Japanese manufacturing investment in the UK 1972-1996: an econometric analysis

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JAPANESE MANUFACTURING INVESTMENT IN THE UK 1972-1996:

AN ECONOMETRIC ANALYSIS

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INTRODUCTION

During recent decades, Japan has emerged as the second largest foreign investor in the world after the USA. This has stimulated research into the geographical distribution, among other things, of Japanese investment at two levels, between-country level and within-country level. Studies on between-country Japanese investment are mainly concerned with examining why some countries have been more attractive than others. These studies explain inter-country variations in Japanese investment by relying on aggregate variables such as relative real exchange rates, differences in labour costs, trade volume, growth of GDP and so on. With regards to within-country studies, the question of why Japanese investors are attracted to certain regions in a certain country is the main concern. It is this question that is the main theme of this study.

The history of Japanese manufacturing foreign direct investment in the UK can be divided into two periods, 1972-1983 and 1984 to the present. In 1996, there were 272 Japanese manufacturing establishments in the UK employing more than 80,000 persons. The range of Japanese manufacturing investment activities in the UK is also very large and diverse, ranging from production of machinery to a wide variety of consumer goods. In the context of Japanese FDI in the EU, the UK has been and is the most favoured destination, accounting for nearly one third of all Japanese manufacturing investment in the EU. However, Japanese manufacturing investment in the UK is still small compared to inward investment from the US and the EU (Mangan 1997). Nonetheless, Japanese FDI has been increasing rapidly since the second half of the 1980s and has been considered as a windfall gain for the UK economy. The UK government at both central and local levels has exerted extensive efforts to attract Japanese firms since the government considers inward investment by Japanese firms not only as a means of employment generation but also as a means of balancing the visible trade account with Japan (Dicken 1983). All of these serve to highlight the importance attached to Japanese investment in the UK.

According to data from the Invest in Britain Bureau, Japanese investment in the UK is not evenly distributed across regions. It is skewed towards the assisted areas. This phenomenon has induced several studies, especially in view of the fact that it has been government policy to encourage inward investment into assisted areas. Most of the investigation so far undertaken, however, have used the questionaire approach rather than econometric techniques (Taylor 1993).

The purpose of this dissertation is to examine the determinants of the location decision of Japanese investors, which has shaped the geographical distribution of Japanese investment in the UK over the last 25 years. One of the primary purpose of this study is to examine the effectiveness and importance of measures to induce foreign investment into the UK assisted areas. The objective is made possible by the availability of data from the Invest in Britain Bureau at the Department of Trade and Industry. This source of data provides information on the exact location of Japanese manufacturing investment in the UK, which is the subject of analysis in this study.

The dissertation is divided into four chapters. Chapter I presents a review on theories of foreign direct investment (FDI) and production location, both of which will serve as the background to understanding the underlying determinants of FDI. Chapter II provides a review of the empirical literature conducted on the determinants of the location decision of foreign investors. This chapter shows a variety of methods and models which have been employed to analyse the location of FDI. Chapter III outlines the Japanese manufacturing investment in the UK. Chapter IV presents econometric models to test which variables and factors have determined the location decision of Japanese investors and contributed in the geographical distribution of Japanese investment in the UK together with the empirical results obtained.

CHAPTER I : THEORIES OF FOREIGN DIRECT INVESTMENT AND PRODUCTION LOCATION

The purpose of this Chapter is twofold: first to consider why firms decide to invest abroad rather than in their own country; and second, having decided to invest abroad, to consider the factors that influence the choice of location within the host country. In so doing, this chapter will review theories of foreign direct investment (FDI) and production location. Section 1 analyses theories of FDI. This is followed in section 2 by a review of relevant theories of production location.

1 Review of theories of foreign direct investment

The traditional explanation of foreign direct investment (FDI) is based upon the concept of capital arbitrage in international capital theory. According to this theory, differing rates of return to capital induce movements of capital flows corresponding to differences in the marginal productivity of capital. This theory explains why investment is expected to flow from capital-abundant countries to capital-scarce countries. However this theory fails to explain why capital flows take the form of foreign direct investment. According to Dunning (1988), this theory can be criticised on at least two points. First, in addition to capital flows, FDI involves the transfer of other resources than merely capital, namely technology, management, organisational and marketing skills, and it is the expected returns on all these resources rather than on the capital alone that induce firms to invest abroad. Second, FDI is different from portfolio investment since in the FDI case, resources are transferred within the parent firms rather than between two parties as in the case of portfolio investment, which means that control over resources is maintained by the parent company. It is this control that helps investing companies to fully exploit the rents from their own resources (Hymer 1976).

It has been argued that when a firm invests abroad, it has to face additional costs in comparison with local competitors due to various kinds of barriers, such as cultural, legal, institutional and language differences. To operate successfully in foreign markets, the investing firm must have some advantage over indigenous firms (the owner-specific advantage). These advantages are specific to the firm and readily transferable within the firm. However, the presence of such advantages means that the necessary but not the sufficient conditions for firms to operate in foreign countries are satisfied. This is because these advantages alone cannot explain why production needs to be located abroad, and the investing firm can exploit the advantages through other alternative options such as exports or licensing. Therefore to account for the FDI option it is necessary to take into consideration such location-specific factors as relative production costs, trade barriers, and market characteristics

(Hood et al 1984). The combination of these two advantages is of decisive importance. It will determine whether a firm has advantages over other firms and whether to exploit these advantages abroad or at home.

1.1 Theoretical explanation based on market imperfections

One of the earliest attempts to introduce market imperfections in the theory of FDI was made by Hymer (1976). He argued that the investing firm must have some advantages specific to its ownership which are sufficient to outweigh the disadvantages they faced in competing with indigenous firms in the host country. These exclusive advantages imply the existence of some kind of market failure. This is because in a perfectly competitive world, all firms are competing equally and have no advantage over others. As pointed out above, FDI cannot take place in such a world. As Kindleberger (1969: 13) has stated, for FDI to take place 'there must be some market imperfections in markets for goods or factors including among the latter technology, or some interference in competition by government or by firms, which separates markets'. These market imperfections take the form of unique and often intangible assets to firms, including product differentiation, brand name, marketing in the product market or special managerial skills, patented technologies, special access to capital markets, or economies of scale either internal to firms or external to firms as a result of government intervention.

However, as other writers have pointed out (Hood et al 1984, Dunning 1988, 1993) the existence of ownership advantages does not necessitate production abroad, for the foreign firm can exploit its advantage through licensing or through producing at home and exporting. To explain the choice of FDI over producing at home and exporting it is necessary to take into account local-specific factors such as trade barriers and market characteristics. This will make FDI preferable to exporting because it allows foreign firms to exploit differences in factor price, overcoming trade barriers and the like. A clear model dealing with the choice between exporting and FDI has been developed and can be found in Cave 1982. This model was originally developed by Horst (1971, cited in Caves 1982). It assumes two countries, a downward-sloping demand curve for the firm concerned and profit maximization. Horst derived the so-called marginal cost of exporting curve showing the quantity that would be exported at differing price levels. Horst also explores various situations in which a tariff is imposed, and the firm enjoys economies of scales. In essence, this model has shown how the firm interacts with different locational-specific factors. As far as the licensing option is concerned, Caves (1982) has argued that the primary advantage of foreign investment is the existence of rent-yielding assets, most of which are intangible. Some of those assets namely technology and know-how are in some way special in so far as they prevent foreign firms

from capturing the full rents embodied in them by selling or by leasing. Several reasons have been advanced. Firstly, those assets are public goods in nature, in the sense that the marginal cost of replicating them is trivial compared with the initial cost of developing them. As a result, the firm will opt for FDI rather than licensing or selling them. Secondly, in addition to their public goods characteristics, there is informational asymmetry and uncertainty which prevents the advantage-possessing firms from providing all information to the potential buyer. This arises from the nature of the assets mentioned above. On his part, the potential buyer will not be willing to pay the full price for the assets once full information about the assets is available. Thirdly, many of the assets are inseparable from the firm. In summary, the explanation of FDI based upon market imperfections is essentially that firms undertaking FDI operate in an imperfectly competitive market environment, where it is necessary to acquire and sustain some net advantages over local firms in the host country (Dunning 1979).

1.2 Internalization theory of foreign direct investment

Internalization is another explanation of FDI, which also focuses on market imperfections. But these imperfections are in the markets for intermediate inputs/products and technology. It should be noted that intermediate inputs in this context are not just semi-processed materials but more often are types of knowledge incorporated in patents, human capital and so on (Hood 1984). Imperfections in markets for intermediate inputs will create difficulties and uncertainty for the firm to fully exploit its advantages. A profit-maximizing firm faced with such imperfections will try to overcome these in the external market by internalizing them in their operation, either through backward or forward integration.

There are a number of such imperfections which are considered important in stimulating internalization. An example is government intervention in the form of tariff, taxation, and exchange rate policies that create difficulties in the firm's sourcing activities and in exploiting location-specific advantages. All these factors stimulate firms to internalize. Again the informational asymmetry with respect to the nature and value of the product between knowledge-possessing firms and the potential buyer is another imperfection in the intermediate product market. When the internalization is undertaken in the international market, FDI is the result. Buckley and Casson (1976, cited in Graham et al 1995) have observed that 'for multinational enterprises to serve non-home-nation markets via FDI' rather than either exporting or licensing 'there must exist some internalization advantage for the firm to do so'. The internalization advantage will be some kind of economy for the firm to exploit market opportunities through 'internal operations rather than through arm's-length transactions' (Graham et al 1995). These economies are often associated with costs of contract enforcement or maintenance of quality or other standards. For example, when a firm selling

intermediate inputs is unsure about the quality or standard of the final product that carries its name, then the firm may internalize by forward integration.

Although the internalization approach is also based on market imperfections, it differs from that presented in the previous section. The difference is that it is not only the possession of unique intangible assets that give the firm its advantages but the internalization process that does. As Dunning (1993: 75) has pointed out, the 'internalization theory is primarily concerned with identifying the situation in which the markets for intermediate products are likely to be internalized, and hence those in which firms own and control value-adding activities outside their natural boundaries'.

1.3 Product cycle hypothesis

In the two previous sections, explanations of FDI have been based upon static advantages, either specific to firms or specific to a location. However, the relative importance of these advantages will change over time as the product develops through its life cycle. As a consequence the firm's choice between export, FDI and licensing might also change. Vernon (1966) developed the product cycle model to deal with such dynamic aspects of FDI activities. Originally Vernon attempted to explain US investment in Europe during the post-war period by answering two questions. The first concerns why innovations occur in developed countries and the second concerns why they are transferred abroad. Vernon tried to answer these two questions by relating the product life cycle, which is divided into three stages progressing from the 'new' to the 'mature' and ultimately the 'standardized' product, to the location decisions made by firms and the choice between exports and overseas production.

In the first stage, market conditions in developed countries, particularly in the US, facilitate the innovation of new products. Because of a combination of higher income levels and higher unit labour costs, a strong incentive exists for producers in developed countries to develop new products which are either labour-saving or are designed to satisfy high-income needs. In addition to this, on the supply side developed countries are endowed with a comparative advantage to produce such goods due to their stronger propensity to investment in research and development. Even so, this does not necessarily mean production will be located in developed countries. However, in this stage because of the fact that the product itself is unstandardised, production costs are not a serious consideration. Moreover, the price elasticity of demand for the new product might be low due to product differentiation or monopoly advantages acquired by the innovating firm, and there is likely to be a need for

'effective communication between the potential market and the potential supplier', so that firms often choose to locate their production at home, in developed countries (Vernon 1966).

The second stage is when the product is maturing, and potential competitors appear. Some degree of standardization has been introduced in the design and production process. Faced with the resultant competition, producers are more concerned with the cost of production. Furthermore, demand for the product might appear abroad creating new market opportunities for the firm. Originally, firms serve foreign markets by exporting from home-based production. But later on, firms also consider two other options, licensing and FDI. However, in international markets, licensing is an inferior option to FDI due to inefficiencies. All these factors affect the production location decision. In general, if the marginal production cost plus the transport cost of the goods exported from the home country is lower than the cost of potential production in the importing country, the firm will export rather than invest (Vernon 1979).

In the final stage of this model, namely the standardized product, less developed countries are at a comparative advantage as a production location. At this stage, market knowledge and information are less important, therefore the priority is for the least cost location; competition is primarily based on price and demand is more price elastic. The net result is that the production facility or assembly is moved to developing countries to take advantage of low labour costs (Vernon 1966).

Although the product cycle hypothesis has several weaknesses and might be an oversimplification of reality, it has provided an explanation of why innovations occur mostly in developed countries, while at the same time it explains both trade and investment flows.

1.4 Eclectic paradigm

Dunning (1979) expresses his dissatisfaction with these theories, arguing that they are only partial explanations of FDI. This has induced him to develop an eclectic approach to the problem. This approach relies on and pulls together different strands of economic theory to explain the ability and willingness of firms to engage in FDI rather than domestic production, exports, licensing or portfolio investment. He states that the capability and willingness of firms to make FDI depends on the possession of assets that are not available to other firms in foreign countries.

Dunning (1993) has identified and distinguished three different kinds of assets. The first group is owner-specific assets which are assumed unique to firms. Such assets include not

only tangible assets like capital, manpower and natural resources but also intangibles such as technology, know-how, information and marketing. They are of the sorts specified in the first section. The second consists of assets which might be specific to a certain location. These include not only natural endowment but also cultural and political factors and government policies such as tariffs. Another dimension of location-specific assets, found in Vernon's product cycle hypothesis, is that it is profitable for the firm to combine its ownership of assets specific to firms with location-specific assets in the host country. The third is the internalization of assets which arise in the presence of market failure. It is the internalization of assets that allows firms to fully exploit owner-specific and location-specific assets.

The principal hypothesis of this eclectic theory is that a firm will engage in FDI if the following three conditions are met:

1. It possesses ownership advantages over firms of other nationalities in serving particular markets. These advantages are specific to the firm.
2. Given (1) is satisfied, it must be more beneficial to the firm to exploit the advantages themselves rather than to sell or lease or license them to foreign firms, that is to internalize its advantages through an extension of its activities rather than externalizing them.
3. Given (1) and (2) are satisfied, it must be profitable for the firm to combine these advantages with some factors in the foreign countries.
(Dunning 1979)

The key point of the eclectic theory is that any one of these advantages may be necessary but not sufficient to give rise to FDI. It is necessary to consider all three conditions together. Dunning (1993) concludes that all forms of FDI can be explained by the above three conditions.

2 Theories of production location

Section 1 offers answer to questions of why firms engage in FDI, which countries they invest in, and when to invest. But once a particular host country is identified, the investing firm faces the question of where to locate its production plant. The answer to this question can be found in the economic geography literature, which offers various explanations of the location decision. The purpose of this section is to examine different approaches to the question of optimal location. This will serve as a useful basis for understanding the location decision made by foreign investors. This will help to provide an understanding of why certain areas in the same country attract so much investment while others do not.

This section begins with neoclassical theories, which are based on the assumption of profit maximization of economic agents. Neoclassical location theory has its origin in the work of Weber, whose work has been developed and expanded. The theory is neoclassical in the sense that it was developed on the basis of Weber's classical theory directed toward the determination of the least-cost location, but it has been extended well beyond the classical approach to incorporate demand considerations. This is followed by the behavioural approach to the question of location. This approach is regarded as a response to the shortcomings of neoclassical theories. Thirdly, the structural approach is presented, which puts the location decision in the macro-context of the whole economic system.

2.1 Neoclassical location theory

Neoclassical location theory is based upon the assumption that entrepreneurs are rational economic agents who seek a profit maximizing location. As mentioned above, the theory is based upon the neoclassical theory developed by Weber, therefore, first of all the least-cost location developed by Weber will be presented. Secondly, the generalization of the variable-cost model will be examined. Thirdly, revenue is introduced to take into account demand factors.

2.1a. Weber's least-cost location theory

Weber (1929) was concerned with finding an optimal plant location. In his work, optimality means least-cost location, which was initially considered purely in terms of transportation cost, and later expanded to account for labour and agglomeration economies. Weber developed his theory on three basic assumptions. Firstly, the locations of raw materials are given. Secondly, market places and sizes are given. Perfect competition is implied, each producer having an unlimited market with no possibility of monopolistic advantages from choice of location. Thirdly, an unlimited supply of labour is available at certain locations but is immobile.

Weber used the locational triangle to derive the least-cost location. The triangle was constructed from two points of material sources and one market point, or two market points and a single material point. The optimal location for the plant is the single point within this triangle such that the costs of shipping materials from the two sources to the plant location and the final product from the plant to market are minimized. The identification of the optimal point is a function of the volumes of the material transported and unit transport cost. Within this triangle, each corner of the triangle will exert a pull on plant location, proportional to the volume to be transported and inversely proportional to the distance to be

covered. At this stage, the primary determinant of location is the transportation cost. However, Weber recognized the importance of labour cost, which can divert the plant from the least transportation cost location to the least labour cost location. Weber pointed out that this would take place if the labour cost saved exceeds the additional transportation cost incurred when locating away from the least transport cost location. He analysed this by using 'critical isodapanes'. Isodapanes are lines joining points of equal transportation cost around the least-transportation cost location. The farther the 'isodapanes' are from the least cost location, the more additional transportation cost the firms has to incur. The 'critical isodapane' is the one that has the same value of the saving in labour cost. Beyond the 'critical isodapane' the additional transportation cost incurred will be higher than the saving in labour cost. If the cheap labour location lies within the 'critical isodapane', it is a more profitable location than the least transportation cost one. As a result, the optimal location will be diverted to the least labour cost location. Weber also dealt with agglomeration economies which are treated in the same way as labour costs. The critical isodapanes in this case will be the isodapanes that have the same value of the benefit brought about by agglomeration economies. The places of agglomeration that firms will locate in are the intersection of their 'critical isodapanes'. Within this intersection, the benefits resulting from agglomeration will outweigh the additional transportation cost.

2.1.b The generalized variable cost model

Smith (1981) argues that the neoclassical framework developed by Weber suffers from an undue preoccupation with transportation and with the determination of the least cost location. He developed a model which deals with total costs rather than just the cost of transportation, with 'the cost of all inputs treated as continuous spatial variables' (Smith 1981:149). He shows that the Weberian triangle can be extended to an n-corner figure to incorporate more material resources, more markets and more realistic situations. This can be done by treating, for example, the cheap labour source as a corner of the figure. Capital, land, other inputs can be treated similarly. In this case, each corner will exert its pull on plant location proportional to the quantity of input needed and the transport cost. The relative strength of all these forces will determined the position of the optimal location. However, he points out that while generalizing the neoclassical model in this way is simple, the problem of solving the least cost location is difficult. This is because it is unsatisfactory to treat the spatial variations in other costs in the same way as transportation. Transportation costs may be considered as a simple or even linear function of distance, but other input costs are not. To overcome this he has suggested that 'each input can be regarded as having a spatial cost surface, which at any point represents the cost of acquiring the quantity necessary for a particular volume of output' and

that the total cost surface can be obtained by summing over all individual input cost surfaces (Smith 1991: 25). At any location (i) the total cost (TC) will be

$$TC_i = \sum_{j=1}^{n} Q_j U_{ij}$$

where TC_i is the total cost at i
Q_j is required quantity of input j
U_{ij} is unit cost of j at i

and the summation is for n inputs. The optimal location is where the total cost is minimized due to the assumption of constant total revenue over space. This results in the maximum profit location where the total cost is least. He also assumed that the production function is the same everywhere. In addition, he assumed away demand conditions, substitution of inputs, government subsidies, economies of scale, and agglomeration economies.

2.1.c Locational interdependence

The framework employed in the neoclassical theory and its later extension, the generalized variable cost model is purely competitive. In this model, buyers are concentrated at certain points and each seller has an unlimited market. It has been argued that this is the major shortcoming of the both neoclassical and generalised variablecost model presented above. In these models, demand is assumed away, and revenue is assumed constant over space. Smith (1981) acknowledges that once demand is allowed to vary in space, the least cost location does not mean the point of maximum profit, which is what the producer aims to achieve. This is because a low cost location might mean a low volume of output and hence revenue due to a poor location. This has led to the interdependence theory of location, which is predicated on the theory of oligopoly. This is because every business has to face competition and the behaviour of competitors may be an important characteristic of the economic environment in which firms operate and this affects the location choice of firms (Chapman et al 1987). The interdependence theory of location abstracts from cost and explains the location of firm as trying to control the largest market area possible. It focuses on demand and spatial competition and on the division of a market area by rival firms, which ultimately affects revenue earned by firms. By assuming that resources and population are evenly distributed and that production costs are constant over space, this theory analyses only the number of firms involved in a market and their transportation cost. As a result the spatial pattern of firms and market areas is a function of spatial variations in demand and the interdependence of firms (Smith 1981, Greenhut 1957).

The locational interdependence approach can be illustrated in two steps as follows. The first step is to derive the boundary of each firm's market area and the second step is to introduce competition from rival firms. The boundary of a firm's market area is derived as follows. At any location *i* the total revenue earned by a firm is:

$$TR_i = \sum_{j=1}^{n} Q_j P_j$$

where TR*i* is revenue at location *i*

Q*j* is quantity sold at market *j*

P*j* is price at *j*

the summation is over *n* market.

Demand is assumed to depend on price such that any price increase will lead to a reduction in demand. This is the point that transportation cost comes in. As other production costs are assumed constant in space, increases in price are proportional to the distance to be covered from the plant to market areas. The price prevailing at market will be the delivered price which reflects the addition of transportation and other distribution costs to the cost of production at the plant. The boundary of the market area of a firm will be determined by the highest delivered price acceptable by consumers. Figure 1 shows that firm A has the production cost C, and the market is willing to pay a maximum of P. The market area of firm A is determined by the intersection of the delivered price line, t_a, which covers production cost, transportation and other distribution costs, with the maximum price line, P, at which consumers are prepared to pay to generate the market area marked by point MA - MA' . In the absence of firm B, firm A can serve the whole market area MA-MA'.

Secondly, competition is introduced by allowing the presence of a second firm. The production cost and delivered price of the second firm is assumed to be equal to that of the first one. The intersection of the delivered price lines of the two firms will determine the market share of each firm. Part of the market area of firm A is transferred to firm B. In figure 1, the fraction X-MA' is transferred to firm B in this linear market model. From this rather simple illustration, it is clear that the demand and revenue facing firms are significantly influenced not only by the number of firms but also by the locations of other firms. Later entrants are clearly influenced by the location of earlier firms. Greenhut (1964) concludes that the elasticity of the demand function, the history of competition, the degree of competition and many other demand factors determined by location have influenced the selection of plant sites.

2.1.d The spatial interaction of cost and revenue

The neoclassical theory of location has developed from the early work of Weber, through the generalized variable cost model and the locational interdependence model. It is clear from the assumptions of these two models that they both suffer from restrictive assumptions. The least cost approach ignores demand conditions. On the contrary, the demand or locational interdependence approaches ignore the variations of cost in space. As a result, on the one hand we can identify the least cost location for a certain level of demand for our output. On the other hand, we can identify the revenue maximizing location with some assumptions on production costs. It is recognized that in reality neither demand nor costs are spatial constants, and that the assumption of rationality on the part of entrepreneurs means they will look for the maximum profit location rather than least cost location or revenue maximizing location. However, several theorists (Smith 1981; Chapman et al 1987) have pointed out that simultaneously relaxing both of these assumptions, it is impossible to construct a model to define the optimum location at which profit is greatest. Nonetheless, Greenhut (1955) attempted this to incorporate factors influencing both cost and revenue (demand) in his theory. Although Greenhut stressed both factors, his theory and empirical enquiry have remained preoccupied with the cost side. However, the two models are very useful in understanding the fundamental factors that are likely to influence the location decisions of firms.

All of this has led to the adoption of the 'spatial margin to profitability' concept to account for the economic fact of life of sub-optimal location decisions. The spatial margin defines an area within which firms can operate profitably, with total revenue exceeding total cost. Operating outside the spatial margin firms would incur losses. The spatial margin is determined by the intersection of the space cost curve and space revenue curve. And different margins can be associated with different volumes of output and in a sense points on the spatial margin are similar to the beak-even points (Smith 1981, 1991).

2.2 Behavioural location theory

The fundamental assumption underpinning the neoclassical location theory presented above is that firms seek to maximise profits. This is done by achieving an optimum location, among other things. It is argued that while neoclassical location theory provides a benchmark for conditions required to find an optimum location, its capacity to explain the actual location decisions of firms is very limited due to abstraction from reality. The conventional profit-maximizing assumption requires the decision maker to be an economic man who follows the single-minded pursuit of profit maximization and possesses complete knowledge of all

relevant economic information including the ability to predict the action of competitors. In reality no one can match this requirement (Chapman et al 1987; Smith 1981). In order to accommodate the sub-optimal location in reality with the neoclassical theory, Smith (1981) introduces the concept of spatial margin to profitability, which defines the boundary of an area around the optimal location within which a profitable operation can be obtained. At the margin, the total cost is equal to total revenue. However, the concept of a spatial margin to profitability suggests sub-optimal behaviour. This has led to the behavioural approach to the study of industrial location, which recognizes that in the real world decision makers do not have the complete knowledge ascribed to economic man and they often 'adopt courses of action which are perceived to be satisfactory' (Chapman et al 1987: 19).

The behavioural theory of location goes further than neoclassical theory by dealing with two specific aspects left open by the neoclassical approach. Firstly, decision makers have neither perfect and complete knowledge and information on which to make the optimal location choice, nor perfect ability to use this information. This aspect was dealt with in the so-called behavioural matrix, in which individual firms are placed according to their information and ability to use it. This matrix was originally developed by Pred (cited in Smith 1981: 117). In essence, the matrix shows that the better informed and the more capable a firm is to use its information, the more likely the firm will choose a location at or close to the optimal point. Conversely, with less information and less ability, the likelihood that a firm will locate at an optimal point is small. The main weakness of the behavioural model is that it allows for the possibility that an enterprise, however ill-informed and incapable, may make an optimal location decision (Smith 1981; Lever 1987).

Secondly, it has been argued in the behavioural theory that the choice of location can be considered as a utility maximizing choice, in which profit is only one among several other elements. Thus, the entrepreneur might choose a location far away from the optimal one in profit terms, but may yield the highest personal utility (e.g. in an area with a favourable climate). In this sub-optimal location, the social and environmental factors can outweigh the profit objective. Furthermore, firms may have more than one goal other than the profit maximization. These multi-goals include growth, security, risk minimization, or even oligopolistic strategy (Lever 1985).

The behavioural approach has treated locational choice as a part of the decision-making process within enterprises which comprise pricing decisions, product development decisions, and marketing and production decisions in addition to the location decision. This approach puts firms in the context of interacting with the environment outside and inside the firm. It has provided many insights to locational choice and has challenged many traditional and simple

notions of the subject. The behavioural approach to location theory presented above is an attempt to overcome some of the rigid and unrealistic assumptions of neoclassical location theory. The behavioural approach is more realistic in its recognization of sub-optimal location, multi-goals and the environment in which firms operate.

Although the strength of this approach lies in the insights it provides, it has several weaknesses. Firstly, its power to predict and evaluate the locational behaviour of firms is limited. Secondly, the approach is too general to be of much value in aiding empirical investigations of the location decision. Thirdly the basic question of why firms choose particular locations still remains unanswered (Smith 1981; Wood 1991).

2.3 Structural approach to location theory

According to Smith (1981), the structural approach has arisen as a response to the inability of existing theory to provide a guide for economic development policy and because existing theory fails to explain actual location decisions. The structural approach challenges both the neoclassical and behavioural location theories in the sense that it is a macroeconomic approach and considers disequilibrium as a normal condition which does not comply with either neoclassical or behavioural theories (Storper 1981).

The structural approach to location theory emphasizes the need to understand industrial location within a framework of political economy. Specifically, it has tried to explain the changing geographical distribution of jobs and industries by resorting to the underlying structure of capitalist society, economic and class relations, and conflicting interest between capital and labour. The literature on this approach is too large to review here and a complete review of this approach can be found elsewhere (Smith 1981, Storper 1981 and Lever 1985). However, there are two essential arguments of the structural approach that should be mentioned. The first is that industry creates a specific demand for labour; this demand changes due to macroeconomic fluctuations or due to organizational restructuring. The resultant changes in demand lead to changes in investment patterns, including plant closures, relocations and new plant establishments (Storper 1981). In the second one, the capital-labour relationship is emphasized. In the capitalist mode of production, capital and labour are put together to generate wages for labour and profit for capital, but a growth in one of them is likely to be achieved at the expense of the other. The conflict of interest between the two is even more apparent in large enterprises. Large enterprises often employ their economic and political power to control their workforce. On the opposite side, labour is organized to respond to this control (Lever 1985).

In summary, the development of a theory of location has evolved over time with the behavioural approach being a response to the perceived inadequacies of the neoclassical approach, with the structural approach supplementing the behavioural approach since the latter fails to take into account the effect of macroeconomic and social forces.

3 Conclusion

This chapter has concentrated on two branches of theory, the theory of foreign direct investment (FDI) and the theory of production location. The former explains why firms decide to invest abroad by referring to the advantages inherent in firms ownership. It then explains where (which country) firms invest in by pointing out the location-specific advantages. Finally, it explains why firms choose FDI rather than opting for other alternatives by resorting to the advantages resulting from the internalization of production.

The review of the theory of production location is very useful. It helps to provide an understanding of where firms should locate, particularly in the context of foreign direct investment. After a firm has decided to invest abroad and a certain host country has been chosen, the firm will have to face the question of choosing a specific location. This theory has developed from the early classical contribution by Weber, which has been supplemented and extended several times into the neoclassical theory. The neoclassical theory itself has been supplemented by the behavioural and the structural approaches which are claimed to be more realistic.

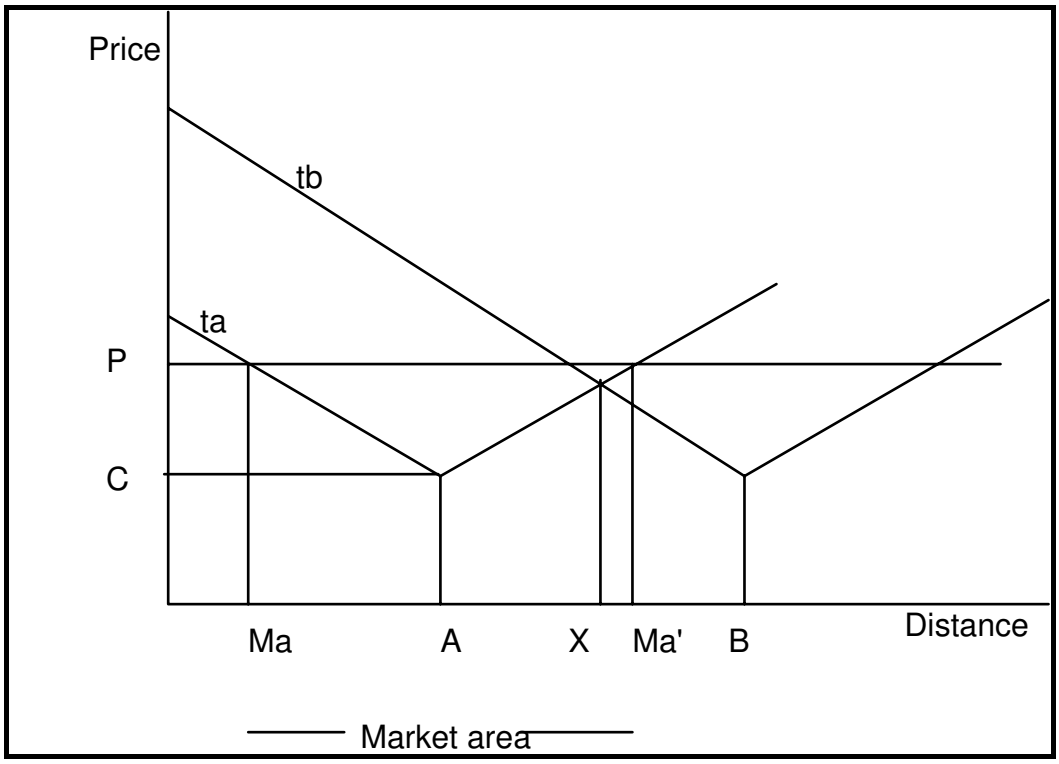

Figure 1.1 Locational interdependence between firms

CHAPTER II - A REVIEW OF EMPIRICAL LITERATURE

This chapter appraises the different empirical studies of the determinants of locational choice of foreign direct investment in a country. These studies have attempted to identify variables which are statistically significant determinants of locational choice in the specific context of FDI in a host country. The purpose of this chapter is to provide a basis for a model to be employed to identify the determinants of the geographical distribution of Japanese FDI in the UK during 1972-1996 in the following chapter. This review draws mainly on studies in the United States and the UK. The chapter is in two main sections. Section 1 provides a summary of the results of various studies while section 2 discusses the extent to which the empirical findings are consistent with the predictions of location theory.

2.1 Main findings of empirical studies

This section discusses the following issues:

a. the definition of dependent variables employed in empirical studies;
b. the 'right-hand-side' variables that are commonly used and believed to be significant determinants of the location of FDI in a host country;
c. the data and methods of analysis employed.

Table 2.1 presents a summary of the results of numerous empirical studies. These results indicate the models employed, the methods of analysis, and the variables which have been found to be statistically significant in explaining the geographical distribution of foreign direct investment.

a. The dependent variable

As can be seen in the summary table 2.1, the dependent variables employed in FDI location studies differ between the various studies. However, they can be grouped into three broad categories as follows:

Continuous variables: This kind of variable is used by several authors and includes measures such as the share of FDI going to each region in cross-sectional analysis (Hill et al. 1992; Glickman et al. 1988) and the level of FDI in each region over time in times series analysis (Hill et al 1991).

Binary variables: The binary dependent variable is employed in conditional logit models (Coughlin et al 1991, Friedmand et al 1992, Head et al 1995). In these models, each firm is an unit of analysis.

Discrete variables: This variable is used in the application of the Poisson model by Taylor (1993) who uses count data for the dependent variable. The dependent variable is the number of FDI establishments which have located in a set of geographical areas during a specific time period.

b. The explanatory variables

The typical variables that have been included in these models are the following:

- Labour

Labour variables are included in empirical studies in many forms. Labour costs are of importance for location since they are part of total production costs. In addition, the unemployment rate and the total number unemployed are often used as explanatory variables since they are indicators of labour availability. Industrial relations are also an important consideration and some empirical studies take this into account by including the unionization rate.

- Market demand

The effect of market demand on location is reflected by population variables, such as population size, population density and population growth. Other variables which have been used to reflect market demand are income and output growth.

- Government policies and assistance

Government policy is believed to be of importance in the location decisions of foreign investors. Variables used to reflect the impact of government incentives include the regional share of financial assistance, expenditure on promotional activities, dummies indicating the status of assisted areas and local taxes.

- Infrastructure

Access to major transport networks (particularly the road network) is a primary consideration in the plant site selection of foreign investors. In the empirical studies reviewed here, infrastructure is included to reflect market access as well as access to material supplies. Spending on infrastructure is used as an explanatory variable in these studies.

- Agglomeration economie:

One of primary determinants of location for manufacturers is existing manufacturing activities. Agglomeration economies result from manufacturers locating in close proximity. Dummies, industry mix and number of manufacturers are often used as a proxy for agglomeration economies. It may also be the case that locations with a high level of dependence on manufacturing activities are likely to have good access to national transport networks since manufacturing activities are highly dependent on demand from other regions (including other countries).

- Regional characteristics

Certain regions might have some special characteristics that attract FDI. Therefore, regional dummies are often included in these studies to control for these special regional characteristics which are believed to affect location decisions.

c. Methods of analysis

Table 2.1 reveals three different statistical approaches to investigating the determinants of the geographical pattern of FDI. They are ordinary least squares (OLS), conditional logit and Poisson models. This subsection focuses primarily on the OLS model and the conditional logit model. The Poisson model is discussed in more detail in chapter IV.

- The OLS model

The implied assumption in these model is the linear relationship between the dependent variable and the explanatory variables. Within the OLS-type model, a number of various models, namely cross sectional, time series and pooled data, are used to determine which variables are significant determinants of the location pattern and site selection by foreign investors.

The estimation procedure in OLS type models is to minimize the sum of squared residuals. The functional form of these models is either linear or log-linear. But usually, they take the following form:

$$Y_i = a + \sum b_i X_i + u_i$$

where y_i is the regional share or level of FDI in location i (or at time i in times series models); the X*i* are typical explanatory variables representing locational/regional characteristics that explain the determinants of location patterns and the decision of foreign investors; u*i* is an error term; and a and b are coefficients to be estimated.

- The conditional logit model

The conditional logit model is based upon McFadden (1974). Under this model, foreign investors are assumed to seek locations that maximize their profits. In location *i* , the profit for foreign investors is:

$$\pi_{ij} = \beta' X_j + e_{ij}$$

where Xj is a vector of attributes attached to location *j*, β is a vector of parameters, and e_{ij} is a random error term. Firm *i* will choose location *j* if expected profits, π_{ij}, exceed the expected profit of all other locations, which means that the firm maximizes its profit at location *j* (Friedman et al. 1992, Coughlin et al, 1991, Carlton 1983, Woodward 1991). If the error terms, e_{ij}, are independently and identically distributed following a Weibull distribution, the probability that firm *i* will choose location *j* is :

$$P_{ij} = \exp(\beta' X_j) / \sum_{k=1}^{n} \exp(\beta' X_k)$$

where n is the number of alternatives in the location choice set (McFadden 1974, Maddala 1984, Friedman et al 1992). At this stage, maximum likelihood procedures can be applied to estimate β by maximizing the likelihood function:

$$L(\beta) = \prod_j P_j$$

In this model, characteristics vector X will include variables representing factors that are identified as determinants of the location decision.

- Poisson model

In addition to the two models mentioned above, the Poisson model has been employed to analyse the location decision. This model is appropriate for count data which take on non-negative discrete values i = 0,1,2...n (Taylor 1993). Because this model will be used in the statistical analysis, it deserves detailed discussion which is delayed until chapter 4.

2.2 An analysis of empirical findings

Glickman and Woodward (1988) conclude that the location of foreign-owned property, plant and equipment can be explained by variables representing labour characteristics, energy cost, agglomeration, and transportation/infrastructure. Interestingly, they also find some convergence of location pattern between foreign and local firms. They did acknowledge the need to construct a more disaggregated model to take into account various other variables which they suggested but failed to include in their model such as labour supply, cost factors and the role of government policies. However, their results find some support from location theories as to the influences of cost, labour, and agglomeration factors on the location decision.

Bagchi-sen et al (1989) conducted research on FDI in 60 metropolitan centres of the USA, identified the importance of population size, population growth and per capita retail sales in determining levels of FDI. They also found temporal and spatial variations of these explanatory variables. In their model, population size was argued to capture market size, economies of scale, availability of skilled labour and technology, and agglomeration economies. Population growth represents market potential and dynamics. Per capita retail sales represents potential demand and measures of wealth. As we can see, by arguing that agglomeration economies are associated with population size, they might ignore the possibility of agglomeration diseconomies in areas with large populations. In addition to this drawback, they did not differentiate between manufacturing investment with other types of investment.

Hill and Munday (1991) conducted an analysis of the determinants of FDI in Wales and stressed the importance of labour cost, followed by the regional share of government financial support to explain the relative share of inward investment in Wales with some mixed results for other explanatory variables. Among others, the most serious problem in their study is the extremely small data set, consisting of only 7 observations, and they included 4 explanatory variables in their multivariate regression. In addition, using time series they failed to analyse spatial factor variations between different regions. In a subsequent study, Hill and Munday (1992) pooled data for 10 years and 9 standard regions in the UK to examine the determinants of inward investment in different regions. In this study they found financial incentives and access to markets are substantial influences on the regional distribution of inward investment but labour cost was no longer significant. Further, some conflicting results appeared when using different measures of the dependent variable. Several shortcomings of the Hill and Munday studies can be identified. First, there may be a problem of endogeneity due to the two-way relationship between the level of inward investment and the financial incentives granted (Taylor 1993). Secondly, there are some important variables suggested in theories such as the agglomeration economies which were omitted in their studies. Thirdly, the conflicting results of their analysis give rise to doubt about their appropriateness. Finally using aggregated data they neglect the location decision of individual investors. However, this is a problem common to all OLS models.

Coughlin, Terza and Arromdee (1991) analysed the location decision at state level of foreign manufacturing firms in the United States during 1981-83, using a conditional logit model. They found the importance of income proxied for market demand, government expenditure in promotion and manufacturing density in attracting FDI. On the contrary, higher wage rates and taxes were found to be a deterrent to FDI. One doubtful but surprising result from their analysis was the positive effect of unionization, which is expected to have negative effects on FDI. However, they referred to similar results obtained by other researchers and argued that this positive effect might be due to an association between unionization and productive efficiency in manufacturing across states. With regards to the dependent variable, Coughlin et al (1991) used aggregate data from the Department of Commerce, which did not distinguish between different types of FDI. More specifically, they combined together investment in new plant with investment in mergers and acquisitions, equity increases, joint ventures, real property purchases and plant expansion. But the decision to invest in a new plant is different from other types of investment because 'greenfield start-ups require an explicit location decision' (Woodward 1992:691). Friedman et al (1992) point to the low correlation between new plant investment and other types of investment as an indicator of aggregation bias in the work of Coughlin et al.

Woodward (1992) was the first to attempt to analyse Japanese investment locations in the USA. He employed the conditional logit model to study Japanese greenfield start-up locational choices during 1980-89. He separated the location decision into two levels, state and county, by arguing that the location decision at state level is different from that at county level. It means that after a certain state was selected, investors will look at different counties for the optimal location. He found that at state level, variables representing markets, unionization, taxes and land availability are significant. In addition, Japanese investors are skewed towards Pacific regions. But they are found to be unresponsive to the government promotion programs. As opposed to Coughlin et al, Woodward finds that labour unionization is a major deterrent to FDI. At county level, Japanese investors are found responsive to agglomeration, population density, wage rates, productivity, education level, land area and unemployment. Interestingly, Japanese investors were found to have some racial bias against the black population. In general, his results are consistent with location theories, but Friedman et al (1992) raises some doubt on the appropriateness of the data used by Woodward. Woodward justified using 1980 data for his explanatory variables by arguing that most Japanese investments were made in the early to mid-1980s, but the data fails to support his justification. Friedman et al (1992) points out that most of Japanese plant investments were made in the late-1980s.

Friedman, Gerlowski and Silberman (1992) also used the conditional logit model to examine the site selection of foreign firms, but they also considered the site selection decision of Japanese and European firms in the USA separately. They found that access to markets, labour market conditions, state promotional activities and taxes are significant factors in the location decision and that the determinants of the location decisions of Japanese and European firms were different. Contrary to Woodward, they found a positive and significant effect of unionization on FDI location.

Another analysis that employed conditional logit was carried out by Head, Ries and Swenson (1995). In their paper, they examined the location decision of Japanese manufacturing investment in the USA. They took a very different approach, concentrating only on agglomeration economies and ignoring other factors commonly included in statistical analysis. They justified this by arguing that these factors were captured in agglomeration economies. Although their results fit well with location theories, they have ignored the possibility that agglomeration diseconomies may deter FDI in areas with large populations.

In all studies using the conditional logit model, there are two basic limitations. The first is that this model requires dropping locations that do not have any investment otherwise it would involve taking the natural log of a zero value. This will lead to failing to fully consider all

locations. Secondly, when two or more locations are close substitutes, the basic assumption that the error terms are independent and identically distributed means that use of the Weibull distribution is no longer valid (Woodward 1992).

Taylor (1993) employs the Poisson model to analyse the location decision of Japanese manufacturing investment in the UK at county level. His findings show that Japanese investors are influenced by two main factors: financial assistance and industry mix but not by regional disparities in labour costs. However, his analysis suffers some limitations due to violations of the basic assumption underlying the Poisson model, the independence of occurrence of individual location decisions. Although he found that statistically coefficients in his model were not affected by removing some obvious observations violating this assumption, he acknowledged that expediency rather than theory dictated this analysis and suggests that this shortcoming can be overcome by using finer disaggregated data at district level.

This section has review some empirical work studying the location determinants of foreign manufacturing investment in a host country. There are three different models which have been used. The OLS model has its drawbacks due to its using aggregate data, thereby ignoring the location decisions of individual investors. The conditional logit model also suffers limitations arising from dropping locations and the assumption holding for the error terms . The Poisson model has its limitations in violating the independence assumption for individual events.

CHAPTER III - JAPANESE MANUFACTURING INVESTMENT IN THE UK: AN OVERVIEW

The purpose of this chapter is to provide a general outline of Japanese manufacturing investment in the UK. More specifically this chapter addresses three questions: why Japanese investors have chosen the UK, what they are producing and where they locate. The first question of why Japanese investors have chosen the UK over the last 25 years rather than other countries in Europe is explained in section 3.1. The second and third questions are examined in section 3.2.

3.1. The rationale for Japanese manufacturing investment in the UK

First of all, Japanese FDI in the UK is explained in the context of the EU as a whole. Theories on FDI state that for a firm to operate successfully in foreign countries, it must hold some advantages over local firms. Dunning (1986) has identified several advantages of Japanese firms. These are: (1) product quality and reliability which embraces quality control and testing procedures of both outside purchases and in-house activities; (2) a flexible manufacturing and work system; (3) an ability to foster both management and worker commitment; and (4) favoured access to the supply of intermediate products. Other advantages lie in machinery, product design, production process, Just-in-Time delivery and marketing methods. Dunning goes on to argue that it is the way that these advantages are combined that give Japanese firms a competitive edge. However, the presence of these advantages only means that Japanese firms are completely capable of competing in the European market by exporting from Japan or other export platforms in Asian countries, but do not necessitate setting up local production in Europe. As a result, to explain Japanese manufacturing investment in Europe, there must be some market imperfections. Several writers (Dicken 1988, 1990; Hood et al 1993) have pointed to the European trade restrictions placed on imports from Japan and the marked yen appreciation as the main causes which have stimulated and accelerated FDI flows from Japan, particularly during the second half of the 1980s (Hood et al 1993, Anderson 1991). Dicken (1990) argues that the most important reason for Japanese manufacturing investment in Europe in general, and in the UK in particular, is to maintain market access and to avoid protectionist measures against Japanese imports, particularly in the coming of a 'fortress Europe'. With respect to the yen appreciation, Hood (1993) notes that this has served as a major subsidy for Japanese producers to 'transplant' industrial production abroad.

Table 3.1 sets out the geographical distribution of Japanese manufacturing plants (facilities) among EU countries. According to this source of information, the UK is the biggest recipient

country, with 206 out of 686 plants as of January 1994, accounting for nearly one third of the total number of plants. This has made the UK the most favoured location for Japanese investors in Europe.

Table 3.1: Distribution of Japanese manufacturing investment among EU countries

Country	Number of establishments in 1994	% of total
UK	206	
Germany	106	
France	121	
Spain	64	
Italy	52	
Netherlands	45	
Belgium	40	
Ireland	31	
Portugal	12	
Greece	3	
Luxembourg	3	
Denmark	3	
Total	686	

Source: Handy facts on EU - Japan Economic relations, JETRO Survey - 1995

Secondly, in explaining the favoured position of the UK for locations of Japanese manufacturing investment in relation to other EU countries, it has been argued that the UK has overwhelming and unique advantages over all other countries. Several reasons have been advanced. The first and most frequently cited factor is the UK government's long-standing, consistent encouragement and positive response toward FDI in general and that of Japanese FDI in particular (Hood et al 1993) which have been supported by various financial incentives. Within the UK, for example, the Invest in Britain Bureau was set up in 1977 to promote inward investment. Under this Bureau there are a number of regional agencies, namely Scottish Enterprise, the Welsh Development Agency and the Industrial Development Board for Northern Ireland (Mangan 1997).

Second is the UK's market size and its membership of the EU. The initial reason for Japanese firms to invest in Europe is to secure a foothold for supplying the whole EU market, and the UK is one of the biggest markets within the EU (Dunning 1986). Being a member of the EU, the UK is often a favoured location because it provides access to the entire EU market. Morris

(1988) states that the UK and Germany, the two largest markets, are often cited in site selection of Japanese investors. Dunning (1986) in a survey conducted on 24 Japanese affiliates in the UK confirmed this.

Other factors in favour of the UK as a location for Japanese FDI are the English language, a pro-business environment, a skilled pool of labour, a favourable infrastructure, a world-famous financial, legal and accountancy centre (IBB 1994), Japanese success stories, good component supply and land availability (Mangan 1997). Table 3.2 below offers various factors that foreign investors consider as keys in choosing the UK.

Table 3.2 Key factors influencing investment in the UK, by country

Investment in the UK by:		
US firms	Japanese firms	German firms
Language	Language	UK market size
Skilled and available labour	Skilled and available labour	Skilled and available labour
UK market size	Welcome	Stable business environment
Welcome	Japanese success story	Lower labour cost
EU access	Good component supply	
US success story	EU access	
Available land		

Source: Department of Trade and Industry, 1991. Adapted from Mangan 1997.

3.2 Compositions and geographical distribution of Japanese manufacturing investment in the UK

According to data made available by the Invest in Britain Bureau (IBB), Japanese manufacturing investment in the UK began in 1972 with the first arrival of YYK in the North West which employed 340 workers in 1996 and produces zip fasteners. By 1996, Japanese investment projects in the UK had increased to 272 (IBB 1996). During the 1970s, Japanese manufacturing investment in the UK was very small. The total number of Japanese companies in the UK was only 18 establishments in this period. The situation, however, changed dramatically in the 1980s with a sharp increase in Japanese FDI after 1984. Figure 3.1 plots the total cumulative number of establishments for each year during the whole period 1972-96, which shows a marked upward trend. However, it should be noted that this might not reflect the true picture of Japanese manufacturing investment in the UK due to the fact that IBB's database does not include joint-ventures in which Japanese venture capital is under 50% (IBB 1996) and records only projects known to the Bureau. This problem has been noted elsewhere by Hill et al (1992). But they also acknowledges that this database has the merit of being up-

to-date and consistent. According to this source, Japanese companies employed an estimated 81,410 workers in 1996.

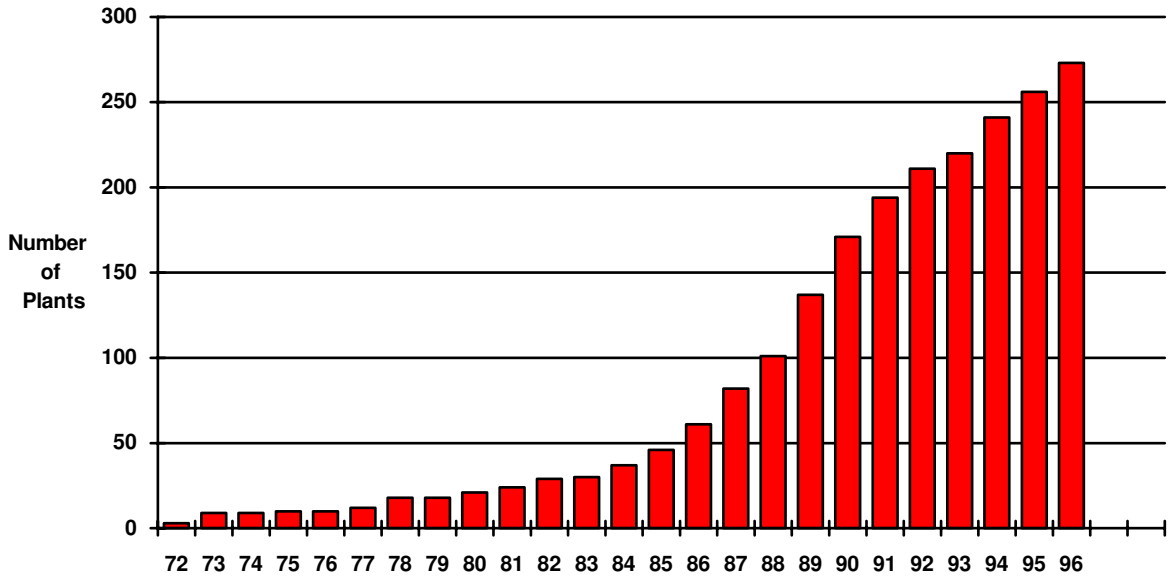

Figure 3.1: Number of Japanese manufacturing establishments in the UK, 1972-1996.

Table 3.3 Geographical distribution of Japanese manufacturing plants in the UK by region, 1996

Region	Number of establishments	% of total establishments (%)	Estimated employment	% of total employment
South East	45	16.5	6,184	
East Anglia	6	2.2	1,308	
London	12	4.4	1,420	
South West	13	4.8	4,116	
West Midland	32	11.7	13,278	
East Midland	22	8.0	5,883	
Yorkshire & Humberside	13	4.8	4,546	
North West	19	7.0	2,839	
Northern	29	10.6	11,715	
Wales	41	15.1	15,863	
Scotland	34	12.5	10,779	
Northern Ireland	6	2.2	3,479	
Total	272	100	81,410	

Source: Invest in Britain Bureau, 1996.

Table 3.3 shows that the geographical distribution of Japanese establishments and associated employment varies markedly across UK regions. The biggest share goes to the South East, which received 16.5% of the total number of projects. Other major receiving regions are Wales, Scotland, the North, and the West Midlands. However, in terms of the number of persons employed in Japanese manufacturing establishments, Wales is the most beneficial region, with the number employed totalling 15,863 out of 81,410 persons, nearly 20 %.

Table 3.4: The concentration of Japanese firms in particular districts

Local authority district	Region	No. of establishments	% of total projects	Employment	% of total employment
The Wrekin	West Midlands	17	6.3	5,839	7
Milton Keynes	South East	11	4.0	1,579	2
Sunderland	North	10	3.7	6,653	8
Wrexham Maelor	Wales	7	2.6	2,088	3
Sedgefield	North	6	2.2	2,208	3
Ogwr	Wales	5	1.85	3,875	5
Cardiff	Wales	5	1.85	2,165	3
Cumbernauld and Kilsyth	Scotland	5	1.85	877	1
Plymouth	South West	4	1.5	1,691	2
Redditch	West Midlands	4	1.5	573	1
Birmingham	West Midlands	4	1.5	4,533	6
Nottingham	East Midlands	4	1.5	434	1
Stockton-on-Tees	North	4	1.5	802	1
West Lothian	Scotland	4	1.5	1,379	2
Total		90	33.2	34,696	43

Source: Invest in Britain Bureau, 1996.

The geographical concentration of Japanese manufacturing firms is even more evident at the district level. Table 3.4 presents the most densely concentrated districts of Japanese firms. These 16 districts account for 32.2% of the total number establishments and 43% of the

employment. Each contains at least four establishments. The Wrekin , Milton Keynes and Sunderland are the three outstanding examples, with more than ten Japanese establishments in each, and containing nearly 20% of total employment. With two exceptions (milton Keynes and Nottingham), the interesting and common feature of these districts is their assisted areas status, which it is argued 'improves their attractiveness for multinational companies looking for a suitable UK location' (Taylor 1993: 1211). Investing in these assisted areas, foreign firms can obtain grants from the UK government. Grants made by the UK government are significant, ranging from 5% to 15% of the total investment project fixed costs (DTI 1995).

The IBB's database has classified Japanese investment in 8 broad categories, ranging from electrical and electronic products and automobiles to food and drinks. This reflects the wide and diverse spectrum of Japanese investment in the UK. Table 3.5 provides brief information on Japanese manufacturing investment by industry. Although, this table shows a wide range of industries, we can identify a heavy concentration of Japanese investment in three groups, namely electrical, automobiles and machinery. The most concentrated industry group is electrical and related. The number of Japanese manufacturing investment in this group accounts for 40%, which is followed by 12.8% and 10.6% in automobile and machinery groups respectively. All of these reflect the comparative advantage of Japan in these industries, particularly in the electrical and automobile groups. In addition, there is evidence of concentration of two industry groups, electrical and automobile, in certain regions (see Table 3.6). The electrical group is highly concentrated in two regions, South East and Wales while the automobile group is concentrated in three regions, West Midland, Northern and Wales. The obvious groupism of Japanese manufacturing investment in certain regions reveals some possibility of agglomeration economies and follow-the-leader effects and reflects Japanese production practices and linkages.

Table 3.5: Japanese manufacturing investment establishment by main industry group

Industry group (Product category)	Number of establishment	% of total establishment
Electrical & precision machinery, OA equipment, Information & communication industry and components	109	40
Semiconductors related industry	4	1.5
Automobile and Automobile parts	46	17
Machinery and Engineering	35	12.8
Chemical, Plastics, Pharmaceutical & Health Care	29	10.6
Textiles & Apparel	21	7.7
Food & Drink	9	3.4
Others	19	6.9
Total	272	100*

Source: Invest in Britain Bureau, 1996.

Note: * Subject to some rounding error.

Table 3.6: Concentration of industry groups by region

Region	No. of plants in electrical group	No. of plants in auto group
South East	19	
West Midland	12	10
East Midland	8	
Northern	10	12
Wales	25	7
Scotland	14	
Total all regions	109	46

Source: Invest in Britain Bureau - 1996

3.3 Conclusion

Three specific questions of why, where and what concerning Japanese manufacturing investment in the UK during the last 25 years have been very briefly discussed in the present chapter. Several explanations have been advanced to account for why Japanese companies have selected the UK as a suitable country in which to locate their investment. Among other factors, government policy, labour availability, UK market size and access to the EU market are identified as the most important ones. Others are language, infrastructure and the role of the UK as a major financial centre. Section 3.2 has dealt with the questions of where Japanese firms have tended to locate within the EU. A strong tendency towards geographical and industrial concentration was found. This has been explained partly by Japanese production practices.

CHAPTER IV: ECONOMETRIC ANALYSIS OF GEOGRAPHICAL DISTRIBUTION OF JAPANESE MANUFACTURING INVESTMENT IN THE UK, 1984-1996.

The objective of this chapter is to examine the determinants of the geographical distribution Japanese manufacturing establishments in the UK. More specifically, this chapter will analyse factors that affect the location choice of Japanese manufacturing investors when they are seeking a production site in the UK. Previous studies of this issue are very limited, particularly in the UK context (see Chapter 2 for a review.). One of the first econometric studies of the location decision of Japanese affiliates in the UK was by Taylor (1993). This chapter extends the model and approach developed by Taylor (1993) both in time space and at a finer level of disaggregation. In this chapter various factors have been identified and their influences on the location of Japanese investors have been tested. They include cost factors, agglomeration economies, locational factors and the influence of government policy. In so doing, a multivariate statistical analysis has been undertaken at a disaggregated level (i.e. the local authority district) to study the inter-district variations in the number of Japanese plants during 1984-96. For that purpose, this chapter is divided into three sections. The first section will be devoted to the construction of the statistical model and database. Section two specifies the hypotheses to be tested. The final section presents the empirical results and the main conclusions.

1 Data and Statistical Modelling

1.1 Statistical modelling

This section develops a model to analyse the relationship between location choices of Japanese manufacturing investors and several factors that have been identified as potential determinants of these location decisions. Following Taylor (1993), the Poisson model has been adopted for the following reasons. First, the dependent variable in this study is the frequency of Japanese manufacturing plants selecting a particular location during the period 1984-96. Since the dependent variable is not normally distributed, the ordinary least-squares method is not appropriate. The Poisson model is the standard model for count data for its merit is that it fits only non-negative values. Secondly, the Poisson model takes into account the special characteristics of the dependent variable, namely the preponderance of zeros and small positive values (Greene 1997, Maddala 1984).

The Poisson regression model specifies that each y_i is drawn from a Poisson distribution with parameter λ_i. The Poisson regression model for Japanese manufacturing investment location taken the following form:

$$\text{Prob}(Y_i = y_i|\lambda_i) = e^{-\lambda_i} \lambda_i^{y_i} / y_i!$$

with $\lambda>0$ and $y_i = 0,1,2 \ldots$

where Y_i is the number of Japanese firms selecting a particular location (district), i; λ_i is the mean number of firms making location decision y_i, and also its variance. The parameter λ_i is assumed to be log-linearly dependent on the explanatory variables X_i, through the link function. This assumption is made to guarantee positive values. So the equation for λ_i is the log-linear link function as follows:

$$\ln \lambda_i = \beta' X_i$$

The explanatory variables, X_i , are those identified as determinants in location decisions of Japanese manufacturing investors seeking for particular site. Because the Poisson model is a nonlinear regression model, the maximum likelihood estimation method is used to estimate the coefficients β. The log-likelihood function for the Poisson model is:

$$\ln L = \sum_{i=1}^{n} (-\lambda_i + y_i \beta' X_i - \ln y_i!)$$

Differentiating this log-likelihood function with respect to β, we will get the likelihood equation which, by further differentiation, will give us the negative definite Hessian matrix for all X and β. The likelihood equations are

$$\frac{\partial \ln L}{\partial \beta} = \sum (y_i - \lambda_i) X_i = \mathbf{0}$$

From this we can obtain λ_i, which can be used to obtain coefficients β from the link function above.

The Newton-Rapson method of algorithm is used to estimate this model and will usually converge quickly. At convergence we will get the asymptotic covariance matrix for the parameter estimates (Greene 1997; Maddala 1983). In this study the coefficients β are estimated by using the LIMDEP statistical software package Version 7 (Greene 1995).

Taylor (1993) has pointed out a potential problem in using the Poisson model for modelling the number of Japanese manufacturing investors choosing specific geographical locations. Under the Poisson distribution, the independence of events is assumed. However, the Japanese industrial production practices and the resultant agglomeration economies might undermine this assumption. It has been reported elsewhere (Dicken 1988,1990; Peck 1990; Morris 1989) that Japanese firms adopt such production practices as 'total quality control' and 'just-in-time' delivery which encourage Japanese firms to locate close to each other and create agglomeration economies. In this connection, Taylor states that 'if these *Japanese* firms (italics added) are moving into a particular county *or location* (italics added) because other firms are doing so, then one of the assumptions of the Poisson model is being contravened' (1993: 1219). He also singles out the sources of this possibility, which are the production linkages and the follow-the-leader effects. However, there are reasons to believe that this is not a serious problem in adopting the Poisson model. First, these practices do not require a location in the immediate vicinity but within a reachable distance; and second, the agglomeration forces, the production linkages and the follow-the-leader effects are argued to operate at a broad level rather than at a small spatial scale (Peck 1990). Therefore, when an appropriate spatial unit of analysis is adopted, the Poisson model is more appropriate. Taylor (1993) shows that the Poisson model is robust statistically when the county level is adopted as the spatial unit of analysis. Still he suggests the local authority district as a 'more appropriate geographical unit' to analyse (1993: 1220).

In this study, local authority districts in the UK are used as the spatial unit of analysis. Thus it is believed that the assumption of independence of occurrences underlying the Poisson will hold. This is based on the grounds that although the follow-the-leader effects might be present, it does not necessitate the location in the same district, and that although the production linkages between Japanese firms might be strong, it just means firms will locate in reachable proximity but not necessarily in the same district. In addition, the selection of local authority districts results in several merits. First, data for a number of the explanatory variables are available at this level. Secondly, this increases the number of observations to a great extent. At present, there are 485 local authority districts in the UK. Thirdly, at the district level the variation in the independent variables is also increased.

1.2. Data

A separate database has been constructed from various sources for this analysis, therefore it deserves some elaboration. The source of information on the dependent variable is taken from the list of Japanese manufacturing companies in the UK which has been compiled by the Invest in Britain Bureau. This list does not only categorise Japanese investment by years, UK

standard regions, Japanese original location and industry but also provides post codes for almost every Japanese manufacturing firm in the UK. This allows us to locate the district of every Japanese firm. The number of Japanese establishments during 1984-96 in each district constitutes the dependent variable. However, there are two cases that the post codes are not provided, consequently, they are omitted from the database. The first Japanese investment was recorded in 1972, but 1984-96 is chosen for this analysis because the magnitude was very small during 1972-83.

Data on independent variables are obtained from various sources. The main source of data is the NOMIS database (The National Online Manpower Information System). This source is capable of providing a comprehensive range of official statistics relating to demography, employment, unemployment and vacancies. However, the NOMIS dataset can only provide relevant data for 459 districts covering England, Wales and Scotland out of 485 local authority districts of the whole UK, forcing the author to drop Northern Ireland. This reduces the number of observations somewhat but it will not affect the analysis for two reasons. First, the number of districts in Northern Ireland is relatively small as compared with the rest of UK, and second, the total number of Japanese plants in Northern Ireland is very small, only 6 establishments out of 273 establishments in the UK. Therefore, it is arguable that this will not create any bias in the statistical analysis.

The New Earning Survey and the Halifax Plc's quarterly publications are two other sources of information on costs, namely wages and house prices. However, there are potential problems with these data because they can only provide data at county level. This forces the author to use these as the average for all districts within the county on the assumption that these figures are less likely to vary between districts than between counties. In addition to these above official sources, information on which areas were assisted areas (Development Areas and Intermediate Areas) was obtained directly from the regional offices of the Department of Industry.

2. Definition of Variables and Hypotheses

This section has two purposes: firstly, to identify variables representing factors that affect the locational choice of Japanese inward investors; and secondly, to explain the hypotheses behind each of the independent variables tested in the regression. The focus of the statistical analysis is to find out significant factors in determining the Japanese manufacturing investment pattern in the UK. Therefore we shall assume that Japanese firms have decided to invest abroad and chosen UK as a host country. Having chosen a location within the UK, what are the factors that they will take into account? The summary Table 2.1 in Chapter 2

provides a list of variables which are often included in empirical studies. However, due to the availability of data and the special characteristics of Japanese manufacturing investment in the UK the following readily identified variables are included in the regression analysis of this study:

- Labour cost: According to location theory, labour cost plays a very important role in locational choice. Labour cost is part of total production costs, therefore firms are likely to be influenced by differences in labour cost in competing locations. Labour cost is proxied by average male earnings. The most appropriate proxy for labour costs, the efficiency wage, is unavailable because it requires labour productivity data which is not available. High labour costs are expected to deter Japanese FDI into an area.

- Labour availability: In addition to labour costs, labour availability is also potentially important. Labour availability is reflected by the number of unemployed persons in each district. This is expected to have a positive effect on foreign investors. Labour availability may also be indicated by the female/male ratio, which is believed to represent the female participation rate. Another indicator of labour availability and labour market conditions is the percentage of part-time female employment. A high percentage of part-time female employment is expected to have a negative effect on FDI.

  Another aspect of labour availability specific to Japanese manufacturing investors is the racial composition of workforce. There is evidence that Japanese manufacturing investors have some racial bias against black employees (Woodward 1992). A high percentage black population is expected to be associated with a low level of Japanese FDI. Thus, the percentage of black population in each district is included in the analysis to test this hypothesis.

- Property cost: Property costs also come into consideration in choosing a greenfield production location. High property costs are expected to deter Japanese FDI. In this study, prices of semi-detached houses are used as a proxy for property costs.

- Industry mix variables: Supplier reliability is revealed as a major consideration for Japanese investors in their locational choice, perhaps due to their industrial production practices. In addition, manufacturing activity is an important determinant of location selection for every manufacturer. Locating in areas of good manufacturing environment will not only secure supplier reliability for Japanese investors but also allow them to enjoy some agglomeration economies. Manufacturing activity is proxied by the percentage of manufacturing employment, on the expectation that districts with a higher

percentage of manufacturing employment will be more attractive to Japanese investors. Manufacturing activity can also be argued to be associated with agglomeration economies, which will exert its pull on Japanese investors.

Similarly, the same argument can be applied to the service sector. Areas with good service systems will be more likely to ensure supplier reliability. The percentage of employees in these sectors is used as an explanatory variable. In addition, the service sectors may also reflect the quality of life index, with the argument that areas having better services will have a higher quality of life. Therefore, districts with a large service sector (relative to other sectors) can be expected to attract more FDI.

A similar hypothesis is that Japanese investors seeking a location will not only take into account industry mix at district level, but also at wider level, for example at county level. In principle, arguments for industry mix at district level are equally applicable at county level.

- Financial assistance: Financial assistance from government has been ignored in the variable-cost model reviewed in Chapter 1. Relaxing this assumption, subsidized firms can operate in high-cost locations, because subsidy reduces cost and thus increases the profit accruing to firms (Smith 1981). In the UK context, financial assistance granted to foreign investors is part of government economic development policy aiming to induce FDI into assisted areas. There is evidence from both surveys and empirical studies (Hill et al 1992; Taylor 1993) that Japanese investors are attracted towards assisted areas thanks to government financial assistance. In this study, the availability of financial assistance is measured by the assisted status of each district. The assisted districts are expected to attract more Japanese inward investors than non-assisted districts. During the period under investigation, assisted districts were classified as either a Development Area or an Intermediate Area. These differ mainly because the automatic Regional Development Grant was available to inward investors in Development Areas up to 1988. Regional Selective Assistance has been available in both types of area throughout the period. Therefore two dummies are created to capture the assisted status effects of each district. The dummy variable approach is preferred over using the amount of financial assistance granted because the latter might suffer the endogeneity problem (Taylor 1993). In any case, the levels of financial assistance are not known.

- Transportation infrastructure: Measures of transportation infrastructure have been included in many empirical studies (See chapter 2.). Locations with good transportation networks and facilities are of course more attractive for foreign investors than locations

with poor ones. A lot of measures have been used to proxy this variable, such as government spending on infrastructure. But in the specific context of this study, data on spending on infrastructure at district levels is unavailable. Another alternative is the length of motor-highways, but this is inappropriate in the UK context, since in the UK, the mortorway networks are well developed and cover almost the whole country, save the peripheral areas. This has led the author to use a dummy variable to identify districts which are not well-served by the national road network. These are referred to as peripherial areas below.

- Regional characteristics: Various surveys of Japanese investment have revealed that areas with active local or regional development agencies are able to attract more investment than other areas. Two UK standard regions identified to have active development agencies are Scotland, which has Scottish Enterprise, and Wales, which has the Welsh Development Agency. These two agencies are empowered to give grants to inward investors (Mangan 1997). In addition, the North is also known to have a very active development agency, the Northern Development Company, which is successful in attracting a large number of foreign investors in the Northern Region despite not having the power to award government grants. Three dummy variables are created to capture the influence of these regional characteristics. They are expected to have a positive influence on Japanese investors. The inclusion of these dummies in the analysis is intended to gauge the effectiveness of regional development agencies in attracting Japanese plants.

However, it should be noted that districts with assisted status are likely to fall within areas having active regional development agencies. This causes some problems in using the regional dummies since they may capture not only the effects of regional characteristics but also the effect of having large number of assisted areas. Therefore caution must be used when interpreting the results.

- Political factors: It is believed that different political parties might have different goals, policies and attitudes towards FDI. Although the Conservative Party was in power at the central government level throughout the period under investigation, different parties, particularly the Labour Party, still can pursuit different policies and can exert an influence at local government level. Therefore political factors might be important in the locational choice of Japanese investors. In the UK context, It is hypothesised that Japanese investors would be attracted to districts that are controlled by the Labour Party at district level. It may be the case, for example, that local authorities controlled by the Labour Party may be more active in encouraging inward investment than districts controlled by the

Conservative Party since that latter is generally believed less interventionist. Although this hypothesis is controversial, it is worthwhile to subject it to empirical testing.

3 Empirical results

The statistical analysis is conducted for 1984-96 period, with the frequency or number of Japanese manufacturing firms selecting a particular district. Various variables have been identified in the preceding section. The following is a list of variables included:

HOUSE88 = semi-detached house prices in 1988 (county level data only).
MANWAG91 = average male earnings in districts.
UNEM84 = total number unemployed in 1984.
PTFEMALE = percentage of part-time female employment in 1991.
DA = Development Area status (districts having this status take a value of 1, and zero otherwise).
IA = Intermediate Area status (districts having this status take a value of 1, and zero otherwise).
PERIPH = dummy variable for transportation infrastructure (districts in peripheral areas take value of 1 and 0 otherwise).
MANUF = percentage of manufacturing employment in 1991.
TRANSFIN = percentage of employment in transport, communications, banking and finance in 1991.
OTHER = percentage of employment in other services in 1991.
WA = dummy variable for districts located in Wales.
SC = dummy variable for districts located in Scotland.
NO = dummy variable for districts located inthe North.
PBLACK = percentage black population in districts in 1991.
CONSERV = percentage of Conservative Party in local district council in 1990/1
LABOUR = percentage of Labour Party in local district council in 1990/1

The results of the Poisson model estimations are presented in Table 4.1 through 4.6. In all cases, the regressions are significant according to the Chi-square test of the log-likelihood and restricted log-likelihood ratios. Under each table, values of the log-likelihood and restricted log-likelihood are presented together with the Chi-square values.

Table 4.1 presents the regression results of the basic model. The unemployment, part-time female employment, DA, IA, PERIPH and manufacturing employment all have the expected

signs and are significant at the 1 percent level. Employment in other services has the correct sign and is significant at the 10 percent level.

Table 4.1 Regression results of the initial model

VARIABLE	COEFFICIENT	STANDARD ERROR
CONSTANT	0.67169	1.3362
HOUSE88	-0.19101E-6	0.72804E-5
MANWAG91	-0.14758E-2	0.42627E-2
UNEM84	0.15261E-4	0.46284E-5*
PTFEMALE	-0.58894E-1	0.12146E-1*
DA	0.70836	0.18873*
IA	0.82492	0.18648*
PERIPH	-0.89720	0.34642*
MANUF	0.27267E-1	0.88825E-2*
TRANSFIN	0.35824E-2	0.15773E-1
OTHER	0.26525E-1	0.14162***

Log-likelihood function	-487
Restricted log-likelihood	-566
Chi-Squared	158
Degree of freedom:	10

Note: * = significant at 1% ** = significant at 5% *** = significant at 10%

Although, HOUSE 88 and MANWAG91 are not significant, they have the expected negative sign. Two possibilities can be advanced to account for the insignificance of the parameters. First they might be poor proxies for the real variables. House prices might be a poor proxy for manufacturing property cost, for example. Secondly, at the district level these two cost-related variables might be no longer important in location considerations of Japanese investors.

Among significant variables, the two policy variables (DA and IA) are the two that play dominant roles in attracting FDI. This indicates that Development Areas and Intermediate Areas have succeeded in attracting Japanese investment, which implies that the development policies conducted are effective. In addition, transportation infrastructure (PERIPH) is very important for Japanese investors in their location decision. Japanese manufacturing investment also appears to be influenced by labour availability, which is proxied by the numbers unemployed and female participation rate.Closer examination, however, reveals that Japanese investors are more responsive to female participation than to unemployment. The

results also lend support to the hypothesis that the industry mix of an area has influenced the location choice of Japanese investors. Finally, there is a tendency, though not very strong, for Japanese investors to locate in areas with a higher percentage of employment in services.

Although I have argued above that the potential problem associated with using the Poisson model for modelling the number of Japanese manufacturing firms choosing a particular location can be eliminated by adopting a more disaggregated unit of analysis, at the district level rather than at county level, tests for this have been made by either truncating or censoring the dependent variable at various levels. Censoring a variable at a certain upper/lower limit means values taken by the variable above/below that limit will assume that limiting value. Truncating a variable at a certain upper/lower limit means that observations with values above/below that limit will be ignored. Although results from these tests are almost the same, the author prefers truncation over censoring for it helps to element the problem, rather than allowing the observations to take an arbitrary value. Table 4.2 reports results from one truncated regression. This regression was conducted to see if there are significant changes in the results when removing some large value observations. In general, the results show no significant change statistically or very little change in the estimated coefficients as well as in the levels of significance. These results suggest that the assumption of the Poisson model hold at the district level. However, this does not means that follow-the-leader effects and the production linkages between Japanese firms were not present or not important, but it means that the estimated coefficients are unaffected by removing some districts where this effect might be strong and that the estimated coefficients are reliable.

Table 4.2: Results from truncated regression

VARIABLE	COEFFICIENT	STANDARD ERROR
CONSTANT	0.52111	1.4218
HOUSE88	-0.40351E-5	0.7717E-5
MANWAG91	0.11182E-3	0.45417E-2
UNEM84	0.14219E-4	0.52476E-5*
PTFEMALE	-0.55436E-1	0.13011E-1*
DA	0.68347	0.19866*
IA	0.67179	0.20112*
PERIPH	-0.81984	0.35024**
MANUF	0.22289E-1	0.93848E-2**
TRANSFIN	0.70065E-2	0.15766E-1
OTHER	0.13168E-1	0.15215E-1

Log-likelihood function -416

Restricted log-likelihood	-475
Chi-Squared	117
Degree of freedom	10

Note: * = significant at 1% ** = significant at 2%

The basic model has been extended to include regional dummy variables with the results shown in Table 4.3. Two regional dummies, WA and NO, are significant at the 1 percent level. As expected, one policy variable, DA, has lost its significance and its coefficient magnitude as well. This lends support to the hypothesis that regional development agencies do have effective roles in attracting Japanese FDI. However, the inclusion of those regional dummies might lead to mispecification. This might be evidenced through the positive sign of the HOUSE88 variable. Although house price may be a poor proxy for land costs, it is very difficult to explain the result that increases in land costs can increase the chance of attracting Japanese FDI.

Table 4.3 : Regression results with regional dummies

VARIABLE	**COEFFICIENT**	**STANDARD ERROR**
CONSTANT	0.50493E-1	1.4204
HOUSE88	0.17184E-5	0.75368E-5
MANWAG91	-0.89475E-3	0.44334E-2
UNEM84	0.19631E-4	0.46978E-5*
PTFEMALE	-0.54947E-1	0.1306E-1*
DA	0.30991	0.23267
IA	0.67971	0.19632*
PERIPH	-1.1026	0.35177*
MANUF	0.31452E-1	0.94096E-2*
TRANSFIN	0.43753E-2	0.16210E-1
OTHER	0.24982E-1	0.14422E-1***
WA	0.83608	0.23449*
SC	0.18692	0.24397
NO	0.80157	0.25561*

Log-likelihood function	-478
Restricted log-likelihood	-566
Chi-Squared	175
Degree of freedom	13

Note: * = significant at 1% *** = significant at 10%

It was also hypothesised that Japanese investors are seeking a location not only influenced by industry mix at district level but also at county level. A regression was conducted with the inclusion of the county-level industry mix variables. But the results obtained do not support this hypothesis. However, this does not mean that the hypothesis is invalid, but there might be some problems in aggregating the data from district level to county level. Due to the limited space, the results are not reported here.

Results from previous regressions have shown that some variables included are not significant, namely the HOUSE88, MANWAG91 and TRANSFIN. Having argued that at district level, the two cost-related variables might not be important, I have decided to remove the two variables together with the TRANSFIN from the basic model and re-estimated the model without these variables. Table 4.4 presents the results of this re-estimation. All the estimated coefficients are now significant. In addition, there is little change in the magnitude and significance level of the estimated coefficients. Furthermore, I have also conducted the same re-estimation with the presence of regional dummies. The results of this regression are presented in Table 4.5. Once again, there is little change in this as compared with that presented in Table 4.3. All of this has led me to adopt this reduced model for further analysis.

Table 4.4: Regression results from the reduced model

VARIABLE	COEFFICIENT	STANDARD ERROR
CONSTANT	0.21531	0.57754
UNEM84	0.15342E-4	0.4267E-5*
PTFEMALE	-0.57537E-1	0.10726E-1*
DA	0.75438	0.15548*
IA	0.86898	0.16107*
PERIPH	-0.88116	0.33917*
MANUF	0.26867E-1	0.71547E-2*
OTHER	0.2522E-1	0.13238E-1***

Log-likelihood function	-487	Restricted log-likelihood	-566
Chi-Squared	157	Degree of Freedom	7

Note: * = significant at 1% ** = significant at 5%
*** = significant at 10%

Table 4.5: Regression results from reduced model with regional dummies

VARIABLE	COEFFICIENT	STANDARD ERROR
CONSTANT	0.88369E-1	0.60625
UNEM84	0.19743E-4	0.4388E-5*
PTFEMALE	-0.57051E-1	0.11303E-1*
DA	0.29274	0.22151
IA	0.66031	0.18743*
PERIPH	-1.1194	0.3649*
MANUF	0.29573E-1	0.73896E-2*
OTHER	0.24282E-1	0.13553E-1***
WA	0.82223	0.22706*
NO	0.78829	0.24986*
SC	0.16552	0.23457

Log-likelihood function -478
Restricted log-likelihood -566
Chi-Squared 175
Degree of freedom 10
Note: * = significant at 1%
** = significant at 5%
*** = significant at 10%

The hypothesis that Japanese investors are influenced by political make-up of a district is tested by introducing two political variables, CONSERV and LABOUR, into the model. The results obtained are reported in Table 4.6, showing that the LABOUR variable is significant at the 1 per cent level. The insignificance of the CONSERV variable is not unexpected, since Labour-controlled districts are expected to be more interventionist than Conservative-controlled areas in their attempt to attract FDI. These results lend support to the hypothesis that political factors at local government level do have an influence on Japanese investors in their location decision.

Table 4.6 Regression results for political factors

VARIABLE	COEFFICIENT	STANDARD ERROR
CONSTANT	-0.42555	0.6914
UNEM84	0.1013E-4	0.48931E-5**
PTFEMALE	-0.48168E-1	0.11227E-1*
DA	0.48712	0.17747*
IA	0.71239	0.16643*

PERIPH	-0.65287	0.357***
MANUF	0.207E-1	0.768E-2*
OTHER	0.2396E-1	0.13461***
CONSERV	0.4322E-3	0.4501E-2
LABOUR	0.11927E-1	0.32555E-2*

Log-likelihood function -476
Restricted log-likelihood -564
Chi-Squared 175
Degree of freedom 9
Note: * = significant at 1%
** = significant at 5%
*** = significant at 10%

There is a hypothesis that Japanese investors are biased against black workers. To test this hypothesis I have included the PBLACK as an explanatory variable in the reduced model. The estimated coefficient of the PBLACK variable is not significant, thus rejecting the hypothesis.

Table 4.7 Regression results with the inclusion of PBLACK.

VARIABLE	**COEFFICIENT**	**STANDARD ERROR**
CONSTANT	0.33922	0.60039
UNEM84	0.16533E-4	0.45176E-5*
PTFEMALE	-0.60179E-1	0.11343E-1*
DA	0.71217	0.16532*
IA	0.84666	0.16322*
PERIPH	-0.88747	0.33896*
MANUF	0.26469E-1	0.71504E-2*
OTHER	0.26502E-1	0.13357E-1**
PBLACK	-0.25144E-1	0.34734E-1

Log-likelihood function -487
Restricted log-likelihood -566
Chi-Squared 158
Degree of freedom 8
Note: * = significant at 1%
** = significant at 5%

Since the Poisson regression model is nonlinear, the reported coefficients in previous regressions are not equal to the marginal effects (i.e. the derivatives of an expected value with respect to each explanatory variable). As a result, the reported coefficients are not the marginal effects of regressors on the expected frequency of Japanese manufacturing firms selecting a certain district .However, under the Poisson model the expected value is

$$E[y_i|x_i]=\lambda_i =\exp(\boldsymbol{\beta}'X_i)$$

From this we can obtain the estimated marginal effects of each regressor by differentiating with respect to X_i the expectation of y_i conditional on X_i. The marginal effects of regressors on the expected number of Japanese in every district can be calculated by applying the following formula

$$\frac{\partial E[y_i|X_i]}{\partial X_i} = \lambda_i \beta .$$

Tables 4.8 produces the marginal effects of the two reduced Poisson model regressions. In the model without regional dummies, the marginal effects of DA and IA are 0.436 and 0.5 respectively. They reflect the effects of regional development policy in attracting Japanese FDI in assisted areas. In the model with regional dummies, the marginal effects of development policy reduce to 0.17 and 0.38 for DA and IA respectively. But the marginal effects of regional dummies are more than the reduction of the DA and IA. This suggests that regional development agencies do have effective and contributing roles in attracting Japanese FDI.

Table 4.8: Estimated marginal effects

Variable	Marginal effect without regional dummies	Marginal effect with regional dummies
UNEM84	0.888E-5	0.114E-4
PTFEMALE	-0.333E-1	-0.330E-1
DA	0.4367	0.169
IA	0.50	0.38
PERIPH	-0.51	-0.64

MANUF	0.155E-1	0.171E-1
OTHER	0.147E-1	0.140E-1
WA		0.476
SC		0.958E-1
NO		0.456

4.4 Conclusion

The objective of this chapter was to identify the determinants of the spatial distribution of Japanese manufacturing establishments in the UK. In order to achieve this objective, the Poisson model was employed, a separate database was constructed and a multivariate regression analysis was carried out. The study has found several important determinants in attracting Japanese investment. They are the government regional development policies through financial assistance, the active roles of regional development agencies, the peripherality of districts, labour availability, political factors and the industry mix. Among important variables, the two policy variables (DA and IA) suggest that financial incentives have had the effect of pulling Japanese FDI into specific locations. The results of this study lend support to results obtained by Taylor (1993), which also found that Japanese inward investors are influenced by regional development policy and industry mix rather than regional disparities in labour costs. However, this study is wider than that of Taylor in two respects. First it is based on a finer disaggregate unit of analysis, and second it examines some other variables which were omitted in Taylor's previous study.

CONCLUSION AND POLICY IMPLICATION

The purpose of this dissertation was to examine the determinants of the geographical distribution of Japanese manufacturing investment in the UK during 1972-1996. In so doing, this dissertation has reviewed theories of foreign direct investment and the production location decision. Chapter I explained the existence of FDI by pointing to the advantages, such as ownership advantages, location-specific advantages and internalization advantages that investing firms might enjoyed as a result of market imperfections. Chapter I also explained the locational choice made by firms by reviewing location theories, from neo-classical to behavioural and structural theories. Pointing to the shortcomings of these theories, the chapter concluded by stating that these different theories on production location are complementary to each other in providing a greater understanding of the location of economic activities.

Chapter II reviewed various empirical studies of industrial location and revealed the use of different methods of approach This chapter also pointed to the appropriateness of the Poisson model in econometric analysis of the geographical distribution of Japanese manufacturing plants in the UK.

Chapter III described the Japanese manufacturing investment in the UK during 1972-1996. Specifically, this chapter explained why the UK has been the most favoured location of Japanese investors in the EU. It went on to explore the composition and geographical distribution of Japanese manufacturing investment in the UK. The descriptive analysis in the chapter also revealed some concentration of Japanese manufacturing investment, not only by regions but also a high concentration of plants in specific locations.

Chapter IV employed multivariate regression analysis to examine the factors associated with the location of Japanese manufacturing investment in the UK. The number of Japanese manufacturing investment establishments in each district during 1984-96 was used as the dependent variable and the location of each establishment was treated as independent from each other at the local authority district level. The Poisson probability distribution model was used to model the geographical distribution of plants and the maximum likelihood estimation method was used to estimate the statistical significance of various explanatory variables. Among significant variables, the policy variables appear to be the most important determinant of the location of Japanese investment. Other factors found to be statistically significant are labour availability, the industry mix and peripherality. The statistical study found no responsiveness of Japanese investors to differences in labour costs and property cost, which coincide with the results obtained by Taylor (1993).

The findings of this study have some implications for regional economic development policy. Since Japanese manufacturing investors are found to be responsive to government policy in their location decision, regional development agencies can be considered effective in implementing this policy. The aim of regional policy are partly fulfilled by inducing capital, in this case foreign investment, to locate in certain areas, particularly depressed ones, which in turn will help to eliminate the disparities between UK regions. This would suggest the maintenance of the policy directed toward inward investment from various sources if the same result is obtained for other countries than Japan.

With respect to further research in this location determination field, investigation can be conducted to examine the scale and effectiveness of factors and regional development policies influencing Japanese manufacturing investment in the EU as a whole. Similarly, the same investigation can also be carried out with respect to inward investment in the EU from other sources. This will require the collection and publication of appropriate data comparable to that made available for Japanese inward investment in the UK.

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