.2351
Food	.0322	.0297
Paper	.0493	.0482
Chemicals	.1211	.1216
Rubber	.0307	.0130
Metals	.0665	.0771
Machinery	.1104	.1006
Electrical Machinery	.0477	.0397
Transportation	.0634	.0741
Other Manufacturing	.0491	.0552
Others	.0945	.0889

Profits data for foreign countries in both U.S. samples were calculated by summing undistributed earnings (U.S. share), interest,

dividends and branch earnings and dividing by the book value of total assets. For home, (i.e. the U.S.) data, investment data from the Census of Production (suffering from the same deficiencies as before) comprising plant and equipment expenditure by all manufacturing establishments were used. Rates of return on home investment were obtained from the Survey of Current Business. For both U.S. samples, 1972 investment shares were predicted from the same sets of rates of return, figures for the latter ranging from 1965 to 1971.

Appendix VI

The Dependent Variable

The dependent variable for this study, investment shares, will be predicted by the model on a 'cross-section' basis; i.e. we predict the allocation of shares for one particular year across a number of countries. Some historical or 'time series' perspective is needed be before we can tackle this problem, if only to ensure that our choice of year is not too 'untypical'.

Table I presents allocated shares of U.K. net capital outflows for the years, 1966-1971, together with the mean share for each country and the coefficient of variation of that host's share over the time period. The share changes are, on the whole, not terribly large from year to year (although for global investment totals on the order of £500 million, these share variations do involve substantial variations in investment flows). Nevertheless, a few exceptionally large allocative shifts do occur - Australia, 1970, South Africa, 1971, West Indies, 1971, U.S., 1969 and Germany, 1971. While several of these large shifts do occur in 1971, there does not appear to be any reason to single 1971 out as an exceptional year. South Africa is low by historical standards and there is evidence of only a weak decline before this. Both Switzerland and the West Indies are negative in that year, and Canada is about half its mean. These historically low shares are compensated for by relatively higher shares for Belgium, Italy and Germany.

Table I

Shares of U.K. Investment in Nineteen Foreign Countries, 1966-71

Country	1966	1967	1968	1969	1970	1971	MEAN	C.O.V.
Australia	.2064	.2017	.2090	.2230	.0957	.1971	.1888	.2245
Irish Republic	-.0125	.0252	.0062	.0387	.0248	.0349	.0195	.9025
New Zealand	.0314	.0089	.0154	.0166	.0206	.0031	.0160	.0839
South Africa	.1456	.1731	.1122	.1384	.1058	.0367	.1186	.3608
Africa	.0180	.0018	.0356	.1041	.0556	.0417	.0428	.7546
West Indies	.0507	.0234	.0201	.0281	.0657	-.0541	.0223	1.695
Hong Kong	.0138	.0003	.0144	.0134	.0173	.0031	.0104	.6057
India	.0083	.0393	.0238	.0180	.0215	.0151	.0210	.4523
Malaysia	.0130	.0468	.0018	-.0003	.0219	.0155	.0164	.9512
Canada	.0814	.1244	.0776	.0682	.1004	.0458	.0830	.2963
United States	.1749	.1913	.2208	.1026	.2675	.2152	.1954	.2579
Denmark	-.0004	.0059	.0028	.0015	.0031	.0056	.0031	.7096
Switzerland	.0100	.0148	.0230	.0061	.0266	-.0191	.0102	1.460
Belgium	.0243	.0200	.0653	.0431	.0252	.0958	.0436	.5942
France	.0692	.0416	.0222	.0345	.0504	.0553	.0455	.3296
Italy	.0096	.0089	.0068	.0170	.0153	.0218	.0132	.3939
Netherlands	.0390	.0364	.0382	.0268	.0171	.0837	.0402	.5199
Germany	.0696	.0044	.0582	.0786	.0382	.1633	.0687	.8006
South/Central America	.0469	.0308	.0456	.0408	.0264	.0389	.0382	.1937

The most variable shares are those of the Irish Republic, the West Indies, Malaysia, Denmark and Switzerland, all of which have, coincidentally, low mean shares. Notwithstanding these yearly share variations, the distribution of these shares shows the same skewness year after year reflecting marked preferences by U.K. investors. On average, about 50% of U.K. net capital outflows go to Australia, the U.S. and South Africa with the remainder more evenly distributed amongst the rest with some such as Canda and Germany getting rather more and others such as Hong Kong and Denmark rather less. In general, within a broad pattern of concentrating the majority of their efforts in a few countries, year to year share variations in the

Table II

PE Shares for the U.S. Sample to Twenty-Six Foreign Countries

Country	1966	1967	1968	1969	1970	1971	1972	MEAN	C.O.V.
Canada	.3373	.2880	.2707	.2652	.2579	.2640	.2869	.2814	.0892
Mexico	.0178	.0185	.0276	.0263	.2025	.0169	.0157	.0204	.0210
Panama	.0021	.0022	.0034	.0029	.0029	.0028	.0022	.0027	.1481
Argentina	.0122	.0231	.0197	.0213	.0263	.0199	.0119	.0192	.2552
Brazil	.0161	.0198	.0347	.0363	.0257	.0289	.0477	.0249	.3311
Chile	.0114	.0175	.0292	.0308	.0250	.0014	.0013	.0167	.6830
Columbia	.0074	.0090	.0096	.0076	.0063	.0068	.0067	.0076	.1447
Peru	.0157	.0168	.0130	.0077	.0066	.0078	.0087	.0109	.3491
Venezuela	.0222	.0236	.0357	.0425	.0324	.0266	.0217	.0292	.2466
Belgium	.0379	.0415	.0312	.0236	.0343	.0436	.0373	.0356	.1741
France	.0614	.0566	.0517	.0552	.0710	.0648	.0826	.0633	.1548
Germany	.1164	.1112	.0839	.1008	.1127	.1375	.1236	.1123	.1389
Italy	.0361	.0422	.0471	.0432	.0533	.0552	.0568	.0477	.1488
Netherlands	.0277	.0371	.0321	.0464	.0375	.0356	.0307	.0353	.1586
Denmark	.0059	.0062	.0053	.0044	.0041	.0044	.0051	.0051	.1372
Norway	.0043	.0043	.0039	.0040	.0052	.0093	.0094	.0058	.3966
Spain	.0176	.0237	.0334	.0240	.0217	.0167	.0172	.0220	.2454
Sweden	.0125	.0140	.0146	.0093	.0111	.0107	.0090	.0116	.1724
Switzerland	.0086	.0074	.0097	.0095	.0110	.0096	.0116	.0096	.1250
United Kingdom	.1249	.1305	.1285	.1175	.1334	.1383	.1245	.1282	.4837
Liberia	.0014	.0020	.0033	.0019	.0022	.0011	.0011	.0018	.3889
Libya	.0150	.0252	.0351	.0374	.0185	.0053	.0079	.0206	.5633
South Africa	.0111	.0103	.0120	.0112	.0132	.0101	.0113	.0113	.0796
India	.0038	.0043	.0000	.0059	.0041	.0037	.0035	.0036	.4444
Philippines	.0088	.0076	.0057	.0042	.0000	.0046	.0039	.0050	.5200
Australia	.0620	.0560	.0578	.0599	.0621	.0730	.0603	.0617	.0827

various hosts is noticeable. Our argument is, of course, that such variations are neither random nor a result of rules of thumb.

Table II contains PE shares allocated by U.S. multinational firms to the twenty-six countries in our sample from 1966-1972. In broad outline, the pattern is similar to the U.K. although there are fewer large share changes (Mexico 1970 and the noticeable deterioration in the Chilean shares in the early 1970's). U.S. investment appears somewhat more evenly spread over a larger sample of countries than the U.K.; preferences of U.S. investors for Canada, Germany and the U.K. account for slightly over 50% of total on average.

Appendix VII

The Independent Variables

Tables I and II show the variance-covariance matrices for the U.K. and U.S. samples calculated from past observations on the rate of return in the various hosts for each of the two investing countries. One point worth noting is that covariances are far from trivial. The information in these tables is difficult to assimilate and on Tables III and IV, expected returns and risk for all countries in each sample are tabulated. On Table V, the expected return and risk figures for the thirteen countries common to both the U.K. and U.S. samples are collected and presented for direct comparison.

Expected returns are simply the arithmetic means for each country over the rate of return series. Risk(i) is the standard deviation over the same series, this being the most common measure of risk. However, it has been long known (e.g. Markowitz, 1959) that standard deviations are not appropriate measures of risk when choice pertains to several options whose covariances do not vanish; the measure, Risk(ii) reflects this. Formally, Risk(ii) is:

$$\text{RISK(ii)}_i = \sum_j \lambda_i \lambda_j \rho^*_{ij} , \qquad \lambda_i = \lambda_j = \frac{1}{N}$$

that is, it is the risk of an allocation of N pounds equally over all host nations so that each get a share N^{-1}. This is merely an <u>index</u> and does not correspond to an optimal policy which is likely to involve unbalanced investment. The ith element of Risk(ii) bears the

Table I

Returns Covariance Matrix for U.K. Sample

	Australia	Irish Republic	New Zealand	South Africa	Africa
Australia	0.3248	0.3998	0.2729	-0.4734	0.1635
Irish Republic	0.3998	1.2173	0.1842	-0.3510	0.2210
New Zealand	0.2729	0.1842	1.0535	0.9453	-0.1282
South Africa	-0.4734	-0.3510	0.9453	0.2998	-0.4210
Africa	0.1635	0.2210	-0.1282	-0.4210	1.8873
West Indies	0.6375	0.1875	-0.5250	0.2500	0.1137
Hong Kong	1.4231	2.5181	1.2818	-0.4831	1.1743
India	0.1389	0.3176	-0.3654	-0.1651	0.6051
Malaysia	0.5464	0.9476	-0.4429	-0.4826	2.8726
Canada	-0.9531	-0.2781	0.8843	0.1853	-0.7103
United States	-0.2275	-0.9625	0.6437	0.6575	-1.3812
Denmark	-0.6609	-0.1384	-2.0621	-0.4440	0.8940
Switzerland	0.5584	1.5171	-1.4315	-1.4446	0.1809
Belgium	-0.2296	0.4470	0.8239	-1.8220	3.8807
France	0.7640	0.7239	-0.8129	-1.0376	2.9351
Italy	0.4853	0.1203	0.2090	-0.7753	3.1928
Netherlands	0.8178	2.0803	-0.8759	-2.0240	6.6140
Germany	0.6834	1.1734	1.3134	-1.2209	3.8046
South/Central America	-0.1973	-0.3410	0.9078	-0.3276	0.9601
United Kingdom	-0.1960	-0.7948	0.6607	0.4385	-1.1398

Continued.....

Table I Continued

	West Indies	Hong Kong	India	Malaysia	Canada
Australia	0.6375	1.4231	0.1389	0.5464	-0.9531
Irish Republic	0.1875	2.5181	0.3176	0.9476	-0.2781
New Zealand	-0.5250	1.2818	-0.3654	-0.4429	0.8843
South Africa	0.2500	-0.4831	-0.1651	-0.4826	0.1853
Africa	0.1137	1.1743	0.6051	2.8726	-0.7103
West Indies	0.1600	0.6875	0.2162	0.6637	0.3250
Hong Kong	0.6875	8.1375	1.0393	3.9606	-0.2787
India	0.2162	1.0393	0.6773	1.3073	-0.2221
Malaysia	0.6637	3.9606	1.3073	6.6823	-0.8621
Canada	0.3250	-0.2787	-0.2221	-0.8621	0.3493
United States	-0.1875	-1.7012	-0.7700	-2.6262	0.5475
Denmark	0.2212	-2.1462	1.1321	1.3534	-0.2993
Switzerland	0.3162	3.3350	2.1328	6.5915	-1.7881
Belgium	-1.1375	-1.0443	-0.3845	0.6667	-1.9984
France	0.3125	0.9743	0.9248	4.0785	-1.1871
Italy	-0.2750	1.3587	0.5446	3.5796	-1.5368
Netherlands	0.5450	5.8950	2.8021	10.1072	-2.5443
Germany	-0.1912	3.7437	0.4103	4.1428	-1.5356
South/Central America	-0.3337	-1.2918	-0.1514	-0.1289	-0.4896
United Kingdom	-0.2450	-1.4918	-0.6539	-2.7239	0.3928

Continued.....

Table I Continued

	United States	Denmark	Switzerland	Belgium	France
Australia	-0.2275	-0.6609	0.5584	-1.2296	0.7640
Irish Republic	-0.9625	-0.1384	1.5171	0.4470	0.7239
New Zealand	0.6437	-2.0621	-1.4315	0.8239	-0.8129
South Africa	0.6575	-0.4440	-1.4446	-1.8220	-1.0376
Africa	-1.3812	0.8940	4.1809	3.8807	2.9351
West Indies	-0.1875	0.2212	0.3162	-1.1375	0.3125
Hong Kong	-1.7012	-2.1462	3.3350	-1.0443	0.9743
India	-0.7700	1.1321	2.1328	-0.3845	0.9248
Malaysia	-2.6262	1.3534	6.5915	0.6667	4.0785
Canada	0.5475	-0.2993	-1.7881	-1.9984	-1.1871
United States	2.0825	-1.7025	-4.7162	-2.7112	-2.9950
Denmark	-1.7025	5.1693	4.2468	0.2559	2.6509
Switzerland	-4.7162	4.2468	12.5919	8.8278	7.8890
Belgium	-2.7112	0.2559	8.8278	24.5711	8.2879
France	-2.9950	2.6509	7.8890	8.2879	5.7698
Italy	-2.0725	0.5312	7.1293	10.5097	5.1784
Netherland	-6.1625	4.5756	17.0731	14.3822	11.2784
Germany	-2.5062	-1.0443	7.6643	14.3653	6.1615
South/Central America	-0.35200	0.3759	1.8128	6.0904	1.9323
United Kingdom	1.7612	-1.4578	-3.8209	-0.9495	-2.3926

Continued.....

Table I Continued

	Italy	Netherlands	Germany	South/Central America	United Kingdom
Australia	0.4853	0.8178	0.6834	-0.1973	-0.1960
Irish Republic	0.1203	2.0803	1.1734	-0.3410	-0.7948
New Zealand	0.2090	-0.8759	1.3134	0.9078	0.6607
South Africa	-0.7753	-2.0240	-1.2209	-0.3276	0.4385
Africa	3.1928	6.6140	3.8046	0.9601	-1.1398
West Indies	-0.2750	0.5450	-0.1912	-0.3337	-0.2450
Hong Kong	1.3587	5.8950	3.7437	-1.2918	-1.4918
India	0.5446	2.8021	0.4103	-0.1514	-0.6539
Malaysia	3.5796	10.1072	4.1428	-0.1289	-2.7239
Canada	-1.5368	-2.5443	-1.5356	-0.4896	0.3928
United States	-2.0725	-6.1625	-2.5062	-0.3525	1.7612
Denmark	0.5312	4.5756	-1.0443	0.3759	-1.4578
Switzerland	7.1293	17.0731	7.6643	1.8128	-3.8209
Belgium	10.5097	14.3822	14.3653	6.0904	-0.9495
France	5.1784	11.2784	6.1615	1.9323	-2.3926
Italy	7.3493	10.8731	8.0743	2.5709	-1.4303
Netherlands	10.8731	25.6169	13.6331	3.1346	-4.8640
Germany	8.0743	13.6331	11.8144	3.2278	-1.5284
South/Central America	2.5709	3.1346	3.2278	1.7223	0.2859
United Kingdom	-1.4303	-4.8640	-1.5284	0.2859	1.6873

Table II

Returns Covariance Matrix for U.S. Sample

	Canada	Mexico	Panama	Argentina	Brazil	Chile	Colombia	Peru	Venezuela
Canada	0.1479	-0.1116	-0.6008	-0.1307	0.8116	-0.5567	0.3986	-0.6609	-0.5344
Mexico	-0.1116	0.7163	0.4311	1.6547	-0.4310	4.7638	-1.4504	3.4907	2.8734
Panama	-0.6008	0.4311	0.4037	0.3492	0.2017	0.8542	0.1560	0.2822	0.1279
Argentina	-0.1307	1.6547	0.3492	6.5635	-0.3579	9.5105	-1.9822	11.1953	6.0716
Brazil	0.8116	-0.4310	0.2017	-0.3579	0.7728	-4.1843	1.2365	-1.7977	-1.6888
Chile	-0.5567	4.7638	0.8542	9.5105	-4.1843	40.9818	-10.4266	24.1456	18.4917
Colombia	0.3986	-1.4504	0.1560	-1.9822	1.2365	-10.4266	4.1728	-4.6815	16.0089
Peru	-0.6609	3.4907	0.2822	11.1953	-1.7977	24.1456	-4.6815	25.8675	13.1073
Venezuela	-0.5344	2.8734	0.1279	6.0716	-1.6888	18.4917	-6.0089	13.1073	11.7716
Belgium	0.1776	-1.1636	0.7190	-1.8622	1.2666	-8.0877	2.8825	-7.0384	-4.7065
France	0.4123	-1.7101	1.0107	-2.9907	1.5796	-10.4650	4.6596	-8.3383	-6.9593
Germany	-0.1356	-1.3509	0.9196	-2.7826	1.4303	-9.5473	3.6903	-8.3347	-5.1752
Italy	-0.1984	-0.3656	0.6265	-2.6218	0.8855	0.6393	0.4931	-2.8056	-1.1095
Netherlands	-0.5732	-1.6573	-0.1965	-4.5216	1.4656	-14.4984	3.4306	-9.8864	-5.9779
Denmark	-0.6758	0.6488	0.7557	2.9265	0.6088	1.3637	0.7304	4.6869	2.8477
Norway	-0.2224	0.6642	0.3919	1.4254	0.1779	-1.005	1.1368	-0.3638	-0.1714
Spain	-0.2065	0.3664	-0.3665	3.5477	0.3517	-1.6877	0.9776	5.7432	1.1527
Sweden	-0.8210	-0.4851	0.3486	-0.8590	0.4315	-4.2003	1.4040	-2.4387	-1.8641
Switzerland	-0.1053	-0.5617	0.4373	-2.3191	0.5909	-1.7132	0.9936	-4.8307	-2.0911
United Kingdom	0.1222	-0.2935	-0.1480	0.9464	0.6415	-4.5722	1.2672	-0.2143	-1.3712
Liberia	0.1164	0.4859	0.2409	1.1009	-0.3225	5.0832	-1.2274	3.0095	1.7567
Libya	-0.6406	8.6224	4.0655	17.9312	-5.4066	76.5741	-18.4191	43.9552	33.5818
South Africa	-0.6409	1.8069	-0.3655	4.6736	-1.3302	11.3349	-2.6546	12.1874	7.1753
India	0.1085	-1.4959	-0.2725	-3.4218	0.7175	-13.5255	2.9497	-12.9932	-5.7013
Philippines	-0.5393	0.3147	-0.5135	0.5648	-0.8470	0.4290	1.1487	2.2939	-0.9233
Australia	-0.2414	-1.0449	0.2863	-1.9546	0.6821	-7.0401	3.2154	14.5265	-4.1684
United States	-0.4944	1.0470	-0.6813	3.1696	-0.9137	6.0097	-2.0307	7.3107	3.9151

Continued.....

Table II Continued

	Belgium	France	Germany	Italy	Netherlands	Denmark	Norway	Spain	Sweden
Canada	0.1776	0.4123	-0.1356	-0.1984	-0.5732	-0.6758	-0.2224	-0.2065	-0.8210
Mexico	-1.1636	-1.7101	-1.3509	-0.3656	-1.6573	0.6488	0.6642	0.3664	-0.4851
Panama	0.7190	1.0107	0.9196	0.6265	-0.1965	0.7557	0.3919	-0.3665	0.3486
Argentina	-1.8622	-2.9907	-2.7826	-2.6218	-4.5216	2.9265	1.4254	3.5477	-0.8590
Brazil	1.2666	1.5796	1.4303	0.8855	1.4656	0.6088	0.1779	0.3517	0.4315
Chile	-8.0877	-10.4650	-9.5473	0.6393	-14.4984	1.3637	-1.0056	-1.6877	-4.2003
Colombia	2.8825	4.6596	3.6903	0.4931	3.4306	0.7304	1.1368	0.9776	1.4040
Peru	-7.0384	-8.3383	-8.3347	-2.8056	-9.8864	4.6869	-0.3638	5.7432	-2.4387
Venezuela	-4.7065	-6.9593	-5.1752	-1.1095	-5.9779	2.8477	-0.1714	1.1527	-1.8641
Belgium	4.3622	5.5785	5.2113	1.1287	2.9880	0.9708	2.1909	-0.9504	1.2808
France	5.5785	8.1141	7.2401	2.4841	4.1062	1.7680	2.7209	-1.2304	1.8560
Germany	5.2113	7.2401	7.1834	2.3771	4.3562	2.5959	3.0193	-1.2144	1.8684
Italy	1.1287	2.4841	2.3771	3.5389	1.1430	0.4652	-0.6199	-2.9793	0.1893
Netherlands	2.9880	4.1062	4.3562	1.1430	6.1892	0.4161	0.2279	-0.3954	1.6793
Denmark	0.9708	1.7680	2.5959	0.4652	0.4161	5.9158	2.6709	2.4511	0.7723
Norway	2.1909	2.7209	3.0193	-0.6199	0.2279	2.6709	3.7365	1.3193	0.9383
Spain	-0.9504	-1.2304	-1.2144	-2.9793	-0.3954	2.4511	1.3193	4.7519	0.3518
Sweden	1.2808	1.8560	1.8684	0.1893	1.6793	0.7723	0.9383	0.3518	0.6987
Switzerland	2.2120	3.3013	3.3241	2.1008	1.4176	0.3229	1.3148	-2.1899	0.6700
United Kingdom	0.7328	0.5793	0.4096	-1.6970	0.8817	0.5322	0.8192	2.0653	0.4552
Liberia	-0.9432	-1.2416	-1.5172	0.2870	-2.0508	-0.5484	-0.9422	-0.6399	-0.7686
Libya	-10.9858	-14.1554	-13.2608	5.8573	-26.1630	5.2794	-3.5142	-6.6705	-8.1226
South Africa	-4.3935	-5.1289	-4.4366	-1.4669	14.0112	2.6464	-0.2822	3.1583	-0.9501
India	5.0710	5.5194	6.4118	-0.9446	5.1151	0.4571	4.9293	-0.1729	2.3194
Philippines	-0.5918	0.3437	0.3864	-0.8218	-0.2403	1.5423	2.4945	2.2437	0.7664
Australia	2.8868	4.7029	4.3933	1.2315	2.9457	1.7471	2.2597	0.1949	1.4669
United States	13.4456	14.7686	-4.6218	-2.5767	-3.0533	-0.4588	-0.8173	2.4735	-0.9568

Continued.....

Table II Continued

	Switzerland	United Kingdom	Liberia	Libya	South Africa	India	Philippines	Australia	United States
Canada	-0.1053	0.1222	0.1164	-0.6406	-0.6409	0.1085	-0.5393	-0.2414	-0.4944
Mexico	-0.5617	-0.2935	0.4859	8.6224	1.8069	-1.4959	0.3147	-1.0449	1.0470
Panama	0.4373	-0.1480	0.2409	4.0655	-0.3655	-0.2725	-0.5135	0.2863	-0.6813
Argentina	-2.3191	0.9464	1.1009	17.9312	4.6736	-3.4218	0.5648	-1.9546	3.1696
Brazil	0.5909	0.6415	-0.3225	-5.4066	-1.3302	0.7175	-0.8470	0.6821	-0.9137
Chile	-1.7132	-4.5722	5.0832	76.5741	11.3349	-13.5255	0.4290	-7.0401	6.0097
Colombia	0.9936	1.2672	-1.2274	-18.4191	-2.6546	2.9497	1.1487	3.2154	-2.0307
Peru	-4.8307	-0.2143	3.0095	43.9552	12.1874	-12.9932	2.2939	-4.5265	7.3107
Venezuela	-2.0911	-1.3712	1.7567	33.5818	7.1753	-5.7013	-0.9233	-4.1684	3.9151
Belgium	2.2120	0.7328	-0.9432	-10.9858	-4.3935	5.0710	-0.5918	2.8868	-3.4456
France	3.3013	0.5793	-1.2416	-14.1554	-5.1289	5.5194	0.3437	4.7029	-4.7686
Germany	3.3241	0.4096	-1.5172	-13.2608	-4.4366	6.4118	0.3864	4.3933	-4.6218
Italy	2.1008	-1.6970	0.2870	5.8573	-1.4669	-0.9446	-0.8218	1.2315	-2.5767
Netherlands	1.4176	0.8817	-2.0508	-26.1630	-4.0112	5.1151	-0.2403	2.9457	-3.0533
Denmark	0.3229	0.5322	-0.5484	5.2794	2.6464	0.4571	1.5423	1.7471	-0.4588
Norway	1.3148	0.8192	-0.9422	-3.5142	-0.2822	4.9293	2.4945	2.2597	-0.8173
Spain	-2.1899	2.0653	-0.6399	-6.6705	3.1583	-0.1729	2.2437	0.1949	2.4735
Sweden	0.6700	0.4552	-0.7686	-8.1226	-0.9501	2.3194	0.7664	1.4669	-0.9568
Switzerland	2.5048	-0.8384	-0.4836	-1.9834	-2.2403	3.2350	0.6075	2.0751	12.5506
United Kingdom	-0.8384	1.5166	-0.6014	-9.3716	-0.3525	1.5556	0.2980	0.4594	0.4251
Liberia	-0.4836	-0.6014	1.0937	11.6383	0.7335	-3.1495	-1.1844	-1.3791	0.6037
Libya	-1.9834	-9.3716	11.6383	165.3300	16.4630	-31.2775	-7.6032	-13.3819	6.3102
South Africa	-2.2403	-0.3525	0.7335	16.4630	7.2396	-5.0027	2.8726	-1.8556	4.0854
India	3.2350	1.5556	-3.1495	-31.2775	-5.0027	13.8770	2.9860	4.4183	-3.2561
Philippines	0.6075	0.2980	-1.1844	-7.6032	2.8726	2.9860	5.6593	2.2950	1.1657
Australia	2.0751	0.4594	-1.3791	-13.3819	-1.8556	4.4183	2.2950	3.6530	12.3874
United States	-2.5506	0.4251	0.6037	6.3102	4.0854	-3.2561	1.1657	-2.3874	3.7310

following interpretation: it is the contribution to total portfolio risk by the ith country resulting from a policy of allocating funds equally between countries. Total risk is the sum of the elements of Risk(ii).

Table III

Expected Return and Risk of U.K. Investment in Nineteen Foreign Countries and the U.K.

Country	Expected Return	Risk(i)	Risk(ii)
Australia	7.437(13)	.5699(18)	.0117(14)
Irish Republic	9.237(10)	1.103(14)	.0254(12)
New Zealand	6.987(15)	1.026(15)	-.0002(16)
South Africa	12.06 (5)	.5475(19)	-.0244(17)
Africa	9.637(8)	1.373(11)	.0770(8)
West Indies	5.100(19)	.4000(20)	.0026(15)
Hong Kong	18.85(1)	2.8526(5)	.0712(9)
India	7.362(14)	.8230(16)	.0253(13)
Malaysia	14.86(2)	2.585(7)	.1070(7)
Canada	5.775(16)	.5910(17)	-.0308(18)
United States	11.00(6)	1.443(10)	-.0676(20)
Denmark	.5256(20)	2.273(9)	.0308(11)
Switzerland	14.57(3)	3.548(3)	.1907(3)
Belgium	7.612(12)	4.956(2)	.2098(2)
France	5.262(18)	2.402(8)	.1318(6)
Italy	5.525(17)	2.710(6)	.1412(5)
Netherlands	8.325(11)	5.061(1)	.2939(1)
Germany	12.47(4)	3.437(4)	.1840(4)
South/Central America	10.36(7)	1.312(12)	.0456(10)
United Kingdom	10 (9)	1.298 (13)	.0056(19)

Expected Return: arithmetic average of rate of return on capital assets for eight years preceding 1971.

Risk(i): standard deviation of rates of return in previous eight years.

Risk(ii): weighted sum of variance and covariances for each country; weights = $(20)^{-2}$.

Numbers in parentheses are rankings.

Table IV

Expected Return and Risk of Total U.S. Investment

in Twenty-Six Foreign Countries and the U.S.

Country	Expected Return	Risk(i)	Risk(ii)
Canada	8.127(14)	.3846(27)	-.0058(22)
Mexico	8.350(13)	.8463(24)	.0160(9)
Panama	11.44(7)	.6353(26)	.0121(11)
Argentina	10.19(8)	2.555(8)	.0548(4)
Brazil	9.628(10)	.8791(23)	-.0057(21)
Chile	11.54(6)	6.402(2)	.1251(2)
Columbia	5.077(22)	2.042(14)	-.0124(26)
Peru	14.85(5)	5.086(3)	.1037(3)
Venezuela	17.82(2)	.9836(22)	-.0114(24)
Belgium	9.041(11)	2.088(13)	-.0009(19)
France	6.598(21)	2.848(5)	.0053(17)
Germany	9.055(12)	2.680(7)	.0079(13)
Italy	3.580(25)	1.881(18)	.0058(15)
Netherlands	7.765(16)	2.487(9)	-.0431(27)
Denmark	2.397(26)	2.432(10)	.0532(5)
Norway	1.577(27)	1.933(15)	.0326(7)
Spain	5.067(23)	2.179(12)	.0156(10)
Sweden	4.082(24)	.8359(25)	-.0028(20)
Switzerland	15.74(4)	1.582(19)	.0054(18)
United Kingdom	7.682(17)	1.231(20)	-.0057(23)
Liberia	9.780(9)	1.045(21)	.0104(12)
Libya	62.51(1)	1.285(1)	.2615(1)
South Africa	15.85(3)	2.690(6)	.0444(6)
India	6.725(20)	3.725(4)	-.0220(25)
Philippines	7.258(18)	2.378(11)	.0215(8)
Australia	7.849(15)	1.911(17)	.0054(16)
United States	7.242(19)	1.931(15)	.0067(14)

Expected Return: arithmetic average of rate of return on capital assets for seven years preceding 1971.

Risk(i): standard deviation of rates of return over past seven years.

Risk(ii): weighted sum of variances and covariances for each country; weights + $(27)^{-2}$.

Numbers in parentheses are rankings.

It is apparent that Risk(i) and Risk(ii) are similar but they do produce different rankings of countries. Indeed, the rank correlation coefficient between them for the two (U.K. and U.S.) samples are R = .8241 and R = .4243 respectively. Clearly, the contribution of covariances under the weighting scheme underlying Risk(ii) is greater for the U.S. than the U.K. The fact that Risk(ii) is everywhere lower than Risk(i) reflects of course the advantages of diversification - should all investment have occurred in country i, total risk would be the square of Risk(i).

Scanning Tables III and IV, it is intuitively apparent that Risk(ii) is somewhat doubtful as a measure of risk. On Table III, South Africa is ranked 19th and 17th <u>least</u> risky (in terms of Risk(i) and Risk(ii) respectively) and the West Indies 20th and 15th while the U.S. is 10th and 20th and Australia is 18th and 14th. But, this does not accord at all with common sense; the former two countries cannot be considered less risky than the U.S. or Australia if only because they are in the process of important political change. One might find particular firms or industries which might find such ranking 'correct' because of unusual circumstances, but not the manufacturing sector as a whole. On Table IV, Germany is ranked 7th and 13th, U.K. 20th and 23rd, Canada 27th and 22nd, France 5th and 17th, while Panama is 26th and 11th least risky and India 4th and 25th. That Panama is considered to be safer to U.S. investors than Germany, and France more risky than India is a little hard to believe. Finally, notice that in both tables the home countries (i.e. the U.K. and the U.S. respectively) are not ranked least risky of all.

What these observations suggest is, I think, that these measures of risk must be viewed with extreme caution and that the amount of information conveyed in the variance-covariance matrices on Tables I and II on the risk of investment is limited. That is, they reflect risk in limited ways. This arises because past returns, however manipulated, cannot be expected to fully predict future risk and problems. The course that this study will take reflects the belief engendered earlier and confirmed here that the approximation of ex ante variables from ex poste data is the most serious problem facing studies of this kind.

Turning to expected returns, there appears to be a weak tendency for expected returns to be higher in less developed than in developed countries. This accords with one's feeling that the power of multinationals to exploit these markets and bargain favourably with such host governments is greater in these countries and that high returns must be within their grasp if they are to invest (ceteris paribus with respect to our measured risk). Compare on Table X, for example, Hong Kong, Malaysia and South/Central America to Australia and the Netherlands. However, observations such as Germany and the West Indies obscure the relation and suggest weaknesses in such casual reasonings*. This weak tendency for less developed countries to have higher expected returns is coupled with a weak tendency for their risk to be higher. Thus, Hong Kong is 5th and 9th most risky and Malaysia is 7th and 7th; however, the West Indies, the Netherlands and

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* Moran (1974) presents a dynamic bargaining model with more appeal than this casual argument which relies on the asymmetry between 'developed' and 'less developed' countries. See also Gilpin (1975) and Spero (1977) on these matters.

Germany all provide exceptions to the pattern. Indeed, for the sample as a whole, the rank correlation between expected return and Risk(ii) is R = .1474 showing a weak tendency for higher expected return to be associated with higher risk (N.B. Risk(ii) is ranked in order of descending risk)*.

On Table IV, the situation is slightly different. The tendency for developing countries to have high expected returns is somewhat more evident: Panama 7th, Argentina 8th, Chile 6th, Peru 5th, Venezuela 2nd and Libya 1st. As far as risk is concerned, the pattern observed earlier is also stronger: Mexico 9th risky, Argentina 4th risky, Chile 2nd, Peru 3rd, Libya 1st and so on. For all countries, the rank correlation is R = .2424, slightly stronger than before.

One final set of observations is worth making. On Table V, we have tabulated risk and return in the thirteen countries common to both samples. It is worth noting that, bar India, they are all developed countries and reference to the two preceding tables show that colonial ties and economic domination of proximate countries has played a large role in the spread of U.S. and U.K. multinationals to less developed countries (see also Reuber, 1973, Appendix A). From Table V, it is apparent that the risk and return to U.S. and U.K. multinationals operating in these countries is quite different and this should come as no surprise. Even in equity investment models return streams and hence optimal portfolios for investors in different

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* This does not conflict with the literature underlying the portfolio model (e.g. Mossin, 1966) for the shares used here to calculate Risk(ii) are not equilibrium shares. Note also that these risk return combinations will lie well within the 'investment opportunity curve' (Sharpe, 1964), for combinations of them will dominate.

Table V

U.S. and U.K. Risk and Return in Countries common to both Samples

Country	U.S. Expected Return	U.S. Risk	U.K. Expected Return	U.K. Risk
Belgium	9.041	-.0009	7.612	.2098
France	6.598	.0053	5.262	.1318
Germany	9.055	.0079	12.47	.1840
Italy	3.580	.0058	5.525	.1412
Netherlands	7.765	-.0431	8.352	.2939
Denmark	2.397	.0532	.525	.0308
Canada	8.127	-.0058	5.775	-.0308
Switzerland	15.74	.0054	14.57	.1907
United Kingdom	7.682	-.0057	9.362	-.0510
South Africa	15.85	.0444	12.06	-.0244
India	6.725	-.0220	7.362	.0253
Australia	7.894	.0054	7.437	.0117
United States	7.242	.0067	11.00	-.0676

countries investing in a given host capital market can differ, most prominently from differences in exchange rate movements and exchange risk (Levy and Sarnat, 1975). There can be no doubting that this factor plays an important role in what is occurring here. More importantly, it is the special advantages or assets which a firm takes abroad which are of crucial importance. There is, of course, no reason to believe that these assets are the same for both the U.S. and the U.K. (in fact, the empirical evidence seems against it; see Geroski, 1976), not that they are exploited with equal success. One would even expect returns to differ between similar firms in the same industry from the same investing country in the same host.

Nevertheless, the pattern shows that U.S. and U.K. investors find these developed countries relatively similar when ranked in

terms of expected profits; R = .7967. One suspects that similar environments in the hosts call forth similar skills and that competition works to reduce profitability differences within a host to some extent. Turning to risk, however, we find a different pattern. Here the rank correlation between the two investing countries is R = -.1209 which is weakly negative. That is, there appears to be a weak tendency for U.K. firms to find countries risky which rank as relatively riskless from the point of view of the U.S. As the rank correlation between Risk(i) for the two investing countries is R = .0440 one suspects that it is the differences in covariances which account for these results. Thus, while the risk U.S. and U.K. firms face bear a weakly negatively relation, both agree on a ranking based on expected returns.

Appendix VIII

A Firm Study

Our empirical work has concentrated the prediction of investment flows by all U.K. (or U.S.) firms to a set of host countries. This, of course, was forced upon us by data constraints. The data available for the aggregate study had some drawbacks but was good enough to support a first effort; very little published data exists on industry let alone firm level and we had to make do with what we could get. Recall that one advantage of such aggregate data was that it gave rise to some hopes that data errors and distortions would cancel; in particular, some reasons were suggested for believing that transfer pricing, which distorts ex poste profits data, might have only moderate effects on our data. This is because many of the determinants of such prices are firm or industry specific and might easily cancel out at the country level. The principal disadvantages of the aggregate testing is that one is not quite sure what to make of a given set of results. On the one hand, we have the famous aggregation problem which is that even if every firm behaved in the manner hypothesised, the aggregate may not so behave. The other side of this coin is that should the aggregate behave as we have hypothesised firms behave, that gives no guarantee that the firms did behave in that manner; the aggregate results might be quite fortuitous.

This aggregation problem was considered serious enough to justify efforts to obtain firm level data from particular U.K. multinational firms. Prior information revealed a number of such firms

(about twenty-five) who have, in the past, proved co-operative and data requests were dispatched to them. Only one firm was willing to supply the data required; everyone else held that the data was too sensitive to release. This firm, Firm X, is a large, well-known U.K. firm producing a mix of consumers and producers goods with quite an extensive world wide set of operations. Data on the two variables were supplied for five geographical regions of the world - the U.K., Europe, North America, Africa, and Australasia. The investment data were plant and equipment expenditures for 1976. Rates of return for three prior years were supplied, defined as the ratio of "Operating Profit to Net Funds Employed".

Three particular problems are opened up by this data: transfer pricing, the small sample size, and new investment. The extent of bias arising from transfer pricing is not clear. The executive in question emphatically denied (several times) the possibility; however, the firm engages in extensive intra-firm trade and some arbitrary element is bound to enter pricing (e.g. through allocation of fixed costs between plants or divisions). The general levels and recent profits trends were discussed freely and the explanations given appeared convincing and to that extent one might be willing to give the benefit of the doubt.

The small sample size cuts two ways. On the one hand, one might really hope to predict allocations to each of the individual plants all over the world and certainly hope to at least consider investment with more diversification possibilities. A sample of five is quite small for these purposes. On the other hand, the firm may well make such decisions on such a basis, leaving each of the

five divisions to allocate the funds allocated to them amongst their plants and/or smaller divisions. Thus, top executives may really think in terms of these five and the optimization procedure proceeds thus through a number of stages.

The final problem is new investment. In aggregate testing one can reasonably expect new investment to be a small percentage of the total and so one can apply an essentially expansionary investment model without much worry on this count. However, this cannot be true at the firm level. New projects abound in our sample and this leaves one in the rather uncomfortable position of applying to new investment a model not really capable of handling it.

Thus, the adoption of a new, firm level sample has some drawbacks and some advantages vis-a-vis the aggregate testing done earlier. One can, I think, have more confidence in the firm level test in the absence of clear knowledge of the aggregation bias; the data shortcomings appear to be secondary.

It is worth noting a few points which came up in the course of the interview with the executive who supplied the data; in particular, two points of interest arose about the investment decision process. First, while plant and equipment decisions were decentralized to the extent that specific suggestions for expansion travelled upwards from plant to division to top management, the centralisation of financial decisions constrained autonomy. The financial controls emanating from the top decision making body appeared in the form of levying dividends from divisions to the parent and setting gearing limits. However, while this controls divisions in an essentially negative way, some flexibility did remain insofar as dividend and gearing decisions were imposed upon divisions and not plants.

Second, one got the impression from our discussions that the general model proposed here would have been disowned by Firm X on the grounds that it was too analytical and required too much information and processing. The general principle, however, met with warm support. Indeed, the findings of Chapters III and IV were quoted and received a favourable reaction and it was suggested that they made a certain amount of sense. The importance of risk was repeatedly emphasised but it was clear that no single risk index was used although rules of thumb, executive experience and some partial indices were relied upon.

Thus, this last test is something of a check. Should the model perform better or, at least no worse than before, there would appear to be no reason to question the results obtained earlier. This in fact turns out to be the case.

Table I contains the estimated shares of Firm X to the five host 'countries'. The first column shows actual shares; the following six are the estimated shares calculated with the following proxies for expected values: MEAN, M76, MEAN+DP, M76+DP, M76+DP76 and MEAN+DP76. Because of the shortness of the sample length no formal significance tests were attempted.

Several interesting features of these estimates are worth noting. The first is that home investment is consistently over-estimated, a result rather different from those we are used to. U.K. investment accounts for 37% of Firm X's global investment and while it is the largest individual share, it is closely followed by the European total. Two points are worth commenting on in this regard. First, unlike our earlier data, the home investment figures are fully compatible

Table I

Actual and Estimated Shares from Firm X to Five Host Countries

	Λ_1	Λ_2	Λ_3	Λ_4	Λ_5	Λ_6	Λ_7
	Actual Shares	Estimated Shares (MEAN)	Estimated Shares (M76)	Estimated Shares (MEAN+DP)	Estimated Shares (M76+DP)	Estimated Shares (M76+DP76)	Estimated Shares (MEAN+DP76)
United Kingdom	.37	.4533	.4497	.4617	.4617	.3683	.4356
Europe	.28	.1034	.1194	.1300	.1218	.1886	.1249
North America	.05	.2053	.1959	.1812	.1807	.1931	.1988
Africa	.21	.1538	.1651	.1575	.1663	.2036	.1784
Asia/Australasia	.09	.0839	.0679	.0693	.0692	.0462	.0620

with the foreign investment figures; the earlier samples included non-multinationals in the home investment totals. The second point is that Firm X is a large, long established multinational; it has, no doubt, gone native in many of its foreign environments. Consequently, its home preferences have weakened. The consistent over-estimation of the home investment figure suggests that the model is marginally more sanguine about home investment than Firm X is. The model also appears to be roughly correct in its assessment of Asia and Australia, assessing them to be risky in much the same manner as Firm X itself. The problems for the model appear in Europe, North America and Africa. The model under-estimates Europe, over-estimates North America and somewhat more accurately, but nevertheless incorrectly, under-estimates Africa.

As with our earlier findings, we suspect that the important driving force is risk. Table II presents correlations between the various proxies of expected and the various estimates of shares from Table I. The pattern here conforms to that observed in Chapter III. The various proxies for expected values are closely related but the shares estimated using each are virtually indistinguishable. Expected returns appear to be playing very little role in the allocation process. Of the various proxies, the share estimates using M76+DP76 appear to produce the closest relation to actual shares, but the differences are, as noted, small.

We can easily extend the model for this sample as we have done in Chapter IV but there is, I think, little point. We can proceed to compute the five h_i's needed to make the model work and reapproach the firm for figures on VALDI which ultimately determine these h_i's

Table II

Correlations between Proxies of Expected Returns

	MEAN	M76	MEAN+DP	M76+DP	M76+DP76	MEAN+DP76
MEAN	1					
M76	.9308	1				
MEAN+DP	.9660	.9905	1			
M76+DP	.8005	.9617	.9269	1		
M76+DP76	.6113	.8556	.7824	.9464	1	
MEAN+DP76	.8272	.9709	.9287	.9783	.9437	1

Correlations between Shares estimated using various Proxies for Expected Returns

	Actual Share	MEAN	M76	MEAN+DP	M76+DP	M76+DP76	MEAN+DP76
Actual Share	1						
MEAN	.5931	1					
M76	.6490	.9956	1				
MEAN+DP	.6912	.9915	.9974	1			
M76+DP	.6831	.9926	.9984	.9992	1		
M76+DP76	.7560	.9002	.9347	.9339	.9330	1	
MEAN+DP76	.6540	.9900	.9982	.9937	.9956	.9506	1

but the gain in knowledge would be small. This little exercise we have performed here has yielded interesting information on aggregation problems with our earlier samples. The model appears to perform marginally better (but only just so) than with the full aggregate

samples and is thus as consistent with the evidence available as were those studies. One cannot, of course, generalize this after only one firm level study, but it does allow some relaxation.

Appendix IX

Some Political Determinants of Risk

All the data used in this study are from Taylor and Hudson (1972). The variables are described in Table I and the data presented in Table II. All quotes in variable description are from this source as well. Some data was apparently not available in the same year for each country, hence the references to time intervals, e.g. "early 1960's". This difference of years is probably unimportant as the variables in question are rather sluggish and probably not subject to appreciable yearly variation.

Table I

Variables

VALDI: Book value of net assets of all U.K. firms in the host country as of year end, 1970. Included are all countries with a figure exceeding £10 million. Data for this variable obtained from Business Monitor M4 series.

IS: Internal security forces per 1000 of working age population for either 1964, 1965 or 1966. This data includes "police forces at all levels of government and such paramilitary internal security forces such as gendarmeries, active militias and active national guards".

MM: Military manpower per 1000 of the working age population. This includes "military personnel actually on duty, including paramilitary forces where significant ... reserve forces are excluded".

PF: An index of party fractionalization. This index reflects the likelihood that two randomly selected members of the legislature will belong to different political parties, based on the number of seats (rather than votes) received by the ith party.

Table I Continued

PRF: Index of press freedom "designed to measure the freedom of a country's broadcasting and press systems to criticise their own national and local governments". The range of the index is ± 4.

PD: Political demonstration 1948-1967. A political demonstration is defined as a "non-violent gathering of people organized to protest the policies, ideaology or actions of a regine, a government or political leaders".

R: Number of riots 1948-1967. A riot is defined as "a violent demonstration involving a large number of people and characterised by material damage or bloodshed".

AA: Number of armed attacks on host country, 1948-1967. An armed attack is defined as "an act of violent political conflict carried out by an organized group with the object of weakening or destroying the power exerted by another organized group".

DV: Number of deaths from domestic violence, 1948-1967. A government sanction is defined as "an action taken by the authorities to neutralize, suppress, or eliminate a perceived threat to the security of the government, the regime or the state itself".

EI: Number of external interventions, 1948-1967. "An external intervention is an attempt by an actor, whether another nation state or a rebel group operating outside the country, to engage in military activity within the target country with the intent of influencing the authority structure of that country. The data are listed by target, not intervening, country".

RET: Number of regular executive transfers, 1948-1967. "A regular executive transfer is a change in the office of national executive from one leader or ruling group to another that is accomplished through conventional legal or customary procedures and unaccompanied by actual or directly threatened physical violence".

Table I Continued

IET: Irregular executive transfers 1948-1967. An irregular executive transfer is defined as "a change in the office of national executive from one leader or ruling group to another that is accomplished outside the conventional legal or customary procedures for transferring formal power in effect at the time of the event and accompanied by actual or directly threatened violence".

GNP: Gross national product in millions of dollars, 1965.

DS: Number of diplomats sent to other countries, 1963-1964.

DR: Number of diplomats received from foreign powers, 1963-1964.

TSA: Total Soviet aid in millions of dollars, 1955-1965.

TUSA: Total U.S. Economic and Military Aid, 1958-1965 in millions of dollars.

Table II

Data

	Country	GS	EI	RET	IET
1.	Australia	39	0	3	0
2.	Irish Republic	27	0	9	0
3.	New Zealand	4	0	4	0
4.	South Africa	843	0	8	0
5.	Ceylon	131	0	10	0
6.	Hong Kong	98	4	0	0
7.	India	518	0	7	0
8.	Malaysia	182	6	15	0
9.	Pakistan	277	0	12	1
10.	Kenya	299	62	12	0
11.	Ghana	164	0	6	1
12.	Nigeria	193	8	4	1
13.	United States	946	0	3	0
14.	Canada	74	0	3	0
15.	Switzerland	78	0	20	0
16.	Belgium	47	0	12	0
17.	France	439	0	21	1
18.	Italy	307	0	16	0
19.	Netherlands	39	0	7	0
20.	West Germany	801	0	15	0
21.	Spain	411	14	0	0
22.	Argentina	1000	0	10	5
23.	Brazil	323	0	12	3
24.	Mexico	119	1	3	0
25.	Rhodesia	318	22	10	1
26.	Jamaica	42	0	10	0
27.	Trinidad/Tobago	6	0	4	0
28.	Zambia	86	4	9	0
29.	Sierra Leone	33	0	4	1
30.	Denmark	29	0	8	0
31.	Portugal	173	14	3	0
32.	Sweden	55	0	4	0
33.	Mozambique	31	16	3	0
34.	Jordan	221	4	30	0
35.	Singapore	142	0	10	0
36.	Malawi	108	2	9	0
37.	Tanzania	90	6	8	0
38.	Uganda	113	7	9	1
39.	Austria	160	0	10	0
40.	Japan	264	0	14	0
41.	Chile	150	0	6	0
42.	Venezuela	430	4	10	3
43.	Thailand	153	10	7	3

Continued.....

Table II Continued

	Country	GNP	DS	DR	TSA	TUSA
1.	Australia	22739	280	190	0	5
2.	Irish Republic	2814	46	57	0	0
3.	New Zealand	5227	91	88	0	186
4.	South Africa	10911	163	98	0	272
5.	Ceylon	1622	66	158	30	74
6.	Hong Kong	1600	NA	NA	NA	NA
7.	India	49220	467	530	1022	4893
8.	Malaysia	2875	65	140	0	36
9.	Pakistan	11160	188	321	94	2360
10.	Kenya	846	2	75	44	31
11.	Ghana	2207	212	242	89	164
12.	Nigeria	4852	151	223	0	158
13.	United States	695500	2782	1419	0	0
14.	Canada	48473	388	383	0	0
15.	Switzerland	13869	240	315	0	0
16.	Belgium	17071	279	473	0	186
17.	France	94125	1152	716	0	84
18.	Italy	56947	511	707	0	1233
19.	Netherlands	19106	352	258	0	449
20.	West Germany	112232	671	778	0	399
21.	Spain	17743	306	342	0	1053
22.	Argentina	17204	301	NA	115	414
23.	Brazil	21970	300	431	0	1648
24.	Mexico	19432	186	315	0	661
25.	Rhodesia	1021	NA	NA	0	2
26.	Jamaica	889	25	50	0	35
27.	Trinidad/Tobago	630	18	44	0	43
28.	Zambia	792	NA	NA	0	3
29.	Sierra Leone	353	35	50	28	27
30.	Denmark	10088	201	231	0	0
31.	Portugal	3731	137	175	0	197
32.	Sweden	19714	237	287	0	0
33.	Mozambique	515	NA	NA	NA	NA
34.	Jordan	505	82	165	0	447
35.	Singapore	933	NA	NA	NA	NA
36.	Malawi	185	NA	NA	0	8
37.	Tanzania	751	9	104	0	44
38.	Uganda	658	6	52	16	17
39.	Austria	9336	162	420	0	70
40.	Japan	84347	638	494	0	1061
41.	Chile	4842	161	214	0	905
42.	Venezuela	7692	133	174	0	341
43.	Thailand	3930	191	286	0	278

Continued.....

Table II Continued

	Country	VALDI	IS	MM	PF	PRF	PD	R	AA	DV
1.	Australia	1114.8	2.5	8.5	.625	2.53	20	3	8	0
2.	Irish Republic	142.4	4.0	7.9	.624	2.37	13	7	42	1
3.	New Zealand	159.3	1.7	8.3	.512	2.24	12	0	2	0
4.	South Africa	626.7	8	2.7	.397	1.07	145	226	342	1000
5.	Ceylon	48.3	1.6	1.5	.725	1.14	22	60	27	339
6.	Hong Kong	54.3	5.6	NA	.900	NA	16	57	199	243
7.	India	297.4	2.1	3.7	.682	.98	201	558	1700	5100
8.	Malaysia	182.8	4.6	5.8	.589	1.66	22	89	8300	13000
9.	Pakistan	56.4	2.6	4.9	.337	-0.01	108	145	67	2900
10.	Kenya	60.7	2.6	0.6	.101	1.20	17	93	439	14000
11.	Ghana	69.9	4.0	2.5	NA	0.34	7	43	34	98
12.	Nigeria	129.7	0.7	0.3	NA	0.45	17	177	393	9400
13.	United States	762.2	3.5	25.9	.491	2.72	1200	683	779	320
14.	Canada	715.9	0.6	10.3	.616	2.78	27	29	113	8
15.	Switzerland	53.7	2.1	177.3	.815	3.06	NA	4	7	0
16.	Belgium	156.2	2.1	16.6	.725	2.53	67	58	34	10
17.	France	220.7	4.7	17.9	.668	1.92	223	127	550	112
18.	Italy	76.7	4.6	11.5	.734	1.98	109	310	249	109
19.	Netherlands	119	2.3	17	.830	3.02	8	4	10	0
20.	West Germany	235.4	3.6	11.6	.582	2.43	193	98	96	10
21.	Spain	80.7	3.5	12.4	0	-0.99	86	65	76	55
22.	Argentina	72.5	1.2	9.3	NA	0.92	99	99	388	6800
23.	Brazil	82.7	2.6	4.5	.438	1.25	28	95	117	143
24.	Mexico	49.9	NA	3.2	.303	1.46	32	131	82	446
25.	Rhodesia	79.5	2.8	2.3	.385	1.16	79	114	134	361
26.	Jamaica	27.3	5.3	2.1	.479	2.16	NA	21	31	15
27.	Trinidad/ Tobago	37.9	4.5	1.9	.457	NA	2	13	3	2
28.	Zambia	32.2	3.7	1.5	.402	1.05	17	74	149	1300
29.	Sierra Leone	24.6	1.5	1.5	NA	NA	NA	6	6	21
30.	Denmark	29.7	2.1	16.2	.752	2.65	31	6	5	14
31.	Portugal	34.2	2.5	25.7	0	-1.42	17	36	15	26
32.	Sweden	39.1	2.0	35.2	.693	2.83	1	10	1	0
33.	Mozambique	18.2	1.3	NA	NA	NA	NA	5	91	1600
34.	Jordan	17.1	5.1	40.6	NA	-0.51	80	67	23	72
35.	Singapore	11.5	8.3	NA	.416	1.81	17	49	30	179
36.	Malawi	11.7	1.5	0.5	0	0.52	15	119	55	106
37.	Tanzania	10.8	0.2	0.2	0	0.87	4	13	26	91
38.	Uganda	10.5	1.3	0.5	.414	0.77	8	104	79	3300
39.	Austria	10.2	NA	5.4	.535	2.10	22	36	25	6
40.	Japan	15.5	2.3	3.7	.586	2.44	173	159	35	28
41.	Chile	15.9	4.6	9.4	.704	1.19	31	64	41	62
42.	Venezuela	13.3	2.2	6.7	.760	2.54	40	170	509	1700
43.	Thailand	12.4	3.3	8.0	NA	0.70	3	8	76	235

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