The location of investment by multinational enterprises has been investigated from many perspectives. It has been suggested that investment may be motivated by experience of a particular location represented by tenure of operations. In contrast, portfolio considerations suggest that increased investment in a given location increases risk exposure. In this paper, the question of whether a multinational with a longer duration of operations at a particular location is more likely to invest further is addressed after taking portfolio risk into account. A conceptual model of multinational investment strategy is developed and empirically tested using data from a survey of multinational enterprises operating in the West Midlands region of the United Kingdom. Two innovative non-parametric tests for duration dependence are applied. After normalising for portfolio considerations, it is found that multinational investment is significantly duration dependent, i.e., firms with a longer tenure of operations are significantly more likely to invest in any given period. This finding has important implications for the strategy of inward investment agencies. In particular, an investment agency is short-sighted if it seeks to attract new investors if that is at the expense of neglecting multinationals with current operations in its jurisdiction.

INTRODUCTION

Foreign direct investment (FDI) has increased enormously over the last thirty years. The total value of global FDI was estimated at US$105 billion in 1967. By 1984 it had climbed to an estimated US$596 billion, and by 1993 it was estimated at US$2,125 billion (United Nations, 1994). The vast amount of resources involved has captured the attention of governmental and commercial organizations worldwide, and has

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I would like to thank Fred Burton, Mark Casson, Neil Hood, participants at the 1996 World AIB Conference in Banff, Canada, seminar participants at Case Western Reserve, Purdue, Cornell and Maryland and three anonymous referees for many helpful comments on earlier drafts of this paper. The usual disclaimer applies.

increased academic interest in how firms choose to locate capital investments.

In addition to substantial increases in volume, FDI has also been characterized by increasing mobility in recent years. Such "footloose capital" (Mudambi, 1995a) tends to be moved in search of the best obtainable return, and new investments in one location are often at the expense of closing operations in others. As FDI has become more mobile, efforts to attract it have increased in magnitude and diversity. Most countries, regions and states, and even many local authorities now have large inward investment agencies (IIAs). The factors governing multinational investment location are of particular interest to these IIAs.

Are the activities of IIAs non-wealth-creating and therefore mere exercises in rent seeking? If there are bidding contests between different IIAs within in a single country, this argument may have some merit. However, in bidding contests between different countries, a Prisoners' Dilemma type situation is obtained and the Nash equilibrium involves all countries setting up IIAs, even though all countries collectively would be better off without them. Two arguments may be made to suggest that IIA activity may be net wealth creating. First, if multinational enterprise (MNE) activity follows a sequential pattern, as has been suggested in the literature (for example, Hood and Young, 1979), where the switch from exporting to FDI is made to maximize a stream of profits (Buckley and Casson, 1981), then IIA expenditures which advance the switch to FDI are wealth-creating. Secondly, given agglomeration effects, IIA expenditures which "prime the pump" to begin a flow of FDI may result in a virtuous cycle of further investment (Peck, 1990; Mudambi, 1995a).

A number of theoretical studies have investigated factors underlying the location of MNE FDI from several perspectives (de Meza, 1979; Eaton and Grossman, 1986; Dunning, 1988; Collie, 1992; Mudambi, 1995b). The factors underlying the location decision include market size and growth; trade policy, including tariff and non-tariff barriers; exchange rate dynamics; tax considerations; and costs, such as the relative cost of borrowing, transport costs, and labor costs. The importance of most of these factors has been confirmed in empirical work (Scaperlanda, 1967; Gilman, 1981; Lunn, 1983; Culem, 1988; Ray, 1989; Caves, 1990; Stevens, 1993). Dunning (1993) and Caves (1996) provide good surveys of this work.

In the literature, investment location is typically investigated within a partial equilibrium framework under the umbrella of Dunning's (1977) ownership-location-internalization (OLI) paradigm. However, even such partial equilibrium analysis must take historically determined constraints into account. Typically the existing location profile of the MNE's operations will be an important constraint. Locating additional investment within known environments provides important tangible and intangible advantages (Gresser and Gaskell, 1993; Porcano, 1993). This is particularly true when investment decisions need to be based on short implementation periods (Vismer, 1994).

The measurement of these benefits is a difficult task. However, nearly all such benefits can be traced, directly or indirectly to experience. At least three separate sources of advantage may be identified here (Davidson, 1980; Benito and Gripsrud, 1992; Benito and Gripsrud, 1995). First, there is the tra-
ditional familiarity or learning argument. Davidson (1980) in particular finds that substantial learning benefits can be traced to the length of multinational experience. Second, there may be substantial first-mover advantages associated with long experience. Third, sunk or switching costs can create "path dependency" relating to an existing location profile.

Therefore, it may be argued that experience is a summary measure of virtually all the intangible benefits of a known environment. This "experience" theory implies that a firm with a greater experience of a particular location is more likely to invest there than a firm with less experience.

Portfolio considerations appear to argue against this theory. Given that each location represents a given risk structure, increasing investment within a given set of locations increases the firm's overall risk exposure. From the MNEs' perspective, multiple locations can be viewed as an additional avenue of diversification. Bowman (1980) showed that firms with high returns can have low risk. Subsequent contributions to the literature (e.g., Bettis and Hall, 1982; Bettis and Mahajan, 1985; Madura 1992) indicate that this can be explained by examining the firms' patterns of locational diversification. There is a large literature asserting that the internationalisation of business activity can be explained as a portfolio decision by MNEs (Rugman, 1976; Rugman, 1979; Thompson, 1985; Kim et al., 1993).

The experience and portfolio theories seem to offer conflicting predictions regarding the location of additional investment by MNEs. In the following sections, this paper: (i) Presents a framework within which IIAs can analyze MNE investment; (ii) develops a conceptual model to reconcile the experience and portfolio theories of MNE FDI; (iii) applies the model to a cross-sectional data set of MNEs operating in the UK; and (iv) discusses the implications of the test results for the investment attraction strategies of IIAs.

The Strategy of Investment Attraction

Background: The concept of investment attraction itself is not new. In 1160, the Bishop Ugucione granted tax concessions to wool weavers to attract them to the upper town of Biella in the Piedmont region of Northern Italy (Castronovo, 1996). In more recent times, with the formation of IIAs, the extent of investment attraction activities has increased greatly. IIAs have been primarily concerned with the attraction of greenfield manufacturing investment from foreign MNEs. Although the professionalism of such agencies has increased greatly, their targeting activities are still not very sophisticated (Young and Hood, 1993). Further, many IIAs continue to focus on greenfield projects, despite evidence that MNEs, responding to increasing competition in their environments, have shifted FDI activity towards non-greenfield projects, many of which involve joint ventures, acquisitions and alliances.

It is therefore crucial for IIAs to identify MNEs that have the greatest probability of making investments in their areas of responsibility. This is a difficult task, made more so by the paucity of research on IIAs. The following quote from Wells and Wint (1990, p. 2) is telling:

"Despite the increasing expenditures by countries on investment promotion activities there is almost
no research on this subject. The existing literature on international business, economic development and international marketing provides little in the way of assistance to practitioners in the field. Especially neglected have been the effectiveness of the investment promotion function in general and the relative effectiveness of different promotional techniques and structures."

Wells and Wint go on to identify three fundamental functions of IIAs. The first is *image-building*, designed to improve the image of the country as a place to invest. Such activities generally take the form of general purpose advertising and information provision. The second is *investment-generating activity*, which involves the use of promotional techniques to identify and contact investors, and encourage investment in the area concerned. The third function is that of *investment service*, which involves investment counseling, assisting with the processing of applications and permits, and the provision of post-investment services.

While this identification of functions is a good starting point, it is still too general for actual use. Young, Hood and Wilson (1994) provide a description of functions that is sufficiently detailed for use in formulating strategy (see Table 1). They point out that IIAs may be differentiated on the basis of the range of functions that they undertake. Thus, in the European context, while almost all grant incentives (function 4), and most formulate policy, attempt to promote and attract investment, and provide actual assistance (functions 1, 2 and 5 respectively), few have a systematic approach to monitoring and aftercare (function 6). Successful IIA strategies must be designed within a detailed template of this type.

**MNE - IIA Relations:** A key requirement for a successful strategy is a clear definition of IIA objectives and a recognition of the objectives of the target MNEs. The ideal investment from the IIA point of view consists of a single facility with regional and preferably global R&D, production and marketing responsibility. Such a facility is a large employer, with a highly skilled, productive, and high-wage workforce, and a high level of local purchases to generate macro multiplier effects (Young, Hood and Peters, 1994). Examining the European evidence reveals that the reality of MNE operations is very far from this ideal. Local operations of MNEs are part of larger corporate systems, whose efficiency they are designed to enhance. From the perspective of the local area, they tend to be truncated, and do not include a wide range of corporate functions. There often exists a substantial gap between the regional optimum that the IIA is (or should be) striving for and the corporate optimum (see, for example, Morris, 1992; Amin and Malmberg, 1992; Peck, 1990). As a result, MNEs have typically not fulfilled the IIAs' desired objectives of facilitating self-sustaining and innovative economic development in many European regions (Netherlands Economic Institute, 1992).

It would be naive to believe that the MNEs' strategies to meet their global objectives will ever completely meet the IIAs' objectives for regional development. How well the IIA's objectives are met depends on the nature and role of the local operation itself. In this context, a schematic representation of the IIA-MNE relationship is provided in Figure 1. The relationship of the MNE with the
local area is split into three stages. In stage I, the MNE is a source of imports into the local economy. In stage II, the MNE sets up a local subsidiary and produces domestically. Basic investment attraction has to do with moving the MNE from stage I to stage II. Finally, in stage III, the subsidiary obtains a “world product mandate.” A subsidiary which possesses a world product mandate is given global (or regional) responsibility for the complete range of functional activities related to a particular product or product line. The acquisition of a world product mandate by the local subsidiary substantially increases the local benefits from foreign-owned manufacturing (Science Council of Canada, 1980; Rugman and Bennett, 1982; Birkinshaw, 1996).

For example, Westinghouse Canada is responsible for gas turbines worldwide; Mack, a German subsidiary of Pfizer USA, has a world product mandate for a range of fine chemicals and cardiology and leukemia-related treatments, and Siemens Japan (with its local partner, Asahi Chemical) has a similar mandate for compact magnetic resonance image machines (Roth and Morrison, 1992). Such subsidiaries with world product mandates operate as strategic business units within MNEs, and provide substantial and dynamic benefits for host economies (White and Poynter, 1984; D'Cruz, 1986). They bring the regional and corporate optima into closer proximity.

This provides a conundrum for IIAs. The initial investment by an MNE may

<table>
<thead>
<tr>
<th></th>
<th>Functions of IIAs</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>Policy formulation</td>
</tr>
<tr>
<td>2</td>
<td>Investment promotion and attraction</td>
</tr>
<tr>
<td>3</td>
<td>Investment approvals</td>
</tr>
<tr>
<td>4</td>
<td>Granting of incentives</td>
</tr>
<tr>
<td>5</td>
<td>Providing assistance</td>
</tr>
<tr>
<td>6</td>
<td>Monitoring and after-care</td>
</tr>
</tbody>
</table>

be truncated and have little positive impact on the region, but with encouragement, it may eventually give its subsidiary a world product mandate. Since the process of encouraging this development in pursuit of a world product mandate cannot occur if the investment is not attracted in the first place, IIAs must continue to court first time investors. However, even with encouragement, not all MNE investors will evolve beyond the domestic production stage. The IIA must decide how MNEs can be effectively distinguished from each other, and which type of MNE is most likely to make future investments. Given a limited budget, a method of differentiating amongst MNE investors is an essential part of a successful IIA strategy.

Research Questions: One way of distinguishing between MNEs is by the duration of their local activity. The basic question addressed in this paper concerns the effect of the duration of local activity on the volume of investment. The answer to this question has important implications for IIAs in a world where competition for FDI is becoming increasingly intense. If MNE investment volume is duration dependent, IIAs would do well to spend more of their resources on maintaining the goodwill of firms which are long established in their jurisdictions. The underlying assumption here is that MNEs making continual incremental investments are more likely to allow their subsidiaries to develop into strategic business units with world product mandates. Thus, tenure of operation becomes a key targeting variable in the IIAs’ strategic segregation of MNEs. Further, the function of monitoring and aftercare of MNE investors (in the Young, Hood and Wilson 1994 framework) becomes crucial.

In contrast, if the investment volume is not duration dependent, tenure of operation provides no information about the probability of further investment. If this is true, IIAs should prefer to concentrate their efforts on attracting new investors, rather than convincing existing investors to make additional investments.

**Figure 1**
The IIA - MNE Relationship

![Diagram of the IIA - MNE Relationship](image-url)
Underlying these considerations is the fact that an IIA's strategy also depends on the existing extent of MNE investment in its region. If the existing pool of investment is very small, then the issue of duration dependence may have limited relevance, since the concentration on attracting new investment is unavoidable. However, if the existing pool is substantial, then the question of duration dependence becomes important. The analysis in this paper has policy implications primarily for areas with large existing stocks of FDI.

A Conceptual Model: These research questions can be formally addressed within the context of a conceptual model formulated to explain MNE investment location decisions. As discussed above, such decisions have been explained as the result of two apparently conflicting sets of factors: Portfolio factors which argue for incremental investments to be dispersed, and experience factors which argue for incremental investments to be concentrated.

One fundamental difference between these factors is that portfolio factors are comparable across different locations, while experience factors are inherently location-specific. This suggests that the two sets of factors may be considered as independent sources of variation. Portfolio considerations are therefore modeled as determining the baseline level of investment in any location, while experience factors determine the variation above and below this baseline level. This implies that MNE investment is composed of two parts. The first is a systematic component based on factors comparable across locations, and the second is an unsystematic component based on factors unique to a given location, as depicted in Figure 2.

The systematic component of MNE investment can be represented by taking into account factors that are comparable across a portfolio of locations. In addition, it is necessary to account for firmspecific heterogeneity. The unsystematic component of MNE investment can be represented by the residual variation after accounting for the systematic components. The model proposes that duration, which is considered to be the summary measure for experience factors, can explain a significant portion of the residual variation. This approach to residual variation has been adopted in several settings. Some examples include the estimation of brand equity (Park and Srinivasan, 1994) and innovation (Stoneman, 1994).

Why model experience as a residual rather than as an explanatory variable? The advantage of this approach is that it does not require a precise specification of the functional relationship between duration and investment. The statistical distribution of duration is highly non-normal; further, duration effects are likely to be characterized by substantial threshold effects and other non-linearities. Indeed, in a study of the investment of German and Japanese manufacturing affiliates in the United Kingdom using a linear specification, Taggart and Hood (1997) report substantial threshold effects, i.e., a minimum level of tenure before experience has value. These threshold effects cause the naive use of duration to have an insignificant effect.

The conceptual model implies an MNE investment equation of the following form:

\[ \text{MNE investment} = \text{Systematic component} + \text{Unsystematic component} \]
component

= \[ \{ \text{(Portfolio factors), (Company-specific factors)} \} + \text{Residuals} \]

(Experience factors)

The model predicts (i) that portfolio factors and company-specific factors should be significant in determining the systematic component of MNE investment; and (ii) that relatively large positive residuals (positive outliers) should be identified as firms with considerable location-specific experience, i.e., with a long duration of local operations. Figure 2 provides a schematic representation of the conceptual model.

**Data and Methodology**

**Data Collection:** Data were obtained in two stages. In the first stage, a list of MNE engineering and engineering-related operations in the West Midlands region of the United Kingdom was compiled from business directories. The region was chosen because it has been the United Kingdom's most successful region for attracting FDI, with more than 900 companies investing over £3 billion and employing over 100,000 workers (Griffiths, 1993). After phone confirmations, a final list of 224 companies with personal contact names was assembled for the purpose of a directed mail survey.

The questionnaire was accompanied by a cover letter explaining the aims of the study, guaranteeing confidentiality, and urging response. In order to improve the response rate, the questionnaire had to be short, concise and of current interest (salient) to the respondent (Heberlein and Baumgartner, 1978). Ten days after the survey was mailed out, a reminder postcard was sent to all companies that had not yet responded.

Non-response bias was investigated with the widely used method suggested by Armstrong and Overton (1977). This involved comparing early and late respondents. Late respondents were defined to be those who responded after receiving the reminder postcard. Six sample measures were compared using

---

**Figure 2**

The Conceptual Model

- **Experience Factors**
- **Firm-Specific Factors**
- **Portfolio Factors**
- **Base-Line Investment Level**
  - Systematic Component
- **Residuals**
  - UnSystematic Component
- **Positive Outliers**
- **Negative Outliers**
a $\chi^2$ test of independence. The responses from early and late respondents were virtually identical.

Overall, 81 responses were received to the mail survey (36.2%). Of these, 4 were found to be national firms mistakenly identified as MNEs and 7 were unusable for various other reasons, leaving 70 (31.2%) valid responses for evaluation. The response rate is well within the range expected for an unsolicited mail survey. The survey collected information on MNE investment flows into the United Kingdom, the rate of return on corporate liquid funds and measures of corporate risk.

In the second stage, several international statistics were computed for the host countries of the MNEs in the sample, using data from the International Financial Statistics published by the International Monetary Fund, and from the capital markets' publication Euromoney. These included inflation rate, exchange variables and country risk variables.

Further, survey responses were cross-checked against company annual reports where possible. A high degree of correspondence between published data and survey responses was found, lending support to the veracity of the survey responses.

Methodology: The objective of the paper is to test the conceptual model. This is done by testing investment volume for duration dependence after accounting for portfolio considerations. Thus, it is necessary to purge the investment volume data of the influences of portfolio variables. This is done using ordinary least squares (OLS) regression analysis. This procedure divides the dependent variable into two additively independent components, as the OLS residuals have the property of being independent of the regressors.

If, as suggested in this paper, portfolio and experience considerations work concurrently and additively in determining the volume of MNE investment, then two sets of results must be obtained. First, the investment equation must be able to explain a significant portion of the investment volume. Second, the residuals from the regression procedure (which represent the experience component of investment volume) must exhibit duration dependence, i.e., firms with longer tenure should be more likely to invest than firms with shorter tenure.

The first set of results is obtained using regression analysis. Obtaining the second set of results is more involved. Firms which have undertaken experience-induced investment must be identified. This is done by applying outlier analysis to the residuals from the regression analysis. (As noted above, the effects of duration cannot be tested by simply inserting tenure into the investment equation.) Once these firms have been identified, their investment flows must be tested for duration dependence.

The first part of the analysis using the OLS estimating methodology is fairly standard. Each MNE has a portfolio of locations, and investment is specified as a function of location-specific factors. Company-specific measurements are introduced into the equation to normalize for the effects of inter-firm heterogeneity. This heterogeneity has already been minimized by selecting firms from a single industry group. The regressand is:
INV94  = MNE 1994 investment flows into the United Kingdom, £ million (see Table 3 for details).

The regressors measuring location-specific portfolio factors for the MNE are:

RINF  = Relative inflation rate, home country/host country (United Kingdom); average, 1991-1994.


CTYRISK = Relative country risk, home country/host country (United Kingdom); average, 1993-1994 (Euromoney risk index, which includes economic performance, political risk, debt indicators, debt default, credit ratings, access to bank, short-term and capital market finance, and the discount on forfaiting).


RORFF = Rate of return on corporate liquid funds (free cash flows as defined by Jensen, 1988), used as a proxy for the opportunity cost of investment funds.

The regressors measuring company-specific heterogeneity are:


GSALES = Global sales of the MNE in 1993 (US$ million).

Descriptive statistics relating to these variables are presented in Table 2. The baseline estimated equation is:

\[ (2) \, INV94 = f \left( \text{[Portfolio factors], [Company-specific factors]} \right) \]
\[ = f \left( \text{[RINF, DEXRT, CTYRISK, FINRISK, RORFF], [EMPL, GSALES]} \right) \]

In addition to the above variable description, it is equally important to mention some of the usual variables that do not appear. Most studies of FDI are comparative studies of different countries or different regions or states. Thus, typical explanatory variables include measures of market size to capture scale effects (Veugelers, 1991; Yamawaki, 1993), of agglomeration and infrastructure to capture positive externalities (Bartik, 1985; Hill and Munday, 1992; Smith and Florida, 1994; Head et al., 1995; Shaver, 1996; Driffield and Munday, 1997) and of public policy like tax rates (Coughlin et al., 1991; Friedman et al., 1992; Bailey et al., 1994). Since the focus of study here is to examine location in a single destination, such measures are not relevant.

Measures of relative labor costs, which could be relevant, were not included because of the theoretical arguments suggesting that the effects are ambiguous (Thiran and Yamawaki, 1996). Empirical evidence in the literature is also mixed; several studies report that higher wages are associated with increased investment flows, reflecting a more productive workforce (Swedenberg, 1979; Dunning, 1980; Beeson and Husted, 1989) while others report the reverse, reflecting cost considerations (Kravis and Lipsey, 1982; Yamawaki, 1993).

Further, the above variable specification does not include measures of the attractiveness of competing host countries. While this is an important consideration, the competing host countries are
### Table 2
**Descriptive Statistics**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>S.D.</th>
</tr>
</thead>
<tbody>
<tr>
<td>INV94</td>
<td>27.53</td>
<td>27.56</td>
</tr>
<tr>
<td>RINF</td>
<td>1.086</td>
<td>0.0162</td>
</tr>
<tr>
<td>DEXRT</td>
<td>-0.158</td>
<td>0.120</td>
</tr>
<tr>
<td>CTYRISK</td>
<td>3.462</td>
<td>9.649</td>
</tr>
<tr>
<td>FINRISK</td>
<td>21.131</td>
<td>5.379</td>
</tr>
<tr>
<td>RORFF</td>
<td>0.044</td>
<td>0.0126</td>
</tr>
<tr>
<td>EMPL</td>
<td>619.91</td>
<td>173.37</td>
</tr>
<tr>
<td>GSALES</td>
<td>130.66</td>
<td>229.087</td>
</tr>
</tbody>
</table>

### Table 3
**MNE Investment Estimation**

**Base-line Regression Results**

Regressand: INV94 = 1994 MNE Investment flows into the U.K. (£ million)

<table>
<thead>
<tr>
<th>Regressor</th>
<th>Coefficient</th>
<th>t Statistic</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>OLS</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>121.260</td>
<td><strong>4.41</strong></td>
<td>0.000</td>
</tr>
<tr>
<td>RINF</td>
<td>-0.0131</td>
<td>0.06</td>
<td>0.953</td>
</tr>
<tr>
<td>DEXRT</td>
<td>6.607</td>
<td>0.31</td>
<td>0.756</td>
</tr>
<tr>
<td>CTYRISK</td>
<td>0.189</td>
<td>0.53</td>
<td>0.595</td>
</tr>
<tr>
<td>FINRISK</td>
<td>-3.541</td>
<td><strong>7.39</strong></td>
<td>0.000</td>
</tr>
<tr>
<td>RORFF</td>
<td>-905.120</td>
<td><strong>4.88</strong></td>
<td>0.000</td>
</tr>
<tr>
<td>EMPL</td>
<td>0.309</td>
<td><strong>2.15</strong></td>
<td>0.035</td>
</tr>
<tr>
<td>GSALES</td>
<td>0.262x10^-4</td>
<td><strong>2.69</strong></td>
<td>0.009</td>
</tr>
</tbody>
</table>

**Diagnostics**

<table>
<thead>
<tr>
<th>Statistic</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>R²(Adj.)</td>
<td>0.6086</td>
</tr>
<tr>
<td>ANOVA: F(7,62)</td>
<td>16.3283</td>
</tr>
<tr>
<td>Log-Likelihood</td>
<td>-294.3882</td>
</tr>
<tr>
<td>S_u²</td>
<td>17.2410</td>
</tr>
<tr>
<td>Amemiya PC</td>
<td>331.2223</td>
</tr>
<tr>
<td>Breusch-Pagan χ²(7) c;</td>
<td>5.3884;</td>
</tr>
<tr>
<td>p value</td>
<td>(0.3874)</td>
</tr>
</tbody>
</table>

*a* Does not include portfolio investment. Includes locally financed new investment over which corporate management exercised locational discretion (opinion of local finance department). Variable can be negative reflecting withdrawal of capital.

*b* \( t(62)_{0.95} \) (crit) = 1.999. t-statistics significant at the 95 percent level are displayed in bold type.

*c* The Breusch-Pagan (1979) test for heteroscedasticity.
likely to be different for each MNE investor. Thus, introducing this consideration into the estimation in a meaningful way is next to impossible. However, it must be noted that the location-specific portfolio factors are likely to be weakened by the non-inclusion of measures relating to competing locations.

While the estimation of (2) is standard, the residuals utilized in the outlier analysis were generated in a non-standard manner. Since it was necessary to ensure that each firm’s investment was explained on the basis of market information external to the firm, the residuals were generated and standardized through repeated re-estimation, using the method suggested by Belsley, Kuh and Welsh (1980). This method requires that each residual be calculated using the coefficient vector and residual variance estimated without that observation. The resulting standardized residuals are called BKW residuals and denoted by $u_t$.

These residuals are used to identify firms that exhibit outlying investment flows. The distribution of $u_t$ is standard normal (with a mean of zero and a variance of unity). All firms with $u_t \geq 1$ are defined to be positive outliers, while all firms with $u_t \leq -1$ are defined to be negative outliers. It is claimed that positive outlier firms have “experience-generated” investment flows, or investment flows in excess of the level that can be explained by purely portfolio considerations. Similarly, negative outlier firms have smaller investment flows than would be expected on the basis of portfolio considerations. The definition of positive and negative outlier firms is summarized in Figure 3.

The conceptual model described in this paper is examined by assessing two related hypotheses:

**H1**: The duration of operations of positive outlier firms is longer than that of negative outlier firms.

**H2**: The investment flows of positive outlier firms are dependent on the duration of operations.

*Testing for Duration Effects*: The second part of the analysis is concerned with testing these two hypotheses. Hypothesis H1 is tested using a simple two-sample difference-of-means test. Hypothesis H2 is tested using two innovative non-parametric duration dependence tests developed by Mudambi and Taylor (1995). Parametric tests would be inappropriate since the underlying data-generating process under the alternative hypothesis of duration dependence is unknown. In the case of duration independence, the data must follow a constant probability process, i.e., the probability of investment in any period must remain the same, regardless of the length of tenure. This process generates a geometric distribution of investment outcomes.

It is necessary to explain the *order of duration dependence* in the context of MNE investment. All the component parts of an investment project are rarely implemented within one year. Once a location decision has been made, the associated investment flows usually occur over several years. The span over which the investment flows engendered by a single decision are completed is defined to be the order of duration dependence. Once the project has begun, investment cannot be terminated before this minimum period has elapsed.

The duration dependence tests are sensitive to the order of minimum duration. The actual order is likely to vary from industry to industry, which is why
<table>
<thead>
<tr>
<th>Investment level relative to that predicted by portfolio considerations</th>
<th>Firm Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Significantly higher</td>
<td>Positive outlier</td>
</tr>
<tr>
<td>Approximately the same</td>
<td>—</td>
</tr>
<tr>
<td>Significantly lower</td>
<td>Negative outlier</td>
</tr>
</tbody>
</table>

The survey was limited to firms in a single industry group. Opinions about this minimum order were sought from survey respondents. The duration dependence tests are performed for several different orders, chosen on the basis of the responses to the survey.

In order to formulate the tests, it is convenient to transform the data to order zero. Thus, if $X$ denotes the duration of operations and $t$ denotes the order of minimum duration, then $y = X - t$ represents duration transformed to order zero. The duration tests may now be applied to the transformed data. The first test is a zero-plim test and generates a test statistic denoted by $Z_1$. The second test is a method of moments test and generates a test statistic denoted by $Z_2$. The specification of both test statistics is presented in the Appendix.

**Estimation and Results**

The quantitative analysis proceeded in three steps. The first step consisted of regression analysis to estimate the baseline equation and assess the fit provided by portfolio considerations. The results of this exercise make it possible to estimate the systematic component of the MNE investment flow. The second step consisted of carrying out the outlier analysis. The results of the outlier analysis provide a test of hypothesis H1 by comparing positive outlier firms with negative outlier firms. Finally, in the third step, the duration tests are applied to the firms identified in the second step. The results of the duration tests provide tests of hypothesis H2, by explicitly testing whether the probabilities of additional investments from positive and negative outlier firms are dependent on duration.

**Regression Analysis:** The results of the baseline regression are presented in Table 3. Heteroscedasticity in the error term was a particular fear since the firms differed considerably in size. This is an issue of great importance in the context of this study, since the error terms are to be used in the following outlier analysis. Therefore, the Breusch-Pagan (1979) test was performed on the error terms from the baseline regression. As can be seen, this test is passed comfortably, leading to the conclusion that heteroscedasticity is not present. Thus, any company-specific heterogeneity that is present has been captured by the company-specific measures in the estimating equation.

The fit of equation (2) is found to be very good, with an adjusted $R^2$ value of over 60 percent. In addition, the F statistic from the analysis of variance is extremely high. Tests of regressor parsimony using the Amemiya Prediction Criterion indicate that the inclusion of all regressors is justified. Of the portfo-
lio factors, FINRISK and RORFF appear to be statistically significant in determining the flow of MNE investment. The effect of the company-specific risk (FINRISK) at the location is negative. This is as expected, since as this risk rises, *ceteris paribus*, the location appears less attractive. The effect of the rate of return (RORFF) on the firm's free cash flows is negative as well. Again, this is as expected, since as the opportunity cost of investment funds rises, the investment flows decline.

It would have been expected that RINF, the relative inflation, would appear significantly. Examining the data more closely, it is found that for the period considered, 1991-1994, the inflation rates in the home countries of many of the major MNEs in the sample were comparable with the U.K. rate. Thus, the variance of RINF is very low, leading to a very high variance in its regression coefficient and an insignificant "t" statistic.

The effect of the exchange rate (DEXRT) on investment flows is likely to vary depending on the type of investment. On cost considerations, investment flows will decline as the local currency appreciates (Stevens, 1993). However, the impact of currency appreciation is unclear in the case of market-seeking investments. This is because imports become cheaper and may substitute local production, and profits from local production become higher when translated into the home country's currency. These conflicting effects may account for the insignificance of the exchange rate variable. The relative location-specific risk (CTYRISK) also does not appear significantly in the estimating equation. This may be because the Euromoney risk measure is too broad to capture effects in a specific industry.

Turning to the regressors normalizing for company-specific heterogeneity, it is seen that both EMPL and GSALES are significant. Thus, both the size of the U.K. operation and the overall size of the firm are important in determining investment flows. Examining these two variables more closely, it is found that they are not strongly correlated. This is interesting, since it implies that for the firms in the sample, MNEs which are large globally do not always have large U.K. operations.

**Outlier Analysis:** The plot of the BKW residuals is presented in Figure 4. These residuals are standardised, and vary from a maximum of 3.19 to a minimum of -2.81. A total of 15 positive outlier firms are identified (u₁ ≥ 1), with a mean duration of U.K. operations of 17.53 years. Similarly, 17 negative outlier firms are identified (u₁ ≤ -1), with a mean tenure of 5.47 years. A two-sample difference-in-means test yields "t" statistics of 5.41 (assuming unequal variances) and 6.12 (assuming equal variances). These results indicate that the following statement can be made regarding hypothesis H1:

**Conclusion H1:** The hypothesis that the mean tenure for positive and negative outlier firms is the same can be categorically rejected.

**Testing for Duration Dependence:** It is now possible to apply the two duration tests to the outlier firms. The shortest observed tenure for firms in the positive outlier group is 8 years, indicating that the minimum order of duration dependence in this group is bounded above by 8. The shortest observed tenure for firms in the negative outlier group is zero (a new subsidiary), suggesting that the order of minimum dura-
The computed values of the statistics $Z_1$ and $Z_2$ for the appropriate orders of minimum duration are presented in Table 4, together with the value of the estimated probability parameter $p^c$. Values are computed for the positive outlier group up to an order of minimum duration of 7, while for the negative outlier group, values are only computed for a minimum order of zero.

While both $Z_1$ and $Z_2$ have standard normal distributions for large samples, the observed sample sizes are small enough to raise some concern about the use of asymptotic critical values. In an attempt to establish the results beyond any reasonable doubt, the finite sample distributions of $Z_1$ and $Z_2$ were simulated in order to obtain exact sampling critical values. The simulations were performed using LIMDEP 7.0, using the observed sample sizes of 15 (for the positive outliers) and 17 (for the negative outliers). All experimental values of the order of minimum duration, were considered, up to the minimum observed duration in the data. For the positive outlier group, the considered values of the order of minimum duration were from 0 to 7. For the negative outlier group, the value was set at zero.

The results of the simulation exercise are presented in Table 5. 1 percent, 5 percent and 10 percent critical values are presented, together with the observed values of the statistics $Z_1$ and $Z_2$. In the positive outlier group, for minimum durations up to 5 years, duration independence can be safely reject-

**Figure 4**

BKW Residuals from the Investment Equation

![Graph showing BKW residuals from the investment equation.](image)

Observations
ed. (In fact, even in heavy engineering firms, the horizon for investment decisions rarely exceeds 3 years (Vismer, 1994).) Further, the results from both the test statistics $Z_1$ and $Z_2$ are in agreement. This leads to the following conclusion regarding hypothesis H2:

**Conclusion H2:** The hypothesis that the investment flows of positive outlier firms are duration independent can be strongly rejected.\(^1\)

For the negative outlier group, again both the test statistics $Z_1$ and $Z_2$ are in agreement. Both support the conclusion that duration independence cannot be rejected. Thus, for the firms which are identified as having negative or zero experience-generated investment flows, these flows appear to be duration independent.

**Implications**

This paper tests a conceptual model that is an attempt to reconcile the portfolio and experience factors underlying FDI. While experience in a particular location has been identified as a factor motivating investment flows, portfolio considerations militate against this. The model proposes that MNE investment flows can be split into a systematic component which is underpinned by portfolio and company-specific factors; and an unsystematic component which is determined by experience factors, for which duration is considered a summary measure.

Using regression and outlier analyses to identify firms with large unsystematic components in their investment flows, it is found that positive outlier firms exhibit duration dependence in their investment behavior. In contrast, the investment behavior of negative outlier firms is characterized by duration independence. In other words, firms whose investment was significantly above that predicted by portfolio considerations, were firms whose probability of investment rose as their tenure in

<table>
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<th>Order</th>
<th>$p^*$</th>
<th>$Z_1$</th>
<th>$Z_2$</th>
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<tr>
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<td>5.9450</td>
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</tr>
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<td>2.8551</td>
</tr>
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<td>7</td>
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<td>2.0253</td>
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<tr>
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<td>1.4914</td>
<td>1.9727</td>
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\(^1\) This conclusion is in line with previous research that suggests a strong relationship between duration and investment flows.
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</tr>
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</tbody>
</table>

Notes: Observed values that cause a rejection of the null hypothesis at the 1 percent level have been marked with a *.
Observed values that cause a rejection of the null hypothesis at the 5 percent level are marked with a ^.

The results seem to support the suggested reconciliation between the portfolio and experience theories. They also imply that portfolio and experience considerations function independently in determining MNE investment patterns. Portfolio factors seem to determine the primary investment pattern, while experience seems to influence incremental changes. This reinforces the findings of Davidson (1980), who

the location (the United Kingdom) increased. Further, firms whose investment was significantly below that predicted by portfolio considerations were firms whose probability of investment was unaffected by the length of their tenure in the location. These empirical results are mutually reinforcing and appear to support the suggestion that firms with longer tenure are more likely to make additional investments.
reports that the increased locational experience of MNEs is associated with lower risk premiums.

These results are of considerable importance to policy makers in government in general and to IIAs in particular. They suggest that a successful investment attraction strategy should incorporate, to the extent possible, both portfolio and experience considerations. In other words, in addition to working on deficiencies in portfolio factors (for example shortfalls of skilled labor and a poor infrastructure) relative to its effective competitors (see, for example Kotler et al., 1993), IIAs should spend time nurturing MNEs which have existing investments in the area. This is because experience considerations suggest that they are the firms with the highest probabilities of making new investments in the area.

The monitoring and aftercare of MNE investors are aimed at generating incremental investments. Within the framework of Figure 1, this can be a prerequisite for moving the local MNE operations from Stage 2 to Stage 3, greatly enhancing the beneficial impact.

The basic conclusion drawn from this analysis is that both portfolio and experience considerations are important in determining MNE investment flows. Thus, neither one set of factors can explain MNE investment location in the absence of the other. In structuring incentives for FDI, government agencies would do well to segment their target firms on the basis of portfolio considerations, and then concentrate their efforts on those which have the longest running local operations. This is particularly important as the current trend towards globalization is making MNEs rationalize their operations. In this context the following statement by John Bridge, the Chief Executive of the Northern Development Company, the IIA responsible for the North of England is particularly illuminating (Waples, 1996, p. 7):

"In the past, it has been seen as automatic that if companies want to increase their capacity, they will enlarge existing plants. This is no longer the case. If an American pharmaceutical company expands in one country, it could shut down plants in several others. Companies are consolidating at the same time as expanding."

NOTE

1. It should be noted that rejection of the null hypothesis of duration independence does not in and of itself imply positive duration dependence. However, it has been shown that for many typical distributions of hazard, like the Weibull, this will in fact be the case (Lancaster, 1990). Further, virtually all standard distributions exhibit monotone hazard rates.

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Stoneman, P. 1994. Devising a methodol-


**APPENDIX**

The Zero-plim Test: Under the null hypothesis of duration independence, \( y \) is distributed according to the geometric distribution, and

\[
(A1) \text{plim } \left[ \frac{\bar{y}}{S_y} \right] - 1 = 0,
\]

where \( \bar{y} \) is the mean of the transformed investment duration and \( S_y \) is the standard error. A test statistic may be developed based on this relationship between the mean and variance of the geometric distribution. The zero-plim test statistic is defined as:

\[
(A2) Z_1 = T^{1/2} \left[ \frac{\bar{y}}{S_y} - 1 \right].
\]
It is possible to claim, using the Central Limit Theorem, that the distribution of $Z_1$ converges to the standard normal as sample size increases. Moreover, since the distribution of $y$ under the null hypothesis is known, it is possible to simulate finite sample critical values, even for relatively small samples.

The Method of Moments Test: An analogous test can be constructed using the method of moments. Define $p^*$ to be the probability that experience-generated investment flows occur in any year. Noting that $\bar{y}$ and $S_y$ are consistent estimators for their respective population parameters, it can be shown that:

\[
(A3) \quad p^* = \frac{-1 + (1 + 4 S_y^{-2})^{1/2}}{2 \ S_y^{-2}}
\]

converges in probability to $p$ under the null hypothesis of duration independence. Conditionally on $S_y$, the test statistic

\[
(A4) \quad Z_2 = \frac{[\bar{y} \ (1/p^* - 1)]}{S_y^{-1}T^{1/2}}
\]

is approximately standard normal for samples large enough to invoke the Central Limit Theorem. Again, it is possible to simulate finite sample critical values for relatively small samples.