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THE REAL COST ECONOMICS
OF
RETAIL DEVELOPMENT
IN TOWN CENTRES

An exploration of shifts in real property values
following major retail development

V O L U M E 1
of three volumes

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SUMMARY

THE REAL COST ECONOMICS OF RETAIL DEVELOPMENT IN TOWN CENTRES
- an exploration of shifts in real property values following
major retail development

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This research investigates the effects that a major development of new retail facilities has on the value of other retail properties in the surrounding area of its influence and puts forward a theory of translated values. The hypothesis is that where the total demand is already satisfied and remains at a constant level, the amount of real property value available for distribution is constant in real terms and the effect of a successful major retail development in a town centre can only be to reduce the values of some existing retail properties whose catchment areas are in the surrounding area of its influence: that is to say, translated values should sum to zero.

The thesis reviews the existing body of economic theory and valuation practice and concludes that the profession's presently accepted concept of latent value cannot be relied upon as an explanation of the phenomenon which results in the realisation of 'development value' at a particular location. The derivation of retail property value from consumption expenditure is explored and a series of derivation equations constructed. Consideration is also given to the relationships which exist between value, development cost, and profit and the ways in which these may be used in a model, not only to test the viability of a proposed development but also to test for the existence of translated values and, thereby, predict the effect that a proposed scheme might have on surrounding properties or on surrounding towns.

The thesis describes the search for suitable research locations and for adequate data bases. It also describes the experimental test of the model carried out in the City of Exeter and further concludes that with improvements in data bases, it will be possible to identify shifts in the location of property value in a localised market and also to predict the size of those shifts. There are strong indications that, following development, both latent value and translated value from other locations are released at the site of the development. Therefore, with further refinement of the model and with the development of data bases giving greater data availability, translated value modelling could be a feasible development appraisal tool and is worthy of further research.

Key words: PROPERTY VALUE MODELLING, RETAIL SHIFTS

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P A R T O N E

A THEORY
OF
TRANSLATED VALUE

CHAPTER ONE

INTRODUCTION

1 The Layman's Assertions

- 1.1 Whenever a major development or redevelopment of retail facilities is proposed within a town centre there is normally a public Local Inquiry carried out with the objective of weighing the benefits to the community as a whole against the objections of, and costs imposed upon, private individuals and groups of individuals with interests in the area. This will, of course, be conducted subject to the normal rules of admissibility of evidence.
- 1.2 Within such Inquiries it is frequently found that existing retailers and property owners object to development proposals on the grounds that their businesses and the value of their properties will be adversely affected. Objectors are particularly vociferous, and the objections are usually most pertinent, in constrained town centres where new or replacement retail

development is proposed. Although there is usually superficial evidence to support the assertions of established traders that their businesses will be adversely affected by the new proposals, there is normally no substantial statistical evidence to support such statements.

- 1.3 What historical evidence there is from such town centre developments is of little assistance as evidence of the effect on retailing businesses and, as a result, substantive evidence of changes in the distribution of property values following major development is scarce. What little is available is inconsistent and, apparently, contradictory giving no clear indication of any real correlation between development and value shifts. There is, however, some substance in the assertions of the layman that a major redevelopment within an established town centre will affect the established patterns of trading. However, based on casual observation, it is very difficult to predict whether the effect on trading patterns is one which will result in an increase or in a decrease in the value of properties, generally.

- 1.4 Indeed, at this point it is pertinent to enquire

what is meant, in this context, by 'value';

Value to whom? In considering such questions it is clear that there exist, at a point in time, many 'values' appertaining to a property or set of properties. In relation to a single property within the overall retail surface there will be, among the many 'values', the following by way of example:

- i/ the value of the site to the site owner
- ii/ the value of the building (the shop) to the shop owner
- iii/ the value of the trade carried on at the shop by the shopkeeper or occupier
- iv/ the value of the shopping opportunity to the shopper
- v/ the value of the retail facility to society as a whole

It should be noted that, often, i/ and ii/ above will be combined. It should also be noted that this example list is not intended to be an exhaustive catalogue of all possible values. However, it is clear that this is a vector of perfectly legitimate values. From here onwards in this thesis, and for reasons that will be

outlined later, it must be made clear that the values to which reference is made, are values in relation to the developer-client and/or the site owner/shop owner, i.e. values to property owners. Even so, reliance solely upon a latent value hypothesis, in cases of multiple development, will bias value estimates upwards and impose costs on the community, viz. 1960's.

2 The Profession's View of Latent Value

2.1 The antithesis of the layman's assertions regarding the diminution of his business and/or property value is the professions' view of the creation, or release, of value at the location of the development. One of the more important aspects of this research is that the current vogue in the valuation and planning professions is to state that there is, within every development site, a latent value waiting to be released. In this context the term latent value is that used by the professional as implied in the quotation in paragraph 2.3 below.

2.2 The term 'development site' (or development property) is used to indicate a type of property the value of which can be increased by an application of capital, by a change in use, or by a combination of these. It is commonly applied to areas of undeveloped land close to existing development and likely to be in future demand for building purposes; to individual sites in towns at present unbuilt upon; and to other urban sites occupied by buildings which have become obsolescent or which do not utilise the site to the best advantage.

2.3 In the professional's view the value, "which in these cases is latent in the property"⁽¹⁾, can only be released by development⁺ of the nature mentioned above and in all cases is subject to the obtaining of any necessary planning and other statutory permissions.

2.4 Latent value has traditionally been stated to be

⁺ Here, the term development is used not in the economic sense but is used in a planning context, i.e. works of construction, reconstruction or material changes of use, statutory permissions.

the extra value which is released by a new development over and above the combination of site value in existing use and the cost of either a new superstructure, or a refurbishment of the existing superstructure, plus a reasonable entrepreneurial profit. The concept of the marginal efficiency of capital, when compared with this implied rate of return, would enable the identification of an upper limit to the capital injection - given current market, general economic and technological conditions.

2.5 However, whilst this description of latent value may appear to be satisfactory in relation to the property being developed, it ignores the fact that, in some instances, a development of one site releases latent value in another as well as in itself; or, conversely, that a development releasing latent value in a site adversely affects the value of surrounding sites.

2.6 It is necessary, at this stage, therefore, to clarify the professional's view of 'latent value'. There appears to be a difference in the acceptance or acknowledgment of the economist's theoretical view of value and the professional's

operation in practice. However, it is conceded that even in practice there is a strongly developed concept of latent value in the economic sense and reference will be made to this in later chapters and further discussion of the use of this term will be found in Volume 2, Appendix 1.

2.7 The profession's view can, to some extent, be justified. For example, surveyors or valuers may be employed by a developer in connection with a proposed development or by an objector to that development. In relation to the former, the professional's role would be to provide an unbiased estimate of value for the developer-client. He is, therefore, not concerned with any distinction between different types of released values. Indeed for the single development the translation effect also could be regarded by the developer or the professional adviser as latent, not in the site, but in the act of development, i.e. by the 'forced' attraction of value to the site. However, as will be seen in 2.8 and 2.9, when, in the event of multiple competing developments, all professional valuers operate simultaneously but independently, there is likely to be an upward and unrealisable shift in the

expected value surface. Alternatively, in the second of the roles described, i.e. where the professional valuer represents an objector to the proposed development at a Public Inquiry, the distinction between realisable latent values and the translational effects is vital.

Unfortunately, the argument is inadmissible.

Inevitably, therefore, the translation of existing values that might be caused by the proposed development can only be argued implicitly when professional surveyors/valuers advance admissible arguments to replace inadmissible 'affected value' arguments. For example: loss of trade, generation of traffic congestion, creation of new pedestrian routes, over provision of floorspace, and general town planning/aesthetic arguments.

- 2.8 Although it is accepted that in circumstances such as those related above, the objector's surveyor or valuer will operate in a way that implicitly acknowledges the phenomenon of shifting or translated values, this is never really made explicit. Moreover, when confronted by such arguments the professional argues that, except in very special circumstances, there is no problem - all rents apparently rise and,

therefore, no property owner loses in the long run. This is pure sophistry for two reasons: i/ a short term loss is still a loss, and ii/ of course all rents rise and will inevitably do so in an inflationary period. Such a generalised assertion that all rents rise ignores the long history of inflationary pressures in the land market. As a result, the ignoring, or assuming away, of the effects of major developments on the value of existing properties could only be justified if, following development, there was no change in the inflationary consequences. But the real argument must be that, even if inflation causes all rents to rise, any redistributive effects cause relative losses to some owners and relative gains to others. Absolute arguments are, therefore, irrelevant.

2.9 Furthermore, a concentration of effort and interest on only one side of the argument is likely to have damaging consequences. These include i/ an over estimate of the total value of the retail land surface; ii/ an ignoring of the interaction of site values as the retail surface is developed and redeveloped over time - value decisions are, therefore, ad hoc and static; and

iii/ a failure to respond to the social costs of development, these being costs to competitors in terms of loss of trade and costs to the general public in terms of the over provision of new retail facilities.

2.10 To summarise: the current practice of surveyors and other property professionals is usually concerned only with the effect on a single property - hence they view all excess value as being latent. However, the development of one property will cause value to shift, or to be translated, from existing property as well as from all other properties under development or so close to the commencement of development that sunk costs ensure that the project will not be terminated. Where value is translated from existing properties this might be considered to be the normal process of market re-adjustment resulting from an increase in the efficiency of one resource. However, where in major developments or redevelopments many properties are being developed or considered at one moment, the assumption of a latent value that ignores translated value effects will result in an over estimation of the net change in land and property

values. Even where total value rises (as it must with an injection of capital) the consumers, and society as a whole, still lose as a consequence of the over-estimation. Obviously some (if not all) developers lose but inevitably resource distribution is sub-optimal and the loss is passed on to the consumer.

2.11 It is, therefore, the contention of this thesis that the identification of value shifts must be given a much greater emphasis in studies of land use. Also, it must assume greater prominence in the actions of professional planners, surveyors and valuers and in their consequent decisions about the redevelopment of urban land. The considerations in this thesis are an attempt to clarify these several concepts of value and to clarify the terminology in common use. In particular, consideration of the derivation of latent value and of the releasing of frustrated demand leads to an explicit acknowledgment of the phenomenon of shifting values and to a concept to which, from this point on, I shall refer to as translated value.

3 The Aims and Areas of this Research Project

3.1 The earlier discourse in 2.8 onwards establishes the existence of conflicts between the economic concept of latent value and the professional's use of the same term to encompass an apparently wider spectrum. Therefore, the basic aim of this research project is to investigate the phenomenon of translated values in an attempt to focus attention on the consequences of planning and development decisions based on the professions' view of latency and to investigate the relationships that might exist between property development and the value of adjacent properties.

3.2 Historical evidence of changes in the distribution of property values following major development is very scarce and is largely confined to discursive arguments in professional journals and newspapers. These tend to proceed by assertion rather than by argument and are, in any case, non-quantitative and therefore such evidence gives no obvious indication of any real correlation between development and value shifts. A full investigation of a phenomenon of such

complexity and magnitude is too large to be economically handled. However, research into the relationship between property development and adjacent property values to give substance to, or refute, objections to development on the grounds of adverse financial effects is long overdue.

3.3 In order to reduce the investigation of shifting values to manageable proportions it was decided to restrict this research to retail properties which are relatively easy to identify and for which there is an adequately isolated market. The primary objective of the research programme was identified as being the investigation of changes in property values. This required, in addition, the determination of a method of analysis, and the construction of a model of retail property values that would facilitate the prediction of changes. It was anticipated that in order to carry out such research it would also be necessary to investigate the costs of development and the developer's profit requirements (on which the traditional definitions and teachings rely) in order to test the correlation between those variables and 'latent value'.

3.4 Here the problem has been to identify the true development costs. Invariably some of the costs of private development are met by public authorities. In addition, there are social costs which affect other individuals, as well as some social benefits which are reaped by other private individuals. A full study of development costs to incorporate changes in social costs and benefits is essential but, in the absence of a means of studying private costs and considering their social consequences, cannot be undertaken here. However, it is anticipated that some form of cost benefit analysis might usefully form the basis of a future research project in an extended investigation of 'latent value' should sufficient data become available. In the meanwhile, it should be noted that the social costs of a particular development scheme are usually perceived as having little or no effect on the value of individual properties and social benefits, such as changes in the attractiveness of shopping areas, are presently acknowledged albeit only tacitly in the existing comparative valuation techniques. Therefore, this research will concentrate on the derivation of retail property values and the modelling of the shifts

which occur in value in terms of the revealed price of the properties involved, without any consideration of the intangible costs and benefits to the community at large. Such social costs, however, can be assumed to exist where the sum of the changes in individual values during multiple development exceeds the total value of the surface under consideration.

- 3.5 The assertion of the landed professions that latent value, when added to current site value, is the maximum that can be obtained out of a site at a particular moment in time, should be capable of substantiation. However, no serious attempt has been made in any research programme to validate the argument, either by way of empirical observation or by drawing on existing economic theory or by the provision of new economic theory.

4 The Hypothesis

- 4.1 The assertions of professional valuers, described in the previous section, that the increase in value at the location of development is a release

of value that is 'latent within the site', should be capable of substantiation. It is the principal contention of this thesis, however, that the value released is both latent value and translated value. That is to say that some property values are translated or transferred from other locations to the development site by the increased attraction of the location which results from the applications of capital to it.

4.2 Therefore, in order to carry out an investigation to test this contention it is necessary to establish a hypothesis capable of being tested. The only alternatives to the contention that both latent value and translated value are released are, therefore, that:-

1. all value is translated value; or
2. all value is latent value.

If the first of these alternatives is true then, following the development of a site or property, the values of surrounding properties would change over a broad surface. If the second alternative is true then, following the development of a site or property, the value of property would change at the point of development but would not change elsewhere.

4.3 Rather than being seen as alternatives, these conditions might exist, under unusual circumstances, as limits to the original contention. However, both are extremely unlikely. Further reference will be made to this in Chapters 9 and 10. In the earlier parts of this thesis the principal considerations relate to the establishment of conditions under which a hypothesis can be tested. There were three ways in which this could have been done. The first of these was to look at a real development situation and to attempt to measure the changes in value that result in both the property under development and in the surrounding properties with the intention of attempting to partition the effects as being either a release of latent value or a translation of existing values. A second approach would be to attempt, via the use of certain ceteris paribus assumptions, to locate a situation in which latent value releases are zero. In this event the test would be of the first of the limit conditions described above, i.e. it would assume that all value is translated value and test accordingly. A third approach would be to attempt to identify a situation in which only latent value is released and to

attempt to measure the extent to which this occurs. This would, however, be extremely difficult to test, yet the proposition that all value is latent is the professionals' underlying assumption in a development situation. However, it may be possible, by investigating the alternatives, to imply the existence of latent value by proving the impossibility of both of the alternatives, i.e. the proposition that on development all values are translated and the original contention that the value released is a mixture of latent value and translated value.

4.4 The first of the ways described in 4.3 assumes that it is possible to develop highly detailed general economic models or, alternatively, that we can look very broadly at the situation and make statements that cannot easily be justified as conclusions but even so have such force that, in a non-scientific sense, implications can be drawn. To this the thesis returns in Chapter 9.

4.5 It was considered to be more useful to concentrate effort on the second described way of proceeding. Given the original contention, and

knowing that the second of the discussed alternatives is not testable, the alternative proposition that all value is translated is possibly capable of being modelled. However, with the present state of urban modelling, no adequate model exists. Therefore, the larger part of this thesis deals with a hypothesis that all value is translated and looks towards the following two questions:-

- i Can a model be built to test the hypothesis that all value is translated?
and
- ii Can a data base be found that would facilitate the testing of a model built to test such a hypothesis?

By implication such an exploration will also investigate whether the second alternative is a reliable proposition on which professionals may continue to base their considerations and advice.

4.6 The latter part of the thesis identifies and discusses the data that would be required if it were to be possible to run a model based on a hypothesis that all value is translated. A test of a valid model could, of course, be expected to fail under two particular circumstances. The

first is that insufficient data exists for a test and the second is that the ceteris paribus assumptions do not hold.

4.7 Chapter 6 describes the search for research locations where data might be available and Chapters 7 and 8 discuss the data base. However, in order to identify the concept of translated value in a theoretical sense, it is necessary to start by making certain assumptions. Where the total retail demand is already fully satisfied and remains at a constant level despite the new development, the amount of real property value available for distribution is constant in real terms. In such circumstances a successful major retail development in a town centre can only be achieved by causing a redistribution of these values. This results, in the main, in a net reduction in the value of those existing retail properties whose catchment areas are within, or partly within, the area of influence of the new development.

4.8 This assumes that it is possible to isolate a property from its hinterland - which, of course, it is not. However, under such conditions, the

aggregate reduction of value of retail properties within the area of influence of a development would be equal to the additional value attracted to, and 'released by', the new development at its own location together with any (relatively rare) increases in value that may well occur at other parts of the retail surface. At this stage of the argument it is not important to identify the reasons why translated value may be positive in some instances outside the new development location. Where necessary, the argument will be developed later.

- 4.9 In the real world such translated values could only be measured where a 'ceteris paribus' assumption could be deemed realistic. In this research it is not intended to attempt to control exogenous factors affecting the ceteris paribus assumptions. Examples of the exogenous factors that might affect the ceteris paribus assumption include changes in transport modes, redistribution of population and changes in car park locations. However, some attempt will be made to control endogenous factors in order to attempt to eliminate possible effects of the new development upon income levels in the community

and price reductions that might result from economies of scale or from the increased efficiency of a more capital intensive industry. The existence of new retail development must impact on one or all of these. The relationship between translated values and the individual elements of both the exogenous and endogenous factors affecting the *ceteris paribus* assumption and, in particular the role of scale economies, is a matter of some considerable interest. However, this thesis is concerned with gross changes in translated values and not with the components of change. It is enough to say that, in the large majority of cases, translated values exist and will be positive at the location of a development in order to question the professional's assumption of latency.⁺

- 4.10 If, therefore, in an empirical test, the level of demand cannot be held constant, the effect of a new development will be more than merely

⁺ More detailed consideration of the individual components will be covered in a separate paper by Barham and Traill which will be published following the main thesis.

distributive. Latent value must also be released within the total surface. This will be distributed and is likely to be at its greatest at the newly developed centre. The degree of latent value at any site will, in the main, decrease as a function of distance from the new development. This relationship would not be smooth as a result of the discrete pattern of retail competition. It is not necessary, for this thesis, to specify the exact form of the relationship, but there will be exceptions from the general trend where, for example, the new development causes liquidation of retail units at a distance from the new centre thus providing a net positive gain in trade for the few survivors. It may fall to zero in many parts of the surface but could only be negative under unusual circumstances. Such circumstances would be analogous to the conditions existing in giffen or inferior product markets and are insufficiently important to require separate treatment.

- 4.11 Therefore, in the experimental test for translated value the model will attempt to identify the nature of the changes of value that occur at each location within the retail surface.

It is this attempt that provides the focus of discussion in this thesis. However, in order to simplify the argument an attempt will be made to locate towns that have a relatively well defined hinterland, a clear development or redevelopment focus and an adequate data base. The research will, therefore, attempt to test the hypothesis that, where the total demand is already satisfied and remains at a constant level, the amount of real property value available for distribution is constant in real terms and the effect of successful major retail development in a town centre can only be to reduce the values of some existing retail properties whose catchment areas are within, or partly within, the surrounding area of its influence: that is to say that, subject to rigorous ceteris paribus conditions, there will be no net change in the value of the surface.

5 The Nature of the Research

- 5.1 If the reduction in the value of retail properties within the area of influence of a development could be quantified, the aggregate change could be measured against the value

'released' by the new development and the amount of latent value arising from the release of frustrated demand. Furthermore, available evidence clearly suggests that, following a development, property values do change - some increasing and some decreasing - over a considerable area. The changes depend upon the land use interaction within the existing retail structure. Clearly the expected direction of change would depend upon whether the existing occupant of a particular piece of land or property operates a business which competes with, or is complementary to, the new development and also upon the spatial relationship between the two locations.

- 5.2 The aims of the research can, therefore, be summarised as being (1) the derivation of a model of property value, (2) an investigation of the nature of latent value, (3) the development of a predictive model of shifts in value occurring as a result of major town centre retail development, and (4) an investigation of the availability of data for the testing of the translated value hypothesis.

- 5.3 In order properly to investigate the nature of latent value it was necessary to commence by researching the literature of economic theory to establish a background against which to set the hypothesis and also to ensure that the stated dearth of published information regarding this alleged phenomenon was correct.
- 5.4 A general review of urban economic theories relating to location and value together with a review of retailing theories and models was carried out as a precursor to the finalisation of the hypothesis and the derivation and construction of a model of property value based on economic theory.
- 5.5 To facilitate the testing of the concept of translated value, a review of development profit, construction cost and estimating techniques has been carried out and some techniques presently in use have been incorporated into the model. Thus the model should facilitate the testing of the concept of latent value against gross development cost and current use value to establish whether a residual translated value exists. Further examination of the increases and decreases in

property value are then utilised to test whether an approximate equation exists between positive and negative translated values over the identified catchment area.

- 5.6 An experimental test of the model was carried out using data obtained after isolating and selecting the city of Exeter, and its hinterland in Devon, as meeting the identified requirements for a survey area.
- 5.7 The report of the selection survey, the data collection and the experimental tests, form Part II of this thesis. It concludes with an examination of the performance of the models (derived in Part I) by summarising the predictions obtained against the realities of the data collected and testing the sensitivity and reliability of the models to exogenous changes.
- 5.8 The final part of the thesis consists of a collection of Appendices containing reports of three other minor surveys and investigations made in support of the investigation of the main hypothesis together with the collection of background materials, samples of the questionnaires used, the raw data collected, and

the algorithms developed to run the models.

5.9 The report of the research that follows is arranged in three parts, Part I: A Theory of Translated Value; Part II: An Experimental Test of the Model; and the Appendices.

CHAPTER TWO

A REVIEW OF RELEVANT LITERATURE

1 Introduction

1.1 For many decades the professions have utilised conventional techniques for the valuation of property investments, in which the capital values of the properties are derived from their rental values. However, no attempt has been made to predict or derive rental values other than by direct comparison with other rentals revealed on completion of transactions. Even without the availability of explicit economic derivation models, comparative rentals have always been accepted, being the result of free bargaining in the market place. Little or no real investigation has been carried out on the economic basis of the landlord's and the tenant's relative bargaining bases.

1.2 Critics of established valuation techniques have pointed out the deficiencies in conventional valuation theory, particularly in the light of

the contemporary economic conditions in which such theories are currently being applied and of the new demands being made for accuracy in valuation. Such criticisms have not originated from within the landed professions themselves, but are levelled by such other experts as the accountant, stockbroker, economist, and actuary, whose areas of expertise, overlapping with those of the surveyor/valuer, led them into taking an increasingly critical interest in the derivation of property values.

- 1.3 Historically there has been very little research of direct relevance to the landed professions' requirements for improved valuation techniques and there has been no attempt to model the 'higgling' of the market in the negotiating process that leads to the fixing of rentals.

2 Recent and Current Valuation Research Projects

- 2.1 Whilst there has been notably little research carried out in the areas of derived property values and latent values there has been, over the last two decades, an increasing output of

articles and commentaries both by leading members of the valuation profession and academicians involved in the teaching of valuation techniques.

2.2 The flow of papers and correspondence, however, predominantly relates to techniques of valuation. Little research has been done on derivation of value or on shifts in value.

2.3 Typical of the works mentioned above are i/ those of Pannell⁽¹⁾, Johnson⁽²⁾ and Rose⁽³⁾ in the late 1960's in respect of adjustments in valuations to allow for the incidence of capital gains; ii/ Wood's paper⁽⁴⁾ in 1973 suggesting that valuation techniques should incorporate an explicit allowance for inflationary growth to deal with value changes; and iii/ the Greenwell Report⁽⁵⁾ in 1976 dealing with a similar concept.

2.4 The late 1970's brought a crop of published papers on more erudite valuation techniques involving double sinking funds, equated yields and 'constant' rents. Typical of such papers are those by Harker⁽⁶⁾, Rose⁽⁷⁾, Marshall⁽⁸⁾ and Bowcock⁽⁹⁾. The Royal Institution of Chartered Surveyors in 1975 set up a working party to

investigate professional valuation techniques. Its terms of reference were to investigate the agreed and accepted methods of valuation and to consider to what extent these were deficient. The working party concluded that the matter would be better researched at an academic institution. The RICS and the Polytechnic of the South Bank produced an interim report⁽¹⁰⁾ as a critique of presently available valuation methods and that report comments on existing valuation methods and suggests a new approach to valuation formulae.

2.5 The completed research programme resulted in the publication of a final report⁽¹¹⁾ which provides a precis of the interim report and recommends specific techniques for particular valuation requirements - for example, the use of an explicit discounted cash flow for the valuation of short leaseholds and the use of equated yields for the valuation of freehold properties. It also recommends the use of more client-specific valuations to reflect 'value to the owner'.

2.6 Research is currently continuing on all of the above mentioned topics but it is noted that valuation techniques is the only area of serious

investigation. Even Sykes' and McIntosh's⁽¹²⁾ recent rational valuation model, published in the aftermath of the RICS Interim Research Report, is concerned only with deriving a mathematically consistent investment valuation model for freehold and leasehold properties and, again, as in all other available techniques, they utilise the agreed rent, or comparison rent, as a basis from which to calculate. They do not attempt to derive the rent.

- 2.7 There are two other publications of relevance to the valuation techniques debate. One is my own paper published in 1986⁽¹³⁾ setting out the arguments for and the basis of using a set of flexible formulae for the derivation multipliers to be used in valuation calculations. The other is one by Parry Lewis⁽¹⁴⁾ which also appeared in 1986 and recommends an integrated approach to investment valuation. The author states, in his introduction, that the paper arose out of an attempt to present a different approach to the investment valuation of a building in a way that i/ allows complications to be introduced, ii/ keeps in mind that different investors will have different income requirements, and iii/ is likely to be understood by and acceptable to not only valuers but also those from other disciplines who

from time to time become involved in the analysis or production of building valuations. The basic approach is to regard a building as an asset that will bring in a stream of annual incomes for a finite period and then have a (possibly zero) 'final' value that may be realised with perhaps a consequent capital gain. Rent reviews, maintenance, refurbishment and other matters complicate the position, but Parry Lewis maintains that they can all be accommodated within the approach presented. However, this approach does not attempt to derive the rental value used as a basis for its capital value calculations. Despite this fact, the paper could well have been valuable. Its appearance in 1986 was, however, too late to affect the course or outcome of this thesis. Its inclusion here is for the sake of completeness and to direct the reader's attention to a potentially useful investment valuation approach.

3 A General Review of Economic Literature

3.1 Introduction

3.1.1 A large part of the early research was spent

on a review of current economic theories in order to establish whether i/ any current theory could be applied to the situation under investigation, ii/ any research of a similar nature was being carried out elsewhere, and iii/ if any research papers existed which, whilst not being directly relevant, might be of some use containing model structures that could be analogous to the model which was envisaged as being developed as a result of this research.

3.1.2 By its very nature any review of general economic theory might appear to be of little relevance to the specific research topic under discussion. However, it is necessary that the later references to specific urban economic theories are first dealt with in the context of general urban economic theory. What follows is, therefore, a general review of available theory; specific discussion of those components thought to be more relevant occurs later in the chapter. There is no attempt in this part of Chapter 2 to make any of the references directly relevant to later parts of the thesis.

3.1.3 There is a suggestion within the main body of

economic theory that a general theory of urban growth is not feasible. At the same time, pure economic theory gives only a partial explanation. It was, therefore, seen as a fundamental requirement of this research project to adopt an inter-disciplinary approach in order to obtain the essential deeper understanding of the detailed workings of the urban system. In this respect the views and practices adopted by the valuer/appraiser and the planner/geographer have also been taken into consideration.

3.2. General Urban Economic Theory

- 3.2.1 The review of the literature of general urban economic theory revealed that, usually, the economist's approach to the urban problem is twofold: one is to concentrate on important sectoral issues and the other is to treat urban economics merely as a sub field or special case within the location theory area of regional economics which enquires into where a particular activity takes place and why.
- 3.2.2 In urban economics the current theories fall into two distinct categories; macro and micro economic

theory. The macro approach is essentially a study of the behaviour of aggregate variables, evidenced by growth models, regional input-output models, etc., which are essentially non spatial but are seen as indicators of performance in the urban economy.

3.2.3 The majority of these studies and theories, being of an aggregative nature, are of little use to the landed professions as the basis of a working hypothesis. The micro approach is non sectorally based and is more concerned with an analysis of the market behaviour of the decision making units, be they individuals, households, firms, etc., and how they seek to optimise their position in the market in an attempt to decide locations. In particular, it is concerned with how these units seem to take advantage of such specialisations or unique features as they possess in their attempt to obtain a share of the market.

3.2.4 However, existing micro economic theory still relies heavily on the theory of the firm and theories of consumer behaviour within a fixed spatial framework and, as a result, is heavily

biased towards location theories based on aggregations of factors. This will become clear from the review of published work that follows.

3.2.5 This research project draws on theory from both the macro and the micro areas of urban economics, bringing together useful parts of models of urban location, urban systems (competition and interference) and urban change/growth. There are many concepts and general theories of urban micro economics that could be of use in this research and many contain propositions of some theoretical relevance. However, some, being predominantly concerned with the location and performance of manufacturing firms or being on too large an aggregative scale, may be regarded as of little operational use in this research project. A general review of the published work was deemed necessary in order to put this thesis into perspective and, as some of the publications on retail location and attraction lead into more relevant theoretical works, they are worthy of mention here as general background.

3.2.6 The general micro economic theories can be categorised into three areas: Urban Location

theories, Urban (Spatial) Structure theories, and theories of Urban Growth and Urban Change.

3.3. Urban Location

3.3.1 Locational theory falls into one of two types: Processual or Systematic. General Systematic Theory focuses its attention on 'the site' and the forces that determine the activity to be carried out on the site⁽¹⁵⁾ whereas Processual Application focuses on an 'activity' and the behaviour of the decision maker, analysed in the light of various influencing forces⁽¹⁶⁾.

3.3.2 The origin of current location theory can be traced back to the work of Von Thunen⁽¹⁵⁾ who postulated, based on empirical evidence, that around a 'central' town, rural land use diminished in intensity in inverse proportion to the distance from the town. He assumed a flat featureless plain and a single market point, where buyers were concentrated and sellers dispersed. His work introduced the concept of a series of concentric zones of reducing demand for land - and hence reducing land values. Further work by Losch⁽¹⁷⁾ developed a theory on similar

lines which took into account competition between various centres; the result being a market area delineation with each centre having a hinterland of hexagonal shape.

3.3.3 Haigh⁽¹⁸⁾ saw transport costs in such systems as being a critical factor and used the term 'friction cost' to describe the cost of overcoming distance. Site rentals, according to Haigh, include a levy for savings in transport costs arising from use of a site and, therefore, in Haigh's opinion site rentals and transport costs are complementary although not in the usual economic sense. This concept has, however, been criticized - see later (3.3.4 onwards). The theories of Isard⁽¹⁹⁾ and Weber⁽²⁰⁾ are based on similar concepts to those of Haigh: Weber used the concept of a 'Locational Triangle' to determine optimum location using a series of materials indices and locational weightings. However, his assumption is that of a linear transport cost function and he has, therefore, to resort to the substitution of hypothetical distances to take account of decreasing transport rates over distance. Isard, on the other hand, whilst also using minimisation of transport costs

to predict location, utilises a system of 'transport inputs'. These are equal to the movement of unit weight over distance, i.e. the exertion of effort required to overcome the resistance encountered moving goods through space. Losch has also taken a technique which utilises space-cost curves and developed from these a system of space-revenue curves and 'demand cones'. These techniques were an extension of his original market areas theory, based on the premise that demand varies as a direct function of price and as an inverse function of transport cost. This notion of transport 'friction' cost or travel time-cost appears in several other theories and is a major determinant of market area (see later). For each good there is a maximum transport distance beyond which the good cannot be sold at the given market price and by analogy it follows, therefore, that there will be a maximum distance that consumers will be prepared to travel to make a purchase of a particular good at the prevailing market price. This latter distance, being different for different classes of goods, is of particular importance within the model developed by this research (see later - Lakshmannan and Hansen, Huff, et al).

3.3.4 Limiting assumptions in each of the models considered above are those of uniform population density, homogeneous individual demand curves, lack of spatial differences in transport rates, and no locational interdependence. Access to, or accessibility by, customers is a very important demand influence on location and the Loschian style model needs adjusting to reflect this as well as to reflect differing concentrations of population.

3.3.5 Work by Hotelling⁽²¹⁾ on accessibility and market location in (duopoly) competition postulated that the differentiation between identically priced homogeneous goods in the eyes of a purchaser was due only to the cost (time/distance) of going to the vendor's location and of transporting purchases home. Additional works by Devletoglou⁽²²⁾, Chamberlin⁽²³⁾ and Lerner & Singer⁽²⁴⁾ develop these locational equilibrium theories into a consideration of oligopolistic competition, concluding that equilibrium is not possible with more than two firms and introduce the concept of 'clustering'. All unrealistically assume, however, that firms are free to change location immediately and without cost.

3.3.6 Other limitations of these traditional location theories are i/ lack of consideration of multiple product production plants (or retailers), ii/ non acceptance of other than economically rational decisions (other non economically rational, subjective personal or 'welfare' considerations are often as important), and iii/ inadequate consideration of market orientation - a very important, and probably the dominant, factor. There are, however, alternatives to the traditional location theories but these alternatives are in the areas of Behavioural Theory, Revenue Maximisation, Satisficing Behaviour or Utility Maximising Theory. These theories lack practical application within a property values context and are not further considered in this thesis.

3.3.7 After considering the general theories outlined above, it is concluded that it is extremely unlikely that any of the traditional location theories could be usefully applied to this current research topic as the subject matter requires a quite different and more detailed and disaggregated approach. Alonso's⁽²⁵⁾ approach to urban location provides a more realistic theory

of rental value but even this is based on the assumption that the market for land is perfect (See later for an expansion of this point).

3.4. Urban (Spatial) Structure

3.4.1 The theories of Von Thunen described earlier in this chapter were further developed by Burgess⁽²⁶⁾ into a theory of concentric zones around a central urban core. The theory assumes equal accessibility to all zones and so omits one of the major factors affecting value. Concentric zone theory is one of four general theories of urban structure, the others being: Axial Theory⁽²⁷⁾, Sector Theory⁽²⁸⁾, and Multiple Nuclei Theory⁽²⁹⁾. All of these theories are based on empirical observation and, with the exception of Multiple Nuclei Theory, put forward dynamic models.

3.4.2 Some parts of each of the four theories can be used to explain the majority of all urban development/land use patterns (e.g. Mann⁽³⁰⁾ combined concentric zone theory and sector theory in analysing British towns) but a more comprehensive theoretical treatment requires a

more detailed analysis of decision theory in respect of locational decisions (for shops, industry, housing, etc.).

3.5. Urban Growth and Urban Change

3.5.1 This area of urban economics has, until recently, remained relatively underdeveloped and as a result there is a dearth of detailed empirical studies, particularly in the subject area of urban change. Central Place Theory, developed by Christaller⁽³¹⁾, introduced the concept that the growth of a city depends on the degree of specialisation of its urban service functions; the level of demand for which determines the speed of growth. The theory explains, as well as growth within the city, a spatial ordering within the regional or national economy. Christaller's theory makes use of a honeycomb of complementary hexagonal market hinterlands for each urban area and the theory eventually leads to the formulation of a "Rank Size Rule"⁽³²⁾ - see the work of Smailes and Hartley⁽³³⁾.

3.5.2 All the earlier urban growth theories, such as Christaller's Central Place Theory, operate at a

highly aggregative level and, as a basis for this current thesis, provide only a general context within which to work. Even though further work, introducing the concept of range and threshold, has been carried out by Berry⁽³⁴⁾, Garrison⁽³⁵⁾, and Mayer⁽³⁶⁾, Central Place Theory is inadequate for a complete understanding of the process of urban growth.

3.5.3 Several other general theories of urban growth and change exist but none appear relevant to the work in hand. Examples include input-output analysis⁽³⁷⁾⁽³⁸⁾, money flow theory⁽³⁹⁾, urban base theory⁽⁴⁰⁾ and communications theory⁽⁴¹⁾. In addition to these, inter alia, one other approach is worthy of specific mention: the Human Ecology approach. This theory, by analogy, seeks to explain how economic forces operate within communities and takes account of the "congesting together" of individuals (to overcome the 'friction' of space), which tendency intensifies the competition for central locations - resulting in higher land values, higher rents, and higher traffic costs. A further ecological concept is that of dominance, e.g. industry and commerce socially dominate an urban community -

Reissman⁽⁴²⁾. This concept, originally developed by Perroux⁽⁴³⁾ and expanded by Hansen⁽⁴⁴⁾ and touched upon by Morgenthaller⁽⁴⁵⁾ in a general critique of simulation in operations research, was originally conceived in relation to an inter-urban situation, but is seen as relevant in an intra-urban location containing 'magnet stores' (see later).

3.6. Urban Systems - Competition and Interference

3.6.1 The urban system is the result of a complex interplay of physical, economic, behavioural and technical factors and all commodities are subject to the interaction of supply and demand. It is accepted that profit maximisation (or optimisation) is generally the supplier's goal and it should be noted that land and building uses are also responsive to changes in costs and changes in demand, i.e. the demand for land and buildings is a derived demand. Competitive bidding for property eventually brings about a market solution; for the use of land and buildings in an urban area represents the cumulative effects of all decisions by many individuals and companies, governments and institutions. The result of all these

independent actions is not chaos; the underlying rationale of market prices allocates the scarce resources of space and location within the property market.

3.6.2 However, after an urban area reaches a certain size, problems of increased costs of operation, due mainly to external diseconomies which are society's concern, can no longer be ignored. As a result attempts are made, by society, to internalise them and thus make private individuals aware of the external, or 'social', costs of their actions. Examples of internalisation of external diseconomies are taxation (compulsory contributions to offset social costs) and restrictions on density of development, particularly near centres of urban areas, which force the use of more distant sites (thus increasing transport costs). Provided that the pre-control level of private benefit, together with additional benefits to society, can still be derived at these greater resource costs then such controls can be economically justified, but this is not always the case.

3.6.3 Other influences at work within the modern urban structure include government intervention and

influence in the form of grants, loans and tax concessions whose effect is to increase demand for production space. Conversely, government policies which reduce profits, or increase prices (thereby affecting consumer demand), eventually affect profitability and, consequently, the rents of real property. Similar and additional effects are also created by such direct governmental controls on real property as Landlord and Tenant legislation, Rent Controls, Leasehold Enfranchisement, etc.

3.6.4 The foregoing review has shown that the largest part of the literature is concerned with predicting the location of facilities within a geographical framework and that any prediction of land or property value is produced as a by-product. However, as land values are an input in almost any locational model, the system of equations is sequential with none obviously coming first. Any model that is concerned primarily with value will have many common elements with such models of location but in most cases the restricting ceteris paribus conditions differ.

3.6.5 Pure retail location theory is a comparatively

recent development but, as retail location derives mainly from a recognition of competition and the fight for spatially protected markets (although some complementary uses thrive on agglomeration), some of the detailed considerations of the more general location theories are of some relevance. Flexibility of use is a major consideration, coupled with an acknowledgment that the cost of immobile factors of production together with the cost of both present and future legal and financial commitments tend to bind an activity to its current site location and, as a result, cut down a firm's mobility. The result is geographical or locational inertia. It is, therefore, a modified form of Ricardian approach to the productivity of land that seems to be the most relevant of the established theories relating to locational value and the relationships currently under investigation.

- 3.6.6 In identifying a 'Ricardian' approach to the productivity of land and buildings as being relevant to the relationships under investigation, considerable emphasis has been placed on the fact that, of the four factors of production, land (and the property thereon) is

unique in that its supply curve is quite unlike those for labour and capital. Ricardo's conclusion was that rents for agricultural land were high because the price of produce was high. He suggested that the other three factors of production, enterprise, labour and capital, should be treated as costs in assessing the asking price for the resultant product. Therefore the sale price, determined in a free (or relatively free) market, produces a surplus after deduction of the costs of these three factors of production and it is this surplus that is the return to land or property. Although this argument would now be equally applied to any factor of production receiving an economic rent, the concept is of assistance in helping to understand how the price or rent for land or property is derived in city centres. This is especially so in a consideration of retail property where the productivity or turnover at a unit of property provides the market determined starting point for a calculation or estimation of the residual price or rent.

- 3.6.7 Whilst the general location theories are of only minor relevance, the development of central place theory by Christaller and Losch is of more direct

use and the later developments by Garrison⁽⁴⁶⁾, Mayer⁽⁴⁷⁾ and Berry⁽⁴⁸⁾ extend the original inter urban area distribution theories to an intra urban area use. These theories recognise the locational requirements of minimum delivery cost (if this is used in its widest sense) or alternatively for the consumer, minimum movement cost and, to a large extent, are consistent with a hypothesis that, within shopping centres, pedestrian flows and intervening opportunities will have a large part to play in the model. Those theories used in the development of the model are described later in this Chapter.

3.6.8 A major consideration of all such locational theories is accessibility and here the work of Holton⁽⁴⁹⁾ is of some value. His explanations of clustering of shops due, on the one hand, to ease of access and closeness to a daytime population of working customers and, on the other hand, to the existence of a large agglomeration of shopping opportunities at a single location resulting in better accessibility for customers, is very illuminating and relevant.

3.6.9 The main approaches to retail location contained in general equilibrium theory, and evidenced by

the work of Hill⁽⁵⁰⁾ and Lowry⁽⁵¹⁾, can each be criticised on the grounds that they do not account adequately for high value situations; they tend to predict a uniform distribution of value and, as such, are not seen as being of use in the preparation of a new model intended to operate at micro level.

3.6.10 Other approaches, accepting that the location of retail units within an urban area do not fit a regular pattern, constitute the 'statistical' theories. Originally postulated by Vining⁽⁵²⁾ and further researched by Dacey^(53, 54) and Rogers⁽⁵⁵⁾ these theories consider the statistical aspects of size, agglomeration tendencies and thresholds but, again, their predictive capacity is poor. The prediction of levels of trade is especially difficult using these models because they contain no explicit reference to market demand or consumer behaviour.

3.6.11 The most relevant areas of published work are to be found in the "modified central place theories" evidenced by the work of Berry (et al)⁽⁵⁶⁾ whereby the travel function, the minimum size thresholds of various trades, and the resultant agglomeration, can be used to define the range of

a good (and thus the market area for a retail centre) and to explain the existence of centres rather than uniform distribution; 'size-threshold' eventually leads to a hierarchy of shopping centres by market area.

3.6.12 Work in the 1960's by Lakshmannan & Hansen⁽⁵⁷⁾ and Parry Lewis & Traill⁽⁵⁸⁾, together with studies of Haydock⁽⁵⁹⁾ and York⁽⁶⁰⁾ carried out by Manchester University's Town and Country Planning Department, provided a further approach to the modelling of attractiveness propounded by Reilly⁽⁶¹⁾. The work by Lakshmannan and Hansen, together with that of Huff, has resulted in the formulation of a gravity model of consumer behaviour with regard to shopping travel by analogy with trip making behaviour. These have the capability of projecting the future location of purchasing power and the ability to define the future state of the transportation system in relation to shopping travel. It also enables an examination of the interaction of consumers with the centres. The work is examined further at a later point in this Chapter.

3.6.13 Further work on a general descriptive model by Parry Lewis⁽⁶²⁾ resulted in the creation of

Mandebus - the Manchester Decision Based Urban Simulator. The idea of Mandebus is to produce a model of an artificial town based on reality and to explore the significance of availability of information to decision makers. Mandebus is a statistical description of a town, produced by specifying information about the characteristics of its several zones and of the flows and links between them. As decisions taken will, in most cases, lead to change, the model explores the effects of these decisions and resultant actions by generating a new description of the town and new information for the decision makers for the next time period.

- 3.6.14 The philosophy underlying Mandebus is stated by Parry Lewis to be "that urban changes result from decisions made by various sets of people, and that the people who make decisions that are intended to have certain specified effects are usually ill-informed about the impact of their decisions on decisions made by others". i.e. there are unintended effects. In his introduction to the report, however, Parry Lewis states that Mandebus is a model of, essentially, the principal urban activities but, although ambitious, its ambition is at the price of a more

simple approach. It is an attempt to provide the decision maker with a tool but, as its approach is simplified, and as no two towns have the same structure, it would appear to be necessary to have a separate model for each town.

3.6.15 By way of comparison Herbert & Stevens' Penn-Jersey Regional Growth Model⁽⁶³⁾ provides a simulation of residential location decision behaviour in differing household types. It is based on the premise that individual households wish to maximise their locational advantage within the constraints imposed by their budgets. The model is based on the economic theory of Alonso whereby a household chooses the location of its residence by reference to its fixed budget (or income), by choosing that which maximises savings or rent paying ability along with the utility obtained from other economic goods. The result of the economic interaction between individual households is that land (property) is allocated to that group of households which can pay the highest price (rent) for it.

3.6.16 However, in any utilisation of this extremely interesting model, the number of households and

the amount of land available are exogenous variables to be input at each iterative period. The model requires a vast amount of data on household incomes, patterns of consumption preference and daily movement, specification of all residential rates within a region and details of the accessibility of alternative destination sites. The model is an attempt to simulate the residential market activity and is useful for the testing of policy decisions. In its consideration of zoning, transportation costs and the location of redevelopment it is of use in a macro level consideration of development location and rental values. The model produces rent levels for each zone under consideration by virtue of its determination of the rent-paying ability of households and, in its latest version, rent paying ability is replaced by a predicted bid rent. This rental prediction is not, however, site specific but at zonal level and, therefore, of little use in this present work. The model itself has proved very difficult to calibrate.

3.7. General Summary

3.7.1 There are, of course, many other general concepts

and theories of urban growth and change which could be cited here, but their relevance to this research is very remote. The majority are either predominantly concerned with the location and performance of manufacturing firms or are on too large an aggregative scale to be of detailed use. However, before proceeding to a detailed consideration of a retail property value theory or model it is necessary to attempt to define what is meant by value - that is to say, in the context of this research, value to the owner, occupier, or property developer - and to consider further the theoretical basis of a model in some detail.

4 Landed Property Values and Location

4.1. Value - an outline

- 4.1.1 All commodities whose supply is limited and for which there is an effective demand may be said to have value (or utility). Value is what one commodity is worth in terms of another, i.e. the exchange price that a willing buyer would pay to a willing seller under perfect market conditions - it is usually expressed in terms of money.

4.1.2 It is an axiom of economic theory that the rental value of land is dependent upon its productivity (and an axiom of valuation technique that capital values can be derived from rentals). Without detailed analysis of this statement at this point it can clearly be appreciated that the same can be said of property; a shop near the centre of a town should obviously be worth more rent than one in a secondary position which does not attract so great a volume of trade. It follows, therefore, that the factors which affect the productivity of a business carried on at a property will also affect the value of the property.

4.1.3 In 4.1.1 value was identified under perfect market conditions. This requires certain assumptions to be made:

- 1) All firms are small
- 2) All products are perceived as homogeneous
- 3) There are no barriers to new entry
- 4) Consumers have perfect knowledge

The property market can hardly be described as perfect for the following reasons:

- 1) In the retail property market few firms exist and those that do are inevitably very large
- 2) No two buildings are perceived as identical - land and buildings are heterogeneous

3) Significant barriers to new entry must exist in any market where major capital expenditure is involved

4) Perfect knowledge is significantly reduced where:

- i/ a multiplicity of legal interests reduces the effectiveness of communication
- ii/ no declared market place exists ensuring that most transactions are between individual buyers and sellers, or landlords and tenants, in relation to unique products, thus eliminating any consumer surplus

Numerous statutes and regulations serve to reduce the care with which information can be obtained and act as barriers to free bargaining and the operation of the price mechanism.

4.2. The Property Market

4.2.1 In the urban real property market, which consists in the main, of an inseparable combination of land and improvements (buildings), the demand for development (i.e. the construction of buildings) is derived from the demand for such buildings required for existing or potential urban uses. As a result, three economic goods - land,

buildings and location, are involved in almost every transaction; but there is only one price. In addition, the multiplicity of interests mentioned above (4.1.3) - both legal (freehold, several terms of leasehold, and other rights) and equitable (mortgages, easements, etc.) - which can contemporaneously subsist in any one piece of real property can (and in the United Kingdom often does) result in the owner of the freehold not being the occupier of the property.

- 4.2.2. The question of whether to occupy or to hold as an investment is obviously based on a consideration of whether the rent that a potential occupier is willing to pay is high enough to persuade the owner to give up user rights. The converse of this, where a property user decides whether to rent or purchase, is based on a comparison of the alternatives, i.e. the level of rent and other commitments demanded compared with the amount of interest and principal repayments on borrowed funds (if any) or the annual rental equivalent of the purchase price. Goodall⁽⁶⁴⁾ asserts that the comparison is between rent and interest on borrowed capital but, whilst this may be theoretically correct,

observation during my own 25 years experience in the property market indicates that the majority of lay users of property are more concerned with total outgoings than the theoretical equivalence of rent and interest.

- 4.2.3 In addition to the above considerations, a property user, in determining how much rent to offer for a particular property, will be aware of the potential profit earning capacity (productivity) of the property and its locational advantages or disadvantages when put to the proposed use. As a result the prospective tenant's rent bid will be a function of the expected profitability of the proposed trading from the premises. The greater the profit or satisfaction expected, the greater will be the rent or price a user will be prepared to offer.

4.3. Location and the Market

- 4.3.1 In order to evaluate the relative merits of real properties, a user will balance the requirement for an amount of space against the requirement for optimum location (accessibility) and these are determined by the external functioning of the

activity; determining quantity and quality of space respectively. The rent bids therefore, will be different for each different property and location available to the prospective occupier.

4.3.2 This difference in location and in type and size of properties results in the creation of many different sub-markets in real property. Examples of these are the sub-markets for retail shops, industrial premises, residential units, etc. It is possible, however, for a single demander to be active in more than one of these sub-markets at a time and for a demand for one type of property, e.g. offices, to be met by a change of use and supply of another type, e.g. a shop, house or warehouse. Notwithstanding these overlaps of boundary, sub-markets are still readily definable, if imperfectly.

4.3.3 In addition, the difference in interests - occupational or investment - results in a further differentiation of the market and this differentiation, together with the abundant modifying legislation and other restraints, tends to confuse the element common to all sub-markets - the process by which price or value is

determined, i.e. the interaction of supply and demand.

4.3.4 The retail market, or rather interactions of demanders and suppliers of property for use in retailing activities, tends to be more specialised and more clearly defined. This is particularly so in estate agency and estate management terms. The effects of the earlier mentioned market differentials, together with the gargantuan nature of trying to assess the whole market, provide the reason for the restriction of this research to the retail property market.

4.4. Accessibility and Rent

4.4.1 In retailing, the larger the number of customers making non-postponable purchases the more critical is accessibility. As the requirement for access varies from business to business, so the demand for properties is highly differentiated and, as a result, values change with changes of user and changes in the general level of profitability. Various means of transport are used to reach a cluster of shops (normally a town centre or neighbourhood centre)

but, once there, customers walk from the transport termini to the point of purchase and so pedestrian routes between these and the 'magnet store' or shopping centre are a very important consideration.

- 4.4.2 Further work by Ratcliffe⁽⁶⁵⁾ on Haigh's 'friction cost' theory (4.3.3), in which rent was seen as a levy for a saving in transport costs, demonstrated that a perfect land market produced minimum aggregate land values as well as lowest aggregate transport costs. Therefore, following Ratcliffe's proposition, payment for location in retailing may be something more than merely payment for savings in transport costs -although from the consumer's viewpoint the disutility involved in transporting goods home from the shops (or to the car from the shops) is a major factor (accessibility) affecting the decision on where to purchase. This in turn affects the distribution of consumer expenditure (which is the turnover received by the retail establishment) and, thereby, the profitability of operation and the retail operator's rental bid for the property location.

4.5. Price and Value

4.5.1 Before proceeding further with a consideration of the elements of value involved in the urban development/redevelopment situation it is necessary to clarify what is meant in this thesis by the term 'value'. Value, in the economic sense, is a function of utility and scarcity. In the context of the real property market, value is taken to mean the revealed price of an interest in real property, or an estimate thereof; this 'value' being the monetary amount that could be obtained by the owner were he to dispose of his interest at any moment. Whether this is a misuse of the economic term or merely an alternative professional view is of no consequence to this research. In relation to 'market value' it is the property market's definition that will be used throughout the remainder of this thesis.

4.5.2 Investment in the property market, as an alternative to use and occupation of a property, has already been considered and all that remains is to define the term 'investment': the giving up of a sum of money (or an amount of capital) now in exchange for a flow of income, preferably



a series of regular receipts, over a period of time. The term 'yield' is used to describe this flow of income, expressed as a percentage rate of return on the amount of capital expenditure earned by the investment.

4.5.3 'Ceiling price' and 'Floor price' are two terms used by economists with which the valuer may be unfamiliar. Ceiling price is a reference to the maximum bid that a potential investor (purchaser) might be willing to pay for a commodity and Floor price is used to describe 'value to the owner'. Both of these concepts represent subjective valuations and as such are incapable of measurement by observation; they may even be incapable of rational quantification by those to whom their existence is attributed.

4.5.4 Market Prices, on the other hand, are directly observable. As revealed market price, incorrectly referred to by the landed professions as 'market value', must be within the limits of floor price and ceiling price set by the vendor and purchaser, and as it is determined in an open market situation by competition for the possibility of earning profits or otherwise obtaining satisfaction, i.e. by the 'higgling of

the market',⁺ it could be a useful measure of 'value'. However, if they can be identified, prices determined in localised spatially protected (and, therefore, to some extent monopolistic) markets must be excluded from use in any models formulated from this research; the reason for this being that such prices may not fall within the defined limits set in the earlier part of this paragraph.

4.5.5 Returning for a moment to the question of the 'negotiation' that takes place in the property market, it should be noted that one result of negotiation can be that the revealed price of the property is lower than that which the tenant, or purchaser, would have been willing to pay. This may be due to several factors, one of which is the landlord's, or vendor's, imperfect knowledge of the supply position.

4.5.6 Revealed price and market value are not the same thing. Value distortions affect revealed prices. These will incorporate, for example, concepts of consumer surplus, monopolistic elements within

⁺ The process is descriptive: single buyer, single seller.

within the market, differing elements of price discrimination dependent upon the negotiating skills of the buyer and seller, preferential relationships between buyer and seller, and different levels of knowledge between the two. Market value relates to the value placed upon the property of the two or more parties to the transaction. This ensures that there are at least two concepts involved that separate buyer and seller:

- i/ the seller's bid (landlord's rent requirement) is based upon the expectation of rent changes in the future
- ii/ the buyer bid (tenant's rent offer) is based upon the stream of future income benefits.

This must lead to alternate views - one incorporates the supply of land and buildings, the other the future states of demand.

4.5.7 Whilst the assumption might be that the revealed price, as a result of these factors, might be less than market value, the same argument can be advanced in reverse: a property owner, not in ignorance of market supply but in ignorance of demand, may be prepared to dispose of a larger quantity of floorspace at given price, or rent,

rather than do without a tenant or do without a sale. The problem, in both of the circumstances described, is that the existence of the 'surplus' is difficult to identify.

4.5.8 The parties use of estate agents and other property professionals is intended to reduce these differentials, although it must be noted that even their knowledge of the market is not perfect. In practice the existence of any surplus is not only masked by the non-availability of information on true market values but the surplus, itself, is inhibited by the negotiating techniques and valuation techniques utilised by vendors/purchasers, landlords/tenants and their professional advisers.

4.5.9 The inhibiting of 'consumer surpluses' is affected by the higgling of the market referred to above. However, during the consumer's (i.e. the prospective tenant's or the prospective purchaser's) search for premises, the fact that the asking prices in the market are lower than the price he would be willing to pay implies that, if a transaction occurs, not only is his actual expenditure less than he would have been

willing to pay but also that at that price his income allocation has been optimised. He has acquired the use of a property of the required size, at a lower cost than he was prepared to pay and is left with surplus funds to spend on other commodities. The price at which the transaction took place was the equilibrium price for, given the market prices of all goods including this property commodity, the consumer aims at maximisation of his utility. In a perfect market the revealed price would move quickly towards the equilibrium price but in an imperfect market, such as the property market which relies heavily on price discrimination and lack of knowledge, the true equilibrium price may be exceeded or may not be achieved.

- 4.5.10 A further reason for this paradox stems from the psychology of negotiation. For example, if a property owner were inadvertently to offer a property in the market at a rent or price lower than the true market level and also lower than the maximum that a prospective occupier were willing to pay, it is quite normal for the prospective occupier's opening offer to the owner to be less than the price demanded. The

resultant settlement of an agreed price or rent depends on the two parties' state of knowledge of the levels of supply of, and demand for, similar accommodation suitable for the use proposed by the prospective occupier. As mentioned previously the role of a property agent or consultant is to reduce the level of imperfection of knowledge available to the parties. However, it is more likely that the property owner, even without professional advice, will be aware of many of the revealed prices for similar properties in the surrounding area, although he does not have full knowledge of the market. As a result the initial price or rent demanded will be more likely to have been determined by taking the highest known figure (a revealed price) achieved locally and adding a percentage increase designed to produce a resultant price higher than all presently known revealed prices. This is a negotiating attempt to reduce or absorb any prospective occupier's consumer surplus, an attempt to absorb perceived 'inflation' effects, and also, to some extent, merely a reflection of the negotiating attitude expressed by agents. In the majority of circumstances evidence suggests that the revealed price does not lie far from the true market value of the property.

4.5.11 An alternative view of the foregoing argument might be that revealed market prices still differ from shadow prices even though the former are determined in a relatively free, if somewhat imperfect, market. The latter concept, shadow price⁽⁶⁶⁾, is utilised mainly in cost/benefit analysis and is an ultimate or absolute price (again incapable of direct observation). This implied price is derived from the market price of a commodity, amended to take account of the additional net social costs incurred by, or in, the production, or use, of that commodity, i.e. in a perfect market. In a situation where the demand curve is inelastic, or relatively so, the difference between the shadow price and market valuation will tend to be higher, implying a high social valuation of that commodity or project. The function of the shadow price is to yield a pattern of production and consumption that is optimal for society as a whole. However, it is of less use in a private cost/benefit analysis, i.e. in private contracts, as the parties have no interest in any social cost, or benefit, except where society imposes a financial penalty for the ignoring of such costs or values. Shadow pricing appears, therefore, to be of little operational

use in a cardinal treatment of value and value changes. As a result, no further discussion of it is required in this thesis. In the property market, development decisions are currently made on the basis of revealed prices which are regarded as indicative of market value.

4.5.12 The question must now, therefore, be asked:

Can the true Market Value of property be accurately measured in a 'free' market where perfect knowledge is not available?

Notwithstanding the problems presented by the heterogeneity of real property, there is a low frequency of transactions and a paucity of reported prices in relation to town centre sites and retail premises. It is necessary, therefore, to bear in mind that, within constraints, land and property generally reaches its highest and best use having regard to all the potential bidders' assumed states of the market at the time of the rent bid (i.e. a lack of knowledge of all the alternative properties available). However, it is reasonable to assume that, although each bidder will have added his own assumptions to his knowledge of the market, statistically the results of all bids and the combining of all

revealed knowledge will result in revealed market prices (or rent) moving towards the equilibrium price and, therefore, towards that being a true reflection of market value in the market conditions prevailing at the time of the rent bid for the interest.

4.5.13 It is also necessary, however, to be aware that, as there can be more than one legal interest subsisting in a property at any one time, there may be several different rentals passing simultaneously in respect of the same premises. The aggregate value of occupation rent and the profit rentals (i.e. the differences between rent receivable from a sub tenant and the rent paid to mesne landlord) arising from each situation should equate to the full current market rental value of the property. But, on a cautionary note, the sum of the capital values of all the separate interests will not equate to the market value of the property were it to be available for letting as a whole, or were it let in parts, at full market rents. Moreover, it is also possible for a landlord to be in receipt of higher rentals than would be normally possible due either to the reasons set out earlier (imperfect knowledge) or,

among other things, to the existence of a fixed rent/fixed term agreement, or to a falling of rental values in the area over a period of time or to economies of scale. In any of these cases, the excess rent earned will eventually cease when rentals are reviewed in the light of known circumstances - as a result, the capital value of the property will be reduced. The converse applies where it is the landlord's market knowledge which is lacking - his asking rent will be too low in a rising market.

- 4.5.14 Another problem exists, from the analyst's viewpoint; the rents actually passing in respect of a property may not be 'full market rents' for another reason. There may have been an historic 'premium' payment of which the analyst is unaware. This makes the comparison of rental values very difficult unless the full terms of the tenancy agreement and the financial arrangements are known, but the expert valuer will already be aware of this problem and ensure a thorough investigation of the circumstances of each letting analysed before using the revealed rentals in any model.

- 4.5.15 Although imperfection of knowledge can result in

land and property, in substantially the same locations, being bought and sold, or rented, at substantially different prices⁽⁶⁷⁾, proper analysis and adjustment is not impossible and again it can be said, therefore, that in a relatively free market the revealed price at which land and property changes hands (rental or capital value) is a reasonably accurate measure of its true open market value - in terms of money.

4.6 Development Potential and Latent Value

4.6.1 Property development or redevelopment occurs when it becomes economically justifiable to build on a site or to demolish existing premises and build new. However, it is also possible that, in such circumstances, the developer is not intending to be the occupier (see 4.2.2) - this is increasingly the case - and as an entrepreneur he is seeking only to maximise profits (returns) by releasing the 'latent value' from the site by either i/ the application of further capital in the form of new buildings (improvements) or ii/ a change of use to a higher and better use.

4.6.2 The fact that these two possible ways of

realising latent value, or some part of it, exist must immediately raise a suspicion that 'latent value' may not be a uniquely quantifiable amount, or alternatively that it may be a composite amount. Later in this thesis, therefore, it will be considered whether latent value is a supply or a demand phenomenon or whether, as a composite value, it is derived from both sources.

- 4.6.3 The profit released by development can be described as being a function of the cost of action relative to the property value or new use created. These costs of action must take into account the ripening or waiting costs/holding costs involved in preparing the property for development, interest on capital during the waiting and developing periods and, in the case of public authorities, the amount of any compensation paid to former owners or occupiers of the site or property. This latter results in the cost of acquisition being higher than the existing use value. In normal valuation technique these are taken into account by carrying out a 'residual basis' valuation, but infrastructure costs, compensation for disturbance, etc., are not normally included

unless a financial contribution is required from the developer. In other words, the developer's only interest is in his private costs of development - he has no interest in any identifiable public financial costs and is not in the least concerned with unquantifiable social costs.

4.6.4 The residual basis of valuation mentioned above can be used to assess either site (or existing property) value for development - a different 'value' from the value in existing use - or the profitability of the proposed development project. Any increase in value, i.e. value for development, over existing use value has been described in economic terms as being the surplus of economic rent over opportunity cost, the opportunity cost being its value in its next best use. However, this idea may need modification for practical purposes.

4.6.5 Consider for a moment the situation where the existing use (or lack of use) is not the next best use vis a vis the development proposed, nor even the fifth best in a ranking order. Is the increase in the value the sum of the surpluses for each higher and better use until the highest

and best is reached? Is this what is meant by 'latent value'? Consider first the question of how the development value has been determined. The increase in value over existing use value is a demand determined surplus based on an assessment of the value of the completed project. At this point it would be prudent to ask whether that project is, with the imperfect knowledge of the market, the highest and best use for the site.

- 4.6.6 However, the answer to this question is not relevant to the developer who believes he knows that his project is the highest and best use for the site. As a result the assessment of value of the completed project is based on the present value of the expected future stream of income (rent) which is, itself, based on the estimated profitability of the potential occupiers' businesses and the resultant expected rent-bids (i.e. maximisation of use). Therefore, although the scheme may not be the highest and best use for the site, it may have to be accepted as being the scheme which provides the maximum realisable value given the market imperfections, i.e. in the given state of knowledge (or ignorance).

5. Retail Theories and Models

5.1 Operational Value of Existing Theories

5.1.1 Having decided to limit the initial scope of this research to the area of property values related to retail development it was felt necessary to look again, in more depth, at the various theories which have been put forward to explain the development of retail clusters (shopping centres) and the various attempts at modelling them. It must be borne in mind throughout, however, that the purpose of these theories and models is primarily to explain location and they are, therefore, looked at only from the point of view of their operational usefulness to the proposed research. What follows is a review of relevant points from the general theories discussed earlier.

5.2 Competition

5.2.1 Retail location theory relies on 'competition' and the fight for spatially protected markets; pure retail location theory is a fairly recent development but some of the more general location

theories have been developed to the point where some of their considerations are also relevant to the development of a retail property value theory; Hotelling looked at oligopolistic competition and Chamberlin investigated monopolistic competition from the production point of view, but neither of these has been fully integrated into general equilibrium study.

- 5.2.3 They are useful, however, in their explanation of monopolistic competition which occurs relatively often in, for example, urban retail grocery due to spatial patterns of local shops. However, oligopolistic situations better describe competition between department stores, multiples and higher order durables vendors in town centres. The resulting competition has a significant effect (see later).

5.3 Flexibility

- 5.3.1 The sunk cost of immobile factors of production and the transaction cost of both present and future legal and financial commitments tend to bind a given activity to a given site and, as a result, cut down on a firm's mobility. Applied specifically to shops, this explains why

retailers with reduced profit patterns who ought to change location cannot do so; because the cost of moving, and other financial considerations, would be too great. The most important of these other considerations are losses which can arise as a result of legal commitments, e.g. covenants, in a lease, to pay a certain rent for a specified period, which can mean that a retailer would have to make a substantial payment to the landlord if a move to cheaper (rented) premises was contemplated and the residue of the lease was not readily saleable or assignment was prevented by covenant. Freeholder occupiers would likewise have the problem of realising the value of their investments; this takes time and may, therefore, involve a significant financial loss. In other words, the greater the fixed costs in relation to variable costs, the greater the inertia.

5.4 Productivity

- 5.4.1 Retail productivity is highly dependent on location. Within a short distance the advantages of sites for retail use can change dramatically, not only because of differences in operating costs but due to the influence of location on the

volume of sales and often, also, on the selling price of the goods. Given the need to attract customers to a retail location, the number of sites in an urban area which could be profitably used for retailing, especially of high order durable goods, is strictly limited.

5.4.2 Consumer orientation of retail facilities must be, therefore, a first principle of any theory to explain retail location whether at the aggregate or the individual level; this must lead, ultimately, to a situation where retailers offer the highest prices for sites or shops with the greatest relative access advantages.

5.4.3 In plain terms: the more customers they can attract, the higher the spending power and the higher the potential profits. Where potential profits are high, rent bids are also high and these, in turn, can result in a high capital value.

5.5 Central Place Theory

5.5.1 In extending and focusing the discussion earlier in this chapter again it should be noted that Central Place Theory, as originally put forward

by Christaller and Losch, has been extended by the work of Garrison, Mayer and Berry. It now covers not only the distribution of retail and service activities between different urban areas but also their distribution within urban areas.

5.5.2 The two tier concept of threshold and range is still utilised at intra-urban level although boundary determination becomes rather unclear. Where location is selected so as to maintain an equilibrium of range and threshold, the long run effect is that shops earn only normal profits provided that the threshold sales are transacted at minimum cost. This requires a location which minimises delivery cost or, alternatively, where a consumer comes to the retailer to purchase the good, a location which minimises consumer movement costs. This, again, indicates that, in a consideration of a town centre, pedestrian flows and intervening opportunities have a large part to play in any predictive model.

5.5.5 Over time, the intra-urban distribution of shops retailing a particular good is critically determined by the distribution of purchasing power which is allocated to individual shops by the degree of accessibility (Holton). One major

problem with the intra-urban distribution of shops is that clear cut markets disappear and overlapping of markets for individual shops is common. This is demonstrated by the tendency for retail shops to form clusters based, in the first instance, on ease of access, closeness to a daytime population of working customers, or both (e.g. in the central business district or town centre) and, in the second instance, on the existence of a large agglomeration of shopping opportunities at a single location which results in customers for one establishment becoming accessible (or having access) to other types of establishment, or even to competing shops in the same trade.

5.6 Equilibrium Theories

- 5.6.1 Four approaches to retailing location theory and models are apparent from a review of published works; the most elementary assuming that the volume of retail trade is directly related to purchasing power, measured either by density of income, accessibility to income or to population strata. Hill utilises such a concept in his work and even the Lowry model has this static equilibrium basis. All the models of such an

elementary nature can be criticised on the grounds that they do not adequately account for high value locations; in other words they tend to predict a uniform distribution of value. For this reason they will not be used in this research work.

5.7 Statistical Theories

- 5.7.1 A second approach is to utilise the statistical properties of spatial distribution, accepting that the location of retail units in an urban area does not fit a regular pattern. Originally postulated by Vining, further operational work has been carried out by Dacey, and Rogers. These works consider the statistical aspects of size, agglomeration tendencies and thresholds but, once again, their predictive capacity is poor. Because they contain no explicit reference to market demand or consumer behaviour, they do not enable predictions to be made of a distribution of levels of trade nor of the location of large clusters.

5.8 Modified Central Place Theories

- 5.8.1 The former two approaches of statistical and

equilibrium theories are integrated and utilised as the fundamental basis for the modern versions of central place theory developed by Berry (et al). This third approach to retail location requires three hypotheses: (a) that consumers are willing to travel to make their purchase, (b) that minimum size-thresholds differently affect distribution in various trades and (c) that these activities result in agglomeration. The first two define the range of the good and thus establish market areas for retail centres and the third is necessary to explain 'centres' rather than uniform distribution. The size-threshold leads eventually to a hierarchy (as previously mentioned: rank-size) of shopping centres by size of market area of 'hinterland'.

- 5.8.2 Work by Manchester University's Department of Town and Country Planning in a study of the proposed Haydock Hypermarket utilised these concepts - in particular the Christaller and Losch theories together with the works of Smailes and Carruthers⁽⁶⁸⁾. The published account of this work states "In the essence of these approaches, a region is seen to contain a range of central places which, because of their differing content (of shops, offices,

entertainments, etc.) can be arranged into a hierarchical system of nested levels wherein a centre of superior order 'provides not only those services that are unique to it, but also to some extent, the services offered by all lower centres in the hierarchy'. By studying each hierarchical level separately, the region may be divided into 'spheres of influence' or 'hinterlands' of each of the centres at that level. The boundaries of hinterlands are lines drawn so that the net flow of money (to be spent in competing centres) across them is zero. Larger centres are assumed to attract more money from greater distances and vice versa".

- 5.8.3 Although the Haydock Study was based on the concepts of hierarchy and central place theory they required amendment and extension to explain, properly, the 'attraction' of various centres and, properly, to delineate the hinterland for each centre. To do this, a modified form of Reilly's Law was applied to journeys by private car. Such a technique is useful to the present research programme in that it will be necessary to define the 'hinterland' for any particular town centre under consideration both before and after the event.

5.9 Gravity Models

5.9.1 The basic concept of accessibility is the fourth, and most relevant, approach and is developed from the original concepts of attenuation of interaction over distance; more particularly the 'gravity model' hypothesis that the spatial separation of supply and demand inversely affects their interaction. Originally conceived by Reilly to describe the relative attraction of two cities, the original 'law' states that "Two centres attract trade from intermediate places approximately in direct proportion to the size of the centres and in inverse proportion to the square of the distances from these two centres to the intermediate place". As Reilly originally formulated:

$$\frac{T_a}{T_b} = \left(\frac{P_a}{P_b} \right) \cdot \left(\frac{D_b}{D_a} \right)^2$$

where T_a and T_b are the trade drawn to the centres A and B from the intermediate place, D_a and D_b are the distances from two centres to the intermediate place and P_a , P_b are the population sizes of the two centres. The market area of

each centre is delineated by the line of equal attraction between them, i.e. where $T_a/T_b = 1$.

5.9.2 As conceived by Reilly, the 'law' has no empirical basis. It was obtained by intuitive analogy with the theories of mass and attraction to be found in classical Physics. Reilly's field tests produced exponent values for D ranging from zero to 12.5 and has, as a result, been the subject of much criticism (e.g. Schwartz⁽⁶⁹⁾ and Thompson⁽⁷⁰⁾). The use of an exponential constant (Reilly uses a value of 2) has no empirical basis for retail gravitational interaction - see later. The basic difference between gravity theory and central place theory is that the former does not assume the existence of non-overlapping or exclusive market areas but that every consumer has some probability of interacting with every shopping centre. However, this distinction is mainly theoretical as, in practice, the probability of interaction falls off very rapidly outside the boundary of a particular market area.

5.9.3 Further work by Huff⁽⁷¹⁾ and the work by Lakshmannan & Hansen has developed these ideas into workable models whose basic operational

features are: (a) the formulation of a model of consumer behaviour with regard to shopping travel by analogy with trip-making behaviour, (b) the projection of the future location of purchasing power, (c) the definition of the future state of the transportation system in relation to (a) above, (d) the choosing of a set of shopping centre locations and (e) an examination of the interaction of consumers with these centres.

5.9.4 In the event that the number of consumers predicted exceeds the number of opportunities available, the size may be contracted or the centre deleted altogether. Lakshmannan and Hansen's derivation of behavioural parameters was taken from trip-making behaviour for shopping purposes, whereas, in other work by Harris⁽⁷²⁾ and Fidler⁽⁷³⁾, parameters optimising the match between opportunities and arrivals in an existing pattern were sought. In these cases actual travel behaviour was implicit rather than explicit and was thus not directly analysed. Behavioural parameters are difficult to set in the context of simplified models and theories.

5.9.5 Another difficulty is the determination of a hierarchical structure in retail trade. Both

Lakshmannan & Hansen and Fidler handle thresholds and scale economies essentially by dealing only with shopping centres of a certain minimum size. Further questions must be raised regarding the treatment of joint demand for retail facilities by different classes of population and the population based at home vis a vis. the work based population. Again the Lakshmannan & Hansen and Fidler models consider only the residentially based demand. Harris, on the other hand, has stratified the demand as well as dividing the demanders into residentially based and employment located.

5.10 The Manchester Shopping Models

- 5.10.1 Further work in this area of shopping and gravity modelling has been carried out by the Manchester University team led by Parry-Lewis following on from the 'Haydock Study'. Their work is based on the Lakshmannan & Hansen hypothesis "that the sales potential of a retail centre is directly related to its size to its proximity to the number and prosperity of the consumers (and) to how disposed it is to competing shopping facilities consequently the location or sales potential of a retail centre is

not to be viewed as a function of the purchasing power of an arbitrary spatial slice of the region. More realistically, it (the theory) describes a situation of overlapping competition between shopping centres and develops a mathematical framework for measuring it".

5.10.2 The Manchester University shopping model provides a much better simulation of real world shopping behaviour than the earlier models based on central place theory but, in terms of its usefulness as a practical valuation tool, predicting the effect of proposed changes on the value of individual properties, it is still on a much too highly aggregative plane.

5.10.3 Other work subsequently carried out at Manchester reviewed the available techniques for assessment of shopping potential and introduced a further parameter to the shopping model. Parry-Lewis and Traill suggest that there is competition between consumers for available opportunities and that this competitiveness of consumers decreases with increasing distance from a shopping centre. As a result, an opportunity-claimant model can be constructed where the effective number of competitors for opportunities in the centre may

be written

$$C_j = P_j + \sum_{i=1}^n \frac{P_i}{d_{ij}^\beta}$$

where C_j is the effective number of competitors
at centre j

P_j is the population of claimants at
centre j

P_i is the population of claimants in other
zones or centres

d is the distance (time-distance)
from i to j and β is an exponent
(determined empirically)

This can be substituted into the normal gravity
model to give the spending of residents of zone i
in zone j as:

$$\sum_{j=1}^n \frac{A_j^\alpha}{C_j^\delta d_{ij}^\beta}$$

where A_j is a measure of the size of (the
population of) zone j .

and C_j is a measure of the number of effective
competitors for the opportunities in j
such that

$$C_j = P_j + \sum_{i=1}^n \frac{P_i}{d_{ij}^\beta}$$

where P_j = the population of claimants in zone i
and β = an exponent to be determined
empirically.

5.10.4 Effectively this model represents the reduction of the attractive power of a shopping centre by an amount proportional to the number of people using the centre (i.e. allowing for the unattractive effect of congested shopping areas). In practice a threshold value could be introduced for C_j so that consumer competition only becomes effective after the car parking capacity or shopping capacity is fully utilised.

5.10.5 The modification to reflect car parking facilities and other aspects of accessibility is discussed in Parry-Lewis and Traill's paper where it is suggested that their adequacy or otherwise can be reflected in the measure of journey time, as the distance-time relationship is really a proxy for some measure of the total cost of the journey defined in a way which takes account of convenience and opportunities as well as of more obvious monetary costs.

5.11 Attractiveness Factors

5.11.1 Two further aspects of gravity modelling in retailing require attention before any discussion of the subject is complete. Firstly the question of 'attractiveness' of centres - as used in the Manchester University shopping model:

$$S_j = \sum_{i=1}^m C_i \cdot \frac{\frac{F_j^\beta}{d_{ij}^\alpha}}{\sum_{k=1}^n \frac{F_k^\beta}{d_{ik}^\alpha}}$$

where S_j = sales in the j^{th} centre of a series of n centres

C_i = consumer/retail spending power available from the i^{th} zone of m zones

F_j = the size or attractive power of the shopping centre in j^{th} zone

F_k = the size or attractive power of the shopping centre in the k^{th} zone

d_{ij} = driving time between centroids of zone i and centre j

β = an exponent applied to F , the attractive power of the centre

α = an exponent applied to d

m = total number of zones of spending

power

n = total number of shopping centres
considered

5.11.2 The attractiveness factor in this model is a derived index of attraction using 21 indices of shopping, entertainment and service content. The published account admits to being unable to use a floorspace indicator (as in the Lakshmannan and Hansen model) due to lack of time, although it would appear that availability of shopping floorspace is a better indication than population size (as in Reilly's original 'law') where urban settlements are closely linked.

5.12 Alternative or Modified Attractiveness Factors

5.12.1 An investigation made by Kilsby, Tulip and Bristow⁽⁷⁴⁾, on behalf of the Ministry of Transport, looked at the common postulation of the gravity model, i.e. that the number of trips from a residential zone to a shopping centre is a function of the number of residents in the zone, the 'attractiveness' or drawing power of the shopping centre and the cost of travelling from the place of residence to the shopping centre. The general acceptance of fit between observed

shopping patterns and those predicted by the gravity model when some measure of size is used as a proxy for 'attractiveness' was questioned in two ways:

"(1) How should the size of a shopping centre be measured for purposes of prediction of trips by a gravity model?" and

"(2) If we accept that size is a dominant ingredient of attractiveness, for modelling purposes, can we obtain a better fit by invoking some other measurements, to produce a more complicated definition of attractiveness based on size and other characteristics of the centre?"

5.12.2 Eventually a list of 43 attributes or variables was produced, listed against survey information, and the results compared with those obtained by use of a conventional gravity model. In no case (in the Manchester data) was there a weighted sum of principal components that would significantly improve the fit. This suggests that there is little point in introducing these other components - "Almost any measure of 'size' is a good proxy for it (attractiveness)".

5.13 Profitability in Models

5.13.1 The second piece of work which is of some relevance to both the above considerations and to the proposed research is the concept of profitability in shopping models put forward by Parry-Lewis⁽⁷⁵⁾. The work considers not only the spending power available (as in other shopping models) but also the other factors which affect the decisions of retailers. In simple terms the gravity model is used to determine the volume of spending in a particular centre arising out of its surrounding population and the population of adjoining areas and from this can be determined the volume of sales per square metre or per square foot of floorspace.

5.13.2 A prospective shopkeeper aware of the current costs of running his particular business will be able to predict his gross profit, cost of labour and other overheads. He will also be aware of the yield required on his capital investment and from these known factors he will be able to determine the maximum amount he would be willing to pay in rent. The demand for shop floorspace, therefore, is related to profit per unit floorspace which is itself affected by the

increase or decrease in floorspace available relative to the population spending potential. Parry-Lewis sees this theory being developed into a predictive model of the growth or decline of certain centres or certain kinds of shopping in specified centres. In my view this is a most useful beginning to a theory of spatial distribution of real property values and it has been most useful to the research described in this thesis. Property values are really another measure of growth or decline.

5.14 Summary - Location

5.14.1 With the exception of the last work cited, all the theories and models currently available are explanations of retail location, mainly on an aggregative scale. It is not known how much disaggregation of shopping by trades (or lines) is possible without these existing theories becoming unreliable, but they all point to a requirement for a new initiative at the 'micro-micro level' of urban retailing theory.

5.15 Problems of Gravity Models

5.15.1 Accepting that gravity models give the best

explanation of aggregate analysis and projection of retail locations and that a volume of potential sales can be derived for a single shopping centre, the time has come for (1) an investigation of the effects of increasing floorspace on existing shops in aggregate and (2) an investigation of the effect of development poles (magnet shopping centres) on individual shops by analysing the process by which the total volume of sales is distributed in a town centre shopping area.

5.15.2 A major problem is defining the boundary of the 'hinterland' for each trade. For certain kinds of goods the effective boundary is further away than for others. As a result, two types of survey are needed - one to determine household incomes and where a resident population goes to do its shopping⁽⁶⁰⁾ and the other to ask shoppers in a centre about where they live and how they travel to shop. One factor in all the cited studies and theories is the collective suggestion that transportation considerations are important in shopping centre location.

5.15.3 Parry-Lewis and Traill in their paper on shopping potential and demand make the point that location

models should also predict the likely effects of their actions on other shopping - their intention was to prevent over supply of new shops but it is equally important to be concerned about the effects on existing shops - nothing is more depressing to a shopper than rows of empty (older) shops and this can lead to a contagious process of town centre decline.

5.15.4 This process of decline was discussed in a paper entitled "Decay Development and Land Values" which developed the concept of obsolescence, decay and their link with general redevelopment requirements. The authors suggested that a simulation model might be one way of studying the problem and, some 17 years later, earlier suggestions by Capper and Parry-Lewis⁽⁷⁶⁾ came to fruition in Mandebus - the Manchester Decision Based Urban Simulator. An outline of the concepts dealt with by this model is included earlier in this chapter (3.6.13) and it is sufficient, here, only to reiterate that it contained a Redevelopment Model, a Shopping Model, an Office Model, a Commercial Tenancy Model, an Employment Model, an Owner Occupied Housing Model, a Rental Housing Model, a House

Building Model and a Network Model. It was, in fact, a simulated town.

5.15.5 The report makes the point that in any process of computer modelling there has to be simplification and compromise. It also draws attention to the existence of the possibility of questioning such an approach by comparison with the ways in which people really 'behave'. It justifies its approach, however, by asserting that the hypothesis that people do behave in the way that the model is structured is not unreasonable and that even if they do not, its use may lead to approximately right conclusions.

5.16 Other relevant topics

5.16.1 In concluding this survey of retail location theory, mention must be made of three recent publications which, whilst not specifically on retailing theory, do have some relevance and are of use in the research considerations. Briefly outlined, these works by Sibert⁽⁷⁷⁾, Odland⁽⁷⁸⁾ and Odland & Balzer⁽⁷⁹⁾ cover i/ the areas of spatial autocorrelation of Assessed Property Values (the American equivalent of the U.K. Rating System), ii/ a conditional-probability

approach to the development of spatial pattern (a stochastic model used in investigating housing deterioration) which relates the probability of deterioration with the presence of deteriorated structures nearby, and iii/ an empirical analysis of the contagious process of deterioration due to localised externalities. Parts of such theories and models have some relevance to the deterioration of shop properties following an initial depreciation in value and a change in accesssibility.

5.17 The Necessity of Review

5.17.1 In the light of the literature review and the considerations of value, price and other related topics, it becomes clear that the preliminary hypothesis set out in Chapter 1 of this thesis is in need of review and restatement taking account of the terminology developed and elicited from the review and the redefinition of the phenomena under consideration

5.17.2 The term 'latent value' used by the landed professions and discussed in Chapter 1 does not properly describe the identified phenomenon of

additional value realised as a result of development. During the course of the research the terminology has, therefore, been redefined. It has been necessary to find an explanation and a terminology which satisfactorily describe, in relation to a development scheme, only that part of the increase in value released by the satisfying of a previously unsatisfied, or increased, demand by a change in use or by an application of enterprise and/or capital and labour to a given piece of land or property.

5.17.3 The development of these explanations and the new terminology are combined together in the next chapter and lead to the construction of a new model of retail property value.

CHAPTER THREE

THE DEVELOPMENT OF A MODEL OF PROPERTY VALUE

1. The Hypothesis and the Model

1.1. Introduction

1.1.1 In Chapter 1 the two concepts of latent value and translated value were discussed and clarified. From that discussion it will be recalled that latent value can properly be used to describe only that part of an increase in value released by the satisfying of a previously unsatisfied demand by a change in use, or a change in the intensity of use, of a given piece of land or property by the application of enterprise and/or capital and labour.

1.1.2 Any other increase in the value of a property which occurs not as a result of a change in the intensity of demand but as a result of a change in its locational distribution must now be properly regarded as translated value. Translated value is present, therefore, where applications of capital to land (as in a property

development) result in additional or disproportionate increases in value.

1.1.3 The increased value which can be released in existing properties, or sites, without any resource expenditure also consists of a realisation of i/ Latent Value and ii/ Translated Value. This is not, however, a subject for investigation in this thesis as the release is not as a result of development or as a result of change in use or of any proposals for the same; even though where there has been no change in the intensity of demand, but a change in its locational distribution, the amount of the resultant increase or decrease in value is that which is described in this thesis as Translated Value.

1.2 Statement of a Model of Property Value

1.2.1 In the earlier chapters of this thesis, reference was made to the standard developer's model used in financial appraisals of development projects. This basic model was written as follows:-

$$GDV_i - (GDC + NP) = RDV_i$$

where GDV_i = Gross Development Value
(based on capitalised rental estimates)

GDC = Gross Development Costs
(excluding acquisition costs)

NP = Normal Profits (i.e. the minimum acceptable to the entrepreneur)

and RDV_i = $CUV_i + X_i$

where CUV_i = the Current Use Value of the property

X_i = an increase in value (latent or translated)

1.2.2 In line with the hypothesis, the potential value of a proposed development site or property could be described and defined in the following forms:-

$$DPV_{i\max} = CUV_i + LV_i + TV_i$$

where $DPV_{i\max}$ = the maximum potential development value for property i

LV_i = the latent value attracted to property i

TV_i = the translated value
attracted to property i

and if LV_i = $FDV_i + IV_i$

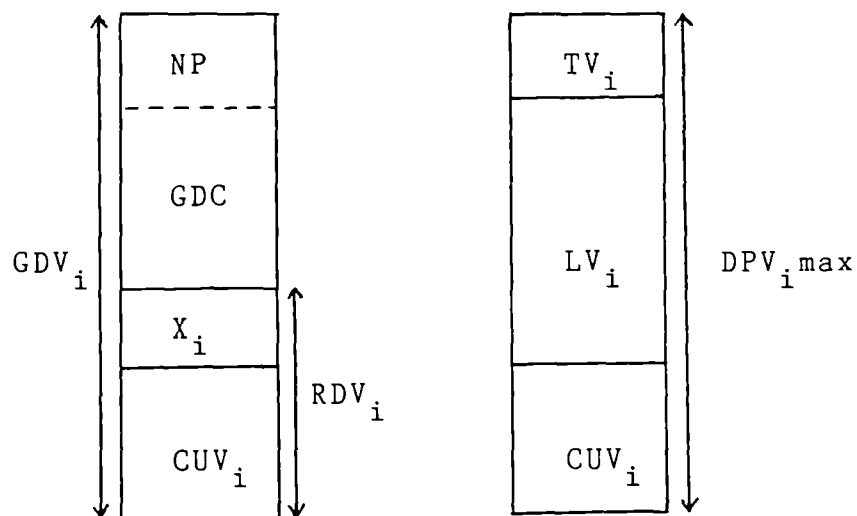
where FDV_i = the amount of frustrated
demand value available to
property i

IV_i = the amount of intensity
value available to
property i

then the total for all properties will be:

$$DPV_{\max} = \sum_{i=1}^n (CUV_i + FDV_i + IV_i)$$

1.2.3 Comparing these two sets of equations in
diagrammatic form



(FIGURE 1)

it can be seen that where

$$GDV_i = DPV_i \max$$

then

$$GDV_i = CUV_i + (GDC + NP) + X_i = CUV_i + FDV_i + IV_i + TV_i$$

and if

$$(GDC + NP) + X_i = FDV_i + IV_i + TV_i$$

then

$$X_i = (FDV_i + IV_i + TV_i) - (GDC + NP)$$

and

$$X_i = GDV_i - CUV_i - (GDC + NP)$$

From this derivation it follows that

$$\text{where } (GDC + NP) = (FDV_i + IV_i)$$

$$\text{then } X_i = TV_i$$

That is to say:

$$GDV_i - CUV_i - (GDC + NP) = \begin{array}{l} \text{Aggregate loss} \\ \text{in value of} \\ \text{adjacent} \\ \text{properties} \end{array}$$

1.2.4 As can be seen from the equations above, if the hypothesis is to hold good TV_i should sum to zero over the whole value surface. It has been

necessary, therefore, to consider the structure and derivation of CUV_i and LV_i in more detail.

1.2.5 The idea of TV_i summing to zero could, in itself, be challenged on the grounds that increased resource efficiency, in new or improved retail property, would act to change the structure or quality of demand and, as a result, there might be some opposition to limiting the surface over which TV might be non-zero. There are, however, arguments to suggest that a non-zero sum of Translated Value might be possible within the whole universe of interactions and, because such a challenge is critical to the whole debate and is central to the hypothesis, an attempt will be made in this research to test the threshold over which the effect can be measured.

1.2.6 For the moment, despite a detailed consideration of the effects of increased resource efficiency, it is proposed, for the early stages of model development, to retain the ceteris paribus condition by holding demand constant and allowing only capacity to change. A further constraint has been deliberately imposed on the form of the model in that it has become obvious, whilst investigating the derivation of value, that the

present structure of current use values (CUV_i) results from historical forces, many of which occurred one hundred or more years ago and are not likely to re-occur. It is not the purpose of this research to try to explain these past effects; more important is the ability to understand the modern forces affecting the urban structure. As a result the model should look to the future, not to the past, and be capable of explaining the consequences of applications of capital (shocks) to the existing system of retail outlets in terms of predicted changes in revealed prices (bid rents and capital values).

- 1.2.7 Further refinement of the terms used in the original descriptive models have been made:
- CUV = the current use value resulting from effective demand
- IV = intensity value available from the release of frustrated demand, i.e. those shopping trips which, at current market prices, could be made but are not because of lack of opportunity or attractiveness
- (IV is potentially of two possible types:
- IV_1 = intensity value resulting from supply-led demand, and
- IV_2 = intensity value resulting from the

release of frustrated demand and
the attraction of some supply-led
demand

but as these will be extremely difficult to
separate due to their overlapping it is proposed
to continue to use the single variable IV for the
time being.)

EC = excess capacity in a shop, or an
 oversupply of shops, which results
 in CUV not being maximised

TV = translated value (+ve or -ve) at a
 shop or centre

and it should be noted, at this point, that
'Latent Value' is not represented by IV and EC
which are mutually exclusive, one being a demand-
side variable and the other a supply-side
variable. In any general equilibrium model
neither will exist; Frustrated Demand and Excess
Capacity are temporary conditions in a dynamic
situation.

2 The Mathematical Formulation of Property Value

2.1 A Derivation of Value

2.1.1 In deciding on the theoretical basis of the

derivation model consideration was given to several hypotheses, in particular to the Freidman⁽¹⁾, Duesenberry⁽²⁾ & Modigliani^(3 & 4) hypotheses as alternatives to the Keynesian⁽⁵⁾ derivation of the consumption function.

2.1.2 The classical school of thought suggests that perfect competition leads to optimum efficiency in the allocation of economic resources. Firms and consumers make decentralised economic choices, each in their own interests. The allocation of resources is, therefore, particular to a given income distribution. However, in the 20th century, real-world persistent unemployment and the development of oligopoly and monopoly trading resulted in divergence from the free market model of efficient resource allocation.

2.1.3. As a result, the post 1945 mixed-market economy in Britain results from an acceptance of Keynes' ideas. These predominantly propose government intervention to ensure more efficient allocation of fully employed resources than the market alone could achieve. By way of contrast, the Marxist school of thought as currently envisaged goes even further. It proposes that the efficient

allocation of resources and a more equitable distribution of income can only be achieved by central economic planning.

2.1.4 The Keynesian approach suggests that:

- i Real consumption expenditures are a stable function of real income, and
 - ii Marginal propensity to consume is positive but less than 1
- also
- iii the marginal propensity to consume is less than the average propensity to consume, and
 - iv marginal propensity to consume probably declines as income rises.

2.1.5 This takes on board the fundamental psychological law that consumers are disposed, as a rule and on the average, to increase their consumption as their income rises, but not by as much as the increase in their income.

2.1.6 Duesenberry developed the consumption hypothesis further by stating that in any consideration of consumption it should be noted that it is not absolute income that determines the level of consumption but rather the relative income of the

consumer in relation to the income and consumption of other consumers. This leads to the conclusion that families/households with low relative incomes are inclined to dis-save, whilst families/households with high relative incomes are inclined to save. The Duesenberry approach, therefore, contemplates a fairly flat short run consumption function that drifts slowly upwards over time.

2.1.7 With Friedman, and the advent of monetarism, a return to a relatively free market economy was contemplated. Some government intervention was envisaged but really only to manage the money supply, control oligopolies and provide essential public goods - thus ensuring an efficient allocation of resources. Monetarism, in fact, converges the classical and the marxist theories.

2.1.8 Friedman, in his theory of the consumption function, sees income as split into permanent income and windfall income, i.e.

$$Y = Y_p + i/w \quad C = C_p + C_w$$

2.1.9 If this is so, then the windfall income and, therefore, the windfall consumption are

transitory and uncorrelated. Friedman says that the true consumption function should read:

$$C_{pt} = K Y_{pt}$$

where K = the marginal propensity to consume permanent income, and
 t = time

2.1.10 Friedman also claims that consumers attempt to manoeuvre utility to their advantage and this implies a consumption plan that does not vary with windfall gains and losses but is based on regular income. The mechanism is, therefore, adaptive:

$$Y_{pt} = Y_{p(t-1)} + g \left(Y_t - Y_{p(t-1)} \right)$$

and, therefore, Friedman's hypothesis becomes

$$C_{pt} = K (1-g) Y_{p(t-1)} + K_g Y_t$$

2.1.11 Modigliani, however, suggests that consumers attempt to stabilise their consumption over entire lifetimes and, in a simplified analysis assuming a particular form for preferences made the assumption, in behavioural terms, that total

resources were allocated between periods so that the ratio of each period's monetary expenditure to total lifetime resources was independent of the size of total resources. Like the earlier writers on life cycle models of the consumption function, Modigliani emphasises wealth as a determining variable. Starting from a homothetic model in which, at constant prices, consumption is proportionate to income for each age group he aggregates consumption by assuming that the distributions of assets, income, and expected income are each invariant with respect to age structure. Thus, the expective model is

$$C_t = \beta_1 Y_t + \beta_2 Y_t^e + \beta_3 A_t$$

Where Y_t^e is an aggregate measure of expected future incomes

A_t is the value of assets held at time t ,

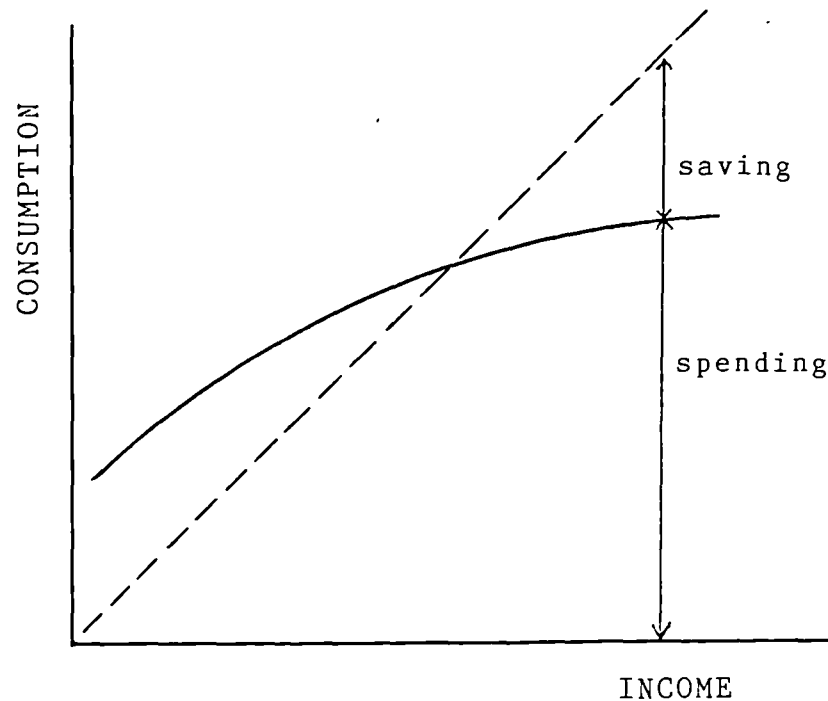
and $\beta_{1,2,3}$ are parameters

2.1.12 Whichever of the several hypotheses is preferred, it is noticeable that every study of consumption confirms that consumption is a function of disposable income. Therefore, in general terms:

$$Y = C + S \quad \text{and} \quad C = Y - S$$

2.1.13 That is to say, when disposable income rises consumption also rises. Beyond a certain level consumption rises less steeply than income:

The Consumption Function



(FIGURE 2)

and it is accepted that the relationship between the two variables is relatively complex. It must also be noted that on low levels of income, consumption exceeds income, implying depletion of savings or welfare contributions of some sort.

2.1.14 Whichever basis of calculation is utilised, the result is a measure of consumption expenditure

and it is this figure which is the starting point for the present model. Therefore, for the purposes of this model it may be assumed that consumption is proportional to disposable income in a fixed manner and, for simplicity, and by way of example, the Keynesian derivation of consumption expenditure is utilised. There is clear room for improvement here but for the purposes of this thesis the only viable alternative is to assume an exogenous distribution of consumption expenditure. In fact, as will be seen, the latter alternative became necessary but, for the theoretical statement, it was deemed important to specify, approximately, each of the model's potential stages.

2.2. The Derivation Model

2.2.1 Let: $C_{rt} = \alpha_r + \beta YD_{rt} + \mu$

(Equation 1)

where C_{rt} = the regional average
consumer expenditure per
household in time period t
and YD_{rt} = the regional net product
per household in time
period t

both of which should be available from published statistical sources.

2.2.2 Taking the regional consumption expenditure, it is adjusted to accommodate variations from town to town by means of a demographic factor:

$$C_{dt} = C_{rt} \frac{\theta_d}{\theta_r}$$

(Equation 2)

Where C_{dt} = the average consumer expenditure per household of town d in time period t
and θ = a demographic factor based on, for example, wage structure, an average age factor and a headship/family structure factor

The construction of a practical θ factor is discussed in Part Two of the thesis.

2.2.3 The amount of retail spending per household can be determined by the disaggregation of C_d :

$$C_d = H_d + (T_h + S_h)$$

where H_d = the amount spent on household accommodation
 T_h = the cost of transportation involved in a shopping trip

and S_h = the balance available for
retail purchases.

2.2.4 It is accepted that, strictly interpreted, the balance available for retail purchases is not the same as the amount of spending by an individual household. However, the amount of savings by the members of a household might be regarded as merely deferred spending. Therefore, in a general consideration of the behaviour of the set of all households it may be assumed that savings from time period $t - 1$ will be spent in time period t and savings in time period t will be spent in time period $t+1$. The net result of these activities will be to allow, for the purpose of this model, the assumption that the variable S_h represents the total retail spending of the household in the period under consideration.

2.2.5 As T and S in the previous equation are difficult to separate, the equation can be re-written:

$$S_h = \gamma(C_d - H_d)$$

and the total retail spending by the households comprising any town (or employment catchment area) in time period t will be:

$$S_{dt} = \sum_{h=1}^n S_{ht}$$

(Equation 3)

2.3. The Inter Urban Allocation Model

2.3.1 In order to allocate this total retail spending to different shopping centres the pattern of spending in each range of goods must be incorporated into the model. In this way the shopping hinterlands of town centres can be estimated.

2.3.2 However, to do this it is necessary to disaggregate the spending generated by the inhabitants of each town:

$$S_{gdt} = K_g S_{dt} \quad (\text{Equation 4})$$

where

$$\sum_{g=1}^n K_g = 1$$

K_g = the percentage of the total retail expenditure of the inhabitants of town d spent on a good or a range of goods g

and S_{gdt} = the total amount spent on a good or a range of goods g by the inhabitants of town d in time period t

(it is unlikely that there will be significant variations in the values of K_g from town to town, but any variations can be dealt with by the addition of a further subscript - making K_{gd})

2.3.3 The aggregate retail spending generated by the inhabitants of a town can now be allocated, by range of goods, to the available shopping centres by the use of a modified form of Huff's allocation model combined with part of Parry Lewis & Traill's opportunity claimant model. (N.B. There are many other gravity models available):-

$$S_{gdjt} = S_{gdt} \cdot A_{gdj} \quad (\text{Equation 5})$$

where S_{gdjt} = the amount of retail expenditure on good g in centre j by the inhabitants of town d in time period t

$$\text{and } A_{gdj} = \frac{\frac{F_{gj}^{\alpha}}{C_j^{\delta} Z_{dj}^{\lambda}}}{\sum_{j=1}^n \frac{F_j^{\alpha}}{C_j^{\delta} Z_{dj}^{\lambda}}}$$

where F_j = the total retail floorspace
in shopping centre j

F_{gj} = the floorspace used for the
sale of the range of goods g
in centre j

Z_{dj} = the travel time/cost from
town d to centre j

C_j = a congestion factor based
on the car parking capacity
of centre j

and where

$$\sum_{j=1}^n A_{gdj} = 1$$

2.3.4 Summing over d and g the total retail
expenditure in any shopping centre in time period
 t can be established:

$$S_{jt} = \sum_{d=1}^n \sum_{g=1}^m S_{gdt} \cdot A_{gdj}$$

(Equation 6)

2.4. The Intra-Urban Allocation Model

2.4.1 The allocation of the total amount of retail

spending in a centre to an individual shop location within that centre can be achieved by going back one stage in the previous model and starting with:

$$S_{gjt} = \sum_{d=1}^n S_{gdt} \cdot A_{gdj}$$

From which it is obvious that:

$$S_{gjt} \equiv \sum_{i=1}^n T_{git} \text{ and } S_{jt} \equiv \sum_{i=1}^n T_{it}$$

where T_{git} = the turnover of a retail shop selling the range of goods g at location i within the shopping centre j in time period t .

2.4.2 The disaggregation of S_{gj} to find T_{gi} can be achieved by the use of a form of gravity model, i.e. another attractiveness factor, Ω_i such that:

$$T_{git} = S_{gjt} \Omega_i$$

(Equation 7)

where $\Omega_i = f^{F_i, F_{ms}, L_{i/ms/op}, R_i, R_{ms}, F_{gi}, P_{gms}, Z_{i/cp}, W_{i/ms} \dots \text{etc.}}$

and where

F is a measure of floorspace

ms = magnet store/anchor store or main
shop)

cp = car park(s)

L = relative location

R = range of goods

P = price of goods

Z = travel time/cost convenience

W = a measure of in-store congestion

2.4.3 As the determination of a value for Ω_i will almost certainly give rise to practical difficulties it will be necessary to find a proxy measure of attractiveness and intervening opportunities. In considering the value of an individual shop and the amount of its trade there are, as can be seen above, many attributes that might have an effect. However, three dimensions stand out from the rest. These are: i/ size, ii/ accessibility and iii/ goodwill.

2.4.4 Goodwill would be a very difficult attribute to quantify, although it is possible to state that some occupiers attract more goodwill than others. These, particularly the larger and better known, constitute the magnet stores. However, in the construction of proxies it is not vital that a causal variable is used if the effect can be

measured in some other way. In this case a pedestrian flow could be considered to perform the necessary function in relation to accessibility and to some extent to goodwill. Floorspace, on the other hand, is a primary measure of attraction and also, to some extent, an indication of the likely existence of goodwill in that goodwill is more likely to exist where larger stores are occupied by nationally known operators (household names).

2.4.5 As with the inter urban allocation model, it should be possible to utilise a measure of floorspace as a relative measure of attraction and to attenuate it with a factor based on a measure of the pedestrian flow past the shop. This should give a sufficient measure for the empirical use of the model and in any calibration tests. Therefore, as a first approximation let us consider Equation 7 in the form

$$T_{git} = S_{gjt} \alpha_i \rho_s$$

where α_i = an attractiveness variable in the same form as A_{gdi}

$$\text{e.g.} \quad \frac{F_{gi}}{F_{gj}} \cdot \frac{F_{ms}}{F_j}$$

and ρ_s = a measure of pedestrian flow in street s

2.4.6 If such a structure were to be used for the attraction factor the resultant sum of predicted individual property turnovers in each retail group would be unlikely to equal the inputted aggregate turnover for the constituent shops in each group. The results thus produced would, therefore, be uncalibratable.

2.4.7 In order to ensure that the resultant allocation of consumer expenditure sums back to the original inputted amounts a structural change in the form of the allocation factor is necessary. Consider a proportioning factor of the form $\frac{x_i}{\sum x_i}$ i.e. a form where the size of the pedestrian flow in relation to some other measure of the size of the pedestrian flow provides the allocation mechanism. However, the ρ factor, as envisaged in 2.4.5, would be a figure based on the summation of the number of pedestrians passing the frontage of a particular shop on their way from, say, the car park of arrival to the magnet store. It would, therefore, be street specific. By contrast, the α factor is floorspace based and is of the same general shape as the inter-urban allocation model. It does not, however, have a time-distance reducing factor, this latter

being implicit within the pedestrian flow measure, ρ . Without a ρ factor the model would be based on the assumption that all retail floorspace is equally productive and equally attractive to all consumers. Clearly this cannot be so. Also, without a ρ factor the floorspace would not be spatially differentiated.

2.4.8 For these reasons, and also to ensure that the resultant allocation of consumer expenditure sums back to the inputted amounts, the structure of the allocation factors needs to be in a form that can not only maintain the existence of a linear relationship between ρ and α but also continues to operate as a proportioning factor. The structure thus requires that the size of the pedestrian flow should provide the attenuation of the consumption expenditure attracted to the individual shop location by a mere floorspace attraction factor.

2.4.9 We are, therefore, now looking at a factor of the structure

$$\frac{\alpha_i \rho_s}{\sum \alpha_i \rho_s}$$

but it is still obvious that ρ as a raw multiplier will not produce an attenuation of the required

order. Similar problems would exist with the addition of exponents to either α or ρ . The value of α will be less than unity and the addition of a further integer exponent would significantly reduce the effect of the floorspace element. Similarly, the addition of an exponent of less than unity, when taken in conjunction with the large ρ factor, would distort the allocation. What is really needed is a suitably calibrated linear structure which will allow the floorspace factor to respond to the relative size of the pedestrian flow.

- 2.4.10 Research enquiries (reported on page 277) indicated that a low unit multiplier was what was needed. If numbers of shoppers per square foot were up to, say, three or four times more at the centre then, logically, the attenuation of the floorspace attraction factor would need to be of that order. This leads, quite naturally, to the use of a denary log function of ρ to provide a multiplier for the floorspace attraction factor and Equation 7 could thus be substituted by:

$$T_{git} = S_{gjt} \frac{\alpha_i (\log \rho_s)}{\sum_{i=1}^n \alpha_i (\log \rho_s)}$$

(Equation 8)

2.5. The Rent Model

2.5.1 The derivation of rent levels for retail property requires the prediction of the level of profit derived from the turnover at the location. Profit may be assumed to be a function of consumer expenditure (turnover) and thus calculated deterministically or predicted stochastically. Thus, simply stated:

Deterministically $\pi_t = T_t - K_t$

or

Stochastically $\pi_t = \alpha + \beta TX + \mu$

where π_t = profit in time period t
earned at location i
 T_t = turnover (consumer
expenditure)

$$= \sum_{g=1}^n T_{git}$$

T_{git} = turnover of a retail shop
selling the range of goods g
at location i in the time
period t

K_t = Costs in time period t
incurred by operating at
location i (exclusive of
rent)

and X = vector of exogenous
variables, one of which is T

2.5.2 The stochastic form of model permits forecasting, but it lacks some economic realism and is, therefore, not found in use. It also requires very complex identification of variables and is non-behavioural in that only the most sophisticated operators would base expectations upon such a model. The simple deterministic form is an accounting relationship and only allows for the calculation of 'actual' profit. For the subsequent prediction of rents, however, it is the expected profit that is required. A solution is to use an expectations model; starting with:

$$\pi_t = T_t - K_t$$

and assuming a cost per unit K , a mark up rate

d-1 and fixed costs f:

$$\pi_t = nkd - nk - f$$

on a sales volume of n units. This form will be viable where (as is usually the case) a percentage mark up is used in preference to market pricing, i.e. as a reflection of market pricing.

2.5.3. However, these assumptions regarding K, d and f, are unnecessary. If a distinction is drawn between actual profit π^a and expected profit π^e then:

$$\pi_t^a = n^a k d^a - n^a k - f$$

But $n^a k d^a = T^a$

and $n^a k = K^a$

$$\pi_t^e = n^e k d^e - n^e k - f^e$$

But $n^e k d^e = T^e$

and $n^e k = K^e$

Therefore π_t^a will differ from π_t^e only if the expected sales volume is not achieved or if the market price differs substantially from the anticipated marked up price or if the level of entrepreneurial efficiency affects fixed costs.

2.5.4 If, as in reality, experience is now allowed to modify expectations it is possible to model expected profit using an adaptive expectations

model, thus the adapted expectation of profit

π^{ae} will be as follows:-

$$\begin{aligned}\pi_{(t+1)}^{ae} &= (n_{(t+1)}^e)^d (n_{(t+1)}^e)^k - (n_{t+1}^e)^k - f + \\ &\quad (\pi_t^a - \pi_t^e) \\ &= (n_{(t+1)}^e)^d (n_{(t+1)}^e)^k - (n_{(t+1)}^e)^k - f + \\ &\quad (n_t^a d_t^a k - n_t^a k - f) - (n_t^e d_t^e k - n_t^e k - f)\end{aligned}$$

where $n^a - n^e$ = change in inventory levels and
where price and cost levels are assumed to remain
constant.

As a result:

$$\pi_{(t+1)}^{ae} = T_{(t+1)}^e - \pi_{(t+1)}^e - f + (\pi_t^a - \pi_t^e)$$

(Equation 9)

2.5.5 At this point the model becomes purely an
economics model. Conventionally a disequilibrium
market would be formulated thus:

$$\text{Demand} = D = f_1(P)$$

$$\text{Supply} = S = f_2(P)$$

$$\text{and Price} = P = f_3(D, S)$$

and these equations can be solved simultaneously
to yield a unique value for each of the three
endogenous variables. However, this approach
both requires, and assumes, a large number of
buyers and sellers acting independently - each
with perfect knowledge of the market. This is a
situation which is very unlikely to occur in the

property market where each plot is unique, the market is localised and consists of, perhaps, only a single seller and a few buyers, none of whom has perfect knowledge of the state of the market.

2.5.6 In the property market it is more likely that, due to the inherent imperfections and the stratified and differentiated nature of demand for property, the tenant and the landlord will each have a different approach to the amount of rent required. The tenant will consider the rent for a particular property on the basis of its affordability to him and his business. The landlord, however, will wish to obtain the maximum rent compatible with the obtaining of a reliable tenant and will, therefore, observe the localised market to find the highest rent being paid in the vicinity for similar premises to those under consideration.

2.5.7 Each party to this process will then take a negotiating position. The landlord will add a percentage to the latest known rent to allow for negotiation downwards (in fact, he is trying to push rental values up by this process) and the

tenant will reduce his bid by a percentage in order to allow for negotiation upwards. This latter position will be taken by the tenant even if the landlord's original asking rent is reasonable or even below what the tenant is willing to pay. The result of the negotiations if concluded satisfactorily will produce a revealed rent for the property somewhere between the two extremes of rents stated at the opening of negotiations

2.5.8 Following Ricardian Theory, therefore, it is possible to predict the range of the tenant's rent bid and the range of the landlord's required rent:

On first letting (i.e. a new letting to an incoming tenant) the tenant's rent bid can be modelled thus:

$$R_{b_{i(t+1)}} = R_{ot}^{\min} + (\pi_{i(t+1)}^e - \pi_{ot}^a)$$

where $R_{b_{i(t+1)}}$ = rent offered for location i for time period t+1

and R_{ot}^{\min} the lowest known rent agreed in time period t for any other location of equal utility

but more likely in imperfect market conditions,
thus:

$$R_{i(t+1)}^{\max} = R_{ot}^{\min} + q(\pi_{i(t+1)}^e - \pi_{ot}^a)$$

where $0 < q < 1$

$$\text{and } R_{i(t+1)}^{\min} = R_{ot}^{\min}$$

(Equations 10 & 11)

and the landlord's minimum rent demand thus:

$$R_{i(t+1)}^{\min} = \beta_1 L_{(t+1)}^e (R_{ot}^{\max})^I M$$

(Equation 12)

where	$L_{(t+1)}^e$	=	the estimated stock of vacant property in time period t+1
	R_{ot}^{\max}		a rent based on the highest known zone A rent agreed in time period t for a retail property of equal utility
	M	=	a factor of tenant desirability such that $0 < M < 1$
	β_1	=	an attenuating factor less than 1

and I = the predicted rate of
inflation

where

$$I = (1 + r)^n$$

$$\text{or } I = 1 + (R_{ot}^{\max} - \frac{R_{o(t-1)}^{\max}}{R_{ot}^{\max}})$$

where n = the number of years since the last
rental evidence became available.

On rent review or lease renewal (i.e. with an
incumbent tenant) the tenant's rent offer will
be amended thus:

$$Rb'_{i(t+1)}^{\max} = R_{ot}^{\min} + q (\pi_{i(t+1)}^{ae} - \pi_{ot}^a)$$

$$\text{and } Rb'_{i(t+1)}^{\min} = R_{ot}^{\min} + q (\pi_{it}^a - \pi_{ot}^a)$$

(Equations 11 & 12)

and the landlord's minimum rent requirement
becomes moderated thus:

$$Rd'_{i(t+1)}^{\min} = \alpha + \beta_1 L_{(t+1)}^e (R_{ot}^{\max})^I \beta_2^{M+\mu}$$

(Equation 13)

where α represents the landlord's fixed and sunk costs and where $\beta_2 M \rightarrow 1$.
 For a transaction to occur, in either of these situations

$$R_{d,i(t+1)}^{\min} \leq R_{b,i(t+1)}^{\max}$$

or

$$R_{d,i(t+1)}^{\max} \leq R_{b,i(t+1)}^{\min}$$

and the effective rent R_i is such that

$$R_{it} \equiv R_{d,i(t+1)}^{\max} \quad \text{if} \quad R_{d,i(t+1)}^{\max} \leq R_{b,i(t+1)}^{\min}$$

otherwise

$$R_{b,i(t+1)}^{\min} \leq R_{i(t+1)} \leq R_{d,i(t+1)}^{\max}$$

or

$$R_{b,i(t+1)}^{\max} \leq R_{i(t+1)} \leq R_{d,i(t+1)}^{\min}$$

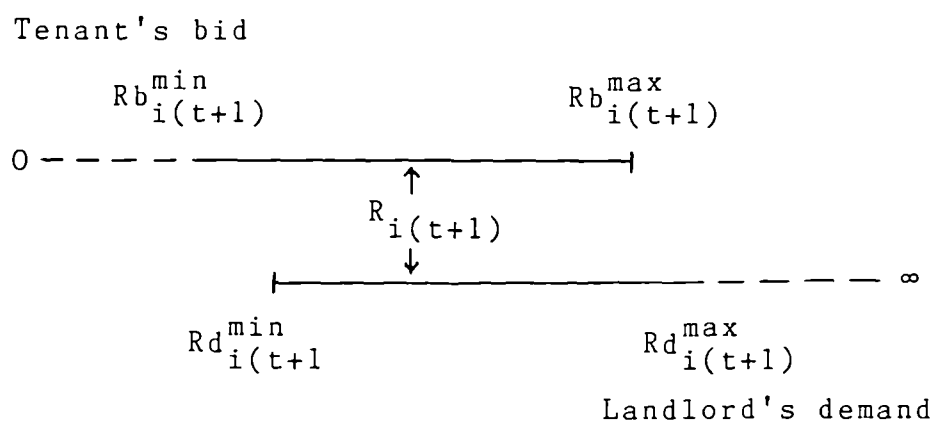
and in practice it is highly likely that $R_{i(t+1)}$ will be halfway between the extremes in each case. The reasons for this likely outcome are described in 2.5.7 and it should be noted that, in the majority of such property transactions, both the landlord and the tenant have the benefit of professional advice. In most

transactions the negotiations are also conducted by the professional advisors acting on behalf of the landlord and tenant but, even so, the advisors' knowledge may still be constrained by the imperfections of the market. Therefore, to reiterate, the likely result of the negotiations will most probably be a rent approximately half way between the extremes in each case:-

$$\text{i.e. } R_{i(t+1)} = \frac{R_{b_{i(t+1)}}^{\max} + R_{d_{i(t+1)}}^{\min}}{2}$$

(Equation 14)

Diagrammatically:



(FIGURE 3)

2.5.9 The rents derived in this manner make no allowance for any overbid⁺ on the initial rent resulting from longer than normal rent review patterns. This can be corrected, if necessary, by applying an equated rent formula to the amount

+ See end note, page 150

of $R_i(t+1)$ as derived by the above formulae. However, in practice it is likely that the under-assessment of some rents will be offset by the over-assessment of some capital values due to the lack of knowledge about existing rents passing and the periods to their review. The rents derived by this model are what the landed professions would term the 'open market rental value' or 'rack rent' on a tenant's full repairing and insuring basis.

2.6 The Capital Value Model

2.6.1 In any model of comparative values it is necessary to ensure that due allowance is made for the difference in the investor's required returns. Different yield requirements are the result of different assessments of the degree of risk involved in different investment forms; and investment in different types of property also results in differing yields being obtained.

2.6.2 The same situation occurs even within a single property type where the yield (reflecting investment risk assessment) in relation to

different types of tenant, different terms of letting, etc., can cause the resultant capital value to vary even though the rent per sq.ft. or per m² is the same.

2.6.3. This phenomenon must be modelled, otherwise to make comparisons on the basis of rent alone would be misleading. A unit change in the rent of a secure, prime investment property will produce a larger change in its capital value (in both absolute and in percentage terms) than will the equivalent rental change affect the capital value of a secondary shop let to a local trader.

2.6.4 Where properties are let, or assumed to be let, on full repairing and insuring leases, the rent R_i may be treated as receivable by the landlord; but where it is known that the terms of letting are other than FRI it will be necessary to net the rent to allow for the landlord's outgoings thus:

$$R_{n_i} = R_i - O_i$$

where O_i = the landlord's total outgoings
in respect of the property at
location i ,
i.e. repairs, insurance,
management, etc.

and where the incidence of the landlord's personal taxation liability is ignored.

2.6.5 The capital value of the property, or current use value CUV_i can then be determined using one of several valuation techniques.

Traditionally:

$$CUV_i = R_{n_i} Y_p$$

where Y_p = the year's purchase multiplier (the present value of £1 per annum) derived from a subjective 'all risks yield' (containing an implied growth (or inflation) rate) for property of type and tenure p.

2.6.6 As an alternative, it is possible to sum the discounted value of each individual receipt of rent, allowing for explicit rental growth (inflation) over the expected period of holding the property and add the discounted anticipated resale price; but this is a clumsy and complex method of accounting for capital value.

2.6.7 There has been much discussion over the years on the subject of allowances for rental growth in property valuation techniques. Typical of contributions to the argument are the papers by Bowcock⁽⁶⁾, Mackmin⁽⁷⁾, Rose⁽⁸⁾, Harker⁽⁹⁾ and Ellis⁽¹⁰⁾. However, the most mathematically rational approach to the capitalisation of rental income flows is that recently postulated by Sykes⁽¹¹⁾ which treats inflationary growth explicitly and is also flexible enough to be utilised for leasehold interests⁽¹²⁾ of differing lengths as well as for freeholds. Modified only for compatibility, Sykes' model of capital value (freehold) reads thus:

$$CUV_i = \left(\frac{Rn_{it}}{r} - \frac{Rn_{it}}{r(1+r)^n} \right) + \frac{Rn_{i(t+1)} (1+m)^n}{y(1+r)^n}$$

(Equation 15)

where	y	=	'rack rented' capitalisation rate (yield)
	n	=	number of years to the next rent review
	m	=	implied rental 'growth' rate (inflation)
	r	=	'risk-adjusted' opportunity cost of money

$$\text{and } m = \left\{ \left[\frac{r-y}{r} \right] \cdot \left[(1+r)^x - 1 \right] + 1 \right\}^{1/x} - 1$$

where x = the rent review pattern of the lease

2.6.8 The model for valuation of a freehold property needs to be amended slightly in order that it might be utilised for the valuation of a leasehold property and, again modified only for compatability, Sykes' model of capital value (leasehold) reads thus:

$$\text{CUV}_{Li} = \left(\frac{R_{nit}}{r} - \frac{R_{nit}}{r(1+r)^n} \right) + \frac{R_{i(t+1)} (1+m)^n}{y(1+r)^n} - \frac{R_{i(t+1)1+m}^N}{y(1+r)^N}$$

where CUV_{Li} = gross capital value of leasehold interest

n = number of years to next review

N = term of years of leasehold interest

y = rack rented capitalisation rate

r = discount rate

This is effectively the same formula as previously stated, because N tends towards infinity as the lease term extends towards perpetuity.

2.6.9 There will be dissent from this approach amongst the traditionalist members of the landed professions who prefer the long established subjective method of property valuation.

However, the economist and the mathematician should prefer the more objective basis of the Rational Valuation Models.

2.6.10 Either basis can, of course, be used at this point in the Property Value Model provided that a consistent approach is retained and applied to all the properties to be valued.

2.6.11 Having established CUV_i , the value of the entire shopping centre is obviously:

$$CUV_j = \sum_{i=1}^n CUV_i$$

and the potential residual development value of a development site can be calculated.

2.6.12 However, referring specifically to the latent value/translated value argument, it must be emphasised that the realised latent/translated value resulting from the maximisation of the potential development value (DPV) of an individual site will not, of necessity, be the same as that realised from an individual site where the objective is to maximise the DPV of the centre.

2.6.13 Nor will the realised latent/translated value of a centre be, of necessity, the same as that realised in any maximisation of DPV over the whole national land surface; and so on ad infinitum.

Hence:-

$$DPV_i^{\max} = CUV_i + (IV_i + EC_i) + TV_i$$

$$\text{i.e.} = CUV_i + LV_i + TV_i$$

and

$$DPV_j^{\max} = \sum_{i=1}^n CUV_i + LV_j + TV_j$$

where

$$TV_j = \sum_{i=1}^n RV_i \text{ and } LV_j = \epsilon L\tilde{V}_i$$

i.e. LV_j is a maximisation (using a vector quantity) and not merely a summation of the individual LV_i 's.

2.6.14 Extending the model of property value to one for all centres:

$$DPV_{\max} = \sum_{j=1}^m \sum_{i=1}^n CUV_i + \epsilon \tilde{LV}_j$$

where TV sums to zero

End Note

+ overbid: the relationship between 'full rental value' and the rent review period is important. In practice, it can be shown that, if inflation is commonplace, it is in the landlord's best interests to have regular reviews of the rent. Currently, in respect of retail property, a three yearly review pattern is common practice. This results in the increased rental figures required due to the effects of inflation being obtained by the landlord at regular intervals whilst, at the same time, not oppressing the tenant with annual rental changes, providing security of tenure by

way of longer leases for the tenant and reducing the landlord's administration costs. Where no reviews, or longer than normal review periods, are incorporated in the lease the tenant can be expected to pay a higher than normal (higher than 'market') rent. The rent overbid, in practical terms, may be merely a subjective addition to the amount of rent offered, to compensate for the longer period at a fixed rent. However, when analysed, it will prove to be the present value of the expected rises in the rent at each of the rent reviews to be omitted from the lease. The discounting factors for these adjustments are available in Tables published by Rose⁽¹³⁾ and Bowcock⁽¹⁴⁾. In real terms, the rents probably do not increase and, therefore, in an inflation free economy such devices are not necessary.

CHAPTER FOUR

PROFIT, MODELS OF CONSTRUCTION COST AND ALTERNATIVES

1 Construction Cost

1.1 An Explanation of Gross Development Cost

- 1.1.1 In the previous chapter the considerations of the model were concentrated on the development of the value derivation part of the general equation

$$GDV_i - (GDC + NP) = RDV_i$$

- 1.1.2 In utilising this general equation the developer's intention is to produce calculations which will demonstrate that the proposed development is worth pursuing. The calculations are carried out, normally, before any final commitment is made to the scheme and in the majority of cases prior to acquiring the land. To this end several sets of calculations might be made, each for a different scheme, with the intention of finding the most profitable form of development within the probable planning permissions obtainable.

- 1.1.3 These budget calculations are based upon an assessment of the Gross Development Value of the potential scheme from which is deducted the estimated expenses of the development and an allowance for the developer's profit and risk.
- 1.1.4 The estimated expenses of development must include not only the costs of constructing the buildings but also the costs of roads and associated sewers and services together with other external works where the development scheme is such that it provides an 'estate' development. In such circumstances the roads and services will be provided by the developer and, therefore, in addition to the capital costs of provision, maintenance costs will need to be covered until such time as they are handed over to the Local Highway Authority and Water Authority.
- 1.1.5 However, construction costs, including demolition and site clearance when necessary, represent a substantial, and in most cases the major, element in the estimated costs of the scheme. Several detailed techniques of cost analysis, cost prediction and cost planning have been developed

out of a need to provide more detailed and precise estimates of construction costs at an early stage in the appraisal of a potential development scheme.

1.1.6 In considering an estimate of costs two other additional areas must be considered. The professional fees of Architects, Surveyors, Engineers, Valuers, Estate Agents and Solicitors and other consultants must be included, together with estimated charges such as Stamp Duty on conveyances, leases, etc. In addition, the costs of finance, or the opportunity cost of monies applied to funding the project, must be included in the calculation.

1.1.7 The funding of the development costs is normally established on a two part basis: firstly the cost of a short term bridging loan for the period of actual construction and secondly, if the developer is to retain an interest in the completed development, the cost of long term funding by way of mortgage or some other financial arrangement.

1.1.8 The manner in which finance is raised and the interest charged depends to a great extent on the

status of the developer. A large, well-established firm is likely to have access to long term continuing funds at rates of interest which are relatively stable, even in fluctuating market conditions, but smaller or lesser known firms may have to accept wide variations in interest rates when these occur, even to the point of being preferred funds in conditions of recession.

- 1.1.9 Although discounted cash flow techniques can be used in the appraisal process, it is normal practice in the early stages of a development calculation to make approximations of some of the costs. The building costs are normally paid in stages against the periodic certificates of the supervising architect. In order to allow for this in a simple first calculation, the accepted and usual practice is to allow for interest to be charged on the full amount of construction costs for half of the construction period. In later recalculations, as the details of the proposed scheme become more firm, a more reliable estimation of the financing charges and their timing can be introduced into the appraisal calculation.

- 1.1.10 It is very important to realise that the accuracy of these residual development valuations is

totally dependent on the accuracy with which these various sums can be estimated. However, as the majority of the smaller percentage additions depend upon the accuracy of the estimate of prime construction costs, the developer and his professional advisers have concentrated upon ensuring the accuracy of the larger items. As a result, they have developed several methods of construction contract price prediction, all of which are intended to be used at the pre-tender stage, i.e. as part of the design appraisal.

- 1.1.11 Such methods are generally referred to as being only methods of approximate estimating, although they are all relatively accurate in results; the term approximate is really a description of the lack of individually priced quantities. The question of accuracy in any construction cost prediction has been the subject of much investigation for many years, and has resulted in several reviews of construction cost estimating techniques.

1.2 Traditional Methods of Construction Cost Prediction

- 1.2.1 The traditional methods of estimating

construction costs fall into three basic categories: approximate methods, analytical methods and operational methods and these are now supplemented by the use of computers which, in addition to providing computer aid for the traditional methods, give easy access to the newly developed statistical estimating methods.

1.2.2 The method utilised in a prospective developer's construction cost prediction will be determined by the developer's own perception, or the professional adviser's perception, of the ease of application of the technique, familiarity with its use, speed of operation and, of course, above all, its believed overall accuracy relative to the use to which it will be put, e.g. preliminary budget appraisal or final cost appraisal.

1.2.3 Historically, approximate estimating was always considered accurate enough for most purposes and in the early part of this century the 'cube method' was in common use. Cubic content of the proposed development was approximated by taking the gross plan area of the building and multiplying it by the height from the top of the foundation to halfway up the roof pitch or to two feet above the roof, should it be flat. Analysis

of previous construction produced construction costs in £'s per cubic foot which could then be applied to the proposed development's cubic content.

- 1.2.4 Although still in use on occasions, this formula approach uses some particularly arbitrary allowances for irregular building shapes. Its principal weaknesses are that it does not take account of usable floor areas, number of floors or plan shape and is therefore now regarded by most quantity surveyors and estimators to be somewhat unreliable.
- 1.2.5 About thirty years ago the storey-enclosure method⁽¹⁾ was introduced in an effort to reduce the unreliabilities of single-variable methods of estimating. In calculating unit cost it is necessary to take twice the ground floor area of the building and to add the roof area measured on plan. To this is added twice the area of the upper storeys, plus a percentage which increased with storey height, and the area of the external walls. This technique attempted to overcome the problems of the cube method by taking account of the plan shape, floor areas and the height of the floor constructions. It was claimed to be more

accurate, on its introduction, but has fallen into disuse mainly because it can not easily be related to the arrangement of the proposed accommodation. In addition, lack of use has resulted in analysed rates for application in practice being difficult to obtain.

- 1.2.6 In estimating the probable construction cost, particularly of proposed public buildings, the unit method is particularly useful where the developer requires a preliminary estimate. A standard unit of accommodation such as a bed space in a hospital development, pupil place for a school development, etc., is used in conjunction with an estimated cost per unit. It relies on the simple but close relationship between the total cost of a project and the number of functional units provided within; and as a method of approximate estimating it is an extremely useful tool. However, considerable experience is necessary in deciding upon an appropriate rate, which must be selected by careful analysis of a large number of recently completed development projects. Any adjustments made to analysed rates are normally made using 'practical judgement' to allow for variations from project to project, such as an allowance for

variations in site conditions, specification differences, etc. It is, however, a simple method, easy and quick to implement, but is lacking in precision. This is a major disadvantage which restricts the usefulness of the method to preliminary budget estimates.

1.2.7 Probably the most commonly used method of construction cost estimating utilises the superficial floor area of the proposed development and multiplies it by a cost per square foot. Separate cost rates can be used for differing types of accommodation or differing plan shape within the overall development, making this type of estimating very flexible. It is an entirely appropriate method for estimating the cost of construction in development projects where storey heights are similar to those of recent comparable projects and, having been in common use since the late 1940s, comparable construction rates are readily available and easily calculated as a cost per square foot or per square metre.

1.2.8 As a variation on the superficial floor area method it was suggested in the early 1970s that a new approach should be developed which combined

floor area with a measure of the proposed building's perimeter. The increased accuracy to be derived from this superficial floor area/perimeter approach⁽²⁾ resulted from the earlier efforts to incorporate the financial effects of plan shape into the estimate. In construction cost economics the floor area/wall area ratio is an important factor, although floor area itself has always been the greatest single-variable correlated price. The method did not, however, prove to be very popular.

- 1.2.9 A more detailed but still approximate estimate of construction cost can be obtained by the use of approximate quantities. By using this method a more detailed and more reliable estimate is obtained but in practice it takes more time and effort than those methods of cost estimating described earlier. Its increased reliability comes from its use of a finer breakdown of the overall project into a series of composite, but still major, units of construction. However, it has been noted that the breakdown of the project into the several major items relies mainly on the experience of the individual estimator and, for the increased reliability required, much more

detail is needed from the designer at an early stage.

1.3. Analytical Methods of Cost Prediction

1.3.1 Analytical methods of estimating provide for detailed costing of each individually measured item of a bill of quantities taking specific account of labour, materials and plant requirements. Analysed methods of estimating construction cost derive their reliability from proper analysis of successful tenders. The developer makes extensive use of feedback, placing particular emphasis on the variations introduced by project factors such as type, size, location, etc. Even so, the analysis of rates is still largely determined by individual value judgements made by the estimator; it is, however, a particularly useful method where existing data is not available. Nevertheless, it is not strictly a pre-tender estimating method, and its usefulness is restricted by the time required to produce estimates by full analysis of other construction projects.

1.4 Cost Planning and Cost Modelling as an Estimating Method

1.4.1 A further method of analytical estimating is available from the early stages of cost planning, in which the project cost is estimated utilising elemental costs analysed from other successful construction projects. Two alternative forms of cost planning are currently in use. The first is known as elemental cost planning and the other form is known as comparative cost planning. In the former the eventual intention is to design a project within an overall framework of a cost limit and in the latter the established design is cost estimated.

1.4.2 A more detailed approach to the analysis of construction cost data and the estimating of construction cost is the cost model⁽³⁾. There is, however, very little evidence of their use in practice although a considerable amount of research has been carried out to test their reliability. In the main, cost models have been developed through multiple regression analysis and it has been suggested that, with the wider availability of computing facilities, simulation techniques might gain more acceptance within the estimating profession. However, the current

disincentives towards the adoption of cost modelling, as a widely applied form of construction cost estimating, are its basic approach (this is considered to be quite radical by the majority of estimators) and its requirement for large quantities of comparative raw data.

1.4.4 If, however, from the point of view of this research, there was to be a potentially useful estimating tool, it must be considered to be the cost model. In work that has been carried out on cost modelling, the development of suitable cost models relies heavily on the collection of suitable data which must be both accurate and reliable.

1.4.5 In any attempt at data collection there are always many difficulties and, in practice, the most difficult problem arises when an estimator or quantity surveyor is faced with having to try to collect data on a wide range of projects other than those with which his own practice or his own client developer has been involved. The majority of developers and building contractors are very hesitant at releasing information for use by

other organisations because of the fundamental awareness that cost estimating at any stage of the development process is a highly sensitive art and the release of data may give competitors an advantage in a tendering situation.

1.4.6 Even so, because of the huge variations that can occur in an individual estimator's estimate of items in different bills of quantities which appear to all intents and purposes to be identical, a large amount of estimating data, even if released, is unsuitable for cost modelling purposes. It would appear to be, therefore, the total building cost or elemental cost data that is of most use for modelling. The type of data available for analysis is, by definition, in the form of historical costs extracted from previous tenders, or from earlier successful development schemes. These data, together with quantified variables are then utilised to describe the costs involved.

1.4.7 The variables usually considered include measures of gross internal floor area, roof area, external wall area, factors to describe shape, height, storey height, etc., all of which can be easily quantified from initial sketch drawings in

cost estimation exercises in respect of a proposed new development. Additional factors such as project location, regionally or even locally within a region, contract terms, perceived or anticipated competition or other market factors are, on some occasions, included in the cost model. However, the decision on whether to include or exclude any of these use variables is based entirely on the estimator's own perception of the situation obtaining at the date of the estimate.

1.4.8 Removal of inflationary effects and updating of historic costs are normally achieved by the use of indices but it must be emphasised that many of the factors mentioned above and the initial interpretation, inclusion/exclusion of raw data is dependent entirely on the estimator's own 'expert' knowledge of the projects analysed and a pre-conceived impression of the nature of the project to be cost-estimated.

1.4.9 There are many types of cost model each of which is intended to be used at a different stage of the construction process; for example, to predict tender cost in the preliminary stages of a development appraisal, to predict the contractor's costs and profit at the tender

stage, or for use in the cost planning process⁽⁵⁾. They are not, however, confined merely to building cost prediction; they can also be used in civil engineering⁽⁴⁾, process plant engineering and many other similar costing situations⁽⁵⁾⁽⁶⁾.

1.4.10 However, in a building cost prediction context, it has been found to be easier to manipulate models based upon a single category of building type and, as a result, such models tend to be more accurate in a development cost forecast.

1.4.11 In considering the techniques available for development cost modelling the most applicable and most useful is stated to be multiple regression analysis⁽⁷⁾⁽⁸⁾. This is because the relationship between variables in construction and development cost analysis is rarely unique; a particular value attributed to a variable does not always correspond to the value of the same variable analysed from data relating to other projects.

1.4.12 As an alternative, it is argued that a basic linear regression analysis of the relationship between two variables can be used in a

consideration of variables such as total floor area and total construction cost; in effect using computer analysis of several projects to produce an allegedly more accurate result than is produced by a 'manual' analysis utilising the superficial floor area method described earlier.

1.4.13 In the construction of a cost model for the prediction of development costs it is suggested that the following four matters must be considered⁽⁹⁾:

a/ A single responsive variable must be identified, or chosen. This will normally be the total development cost or the cost of an element of the development or of the building contract price, etc.

b/ Several regressor variables must be chosen in the anticipation that they will determine the response. The choice will depend upon what it is hoped to predict and many variables will be considered initially. Typical regressor variables in construction cost prediction are such items as floor or roof areas, number of storeys, wall areas, etc. All these variables can be quantified from sketch drawings at an early stage of the initial development appraisal prior to the preparation of detailed construction drawings.

c/ It has been suggested that ideally the number of sets of data should be at least two and a half times the number of variables utilised in the analysis. The reason for this requirement is that force fitting of the model may occur where the number of data sets is less than this and an incorrect analysis will result.

d/ The number of variables in the final model can be reduced by combining some of the regressor variables to form derived variables which, in practice, may be found to be more useful.

1.4.14 In selecting the final form of the cost model there appear to be two opposing criteria to be considered: firstly, a theoretical requirement to include as many regressor variables as possible in order to make the equation as useful as possible and, secondly, a practical requirement to include as few variables as possible in order to keep down the cost of data collection.

1.4.15 These requirements appear to be irreconcilable and there is, unfortunately, no unique statistical procedure for resolving the conflict and selecting the best regression equation. There are a number of differing methods,

including computer programs available to isolate the most important variable but, in selecting the best overall regression equation, reliance must still be placed on the personal skill and judgement of the estimator using the model.

1.4.16 Although it could still be argued that stepwise regression can be useful in the building of a cost prediction model, in using this technique it may well be found that a regressor variable which was significant at an early stage of the modelling procedure may be removed entirely due to the addition of other regressor variables.

1.4.17 This backwards elimination and forwards selection process involves a considerable amount of arithmetic which can only be undertaken efficiently with access to a computer. However, with the increasing availability of micro computers and even of access to large scale computing facilities, cost models which, from a practical point of view, might have been unacceptable in time or expense can now be developed utilising standard computer packages for statistical analysis and are being introduced into the larger quantity surveying and property developers' offices.

1.4.18 The subsequent analysis of the cost model requires an interpretation of the results by the estimator. This interpretation has to rely on the usual statistical tests being applied in relation to the results produced and, of the many statistical comparators that can be used to measure the values produced by the model, those seen by the quantity surveying profession as being most useful are the coefficient of variation, the correlation coefficient and an explanation of the residuals.

1.4.19 It has been stated that a cost model developed in this way needs to possess the following characteristics:-

a/ It should explain a high percentage of the variations within the data and it is suggested that an explanation of less than 80% of the available data demonstrates that its predictive powers are restricted.

b The coefficient of variation should preferably be below 10%, but research has demonstrated that there is a tendency for the value of the coefficient to deteriorate when cost models are applied, for predictive purposes, to new data.

c/ There should be no discernible pattern in the residual values.

In addition, in order to reduce the time and costs involved in collecting data for the future cost predictions, the maximum number of variables should be kept as low as possible. It has been suggested that 12 is the maximum that can be logistically considered. However, it could be counter argued that such a model may well be of reduced value due to potential problems of multicollinearity.

1.4.20 In testing the reliability of cost models, two tests have been suggested. Firstly, a comparison of the model's predictions against the actual cost of other development projects and, secondly, a comparison of predicted costs against cost estimates prepared by traditional methods.

1.4.21 It is argued that the application of cost modelling techniques in the wider context of estimating pre-tender construction costs can have the advantages of providing cost information more quickly and generating more information on which better decisions can be made. It is also claimed that the information produced is more reliable and can be produced at an earlier stage in the

design process, thereby introducing greater confidence into the estimating process and facilitating more informed development decisions.

1.4.22 However, the cost model, despite the advantages claimed by its proponents, has not yet found great acceptance within either the construction industry or in the development world. Some use has been made of the technique in connection with major civil engineering works but it must be concluded that, presently, cost planning, life cycle costing, and cost modelling techniques are still in their infancy.

1.5 The Acceptability of Budget Pricing

1.5.1 Approximate estimating remains the most popular approach to construction cost estimating and the most used technique would appear to be the superficial floor area method. This is presumably because of its simplicity, relative reliability, and speed of use; although on awkward construction projects resort might have to be made to the more detailed approach of approximate quantities.

1.5.2 Ashworth & Skitmore⁽¹⁰⁾ make the point in relation to estimating experience that

"it has been shown that a consistent disparity of performance exists amongst estimators⁽¹¹⁾.

Proficiency in estimating is said to be a result of skill⁽¹²⁾, experience⁽¹³⁾, judgement⁽¹⁴⁾, knowledge, intuition⁽¹⁵⁾, feel⁽¹⁶⁾, academic background, personality, enthusiasm⁽¹⁷⁾, hunch⁽¹³⁾ and a 'feeling in the back of the head',⁽¹⁴⁾."

1.5.3 Furthermore they reinforce the point of subjectivity by quoting from Blakeslee⁽¹⁸⁾, as follows:-

"If we take the plans for a house we want built to an experienced contractor, he may glance over them for about ten minutes and tell us what it will cost and how long it will take. This is intuitive judgement. Another approach he could use would be to add up every item on the bill of materials, calculate the price one item at a time, then schedule each stage of the construction, and estimate the building time. With experience, the intuitive judgement can be as accurate as the methodical one. If you ask him to explain the intuitive estimate, he might say something like 'gut feeling' or 'experience'. In actual fact, the intuitive approach is a result of right-brain thinking. Just as it can

recognise a face in a crowd at one glance, the right-brain can analyse large masses of data and make a judgement in one step."

- 1.5.4 They conclude, however, that the accurate forecasting of construction prices (i.e. development cost predictions) involves rather more than numerical synthesis⁽¹⁹⁾ and that the qualities demanded of cost forecasters include experience⁽²⁰⁾, intuition and a 'feel' for costs⁽²¹⁾.
- 1.5.5 It would appear that a commonly held view among developers and construction estimators is that an estimated project cost that is accurate to within 5% is generally acceptable, although there would appear to be no data available to support this assertion of acceptability. However, confirmation of an apparent ability amongst estimators and quantity surveyors to produce construction cost predictions by traditional methods which fall, generally, within the limits mentioned as being acceptable is to be found in a paper by Greig⁽²²⁾. His investigations revealed that forecasts of construction cost made during the pre-detailed design and post-detailed design

stage of a series of construction contracts produced, during analysis, coefficients of variation in the region of 6% in the pre detail stage and less than 5% once the design detail was finalised. Further confirmation of the 5% coefficient of variation is given by Japp's⁽¹⁹⁾ opinion survey of quantity surveying practices but the 6% coefficient of variation claimed for the initial cost estimates is disputed by Flannagan⁽²³⁾ who, on the basis of an analysis of two sets of cost planning data held by two local authorities, maintained that the accuracy of prediction at the sketch scheme stage produced a coefficient of variation of about 15% and that only about 25% to 30% of cost predictions had been made with an accuracy of plus or minus 5%. An analysis of Greig's conclusions produces the histogram set out in Figure 4 (Source: Ashworth & Skitmore).

- 1.5.6 In practice the superficial floor area method is invariably used at the pre-detailed design stage and, therefore, it must be accepted that the accuracy of the estimate depends to a large extent on the ability and the experience of the estimator and the way that he interprets the data available to him.



Accuracy of forecasts made through design stages (from Greig pp102, 106)

Source: Ashworth & Skitmore

FIGURE 4

1.5.7 Whether the accuracy achieved in the pre-tender phase of a development project produces a coefficient of variation of 5% to 6% as stated by Greig or 15% to 20% during early design stages, improving to 13% to 18% immediately prior to tender, it must be stressed that the major advantage of approximate estimating methods, in practice, is speed. Using approximate quantities (not the same as approximate estimating) or cost planning/cost modelling techniques can take from a few days to several weeks to prepare an estimate of the construction costs for use in a development appraisal and frequently the time available for the acquisition decision is very short indeed.

1.5.8 As a general rule, the budget figure produced by synthesising global rates (adjusted for market conditions by the value judgements of the estimator) is satisfactory for most purposes at the present time.

2 The Developer's Profit Requirements

2.1 Introduction

2.1.1 The property developer is essentially an

entrepreneur, taking the risk in proposing and constructing a development scheme. In economic terms the return for taking these risks is profit, but in the property development world the developer considers the earnings from a property development to be of two forms: profit and an allowance for risk. The former of these is, in reality, an alternative description of the managerial entrepreneur's wages and the risk allowance should be truly described as profit.

2.1.2 However, in all developer's calculations of profitability only a single percentage allowance appears to be made and this single figure is usually stated to cover both of the elements mentioned. It would appear, therefore, that the difference of approach is, in the majority of cases, more apparent than real.

2.1.3 The size of the required profit, i.e. the normal or minimum acceptable profit, varies with the type of development scheme, the anticipated time period to completion of the project and the expected competition. Where speculative development is involved the profit requirement is likely to be quite substantial.





2.1.4 There is very little published material on property developer's normal profit margins earned on individual projects, although the dividends and yields resulting from the overall activities of the development and investment companies quoted on the stock exchange are openly available - see Table 1.

2.2 Entrepreneurial Activity

2.2.1 Published sources confirm that the principal method of profit taking employed by the entrepreneurial company involved in property development is by way of capital profit as opposed to the alternative of retaining a property development in order to derive an income-based profit therefrom. However, in relation to capital profit there are differing requirements depending upon the nature of the entrepreneur. There are, basically, three types of entrepreneurial involvement in property development.

2.2.2 Firstly, there is the simple involvement of a land owner who might employ a building contractor to construct the property (typical of early residential development situations). In this

relationship the 'developer' expects to earn a profit for taking the risk of financing and organising the development and the contractor earns a profit on the labour, materials and management organisation involved in the building contract. The two elements are separate and distinct.

2.2.3 The second type of entrepreneurial activity involves the contractor/developer. In this situation the building contractor takes on the additional role of developer by involving himself in the acquisition of land and the financing and organising of the development as well as engaging in his normal contracting or building operations as part of the scheme. By so doing, the contractor/developer is able to forego some or all of one of the profit requirements and, as a result, can engage in more marginal or less profitable development schemes than can the modern, purely entrepreneurial property development company. The builder/developer is normally involved in smaller development schemes and is normally active in a more localised market.

2.2.4 The third and most common of the entrepreneurial

situations is similar to the first one described above. Here the property development company acquires the land for the development, either by outright purchase or by way of a lease, and arranges for the scheme of development to be carried out either by a directly employed labour force or by engaging a building contractor to carry out the work.

2.3 Profit Requirements

- 2.3.1 In the first of the situations described above the minimum entrepreneurial profit, i.e. return on capital employed, regarded as sufficient to attract an owner to develop his land has, typically, been in the region of 5% to 6%. However, this yield is regarded as being unacceptable to the 'modern' developer and is more akin, in the U.K., to the 5% 'real' return utilised as the Treasury Test Discount Rate. Information recently obtained from a sample of U.K. property development and investment companies reveals that, on average, the normal or minimum rate of return that would be expected from a town centre retail development project would be of the order of 20% on cost (i.e. 20% on capital employed) and that even in a

refurbishment project the developer would seek to maintain this minimum rate of return.

2.3.2 Full details of the enquiries made of property development companies and property investment companies are given in Appendix 3. From the returns obtained, it is safe to accept that, currently, a 20% mark up on cost or a return representing 16.66% of the Gross Development Value of the completed development project is the minimum profit that the developer would accept. Therefore, for the purposes of this research, normal profit (NP) is taken as being a 20% addition to the Gross Development Costs.

2.3.3 In conclusion, the point must also be made that, in any development scheme, delays in sale(s) or letting(s) (known as voids) increase interest charges and consequently reduce profit. Even though the developer's initial appraisal makes an allowance for voids, or the period that the property or part of the property stands vacant, it is seldom possible to estimate the period with accuracy and it is for this reason that pre-let schemes are acceptable to the entrepreneur even at lower profit margins than the 'minimum' 20%; the risk of an extended voids period being negated.

3 The Cost and Profit Model

3.1 The Model of Costs

3.1.1 In constructing a model of Gross Development Cost suitable for use in this research it is convenient to accept the basic approach outlined earlier in this chapter.

3.1.2 A suitable starting point, therefore, would be an estimate of the amounts of the several types of floorspace to be provided in the development scheme. In a typical town centre retail development scheme the amount of ancilliary uses is likely to be minimal.

Thus:

$$PBC_i^e = \sum_{x=1}^n A_{ix} C_x^e$$

where PBC_i^e = the estimated prime building cost of the development project at location i

A_{ix} = the gross floor area of use type x to be constructed in the development at location i

C_x^e = the estimated cost per unit of

floor area of type x

and

$$PBC_i = \sum_{x=1}^n A_{ix} C_x$$

will describe the actual cost, if known.

3.1.3 To these prime building costs are added an amount for roads, services, sewers, and external works, etc.

$$SBC_i^e = \sum_{r=1}^n L_r C_r^e + \sum_{s=1}^n L_s C_s^e + \sum_{w=1}^n A_w C_w^e + \sum_{t=1}^n S_t^e$$

Where SBC_i^e = the estimated cost of roads,
sewers, services and other
external works at location i

L_r = length of roads

C_r^e = the estimated cost per unit length
of road

L_s = the length of sewers

C_s^e = the estimated cost per unit length
of sewer

A_w = the area of external works of
type w

C_w^e = the estimated cost per unit area

of external works of type w
 S_t^e = the estimated cost of public
 utility service connection charge
 for service type t

and

$$SBC_i = \sum_{r=1}^n L_r C_r + \sum_{s=1}^n L_s C_s + \sum_{w=1}^n A_w C_w + \sum_{t=1}^n S_t$$

will describe the actual cost if known.

3.1.4 The total cost of construction will, therefore,
 be

$$TC_i = PBC_i + SBC_i$$

where TC_i = the total cost of building
 construction work at location i.

3.1.5 The next stage in the model is the allowance for
 the professional fees that will be charged in
 connection with the design and supervision of the
 construction work. As these are normally charged
 as a percentage of the total construction cost,
 as are contingencies, then

$$FC_i = TC_i(1+p) (1+ce)$$

where TC_i = the total costs at location i

that are to be subjected to
financing charges

$$p = \sum_{t=1}^n (pf_t)$$

where pf_t is the decimal rate % charged as a
professional fee by a
consultant, t

c = a decimal rate % added to the
overall construction costs to
allow for errors in estimating

e = 1 where TC_i is an estimate

and

e = 0 where TC_i is a known or
historic cost

3.2 The Cost of Finance

3.1.6 The addition of financing charges to the model is
achieved by utilising either the approximation
technique used in practice or, for analysis
purposes using known costs. The Gross
Development Cost, including an approximate
estimate of financing charges can be obtained as
follows:-

$$GC_i = FC_i \left(1 + \frac{r}{c}\right)^{\frac{cn}{2}} \left(1 + \frac{r}{c}\right)^{\frac{cn}{2}}$$

where GC_i = the gross development costs
involved in constructing a
property at location i

FC_i = the total costs at location i
that are to be subjected to
financing charges

r = a decimalised rate of interest
representing the opportunity cost
of capital utilised for the
development

c = the number of conversions of
interest per annum

n_1 = the number of years taken for the
development from inception of
construction to completion of
construction

n_2 = the 'voids' period between
completion of construction and
the (estimated) date of full
letting, or sale, of the
development

3.3 The Profit Addition

3.3.1 Once GC_i has been established, it is only
necessary to add the normal profit requirement

and the model is complete. Where normal net profit = 20% of cost:

$$(GC_i + NP) = 1.2 GC_i$$

3.4 Marketing and Disposal Costs

3.4.1 The only items not explicitly dealt with above are letting and selling costs (including advertising) in relation to the proposed new development, an allowance for fees and stamp duty on acquisition of the site or properties at location i and the cost of holding the assembled development site from its date(s) of acquisition to the date of completion or disposal. These final adjustments are made as follows:

$$NDV_i = GDV_i - (R_i(as_1) + A + GDV_i(as_2))$$

where NDV_i = the net development value
created at location i

R_i = the total rental value of the
new floorspace created at
location i

as_1 = the decimal rate % charged by
the agent and solicitor for
letting the property and

preparing the lease

A = the cost of advertising the
development to attract tenants
or purchasers

as₂ = the decimal rate % charged by
the agent and solicitor for
selling the completed
development project to a
purchaser or investor

$$GDC_i = GC_i + (GDV_i - NDV_i)$$

$$NP = 0.2 GC_i$$

$$RDV_i = GDV_i - (GDC_i + NP)$$

and, therefore:

$$NRDV_i = RDV_i \left(\frac{1}{\left(\left(1 + \frac{r}{c} \right)^{cn_3} \right)} \cdot \frac{1}{1 + as_3 + sd} \right)$$

where

NRDV_i = the Net Realised Development
Value at location i

r = a decimalised rate of interest
representing the
opportunity cost of capital
utilised for the development

c = the number of conversions of
interest per annum
 n_3 = the number of years taken for
the development from
site/property acquisition to
completion of sale
 as_3 = the decimal rate % charged by
the agent/valuer and the
solicitor for acquiring the
site/properties at location i
 sd = the stamp duty payable by the
entrepreneur/developer on
acquisition of the
site/properties at location i

3.4.2 The first of these last two adjustments does not
need to be within the earlier calculation as the
fees, etc., are not subjected to interest or
other financing charges. They are invariably met
out of revenue. The latter, of course,
automatically allows for the fact that interest
charges will have accrued on the fees and other
costs during the whole of the development period.

CHAPTER FIVE

THE MODELS IN THE CONTEXT OF A THEORY OF TRANSLATED VALUES

1 Latent Value and Development

1.1 Where development of a town centre site or an existing town centre property can be profitably carried out by an entrepreneur the return that is expected is one of profit, i.e. profit for his taking the risk of carrying out the development and for his providing the expertise to see the development through to completion. However, in the private sector, land and existing buildings are almost invariably not brought forward for development unless the price offered for, or value of, the site or existing building (RDV) is higher for its proposed use than it is in its existing use. This increase in value has been known, to date, as latent value.

1.2 Within the context of the theory developed in this thesis, however, the increase in value over

and above existing use value, also referred to as current use value (CUV), has been identified as being either latent value, translated value, or a combination of both. Latent value has been defined as being the increase, or that part of an increase, in value released by the satisfying of a previously unsatisfied demand by the change of use or by the application of enterprise and/or capital and labour to a given piece of land or existing property.

2 Translated Values as an Additional Explanation

2.1 In the hypothesis put forward at Chapter 1, section 4, it was stated that any other increase in the value of a property which occurs not as a result of a change in the intensity of demand but as a result of a change in its locational distribution must be regarded as translated value, as must additional or disproportionate increases in value resulting from applications of capital.

2.2. The hypothesis that must be tested by the model constructed in this thesis is set out in Chapter 1, 4.11. However, it will be recalled that it was expected that in an experimental test of the

model constructed to test the theory of translated value, it would be necessary to attempt to hold a *ceteris paribus* condition in relation to certain endogenous factors. This would make it possible to identify whether value changes were purely translated value. The model, as constructed, would also locate the changes of value that occur at all points within the retail surface and attempt to identify whether there was any latent value component present in addition to the translated value component.

- 2.3 In the light of this statement and the earlier explanation for its basis, the reader is led to the conclusion, where there is no change in the structure or level of demand, that any application of enterprise, capital or labour to a given piece of land or existing property that changes the attractiveness of that location to potential consumers thereby results in a translation of values from other locations to the developed site or property. In terms of retail property, it is the change of use, application of capital and labour, etc., that results in the attraction of retail spending away from other locations, i.e. the location or distribution of demand is shifted; the location of demand-derived, or residual, values is translated from one (or more than one) location to another.

3 The Full Model

3.1 In order that this theoretical concept of Translated Value may be tested, it is necessary that algorithms suited to the data, and to the theoretical concept, be written. For this to be done it is necessary, however, to first set out the model in full in order that the relationship of its several parts can be readily perceived. The full model is, therefore, as follows:-

3.1.1 The Value (Derivation) Model (VALDER 1)

$$C_{gdt} = C_{grt} \frac{\theta d}{\theta r} \quad \begin{array}{l} \text{where } g > 0 \\ \text{and } g < 14 \end{array}$$

$$C_{dt} = \sum_{g=1}^n C_{gdt}$$

$$\text{and } C_{rt} = \sum_{g=1}^n C_{grt}$$

$$C_{dt} = C_{rt} \frac{\theta d}{\theta r}$$

(VALDER 2)

$$S_{gdt} = (C_{st} - H_{dt}) \cdot \frac{C_{gdt}}{C_{dt}}$$

(VALDER 3)

$$S_{gdjt} = S_{gdt} \cdot A_{gdj}$$

where

$$A_{gdj} = \frac{\frac{F_{gj}^{\alpha}}{C_j^{\delta} Z_{dj}^{\lambda}}}{\sum_{j=1}^n \frac{F_j^{\alpha}}{C_j^{\delta} Z_{dj}^{\lambda}}}$$

(VALDER 4)

$$S_{gjt} = \sum_{d=1}^n S_{gdjt}$$

(VALDER 5)

$$T_{gjt} \equiv S_{gjt}$$

$$T_{git} = S_{gjt} \frac{\alpha_i (\log \rho_s)}{\sum_{i=1}^n \alpha_i (\log \rho_s)}$$

(VALDER 6)

$$\pi_{it}^a = \sum_{g=1}^n T_{git} - K_{it} - f$$

$$\pi_{i(t+1)}^e = \sum_{g=1}^n T_{gi(t+1)}^e - K_{i(t+1)}^e - f$$

(Extension of VALDER 6)

$$\pi_{i(t+1)}^{ae} = \sum_{g=1}^n T_{gi(t+1)}^e - K_{i(t+1)}^e - f + (\pi_{it}^a - \pi_{it}^e)$$

(VALDER 7)

$$Rb_{i(t+1)} = f \pi_{i(t+1)}^{ae}$$

(VALDER 8A)

$$Rb_{i(t+1)}^{\max} = R_{ot}^{\min} + q (\pi_{i(t+1)}^e - \pi_{ot}^a)$$

$$Rb_{i(t+1)}^{\min} = R_{ot}^{\min}$$

$$Rd_{i(t+1)}^{\min} = \beta_1 L_{(t+1)}^e (R_{ot}^{\max} - I) M$$

(VALDER 8B)

$$Rb'_{i(t+1)}^{\max} = R_{ot}^{\min} + q (\pi_{i(t+1)}^e - \pi_{ot}^a)$$

$$Rb'_{i(t+1)}^{\min} = R_{ot}^{\min} + q (\pi_{it}^a - \pi_{ot}^a)$$

$$Rd'_{i(t+1)}^{\min} = \alpha + \beta_1 L_{(t+1)}^e (R_{ot}^{\max I}) \beta_2^M + \mu$$

(VALDER 9A)

$$R_{i(t+1)} = \frac{Rb'_{i(t+1)}^{\max} + Rd'_{i(t+1)}^{\min}}{2}$$

(VALDER 9B)

$$R_{i(t+1)} = \frac{Rb'_{i(t+1)}^{\max} + Rd'_{i(t+1)}^{\min}}{2}$$

(VALDER 10)

$$CUV_i = R_{i(t+1)} Y_p$$

(VALDER 11)

$$CUV_j = \sum_{i=1}^n CUV_i$$

3.1.2 The Cost (& Profit) Model

(COSPROF 1)

$$PBC_i^e = \sum_{x=1}^n A_{ix} C_x^e$$

$$SBC_i^e = \sum_{r=1}^n L_r C_r^e + \sum_{s=1}^n L_s C_s^e + \sum_{w=1}^n A_w C_w^e + \sum_{t=1}^n S_t^e$$

(COSPROV 2)

$$TC_i = PBC_i + SBC_i$$

(COSPROV 3)

$$FC_i = TC_i (1 + p) (1 + ce)$$

(COSPROV 4)

$$GCNP_i = 1.2 (FC_i((1 + \frac{r}{c})^{\frac{cn}{2}} (1 + \frac{r}{c})^{cn2}))$$

3.1.3 The Translated Value Model

(TRANVAL 1 to TRANVAL 10)

Derive CUV_i 's as before in VALDER 1 to VALDER 10 and establish CUV of new development

(TRANVAL 11)

$$GDV_{ndi} = CUV_{ndi} \quad \text{where nd = new development at location i}$$

(TRANVAL 12)

$$NDV_i = GDV_{ndi} - (R_i (as_1) + A + GDV_i (as_2))$$

(TRANVAL 13)

$$RDV_i = (NDV_i - GCNP_i)$$

(TRANVAL 14)

$$\text{NRDV}_i = \text{RDV}_i \begin{pmatrix} 1 & 1 \\ \frac{1}{(1 + \frac{r}{c})^{cn_3} \cdot 1 + as_3 + sd} & \end{pmatrix}$$

(TRANVAL 15)

Ceteris paribus, if

$$\text{NRDV}_i - \text{CUV}_{i(t-1)} = \text{CUV}_{j(t-1)} - \begin{pmatrix} n \\ \sum_{i=1} \text{CUV}_{it} - \text{GDV}_{nd} \end{pmatrix}$$

then Translated Values sum to zero.

P A R T T W O

AN EXPERIMENTAL TEST

OF THE MODEL

CHAPTER SIX

A SEARCH FOR SUITABLE RESEARCH LOCATIONS

1 The Selection Survey

1.1 The Ideal Requirements of a Research Location

1.1.1 In considering a basis for a field test of the model, two factors were important. These were i/ that few exogenous changes had occurred during the proposed investigation period, thus allowing that only the endogenous factors that might affect the ceteris paribus condition need be controlled, and ii/ the towns identified by the survey should have the most complete data bases. Whilst the first of these criteria would lead to the identification of a number of potentially suitable towns, the second would facilitate their ranking to enable the identification of a small set that would be capable of adequate investigation. In addition, it would be most useful if the identified towns contained only a single retail development in a clearly identifiable town centre. Even with

these factors in mind, it might have been that several towns were identified as being of equal utility. In the event, although three potential research locations were identified, only one was researched. This satisfied both the primary requirements identified earlier in the paragraph. The other two were dismissed for reasons that will be given later (1.6.2).

1.1.2 Three other criteria were important to ensure a feasible test for the model. First, there should be a period of identified stability in retailing patterns over a period of years prior to the development scheme being carried out. Secondly, there should be only the one major retail development scheme within the immediate catchment area of the centre of the town. Thirdly, there should be an adequate period, subsequent to the development, during which no further major retail developments have occurred, in order that time lagged effects or recovery could be measured.

1.1.3 In order that any tests of the model made in such single-development town centres could be regarded as adequate, it was also necessary to ensure that basic information and data requirements could be

met. As these were judged to be mainly obtainable from the local authorities having administrative responsibility for the urban areas in which the shopping centres would be located, it was to be with the local authorities that the search for suitable research locations was to commence, in order to identify a representative sample of town centres where development of the type to be modelled had taken place.

1.1.4 In order to be considered as a potential research location it was envisaged that a town centre should have, in addition to a stable retail scene disturbed only by a single major development project, clearly identifiable transport termini and car parks. The main reason for these latter requirements was to ensure the origins of internal pedestrian flows were distinguishable; pedestrian flows having been identified as a major component of the intra-urban distribution model.

1.1.5 The availability of the data that would be sought eventually in the experimental test of the model was the next criterion for selection. The availability of pedestrian flow surveys both

before and after the dates of the new development, together with access to the results of car parking surveys and public transportation surveys before and after the date of the development, would be of importance in dealing with the origin and destination of shoppers and in the calculation of shopping trip travel times.

1.1.6 In addition it would be vital to the exercise that land use plans, for the town centre particularly, should be available for dates both before and after the new development took place. Two other matters would also be of assistance in any investigation of a phenomenon such as translation of values. The first of these was the availability of a new development in a town centre that is constrained in some way, thereby predictably amplifying any shifts in value that might have taken place. The second was the involvement of the local authority in the development scheme itself, in some way; this latter giving access, hopefully, to a ready source of data about the construction and financing of the development project.

1.1.7 A final piece of information to be solicited from

any administering local authority was the availability of rental information in respect of other retail premises owned by the authority within the town and whether the authority was prepared to allow access to its planning and estates records should the town prove to be suitable for experimental investigation.

1.2 The Research Location Questionnaire

1.2.1 Several drafts of the research location questionnaire were produced before the final version was prepared and sent out. A copy of the questionnaire and its accompanying covering letter is contained within Appendix 5.

1.2.2 The purpose behind the questions contained within it are as follows:

Section 1 - General Planning Information

Q1.1 Seeks to establish whether there has been any major development or redevelopment of retail facilities within the town centre in the preceding 20 years. Definitions of Major Development and Redevelopment are included in the questionnaire.

Q1.2 & Are intended to establish whether the
Q1.3 major development or redevelopment is of
a single cohesive scheme on a clearly
identifiable site or whether it is merely
a large collection of small ad hoc
developments.

Section 2 - Information on Specific Town Centres

Q2.1 As each local authority is responsible
for more than one urban area and hence,
by definition, for more than one town
centre, the authority is asked to
identify the centre(s) upon which it is
reporting.

Q2.2 Seeks to clarify whether the major
development or redevelopment upon which
the local authority is reporting consists
of one or more schemes or phases of
schemes, i.e. constructed sequentially or
contemporaneously.

Q2.3 & Simply ask for the total retail

Q2.4 floorspace in the town centre and the
size and number of units in the new
development in order to gain some
impression of the relative sizes and
probable impact of the scheme.

Q2.5 Establishes the year that the new retail

units opened for trading, in order that the relevance of dated survey information could be assessed.

Q2.6 Seeks to establish the availability of, and dates of, surveys both prior to and subsequent to the new development covering pedestrian flow, car parking and public transportation use.

Q2.7 Relates to the availability of land use plans for the town centre, the existence of which would facilitate the identification of shop and other retail locations at the several dates that might have to be investigated.

Q2.8 Enquiries as to the presence of constraints to the town centre which might have either disrupted the laissez faire economic redistribution of shopping activities or, alternatively, might act to amplify the phenomenon being investigated.

Q2.9 & Are in the questionnaire to identify the possibility of aid and assistance from a local authority which has had involvement in a development with research potential.

Section 3 - Estates Information

Q3.1 & Are to identify local authorities with

Q3.2 retail property ownership within the town

centre retail core, or in surrounding areas, as potential data sources should the other data indicate the possibility of a researchable location.

Q3.3 Asks whether the property management records are in an easily useable form. and, in addition, the covering letter to the Chief Executive of each authority asked whether it would be possible, should a town in that authority's administrative area be chosen as a research location, to have access to the information and data referred to in the questionnaire.

1.3 A Report on the Survey

1.3.1 The identification of researchable locations was achieved in two stages.

1.3.2 First, having decided to address the enquiries to District Councils and Metropolitan District Councils in England, Wales and Scotland by means of a questionnaire, it was necessary to omit from the survey all District Councils which were contained within a continuous agglomeration of urban development. The initial exclusions were

obvious - those Councils within the administrative area of the Greater London Council and the majority of those within the areas of the Greater Manchester Metropolitan County Council and the West Midlands Metropolitan County Council.

1.3.3 A geographically based sift of the local authorities remaining on the list was then used to remove any where there were no separately identifiable townships within its administrative area or where its developed urban area merged with, or was contiguous with, that of an adjoining local authority. This reduced the list of local authorities to be surveyed to the 384 shown on the list contained within Appendix 5.

1.3.4 The second stage of the identification process was the production of a questionnaire to be sent to the listed local authorities. The questionnaire, which was forwarded to the Chief Executive/Town Clerk of each local authority, sought to identify whether any development or redevelopment of any town centre had taken place in the Council's administrative area within the preceding twenty years and, where it had, to clarify what form the development took.

1.4 A Summary of the Returns

1.4.1 Upon their return the questionnaires, and other responses, were segregated to collect together those where some form of suitable development had taken place, ready for further analysis and the identification of suitable town centres for research.

1.4.2 In all, 227 responses were received to the request to local authorities for assistance. Of these, 39 stated that they were unwilling or unable to assist for a variety of reasons; another 64 revealed that there was no suitable development within the administrative area; 4 identified proposed development or uncompleted development; and the remainder stated that development of a relevant nature had taken place; this giving a total of 158 possible town centres for research.

1.5 Identification of Suitable Research Towns

1.5.1 Those questionnaires which revealed 'apparently suitable' town centres were further analysed. It was most important to ensure that the required

survey information was actually available and accessible for dates both prior to and after the development scheme. This was achieved by listing the questionnaire responses in the form of a bar chart of positive responses and selecting those town centres where the bars were largely unbroken. The bar chart analysis is contained within Appendix 5, and contains full details of the retail floorspace within each of the towns reported.

1.5.2 As a second selection procedure, the questionnaire for each of these town centres was checked for the availability of access to the Council's records. The combination of the first and second selection procedures narrowed 23 centres to a mere 8 where it might be possible to test the model.

1.5.3 A further analysis of the size of the new shopping development as a proportion of the total amount of retail floorspace available in the town centre made it necessary to dismiss those centres where the new development was insignificant vis a vis the total shopping available, or where the new retail development constituted the majority of the town's retail core, as it would be unlikely that the effects of the new development

would be practically measurable.

- 1.5.4 Although in an ideal situation the field test should be run in several different town centres, the analyses of the questionnaires revealed that, of the original 128 town centres identified by the survey as containing new retail developments, only three, Exeter, Great Yarmouth and Leicester, could be regarded as satisfying the majority of the originally specified requirements.

1.6 The Choice of Research Location

- 1.6.1 At this point it became necessary to visit each of these towns in order to verify the information given on the questionnaire and to gain a preliminary impression of the town centre and the relative ease or difficulty of carrying out the on-site research. On each visit a plan of the town centre was obtained; the retail core was 'walked' to gain a 'feel' for the layout and an idea of the sort of locational shift that had occurred. Of the three centres, Exeter appeared to be the most viable research location, the principal reason for this being that preliminary verbal enquiries as to the local retail operators' impressions and opinions as to the effect of the development in each case indicated

that more information might be forthcoming in Exeter and that the effects would be more clearly definable. This led to the conclusion that Exeter would provide the most suitable location for research on which to base the testing and calibration of the value model. However, even Exeter, considered to be the best of the identified potential research locations, subsequently proved to be lacking in some of the detailed data that, at this stage, was stated to be available. The effects of these deficiencies on the experimental test of the model are fully described in the following chapters.

1.6.2 Further reasons that reinforced the decision to use Exeter, in preference to Great Yarmouth and Leicester, were:-

i/ Great Yarmouth

On detailed investigation and after a visit to the town and to the local authority's Planning Department it was revealed that not all the required background survey information was available in a usable form. It was predominantly contained in overall planning surveys of an aggregate nature. In addition, the original focus of retail activity, the Market Square, remains undisturbed and the new retail development is still sufficiently new, close to, and part of the original centre as to represent

an insufficient disturbance to property values to allow for the reasonably accurate determination of any resultant changes.

ii/ Leicester

Even prior to a visit to the town centre of this city it was apparent that the size and spread of the retail centre would probably make it unsuitable for utilisation in a research project of this nature, although it may be suitable for a possible future investigation once the general concepts of the model have been tested elsewhere and more resources are available. The visit to the city centre confirmed this preliminary impression.

- 1.6.3 There were, therefore, clear advantages to using Exeter. All the research and filtering of data availability, etc., pointed to Exeter being the most suitable location for further research. One of the other factors which reinforced this decision was that, in addition to the availability of basic survey information and the offered co-operation of the District Council and the County Council, there was very real evidence of the phenomenon that is under investigation. Being a town centre which was rebuilt in the aftermath of the 1939-45 war, it had no very traditional shopping locations and the

construction of a single large off-centre shopping development in 1976 has very obviously led to several major stores moving along the main shopping street to congregate around the new focus.

- 1.6.4 This last point, together with the relative compactness of the town centre, indicated that the retail core of Exeter should have been suitable for the research which has been associated with the testing and calibration of the models and the subsequent testing of the hypothesis.

2 The City of Exeter

2.1 The Information Provided

- 2.1.1 The conclusion that Exeter appeared to be the most practical and most suitable research location was reinforced by the indications that an almost complete set of data might be available. At this stage, such anticipation was based only on the information provided in Exeter City Council's returned research location questionnaire. Subsequently, as previously mentioned, the form of some of the data proved to be a problem and this is discussed later: the

questionnaire return is summarised in the following paragraphs.

- 2.1.2 Within the last 20 years there has been both redevelopment of the existing retail core and major development of new shopping zones in Exeter consisting, over that period, of a series of ad hoc improvements, spread over several parts of the city.
- 2.1.3 However, some of the new development in the town centre does consist of a large and significant project/improvement scheme situated on a single contiguous site - the Guildhall Shopping Centre.
- 2.1.4 The City of Exeter return stated that the city had a retail core of approximately 870,000 square feet of floorspace and the new Guildhall Shopping Centre, which opened for trading late in 1976 providing a further 28 shopping units, totalled approximately 180,000 square feet of retail sales space. (The actual figure, when measured, was nearer to 161,000 square feet.)
- 2.1.5 Furthermore, the City Council stated in its returned questionnaire that it had available a survey of City Centre Shopping carried out in 1971, and surveys of the Guildhall Shopping

Centre carried out in 1977 and 1979. The last of these was stated to be related to the Structure Plan, but all of the surveys were stated to contain general information on pedestrian flow, car parking, etc.

- 2.1.6 In addition to the above mentioned information, it was indicated that land use plans were available for both before and after the Guildhall development. The earlier plan had been prepared during the period 1973 to 1976 and the later plan in 1979.
- 2.1.7 In answer to the question regarding constraints on the town centre, the City Council replied that its policy directs shopping to the city centre which is located within an area bounded by the River Exe and an inner ring road.
- 2.1.8 The City Council is also ground landlord (freeholder) of the site of the Guildhall Shopping Centre and has a partnership arrangement with the developer of the site. In addition, it is also the freehold owner of a large amount of real estate within its boundaries both as a ground landlord and as a landlord of improved freeholds leased for retail use and occupied,

currently, by retail traders. Access to the City Council's records was stated to be available on a confidential basis and most of the usable data has been collected and collated for use in the model strictly on the understanding that it is not listed in easily identifiable form in the published lists of raw data in Appendix 9.

2.2 Additional Information Required

- 2.2.1 If the model developed in the latter parts of Chapter 3 and Chapter 4 (collated and re-presented in Chapter 5) was to be tested it would be necessary to obtain sufficient data for the entire model to be run from start to finish. The questionnaire returned by Exeter City Council had indicated that a large part of the information should be available from that source but there were, also, other areas from which data would need to be collected if the model were to operate fully. In the end, it transpired that all the data which even Exeter City Council had said that it had available could not be obtained or could not be obtained in a usable form and, therefore, changes had to be made in the way that the model was specified which, to some extent, moves the model, at certain points, into the realm of

simulation. However, by the end of the research programme, the results of the tests proved to be of less significance in relation to the original hypothesis than had been hoped. Nevertheless, these tests did yield some very useful information which led to other pertinent conclusions.

2.2.2 Having identified that Exeter had experienced only the one major retail development scheme within its town centre during the past two decades and that the development was undertaken during 1975 and 1976, it was decided that data should be collected for the period immediately prior to the development and for that immediately post the development together with similar data for 1983 (this being the date when the majority of the data collection was undertaken) and 1966. The reason for the selection of this last date was a desire to try to establish whether or not there had been a period of reasonable stability within the centre prior to the intrusion of the new shopping centre; a period of ten years seemed suitable. All the evidence available, at the time that this decision was taken, pointed to there having been no other retail development of

any significance within the town centre and, therefore, it seemed logical to conclude that in real terms the centre should have been stable over that period. Purely by coincidence, when investigations were made in the Planning Department of Exeter City Council it transpired that there had been some retail survey work carried out during the period 1965 to 1967 and this fitted neatly into the proposed mode of operation, i.e. a collection of data at 1966 for comparison with similar data at 1975 in order to establish whether or not there was reasonable stability within the centre, followed by a collection of data at 1976 and 1983 to investigate whether the imposition of the new shopping centre had any significant effect upon the values of properties within the town centre and whether that effect was of a permanent or transient nature.

- 2.2.3 The data collected was of two types. One part of the data collection was concerned with the obtaining of the information necessary as inputs to the model in order that the various calculations could be made to see whether the values of individual properties could be

predicted accurately from the data collected. The second part of the data collection was concerned with the obtaining of information against which the model's predictions could be tested. Both areas of the data collection included statistics which the operators of retail businesses, their professional advisers and their several trade associations regarded as highly sensitive. In some areas satisfactory amounts of such data were actually obtained but the various sources required assurances that confidentiality would be maintained and that the data would not be published in a form which would identify individual profits from individual properties, etc. These assurances were given and, as a result, the raw data contained within the data collections in Appendix 7 and Appendix 9 do not contain any specific addresses except as an identification of the location of retail premises. Notwithstanding these assurances, and their having been put into practice, some of the sources approached for assistance in the provision of data for the testing of this model were not prepared subsequently to co-operate. As a result, some parts of the data collection required for the checking of the model's

predictions are a little sparse.

2.2.4 The model itself breaks down into three distinct parts. The first part is concerned with the prediction of the value of an individual retail property within the town centre under investigation and is referred to as the Value Model. The second part of the model concerns the prediction of the redevelopment cost and developer's profit and is, from now, referred to as the Cost Model. In relation to the concept of Translated Value the third part of the model looks at the net residual development value at the development site location and compares it with the changes in current use value at all other locations and is referred to as the Translated Value Model.

2.3 The Value Derivation Model

2.3.1 In dealing, firstly, with the Value Model, the theoretical starting point was to establish the regional consumption expenditure for each of a specified range of goods which fitted in with the range of shops to be found in the City of Exeter. In fact, any published information on regional

consumption expenditure would need to be modified and re-grouped to fit the shop categories utilised in the City of Exeter's Planning Department's survey of retail establishments. In the event, this was done to the figures used because it was easier to re-group them than to re-classify and re-categorise the twelve hundred or so shops identified within the boundaries of the City of Exeter on each of the four dates in question.

- 2.3.2 The first stage of the Value Model recited earlier in this thesis proposed the calculation of the amount of consumption expenditure for each of the counties within the standard south west region. It was suggested that this could be achieved by the proportioning of the regional consumption expenditure using a demographically based proportioning factor, θ . In order to achieve a satisfactory construction of the factor for the region and a separate θ factor for each of the counties it would be necessary to have sufficient data adequately to describe the structure of the population and its spending power. Typical examples of such data would be household composition, distribution of incomes,

propensity to save, housing tenures, socio-economic groupings, wage levels, etc. Such a data set, even if fully available, would require an immense analysis which, in terms of collection time / analysis time and cost would be outside the limits available for this research programme. It was decided, instead, to use a simplified proxy that might be accepted as fairly describing the main attributes of the expenditure demographics of the several areas within the region.

- 2.3.3 Several alternatives were available for such a proxy; for example, size of household, income per head of population or average wage. However, none of these factors alone could be accepted as adequately representing the many variables which together affect consumption expenditure but, the purpose of the θ factor being to proportionately re-allocate a known expenditure, consideration was given to whether a combination of the three available data on number of households, socio-economic group of head of household and average earnings of that economic group would be sufficient. Although the use of such data, and even such a combination of data, has obvious

limitations, it was accepted that the earnings of the head of household, to a large extent, dictated the lifestyle and expenditure profile of the entire household. The differences in the earnings of different socio-economic groups used in combination with the numbers of households whose head belonged to that socio-economic group could, therefore, provide a limited but easily obtainable set of variables from which to construct a proportioning proxy.

- 2.3.4 Therefore, as a suggestion for the model, θ can be calculated on the basis of the numbers of heads of household in each of the standard socio-economic groups multiplied by the average weekly earnings for workers resident within the region or county under consideration. For simplicity, it has been assumed for the purpose of this research that all heads of household are male and that non-economically active heads of households have incomes which are 50% of those of economically active heads. The effects of these assumptions on θ are likely to be small because of the demographic structure of the population and, because they affect both numerator and denominator in the same direction, are likely to

be of second order. However, it is acknowledged that there may be a small redistributive effect that could result from changes in demographic structure over the period from the date of the census to the test date. Due to the way that expenditures were derived for this research (discussed later), this was of no consequence, but the redistributive effect would need to be assessed, and any necessary allowance made, in any use of this part of the model in other research, etc.

- 2.3.5 Once the regional expenditure by range of goods has been split down into expenditures by county, the calculation can be repeated using a similarly constructed θ factor to calculate the proportion of the county consumption expenditure on each range of goods which originates in each town or district within the County of Devon. The same basis of calculation can be used, i.e. the heads of household by socio-economic group by average earnings of male workers in each socio-economic group. It is preferable, of course, to deal with this disaggregation and allocation in a single calculation (such as is described in Chapter 3) so as not to compound any errors

resulting from minor deficiencies in the factor construction.

2.3.6 It is at this stage that the expenditure by households on accommodation and related items is removed from the total of consumption expenditure and the net amount re-allocated to the towns or districts in proportion to the proportion of expenditure on each range of goods to the total consumption expenditure arising out of that town or district. Up to this point all the population data used are published, at various levels of aggregation, in the returns of the Census of Population Small Area Statistics, the economic activity leaflets, the Household Surveys and the Earnings Surveys all of which have been carried out at various dates between 1961 and 1981.

2.3.7 The third stage of the Value Model would take retail consumer spending figures generated by the earlier part of the model for each town or district in Devon and, using the Huff allocation model, would distribute the retail spending to the various shopping centres throughout Devon. In order to do this the floorspace given over to retail sale of each group of goods is needed for

each of the shopping centres. These data are available from the Census of Distribution for the earlier test years but not for 1981-1983. The 1981 data, in partially aggregated form, was obtained from a private Survey of Shops carried out by Devon County Council. These data, when used in conjunction with the travel time, would enable the attractiveness factor to be calculated. The data for the shortest travel times can be obtained from a computation of the road distances between each of the towns under consideration or a notional point representing the location of rural districts. These are the points from which the retail consumer spending is deemed to originate. The travel times for different modes can be calculated by applying average travel speeds to class A roads, class B roads and class C roads together with, in later years, the faster travel times on sections of motorway and by making similar calculations based on the average speed of passenger bus travel. For that proportion of the population which travels by rail to do its shopping the published time-tables of British Rail's South Western Region are available together with information on the rail links available to passengers for the several years under consideration.

2.3.8 This inter-urban part of the model utilises the three different modes of transport, but explicitly ignores pedestrian travel. The reason for this is an assumption (explained in Chapter 7) that pedestrian arrivals are evenly distributed around the external cordon of the town's retail centre and their numbers, therefore, contribute nothing to the distributive power of the model. This part of the model also uses the retail consumer spending proportioned on the basis of percentages obtained from retail surveys carried out in the Exeter shopping centre by other researchers over the period in question. By this means it is possible to allow for the differing thresholds involved in the different modes of transport used for the shopping trip.

2.3.9 At this point in the Value Model it would be possible to produce a list of predicted retail spending for each of the several towns and areas under consideration. These turnovers could be checked against those locations having more than 20,000 sq.ft. of retail floorspace for which a reasonably full break down of turnovers by range of goods is published in the Census of Distribution for the South West Region. It would

be, therefore, at this point that the first calibration of the model would take place.

2.3.10 In the early part of the research, some time was spent collecting data and developing an algorithm for the distribution of the origin of regional consumption expenditure by constituent counties and, ultimately, by town/district within the Devon County area. However, difficulties were envisaged in developing a suitable derivation model of net retail consumption expenditure in line with one of the hypotheses suggested in Chapter 3. Moreover, a questionnaire survey of a sample of households in Devon generally was intended with a view to eliciting information at local level regarding household incomes and expenditures on ranges of goods and the thresholds of expenditure trips. A parallel interview survey on shopping trips was actually designed with the intention of obtaining similar information from arrivals at the Exeter shopping centre. However, non-availability of research council funding and, consequently, an inability to employ survey interviewers, meant that the proposed surveys could not be carried out. On advice, therefore, the proposal to derive the

origins of net retail consumer expenditure by local district was abandoned. Nevertheless, the proposed interview questionnaire for the last mentioned survey, the distribution data and the algorithms prepared for this part of the model have still been included, where relevant, in the later parts of the text of the thesis and in the Appendices for completeness.

- 2.3.11 In order to proceed with the research it was necessary, therefore, to enter the model's sequence of equations at a lower level. Consumption expenditure, in net terms (actual spending) is reported by category of shop at regional level in the Census of Distribution. It is also reported by category of shop for towns having a population of over 20,000. With this information, and with information on the relative sizes of the trade group retail floorspaces receiving the retail spending, it would be possible to utilise the retail spending figures reported as received in Exeter as the basis for a test of the internal spending distribution to individual shop locations. Whilst, in fact, this was done, it must be reported that further problems were encountered with availability of

data. Whilst these did not prevent the test from taking place the proposed additional runs of the model, using financial data at 1983 levels and again at 1966, were not made. As a result the experimental test of the model uses only 1975/76 expenditure data (as a real expenditure base) with each set of the data on the location, spatial distribution and type of trade in shops at 1966, 1975, 1976 and 1983. The data problems and deficiencies are fully described later in this chapter and in Chapter 7.

- 2.3.12 The starting stage of the model in the test, i.e. the next stage of the theoretical model, looks at the retail turnover/consumer spending allocated to the Exeter system. The City of Exeter is divided into 17 wards. For the purpose of the test, the area defined as the 'central area' of the town lies partly within each of three of these wards but does not form the entirety of any one of them. This central area is predominantly the area enclosed by the old city walls, bounded by the other physical barriers described in the City of Exeter's returned questionnaire and identified in the plan shown in Appendix 6. In order that an intra-urban allocation of retail spending can be achieved, the same kind of

allocation model is used as was used in the origins allocation to districts within Devon. On this occasion the attractiveness of individual shops is a function of the retail floorspace available and, therefore, data obtained from the City Planning Department from surveys carried out in 1965/67 and 1975/76 are required as the basis of calculation. A further update of the floorspace information was carried out by means of a walk-round survey noting the position and user category of all shops within the city boundaries during 1982 and this was further updated by reference to Planning Office records and a further physical check during 1983. The actual data required from these surveys for use at this stage in the model, and at later stages, consist of the spatial location of the unit, the amount of retail floorspace in use, the amount of ancilliary floorspace in use (together giving the total amount of floorspace), the number of storeys given over to retail use and the retail use category, i.e. type of retailer.

- 2.3.13 To enable the next stage of the Value Model to function the outer areas of Exeter, which consist of separate wards, are given the same treatment with regard to the allocation of turnover as were

the districts and rural areas within Devon. This allows the turnover by trade groups, attributable to the City of Exeter, to be allocated between the city centre and the outer areas, and also eases the computational problem. A further allocation between the aggregate amounts of shopping available in each ward area, treated as centred on the approximate centre of gravity of each of the Wards, and of the central area, is carried out using the same types of data. The aggregate amounts of floorspace for each range of goods and the travel time between the centre of Exeter and the various ward centres are utilised to allocate some of the spending attracted to Exeter back to the local shops within the ward areas.

- 2.3.14 Within the town centre the allocation of spending power to individual shop locations as turnover is achieved by a further stage of the model which utilises the floor area of each individual shop in each retail use group to calculate the proportion of turnover attracted to that shop as a proportion of the total turnover by means of the fraction created by its floorspace over the total floorspace given over to the sale of that range of goods within the Exeter centre. This

floorspace attractor is modified by a function calculated from the pedestrian flow past the various shops. In order to operate this part of the model it is necessary to have data on the location, use and capacity of the car parks available for each of the test years, together with details of the pedestrian flow through the matrix of streets and thoroughfares within the town centre. It is also necessary, therefore, to have co-ordinate data for the beginning and end of each length of street or thoroughfare.

- 2.3.15 Once the modified attractiveness factors have been calculated for each individual shop and the turnover of that shop predicted, the amount of the tenant's rent bid can be calculated. The adaptive expectations model shown within the earlier part of this thesis should be utilised to calculate the amount of the tenant's bid and, in order for this part of the model to be operational, data are required on the average costs incurred in the operation of each type of retail business together with the amount of fixed overheads. From the amount of net profit so calculated the amount of the rent bid can be determined and this will be a proportion of the

amount of net profit. However, lack of these data prevented this part of the model from being used or tested. A different algorithm was substituted; this and the data required and utilised are described later in this chapter.

2.3.16 The next stage of the Value Model is more subjective. It deals with the amount of the landlord's rent demand and in period t will be based on a knowledge of rents presently and previously passing in the vicinity of the individual shop under consideration. The landlord's rent demand, for the reasons outlined earlier in this thesis (Chapter 3, 2.5), will tend to be a small percentage higher than the maximum rent for similar use of which the landlord is aware.

2.3.17 Also, as described earlier, the tenant's rent bid will be suitably reduced to allow for subsequent negotiation, just as the landlord's rent demand will have been increased. The resultant rent on completion of the negotiations, in all probability, tends towards the centre of the range but its precise location will depend upon the knowledge and negotiating ability of the landlord and the prospective or incumbent tenant.

2.3.18 The Value Model concludes at this point with a calculation of the current use value of the retail unit. This is obtained from the predicted rent by means of a multiplier based on the anticipated yield that an investor in the property market would expect from the property. Without a large data base, and in the absence of any public register from which to obtain data on yields, the yield information will need to be obtained either by analysis of the few recorded and available transactions within the town centre, from information provided in answer to the property values questionnaire or, alternatively from the collective and collated subjective opinions of property professionals dealing with retail premises within the town centre. With the information on yields on various portions of the shopping streets within the town centre, the capital values of individual shop units can be calculated and summed to find the total capital value of the town centre shop properties, thus concluding the Value Model.

2.4 The Cost and Profit Model

2.4.1 The Cost Model is, in all respects, a straight-

forward residual valuation or development appraisal calculation. It requires, as a starting point, a calculation of the prime building costs of the proposed building or shopping centre. The data required in order for this to be estimated are the floor areas of the different types of accommodation and/or construction and the cost per areal unit of that construction. In respect of the test of the model, this information is required for the actual shopping centre constructed in the centre of Exeter, the Guildhall Shopping Centre. The data is therefore obtainable from the developer. Also required at this stage of the Cost Model are data on the secondary building costs and finance charges together with details of the construction periods involved in order that the gross cost of development and the developer's profit can be calculated.

- 2.4.2 As the test is being conducted in relation to an actual building, all this information is available from the developer on the basis of actual costs incurred up to the out-turn date of the development, but it should be noted that in a normal use of the model all this data would be

inputted in the form of estimated costs and charges.

2.5 The Translated Value Model

- 2.5.1 The figures derived in the Cost Model are then utilised in the Translated Value Model where the current use value of the completed new shopping development can be derived utilising the Value Model and the retail spending data derived earlier.
- 2.5.2 No further data requirements exist and all that remains is i/ to check the realised development value of the site of the proposed (in this case existing) shopping centre against the existing use value of the site of the shopping centre (with probably existing building used for retail purposes still upon it) and ii/ to test any increase in realised development value over existing use value against any decrease in the total amount of the current use values of all other buildings within the catchment area of the centre. Should the two figures be equal (*ceteris paribus*) the existence of translated value will be established.

3 Review

3.1 The purpose of this chapter has been to define, in an ideal sense, the data that will be required for the testing of the model. The attempts to collect this data from a town that had already been identified, by survey, as having the most complete data base are described in the next chapter. However, as Chapter 7 will show, even this posed problems that were difficult, in some cases impossible, to overcome.

3.2 Therefore, Chapter 7 also discusses the deficiencies that were discovered in the data and outlines the attempts that were made to overcome them.

CHAPTER SEVEN

DATA COLLECTION

1 Introduction

- 1.1 Following a widespread search, and on the basis of the survey questionnaire returns, Exeter had appeared to be the most fruitful location for the experimental test of the theoretical model developed in Part One of this thesis. Despite this, it became apparent that much of the additionally required published data that were available for the south west region as a whole, and for Devon and Exeter in particular, were not ideal. It might be suggested that these problems with published data could have been discovered earlier and avoided but militating against this is the problem faced by many researchers. By the time that the initial literature reviews and preliminary investigations and theoretical/ conceptual developments were completed, there was a considerable investment of time and effort that would have been wasted if the experimental test were not continued.

1.2 Additionally, an investigation of the availability of an adequate data base, both published and unpublished, was one of the stated objectives of the research. It took considerable further research effort to demonstrate that what had been stated in the returned questionnaires to be available did not, in fact, exist in appropriate forms. Eventually, in relation to the selected test location, Exeter, proxies became inevitable and a discussion of their nature, relevance and appropriateness forms an important part of this chapter. The consequences of data deficiencies and the use of proxies are further discussed in Chapters 8 and 9.

2 Deficiencies in Available Information

2.1 The Value Derivation Model

2.1.1 The first problem encountered during the data collection was a general lack of availability of statistical data for the precise years under investigation. However, adjustments could be made to the majority of published statistical information to enable it to be utilised for the

years in question. In the majority of cases, adjustments to financial data (net consumption expenditure data) were possible by the use of published index numbers such as the Index of Retail Prices. This was not the only index available for use but it did seem to be the most appropriate in the circumstances. Other indices that could have been used include the Wholesale Prices Index and the Commercial and Industrial Rent Index. The former of these did not seem to be as appropriate to net consumption expenditure and research into shop rents as did an index based on retail prices. The latter (CIRI) had a major deficiency; it is constructed only out of data on rents of new buildings. The decision to use the Retail Price Index was further reinforced by a major analysis of rents/rates and indexation that had been carried out in the earlier part of this research project. This confirmed, on the data available, that the Retail Price Index was a better adjustment index than others available for the same period. A full report of this subsidiary research can be found in Appendix 2.

2.1.2 Where other published statistics required for allocation functions were only available for

dates other than the years under investigation, no adjustment has been made as this was unnecessary. The proportionate increases due to indexation would still result in the same allocation factor. The raw data could, therefore, be used in its unadjusted form in the construction of such proportioning devices as θ_d and θ_r .

2.1.3 More specifically, the first problem to arise in the availability of data for the model was in the consideration of household membership of socio-economic groups and earnings, both of which would have been required for the construction of the factor used in the re-allocation of regional consumer expenditure. Whilst the 1981 census, the 1976 10% sample census, and the 1971 census information was adequate, the 1961 information was lacking to a large extent. The grouping of households by socio-economic groups was not available. The only population structure by socio-economic groups that was available for the 1961 census was a 10% sample of economically active males. In addition, the earnings data for 1961 were not available for the South West region and, in this respect, resort to indexation back from 1971 was necessary.

2.1.4 A further complication which affected all the

statistical data available for the 1961 and 1971 censuses was the reorganisation of county administrative boundaries. After local government reorganisation in 1974 there is an additional county of Avon which, prior to 1974, was within Somerset. However, there is no significant increase in the overall land area occupied by the seven counties post 1974.

- 2.1.5 In relation to the 1971 Small Area Statistics, Census of Population, it was noted that socio-economic groups 5.1 and 5.2 were reported simply as group 5 and, furthermore, the socio-economic groups reported in 1961 show groups 3 and 4 aggregated, groups 1, 2 and 13 aggregated, groups 8, 9, 12 and 14 aggregated, groups 5 and 6 aggregated, groups 7, 10 and 15 aggregated and groups 11, 16 and 17 aggregated.
- 2.1.6 Similar problems were encountered regarding the availability of floorspace and turnover figures from the Census of Distribution. The earlier census information, i.e. the 1961 survey, did not require a return of floorspace data. Fortunately, the 1971 survey did give total floorspace for all the shopping centres in the south west region and, for those more than 20,000 sq.ft., a breakdown of the floorspace into totals for each of the standard retail use groups. However, by the time the new shopping development

in Exeter was in hand, the Census of Distribution had been discontinued and access to up to date total floorspace and turnover figures was not possible by way of nationally produced statistics. However, the Survey of Shops produced by Devon County Council for 1981/82 had been stated to be available. This, when obtained, proved to contain a large amount of aggregation and re-grouping of data and was, therefore, of limited use.

2.1.7 Fortunately, on the revised basis that the experimental test was to be conducted, the 1971 Census of Distribution information was to prove adequate, providing a floorspace survey report at a suitable level of disaggregation for the majority of town centres within the south west region

2.1.8 By contrast, no problem had been encountered in the calculation of road distances and travel times. Distances were obtained from maps, rail times were obtained by courtesy of British Rail from passenger timetables, published in the years tested, and bus and car travel times calculated on the basis of average road speeds provided by the bus companies and by the larger multiple store retailing organisations' research departments.

2.1.9 If the inter-urban allocation of originating net consumption expenditure was to be attributed to the shopping centre locations in Devon, the model required an additional set of data - congestion factors. In the earlier part of this thesis the congestion factor had been taken as a measure of car parking capacity in each of the towns/districts under consideration. It had been assumed, as a result of the questionnaire returns, that such information was readily available and this proved not be the case. Car park capacities were only fully available for the later years in Exeter; partial information was available in respect of some, only, of the other Devon towns and districts even for the later years; and virtually no information was available for the earlier years required for a fuller test of the model. As a result it would have been necessary to test this part of the model without the inclusion of the opportunity-claimant congestion factor modification as made to Huff's original allocation model. The model description would thus become:-

$$S_{gjt} = \sum_{d=1}^n S_{gdjt}$$

where

$$S_{gdjt} = S_{gdt} \cdot A_{gdj}$$

and where

$$A_{gdj} = \frac{\frac{F_{gj}^{\alpha}}{Z_{dj}^{\lambda}}}{\sum_{j=1}^n \frac{F_j^{\alpha}}{Z_{dj}^{\lambda}}}$$

Mainly as a result of the lack of a comprehensive set of car parking data for Devon, and, additionally, due to other inadequacies in the data required for the reliable operation of the consumption expenditure derivation and inter urban allocation, it was decided, eventually, to abandon any thought of using the first sections of the model in this experimental test.

2.1.10 With the decision not to run this part of the model's algorithms, the net consumption expenditure attributable to Exeter City's retail system was taken from the 1971 Census of Distribution. The original form of the model

would have been better used, because it would have been more complete. It would, therefore have been of more use in obtaining an understanding of the working of the urban system and would enable a more flexible approach to be taken in the investigation. The removal of exogenous data would also make for a better model.

- 2.1.11 In acquiring data for a check of the distribution, to individual shop locations, of the net consumption expenditure per trade group received by Exeter as a whole (to provide estimates of turnover), questionnaires were utilised. These were circulated to the occupiers (at 1983) of all the shops within the Exeter City boundaries. The data obtained were used to facilitate the check on the model's predictions of turnovers at individual shop locations. A copy of this questionnaire is included in Appendix 7. A similar questionnaire was forwarded to all the estate agents, surveyors and valuers practising within the Exeter City boundary and both oral inquiries and questionnaires were utilised to obtain information from the local authorities. Again, a

copy of this questionnaire is included in Appendix 7. The returned questionnaires, together with current agents' sales particulars (some of which additionally contained historic information on leases and rents) provided sufficient information on turnovers and rents to provide a representative sample for use in the test. However, in order to utilise the sample rents and turnovers it was necessary to adjust them all to the relevant years under investigation. Again, this was done by the application of the Retail Prices Index to the figures as supplied from the surveys.

2.1.12 Within the surveys of retail floorspace, etc., of the individual shop units within Exeter there were some minor omissions due mainly to an inability to locate the precise position of some of the shops listed in the various directories and lists which were available. In other circumstances items of floorspace or use were missing, but out of the 1,200 or so properties under investigation the number of missing values was insignificant.

2.1.13 There was, however, an area of data on which specific questions had been raised in the

original questionnaire to local authorities and which the City of Exeter's returned questionnaire had indicated would be available. In the event, the information provided by the Planning Department of the City of Exeter on pedestrian flows and on utilisation of car parks was either inadequate or incapable of being used. This was because it was not possible to analyse the data in the form in which they were presented. The original raw data were not available. The pedestrian flows, for example, were aggregated and displayed as straight line movements from one side to the other of an external cordon around the town centre. This information was contained in the several reports of the Exeter and area transportation study ⁽¹⁾ and the City of Exeter Land Use Transport Survey⁽²⁾ produced in 1974 and 1969 respectively. Similarly the Devon County council report on transport policies⁽³⁾ produced in 1981/1982 also failed to provide other than generalised statements in relation to car parking policies and information on traffic management and road improvement schemes, etc. However, reasonably detailed reports on car park utilisation were made available by Exeter City Council for 1981⁽⁴⁾. Additionally, in a report entitled 'Car Park Survey',⁽⁵⁾ produced by the

Council as a summary of the results of a survey of cars entering and leaving Council-owned car parks, carried out by the Council itself, together with a summary of a survey of people using the car parks carried out by students from Exeter University's Department of Geography, there is sufficient information to produce user statistics for the period 1981 to 1983. When read in conjunction with the car park availability information contained in the earlier reports⁽⁶⁻¹⁰⁾ such as the Third Interim Report on Preliminary Planning Proposals⁽⁶⁾ dated April 1968 and the other transportation reports mentioned above, it was possible to identify those car parks which were in existence at the various years under consideration in the test of the model and their capacities.

- 2.1.14 Further problems were encountered in the establishing of net trading profits. Gross margins are reported in the later Censuses of Distribution and, fortunately, sufficient information was available to cover the years under investigation although some averaging had to be undertaken in respect of one or two of the groupings utilised in this work which did not

conform specifically to the groupings reported in the Census of Distribution. There is, however, no published information on average net profits for the various retail groupings. Enquiries made of many sources, including both the Institute of Marketing and the Institute of Sales Managers, failed to reveal any source of such information. The only information available for the test was, therefore, the sparse information given in the responses to the questionnaires sent out to the local traders in Exeter. The returns were, however, insufficient to form the basis of a satisfactory calculation of averages of net profits. Colleagues within the landed professions have, from time to time, mentioned that the Inland Revenue District Valuer and Valuation Officer has some listing of average, or expected, profit margins for different types of businesses but, unfortunately, that information is not available to the general public and is covered by the Official Secrets Act.

- 2.1.15 No such problems were encountered in the obtaining of information from the developers of the Guildhall Shopping Centre and a full summary of the financial appraisals made both before and

on completion of the development have been made available for this research although an undertaking that the information would not be released in detail had to be given. The detailed breakdown of costs and financing charges, etc., is, therefore, confidential and is not included in the data collection in the Appendices.

2.1.16 Earlier in this chapter (1.2.4) it was stated that regional floorspace data were not available for the later test years of the model. However, it was possible to obtain a copy of the Survey of Shops 1981/82 by Devon County Council. This provided similar data to the discontinued Census of Distribution: net retail consumption expenditure by trade group, location of expenditure and floorspace (both retail and total). In fact, the expenditure by trade groups is not disaggregated as finely as that in the 1971 Census of Distribution and its grouping into 'shopping systems' around Devon's principal shopping towns introduces a requirement, for the experimental test, to re-group some of the data.

2.2 The Cost & Profit Model and the Model of Translated Value

2.2.1 During the assessment of available data,

no substantial deficiencies were present in the raw data identified as necessary for the running of this part (cost & profit) of the experimental test. However, some of the required input data for the translated value test were to be the output of earlier parts of the value derivation model - for example, predicted turnovers and predicted rents at individual property locations. These data did, subsequently, prove to be somewhat unreliable and, therefore, became a source of some difficulty in the final analysis. These deficiencies and their consequences are considered in detail in Chapters 8, 9 and 10.

3 Alternative Data and Use of Proxies

3.1 Data for Value Derivation

3.1.1 Where adequate raw data were not available or where no data were available to fit the requirements of the model it has been necessary to resort to the use of proxies or alternative data.

3.1.2 Even in the theoretical description of the model

it was necessary to accept that a measure of pedestrian flow would have to be used as a proxy for the adaptive part of the intra-urban attractiveness factor. As explained earlier, this proxy (pedestrian flow) was not available in a form that could be utilised in the test of the model and it was, therefore, necessary to simulate the pedestrian flow in order to conduct the test.

3.1.3 Some difficulty was encountered during the development of this simulated proxy variable, most of which was a result of minor illogicalities in the algorithm. However, the algorithm was eventually produced and a simulated proxy variable constructed from the available data. The measure of pedestrian flow utilised in the test of the model is derived from a distribution of hypothetical shoppers throughout the street matrix of Exeter's retail centre. The details of the simulation are further discussed in Chapter 8 at paragraph 2.1.16.

3.1.4 For the model to incorporate such a distribution and in order to construct a reasonable proxy measure for the pedestrian flow, we must start

with an enquiry regarding the origins of pedestrian shopping traffic. The origins of internal pedestrian flows can be identified as being the arrival points for the majority of (mainly inter-urban) shoppers, with the town's retail centre cordon crossing points being used for the remainder. However, as discussed earlier in this chapter, without considerable survey effort it would be difficult to obtain precise crossing points and routings for foot-borne arrivals.

- 3.1.5 An inspection of land use maps and a tour of several parts of Exeter reveals that, for the specific town under consideration, the residential and commercial/industrial property in the immediate vicinity of the town's central retail core was fairly evenly distributed. As a result, foot-borne arrivals should be evenly distributed around the town centre cordon and, therefore, evenly absorbed into the initial pedestrian flows emanating from arrival points/cordon crossing points. Observation also revealed that their numbers were also likely to be relatively low. In consequence of these last two points it was considered that foot-borne

arrivals would have little effect on the calculated proxy measure. Appendix 6 contains a geographical background and description of the test town.

3.1.6 It should be noted at this point, however, that it is possible that in other towns an unequal distribution of residential or work place origins of foot-borne shoppers visiting a town centre might create a need to vary this assumption. Similarly, a set of surrounding districts of heterogeneous housing quality reflecting varying socio-economic characteristics of its inhabitants (or commercial/industrial property reflecting the groupings of its workforce) might also require special treatment. In such circumstances 'in-street' pedestrian flow counts would be necessary around the retail centre cordon and the principal crossing points would need to be identified for a proper spatial emphasis within the pedestrian flow simulation model.

3.1.7 In such a model, the distribution of walk opportunities would suggest that any non-uniformity of the distribution of internal pedestrian flows is a function of the location of car parks and of the location of the bus and rail

termini. These are the arrival opportunities that determine the form of the allocation model. (Indeed, within the test of the model the bus and rail termini are treated as being additional short term car park locations.)

3.1.8 However, there are further difficulties in using car park arrivals as a basis for the numbers of households undertaking shopping trips. One of these is that there will be car-borne arrivals whose cars are parked on-street; however, these are relatively few in number due to local parking restrictions. Another, is that set of people who arrive at, and use, car parks but whose intended purpose does not include shopping. These include people on business trips, such as sales representatives, visitors to non retail premises and persons employed in the Exeter central area. Some allowance for these groups is made within the model's operation although the method of allowance is not entirely satisfactory. The following considerations influenced the decision in this regard:

i/ shoppers will tend to avoid the long stay car parks as a result of their outlying location and early filling by 'all day' users. In addition,

long stay car parks tend to be relatively expensive for short stay users as a result of the operators' discriminatory time-cost policies. Shoppers are, therefore, unlikely to make use of them in any significant numbers. Conversely, most business travellers will use the long stay car parks because of the price discriminatory policy which results in a cheaper 'all day' space. However, some will not - particularly sales representatives carrying samples, etc. These, along with members of the public visiting the town centre for commercial purposes rather than shopping will tend to use the short stay inner parking locations.

ii/ Of the group consisting of short stay business, etc., visitors to the town centre, many will not have any intention of also making a retail purchase whilst in the retail core of the city. However, they do still represent an opportunity of a sale for the shopkeeper as many will take the advantage of a casual shopping opportunity even though there was originally no intention to visit any specific shop or retail centre.

3.1.9 Notwithstanding these considerations, care should be taken to look at the location of non retail uses in relation to the distribution of car parks and their users. Without detailed analysis of these matters this approach cannot be said to

produce a perfect allocator, but it does provide a basis for a reasonable distribution of the measure of pedestrian flows along streets even though the mean level of flow will be somewhat understated, particularly by the omission of the foot-borne arrivals. Some problems will emerge if there is an uneven distribution of such arrivals. These could be removed only by detailed in-street and car park surveys but time and resources did not permit these to be included in the research programme underlying this thesis. However, in the experimental test, the numbers generated were used only to produce a proportioning factor in relation to turnover. They are, therefore, consistent during each test run through the computer, i.e. only the relative sizes of the simulated numbers matter. In reality, however, such an assumption, which might be acceptable for foot-borne shopping arrivals, might not adequately reflect the unintentional (e.g. sales representative or office worker) shopper's arrival and pedestrian route.

- 3.1.10 Survey reports on Exeter shopping by Dawson⁽¹¹⁾ in 1974 and Shaw^(12 & 13) in 1979 and in 1984 provide the only available evidence on the proportions of shopping trip arrivals by motor car, bus, rail and foot. As mentioned earlier, resources were not available for a new survey of

shoppers and/or households even though, at an early stage in the research, questionnaires had been drafted for use in such surveys. Whilst the data available from Dawson's and Shaw's work cannot be considered perfect for use in this model, it can certainly be considered to be adequate. It was not necessary, therefore, to supplement it. The proportions identified in Shaw's surveys and in Dawson's survey were taken as representative of the proportions using Exeter as the final destination of a household shopping trip.

- 3.1.11 These trip transport mode proportions were then applied to the totals of car park users (households) and the proportion of arrivals by train and by bus were calculated from the 1981 data. The locations of these arrivals, and the number of household shopping trips thereby derived, were treated identically with car park locations for the purpose of the algorithm (see later). The remaining shopping trips - arrivals on foot - were not utilised in the construction of the proxy variable on the assumption, discussed earlier, that these arrivals would be fairly evenly dispersed around the centre boundary and then throughout the centre. They were, therefore, perceived as being of little consequence to the result of the construction.

3.1.12 In order to simulate similar car park and household shopping trip data for the earlier years involved in the test of the model, the 1981 car parking data (and the 1978 car parking data) were re-apportioned to the known car park locations - firstly, in proportion to their capacities and, secondly, in accordance with the proportions utilising the different modes of transport (again treating bus arrivals and train arrivals as arrivals at two additional car park locations). The figures thus produced were then proportionately reduced in relation to the numbers of households in the perceived catchment area at the census date closest to the relevant test date. This was actually achieved by averaging the Exeter households growth data and the Devon households growth data as follows:-

Comparison of Growth in Number of Households in Exeter and in Devon 1961-1981

YEAR	EXETER	% of 1981 POPULATION	DEVON	% of 1981 POPULATION	MEAN%
1961	24828	71	268105	77	0.74
1971	32080	91	309860	89	0.9
1981	34981	100	348091	100	1.0

TABLE 2

3.1.13 By interpolation from the following graph, the appropriate reduction factor was obtained:-

Increase in Number of Households in Exeter
1961-1981

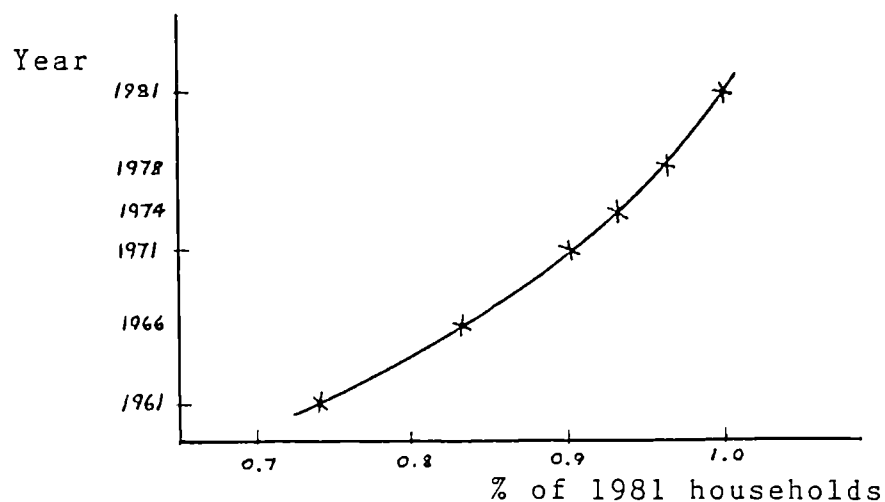


FIGURE 5

Source: Census of Population

Car Park Utilisation Reduction Factors

1961	1966	1971	1974	1978	1981
0.74	0.83	0.9	0.93	0.975	1.0

TABLE 3

3.1.14 The figures for shopping trip arrivals, even though simulated, present a pattern over time which reflects reported patterns describing the growth in motor car ownership, the decline of

rail facilities, the reduction in bus usage and the growth in the number of households. As a result, the simulated figures were considered to be acceptable and, therefore, were used in the test. The figures are shown in the table below:-

Shopping Trip Arrivals - Exeter Centre
(percentage)

MODE	1984	1979	1974	1966 (by regression)
Car	59.4	52.4	34	13.36
Bus	15.5	22.2	32	44.7
Rail	0.1	2.8	6	10.6
Other	25.0	22.6	28	29.1

TABLE 4

Source: Surveys by Shaw & Dawson

Proxy Shopping Trip/Transport Modes (adjusted)
- calculated from car park utilisation statistics

Year	Car	Bus	Train	Other	Total
1981	10409	2716	18	4381	17524
1978	8951	3793	479	3861	17084
1974	5540	5214	977	4563	16294
1966	1944	6503	1542	4234	14223

TABLE 5

Comparison of Households (Exeter) with Total
Proxy Shopping Trips

Year	Proxy Shopping Trips	No. of House- holds	Factor	Av. Factor
1981	17524	34981	1.996 2.048	2.02
1978	17084	-		
1974	16294	-		
1971	-	32081	1.969 2.256	1.969
1966	14223	-		2.00
1961	-	24828	1.746	

TABLE 6

3.1.15 Utilising the figures from the table, the location and numbers of the simulated arrivals for shopping trips could then be treated as origins and numbers for internal pedestrian flows within the retail centre. An attraction algorithm was produced which simulated a shopper's passage through the retail core. The assumption was made that all shoppers were attracted by the magnet store. This latter being defined within the algorithm as the store having the largest retail floorspace. (For the purpose of the post-Guildhall development tests, the floor areas of the individual shops of the

Guildhall Shopping Centre were aggregated and the Centre treated as a single variety store.) The shopper's decision at a street intersection was modelled by apportioning the arrivals, at that point, to the several possible exits in proportion to the attraction of the amount of shopping along the alternative routes and the dis-attraction of the extra distance travelled assuming that, at the end of that leg of the route, the shopper would wish to resume direct progression to the magnet store, viz:

$$S_{p1,p2} = \frac{\left(\frac{f_{\ell}}{n_{\ell}} + \frac{F_{mp2}}{N_{mp2}} \right) \frac{1}{d_{\ell}}}{\sum_{\ell=1}^n \left(\frac{f_{\ell}}{n_{\ell}} + \frac{F_{mp2}}{N_{mp2}} \right) \frac{1}{d_{\ell}}}$$

Where f = total amount of retail
floorspace along route leg ℓ

n = the number of retail shops
along route leg ℓ

F_{mp2} = total amount of retail
floorspace between P_2 (the end
of route leg ℓ) and m (the
magnet store) including the
magnet store

N_{mp2} = the number of retail shops
 between P_2 and the magnet
 store, including the magnet
 store

 d = the additional distance
 travelled by using alternative
 route leg ℓ to move towards
 the magnet store location

 and S_{plp2} = the number of shoppers
 attracted into route leg ℓ ,
 i.e. into the street running
 between points P_1 and P_2 in
 the retail centre street
 matrix.

3.1.16 The aggregation of the proportioned flows from
 the several car park locations produces the total
 numbers of shoppers in each street between the
 car park and the magnet store. A run of the
 simulation model using only one origin and a
 round number of shoppers (2000) was sufficient to
 demonstrate that the distribution effected by the
 algorithm appeared to be proportionately correct.
 Cul-de-sacs with shops, and streets without shops
 but on the through route to the magnet store,
 were allocated numbers of shoppers, demonstrating

that the algorithm was functioning correctly. The proportioning and the resultant numbers appeared to be of the right order when the individual street sections were assessed and compared. Those streets with large numbers of contiguous shops with varieties of uses attracted proportionately more shoppers than others with low numbers of shops, poor quality shops, or shops with small retail floorspaces. The numbers of shoppers increased in streets closer to the centre of the retail core and the more direct routes from arrival points to magnet store contained relatively higher numbers of shoppers. The distribution algorithm, therefore, appeared to be reasonably reliable. However, it is not possible to be sure that the allocations are exactly right.

- 3.1.17 Let us suppose, therefore, that they are to some extent wrong. Errors in the prediction of numbers of pedestrians allocated to individual street sections might cause some marginal disruption of the relative sizes of the pedestrian flows. However, it should be remembered that exact numerical size of each flow is not, of itself, important. The factor used in

the research utilises only the logarithmic value of the numeric size of the simulated pedestrian flow. As logarithmic size is used to indicate the relative importance of the particular street section (to attenuate, or adjust, the significance of the retail floorspace of an individual shop in that street) it is the order of size that is the important output from the simulation.

- 3.1.18 In order that the algorithm should deal adequately with the allocation of numbers of shoppers to cul-de-sacs, etc., as described earlier, the original constraint on return flows had to be relaxed. This did result in a slight overcount in one unique circumstance, i.e. where shoppers were attracted away from the main flow due to availability of shops and then because of the strength of attraction returned to the main flow at the point from which they had departed, for a continued progression towards the magnet store. The condition could be controlled where the attracting shops were on a cul-de-sac and in that circumstance double counting was avoided. However, the same constraint when applied to all route legs resulted in substantial undercounting

on many of the routes and restrictions on the free flow of shoppers. The numbers involved (in the mock test) were 6, shoppers out of the original 2000 and only one peripheral leg out of the 50 utilised in that progression towards the magnet had the count of 2006. As, on an aggregation of car park inputs, the more central streets would have significantly higher numbers of shoppers than the peripheral streets, it was decided that the backfeed error was an acceptable problem. This decision may have been a contributory factor to the rental distribution problem that eventually arose. The problem is discussed at length later in the thesis.

- 3.1.19 In the pedestrian flow model outlined above there is one further factor that could be included. For a pedestrian flow model to have any realism it ought really to contain a variable to account for congestion. As more pedestrians enter a street, because of its attraction as a shopping street or as a through route, the resulting congestion makes the street less attractive to subsequent, but temporally linked, shoppers and alternative routes may be sought. Further investigation of the relationship between pavement capacity, speed of pedestrian flow, perceived congestion and the decision to use alternative routes is necessary but,

unfortunately, time constraints prevented its being researched as part of this work. Observation of flow densities in Exeter's central area, over long periods, suggested that there was no time of day at which such a congestion factor would have been triggered and, therefore, this is a mere detail in the model. With the exception of two very short, narrow streets within the centre it would have had no significant effect in this experimental test. Accordingly, the unadjusted pedestrian flow figures produced by the simulation model were utilised in the tests of the Value Model in this research.

- 3.1.20 Observation of the usage of retail premises by shoppers and informal interviews with store managers in central Preston and Blackburn indicates that the number of shoppers per square foot of retail floorspace is about three to four times higher in centrally located major stores than in peripheral shops selling the same range of goods. In addition to this casually observed phenomenon there is the fact that many shoppers setting out with the intention of purchasing goods in one store actually make that purchase elsewhere, taking advantage of an intervening opportunity to make the purchase. This reinforced the view, taken earlier, that an allocation of consumer spending to retail shops

entirely as a function of floorspace is imperfect.

3.1.21 However, it will be recalled that, in this research, the factor α shown in the original theoretical derivation discussion was an attractor based solely on floorspace. In an attempt to accommodate the matters discussed in the previous two paragraphs it was modified during the conceptual development of the model to reflect the size of pedestrian flow and the intervening opportunity by the addition of ρ_s , the number of pedestrians passing shop i in street s . The original floorspace attractor, α_i was simply:

$$\frac{F_{gi}}{\sum_{i=1}^n F_{gi}} \quad \text{or} \quad \frac{F_{gi}}{F_{gj}}$$

thus attempting to ensure that

$$\sum_{i=1}^n T_{gi} = S_{gj}$$

3.1.22 In the allocation factor described in the previous paragraph, it will be noted that the additional apportionment (i.e. the further

(multiplication by $\frac{F_{ms}}{F_j}$) has been omitted.

The reason for this was explained in Chapter 3 (section 2.4) i.e. the application of reduction (in this experimental test) of $\frac{160,000}{1,000,000}$, or 0.16) consistently to all of the calculated allocation factors would over emphasise the magnet store's influence on the pedestrian flow. It was, therefore, dropped from the model during its early development.

3.1.23 The lack of real pedestrian flow data was the only major deficiency in data and the only one requiring a re-specification of part of the model and its variables, i.e. to provide for the simulation of pedestrian flows. Other data deficiencies were encountered but have been dealt with by adaptation or adjustment of available data as will be described in the subsequent paragraphs.

3.1.24 In the early part of the modelling work, prior to the decision not to continue the attempt to construct the consumption function and the origin of consumption expenditure distribution, there was a requirement for the establishment of socio-economic structures and wages needed for the construction of the θ factors. Data on wages and wage rates for 1961/1966 were not available from

either the Department of Employment or from census data publications held by the usual library sources. It was possible, however, to obtain an index of wages for the relevant period and, therefore, the wage rates for male manual workers and for male non-manual workers were calculated. The resultant data utilised in the model are shown in Table 7.

South West Region 1961-1981

Weekly Wages (all industries) f's

	1981	1971	Index No.	1961
Full Time Manual Men				
SW Region	114.4	28.79		
Avon	124.5	-		
Cornwall	103.4	-		
Devon	106.0	-	58.6	
Dorset	110.9	-	112.4	15.0
Glous'shire	118.7	-	(assumed)	
Somerset	113.2	-		
Wiltshire	112.8	-		
Full Time Non Manual Men				
SW Region	153.3	36.5		
Avon	157.6	-		
Cornwall	142.7*	-		
Devon	145.5	-	58.6	
Dorset	154.0	-	112.4	19.0
Glous'shire	157.3	-		
Somerset	154.2	-		
Wiltshire	153.8	-		

* small sample

TABLE 7

Source: New Earnings Survey & Employment
Statistics Year Book, Department of
Employment

3.1.25 Enquiries made of the Department of Employment for unpublished data or access to the raw data collection in order to fill in the blanks in the above table from the original disaggregate returns met with an unsatisfactory response. The Department's advice being that, if the data were not published, they were not available. A letter sent to the Statistics Section of the Inland Revenue requesting assistance with average earnings data met with no response whatsoever.

3.1.26 Furthermore, the socio-economic groupings of heads of household were not published for the period 1961/1966. The only data that could be obtained for these periods were data on the socio-economic groupings of economically active males. It was decided, however, that a model could still run utilising this different data but it was noted that a comparison of the results with the results from tests on data for later periods utilising head of household data would not be very meaningful. It might, however, be a useful guide.

3.1.27 The summary tables of socio-economic groups at South West Regional level, County level, Devon town/district level and Exeter Ward level are included in the data collection in Appendix 9.

3.1.28 The data collected by survey, as a basis for a check of the model's predictions, also demonstrated some potential problems when it was collated for use. In reviewing the data sets created from the survey of rents, etc., it became obvious that the rental information was very sparse for the 1966 test. Not only was the data sparse for 1966 but the number of properties providing a return, even for later years, was insufficient for a proper test of the model's predictive power. The data provided also needed adjustment to the test years and, therefore, it was decided, firstly, to adjust the given figures to the test year by using a Retail Price Index adjustment and, secondly, to adjust all rental information relating to dates from 1980 onwards up to a 1983 base; all rents relating to dates between 1971 and 1979 were adjusted to a 1975/76 base and those prior to 1971 were adjusted down to a 1966 base. The adequacy of indexing in this manner is discussed in the next section.

3.1.29 The adjusted data thus available were utilised in the calculation of hypothetical rents for all the properties involved in the test. It will be recalled that an earlier investigation of the validity of the relationship between Gross Value for rating and rents paid had been carried out in

order to test the strength of the mandatory requirement of the General Rate Act for the Gross Value to be 'the rent which a hypothetical tenant would pay for the premises' at the date of the rating valuation. There were two parts to the investigation carried out. The first was to test the consistency of the several available indices relating to rentals for properties. Those tested were the Hillier Parker/Investors Chronicle Rent Index, the Department of Environment Commercial and Industrial Rent Index and the Retail Prices Index (All Goods). A full analysis of the adjusted rents against the original rental data obtained from a sample of properties in London's Oxford Street and Bond Street revealed, following regression analysis, that the Retail Prices Index provided the best and most reliable form of index adjustment for rents over the period investigated.

- 3.1.30 The second stage of the rent/rates survey tested the inflation adjusted rents against the finally agreed Gross Values entered into the Valuation List. The analysis was made on the basis of several hundred observations and an extremely high correlation ($R^2 = 0.9$) between the inflation adjusted rents and the finally agreed Gross Values was demonstrated, making this result very

significant. An analysis of the linear relationships revealed by the several regression analyses demonstrated that, considering the overall range of rents tested, the agreed Gross Value could be related consistently to the Retail Price Index adjusted rent for the 1973 revaluation and that this consistency held good even when the data was split up into blocks of high rents and blocks of low rents. A full report of the rent and rates survey is included in Appendix 2, together with its raw data collection and plots of the regressions.

3.1.31 The analysis substantiated the claimed consistency of the rating hypothesis and, as a result, it was decided to utilise the Gross Value assessment for rating purposes as an indication of the relative sizes of the rental values of all the shop properties involved in the test of the model. The adjusted revealed rents obtained from the Exeter Shops questionnaire survey were, therefore, analysed to provide an average rental value per pound sterling of Gross Value and this average figure was then applied to the Gross Value of each property to provide its hypothetical rental at the test date. It is against these hypothetical rentals that the predictive powers of the Value Derivation Model were tested.

3.1.32 Further, the analysis of the questionnaire survey on turnovers and rents revealed a similar dearth of information on net profits and, as only the gross margins were available from published data (and, even then, only for the later years of the test), it was necessary to resort to an alternative approach to the establishment of net profits than that set out in the description of the theoretical model.

3.1.33 The alternative was decided upon by resorting to published material on the existing practices used in the property valuation process. Where geographic or legislative monopolies exist it is common practice to derive a hypothetical rent from the profits and accounts of the businesses occupying a property for which no comparative evidence exists. Where access to actual net profit per accounts is not available it has been practice to assume that net profits lie in the region of 25% to $33\frac{1}{3}\%$ of gross profits (i.e. turnover multiplied by the percentage of the gross margin) for the 'usual' types of retail business. In the absence of any better approach to the requirement to derive net profit and in the absence of sufficient data from which to analyse a range of gross/net profit percentages,

a factor of 30% of gross profit has been utilised as an 'average' for application to the gross profits produced by the application of gross margins to predicted turnovers. The gross margins utilised in the test are set out in Table 22 in Chapter 9.

3.1.34 Similarly, the amount of the hypothetical tenant's rent bid, whilst modelled theoretically in the earlier parts of this thesis, could not be derived by the sophisticated model constructed due to a lack of information on average fixed overheads and trading costs for the several retail trade groups identified. In the absence of accounting details it has been necessary to resort, again, to an established valuation practice (the profits and accounts method) for assistance. Texts in common use suggest that the net adjusted 'profits' of a business, which constitute a 'divisible balance' can be fairly split 60:40 between tenant and landlord, the 40% of 'profit' being the rent fairly payable to the landlord for the use of the premises. The process, and the proportions of the division of the balance have been argued before the Courts on many occasions; the Courts, on appeal, have upheld the approach.

3.1.35 The 'profits and accounts' approach is justified by accepting that the tenant's 'profits' are, in economic terms, truly a combination of the four factors of production: wages (for his labour), interest (on his capital investment in stock, fixtures and fittings, etc.), and true profit (for his enterprise or risk taking in running the business); this leaves the remainder of the divisible balance for the return to the fourth factor of production - rent. In practical terms the actual calculation of each of the first three listed returns usually results in an aggregated amount which approximates, for most retail businesses, about 60% of the net adjusted profits. Therefore, in view of the problems encountered with shortages of information, a figure of 40% of the net profit was taken as the tenant's rent bid in this research.

3.1.36 The one other area of the model that required more information than could be obtained from the questionnaires returned, was the capital value calculation (VALDER 10). In order for this part of the model to operate it is necessary for an investment yield (discount rate) to be available from analysis of transactions in comparable properties. This investment yield could only be

analysed in a very few of the returns and, as a result, resort was made to obtaining the subjective opinion of the senior partners of the major firms of professional, industrial and commercial valuers practising in Exeter, and the opinion of the City Estates Officer, on typical yields for the several sections of shopping street frontages within Exeter City Centre at the years in question. These yields were then scheduled and included in the data set for use in the concluding part of the Value Derivation Model. The list of yields, and the street matrix sections to which they apply, is included in Appendix 9.

3.1.37 It is clear that even in Exeter, already identified as having the most comprehensive data base, deficiencies in the information are serious. Despite this, Chapter 8 provides the most complete investigation possible of the model. In addition, an alternative method of analysis of the available data is examined in Chapter 9.

CHAPTER EIGHT

THE MODEL AS A PREDICTOR

1 The Algorithms

1.1 Introduction

1.1.1 A comparison of the model as run and the model as set out in Chapter 5 already casts considerable doubt upon the ability properly to test the hypothesis. The changes that, of necessity, were made to the model to accommodate the identified data deficiencies, are fully explained in this chapter and a description and explanation of the results of the experimental test will be found in Chapter 9.

1.1.2 To keep the text of this chapter free from interruption, the computer listings of the model and its sub-routines have been confined to a special section at the end of the chapter where the full listing of each is set out in sequence (without comment or annotation), the order following that in the list of the component parts

of the model set out in Chapter 5. Where additional routines have been used to sort data or prepare additional data from the raw data collected, these are to be found in Appendix 9. Comment on the form and operation of the several components of the model is made in the following paragraphs.

1.1.3 In order to carry out the test of the predictive capacity of the Value Derivation Model and thereby provide data for a test of the Translated Value Hypothesis, it was necessary to construct computer routines for the several stages of the model. The programs were written, mainly, in BASIC so that they could be transferred to, and utilised on, any suitable computer. Only those algorithms written specifically to produce mapped data for illustrative purposes were written in languages other than BASIC, the reason being that they are plotter driver programs and are machine specific, therefore not portable.

1.1.4 As, throughout the text of this chapter, reference is made to the model's sub-routines by the name of the computer program, the several

The Model Components : text references

SUB ROUTINE Original Reference and Discussion

The Value Derivation Model

VALDER 1A)	
VALDER 1B)	Chapter 3, Page 122 & Chapter 5, Page 198
VALDER 1C)	
VALDER 2	Chapter 3, Page 123 & Chapter 5, Page 199
VALDER 3 & 4	Chapter 3, Page 125 & Chapter 5, Page 199
PREVALDER	Chapter 8, Page 295
VALDER 1-4	Chapter 8, Page 295
VALDER 3A & 4A	Chapter 8, Page 302
VALDER 5	Chapter 3, Page 128 & Chapter 5, Page 199
VALDER 6 & 7	Chapter 3, Page 134 & Chapter 5, Page 200
VALDER 8 & 9	Chapter 3, Page 139 & Chapter 5, Page 200
VALDER 10 & 11	Chapter 3, Page 144 & Chapter 5, Page 201

The Cost & Profit Model

COSPROF 1-4	Chapter 4, Page 187 & Chapter 5, Page 202
COSPROF 1-4A	Chapter 8, Page 309 & Chapter 8, Page 330

The Translated Value Model

TRANVAL 1-10	Chapter 3 as Valder & Chapter 5, Page 203
TRANVAL 11-14	Chapter 4, Page 191 & Chapter 5, Page 203
TRANVAL 15	Chapter 3, Page 149 & Chapter 5, Page 204

TABLE 8

sections of the model are listed in Table 8 together with references to the text of the chapter where they are developed and discussed and, where appropriate, Chapter 5 where they are summarised and reviewed in order.

- 1.1.5 It should be noted, at this stage, that for the reasons explained earlier, those parts of the model relating to the derivation of consumption expenditure and the distribution of its origins were not utilised in the experimental test of the model. The algorithms that had been developed for the later parts of the derivation process are, however, still included in the end section of this chapter and discussed below as they may be of some interest to other researchers.

1.2 The Value Derivation Algorithms

- 1.2.1 VALDER 1A, 1B & 1C : The Value Derivation Model in Chapter 5 commences with regional gross consumption expenditure and runs through to VALDER 2 before having the transport costs and housing related expenditures removed. Expenditure data available at regional level is proportionately allocated to the constituent

counties of the South West Region and, thereafter, similarly allocated to the constituent towns and districts of Devon. Although it would be possible to move directly from regional level to any individual sub-areal unit, the region-to-county, county-to-district, district-to-ward approach has been maintained for clarity of demonstration. The algorithm has been split into 1A, 1B and 1C in order to accommodate this proposed approach, which would have been demonstrated in a test run on the data for the South West Region. The three algorithms are based on the model:

$$C_{dt} = C_{rt} \frac{\theta_d}{\theta_r}$$

and are supported by the sorting and preparation routines VALDER 1.1 to VALDER 1.5 contained in Appendix 9.

- 1.2.2 VALDER 2 : In the experimental test of the model, the net retail consumption expenditure data was obtained from the Census of Distribution and, therefore, as the data exists in the form assumed by Valder 2 the routine Valder 2 is not required for this test.

1.2.3 VALDER 3 & 4 : In a test of the full model, the origin of retail expenditure would, at this stage, have been allocated to the several towns and districts of Devon from which it arose. This next part of the model would then have been used to allocate the expenditure arising from those towns/districts to shopping centres. The allocation algorithm that was prepared for the test was that set out in Chapter 7 (the amended version of that contained in the original theoretical model summarised in Chapter 5); the version of VALDER 3 & 4 without the opportunity-claimant factor. However, even though the experimental test did not proceed through this stage, the computer routine is included at the end of this chapter (merely for information). If run, it would have been supported by the sorting and preparation routines VALDER 3.1 to VALDER 4.1 contained in Appendix 9.

1.2.4 In developing a behavioural model it is always preferable that each decision stage of the model be investigated. In this experimental test, however, it has been suggested that the data that were available for Exeter and for Devon were not

sufficient for detailed analysis and, although consideration has been given to several ways of proxying the required information and data, the use of such proxies would weaken any conclusions that might be drawn from any run of the model which made use of them. As a result, an alternative course would seem no more damaging. It was decided, therefore, to enter the model at the stage where a known distribution of net retail consumption expenditure existed, thus permitting the testing of the de facto provision.

1.2.5 PRE-VALDER & VALDER 1-4: Following the entry point decision to which reference is made in the previous paragraph which perhaps makes the model not as good at prediction but probably helps it to explain the present with some confidence, the 1971 Census of Distribution was used as a basis for a 'before and after' check on the internal turnover distribution within Exeter at the time of the construction of the Guildhall Shopping Centre in the mid 1970s.

1.2.6 As the development of the Guildhall Shopping Centre occurred during the period 1975/1976 and

it was the 1975/76 levels of floorspace that were to be the basis of the investigation of a redistribution of a fixed amount of spending within the centre, it was necessary to utilise a set of net retail consumption expenditures (per retail trade group) that had been adjusted to a 1975/1976 base. The necessity was occasioned also by the fact that the survey data collected for the purpose of checking the results had been solicited for the specified test years. Merely adjusting net retail consumption expenditure data from the 1971 Census of Distribution would have caused a problem - the amount of retail floorspace in Exeter, established by survey, was different in total and differently distributed among the retail trade groups by 1975. In addition, the establishment of some reliable relationship was necessary in order to ensure that any adjustments made to, or any re-allocations of, regional net retail consumption expenditure would be reasonably accurate.

1.2.7 On consideration, it was obvious that there ought

to be a relationship between the range of a good and the dominance of Exeter at the centre of the regional hierarchy. Different commodities have different ranges. Therefore, the use of an adjusting multiplier, similar to the factors utilised by Lachsmannan and Hansen (and others) in gravity modelled distributions, appeared to be a suitable way of flexibly maintaining the relative sizes of expenditures established at one date when adjusting, re-allocating and re-distributing regional consumer expenditures as at 1975/76. Therefore, an analysis of the relationship between regional net retail consumption expenditure data and the Exeter net retail consumption expenditure data as at 1971 was made. This was in order to establish a set of adjusting multipliers through which to attempt to assure a reasonable accuracy in the adjusted data to be utilised as the fixed level of retail expenditure in Exeter both before and after the development of the Guildhall Shopping Centre.

1.2.8 This analysis of 1971 data, to provide

multipliers, was achieved using the substituted computer program, PRE-VALDER, based on the following equation:-

$$E_g^x = E_g^{*x}$$

where

$$E_g^x = F_g^x \frac{E_g^r}{F_g^r} \cdot \frac{E^x - \sum_{j=1}^n \frac{E_j^r F_j^x}{F_j^r}}{E^{*x} - \sum_{j=1}^n \frac{E_g^r F_g^x}{F_j^r}}$$

where E^x = total actual net consumption expenditure in Exeter

E_g^r = total actual net consumption expenditure on good type g in SW region as a whole

F_g^x = total floorspace given over to retail sales of good type g in Exeter

F_g^r = total floorspace given over to retail sales of good type g in SW region as a whole

$$E^* = \sum_{i=1}^n \frac{E_g^r F_g^x}{F_g^r}$$

and

j is a sub-set of g where the result of an iteration of the model is deemed to produce a result that is within 5% of the observation.

therefore

$$M'_g = M_g \left(\begin{array}{c} (\\ (\quad E^x \quad - \quad \sum_{j=1}^n \quad \frac{E_j^r \quad F_j^x}{F_j^r} \quad) \\ (\\ (\\ (\\ (\\ (\\ (\\ (\quad E^{*x} \quad - \quad \sum_{j=1}^n \quad \frac{E_j^r \quad F_j^x}{F_j^r} \quad) \\ (\\ (\end{array} \right)$$

where M_g = the value of the adjusting multiplier at the first iteration

M'_g = the cumulative value of the adjusting multiplier on completion of sufficient iterations to ensure that the subset j = the original set g, i.e. all multipliers are deemed correct within calculation rounding error limits

- 1.2.10 In the iterations to find M'_g it should be noted that two separate iterative loops are needed; one to deal with over-estimates of expenditure and one to deal with under-estimates. If separate iterations are not utilised it will be found that, at some stage in the iterations, the under estimates will balance the over-estimates and incorrect multipliers will be reported.
- 1.2.11 The set of computer instructions, PREVALDER, which is used to calculate the adjusting multipliers, is included at the end of this chapter.
- 1.2.12 The second stage of this early analysis is VALDER 1-4, replacing those routines designed to follow the construction of the theoretical model. This instruction set is used to break down the regional net consumption expenditure by trade group (adjusted from 1971 to 1975/76 levels by the use of the average of the retail price index numbers for 1975 and 1976) to produce an estimation of the amounts spent in Exeter based on the 1975/76 surveyed floorspace allocations. The algorithm is based on the following equation:-

$$S_g^x = \frac{S_g^r F_g^x}{F_g^r} \cdot M_g^x$$

where S_g^x = the total amount spent on good type g in Exeter as a whole

S_g^r = the total amount spent on good type g in the SW region as a whole

F_g^r = the total floorspace given over to retail sales of good type g in the SW region as a whole

F_g^x = the total floorspace given over to retail sales of good type g in Exeter as a whole

M_g^x = an adjusting multiplier calculated by analysis of the 1971 data

1.2.13 The resultant full sub-model program is included in the end section of this chapter. It should be noted, however, that the use of these analysed adjusting multipliers in conjunction with the changes in floorspace between 1971 and 1975/76 resulted in an apparently wide-ranging adjustment. The effect of this combination is examined in the next chapter together with an examination of the derived multipliers.

1.2.14 VALDER 3A & 4A : In the test of the model based on revealed expenditure locations it should be noted that the Exeter system was treated in the Census of Distribution as a single town attractor. In order properly to operate the internal attraction/allocation model at the level of detail required it was noted that the shopping facilities in, and expenditure arising from, each ward within the Exeter system, in a full run of the model, would have been dealt with as though each ward was a separate town or a district within the allocations that would have been made by VALDER 3 & 4. However, even if the allocation to wards had been dealt with in such a manner it might have been felt that their individual attraction powers in relation to the other towns and districts of Devon would be so minimal that distorted figures might be obtained. Therefore, if VALDER 3 & 4 had been allowed to operate with the full weight of the Exeter system it would have been necessary to re-allocate the expenditure arising out of Exeter's wards back to those wards as neighbourhood shopping centres. As a result, the algorithm VALDER 3A & 4A was devised to deal with this re-allocation. It also, conveniently, can be used to allocate the retail spending in Exeter (based on the reported amounts in the Census of Distribution) between the central area and the ward-based neighbourhood

shops. VALDER 3A & 4A, therefore, takes all the expenditure attracted to the Exeter system and re-allocates some of it back out from the centre (location 18 within the algorithm) to the seventeen constituent wards surrounding the central area. For this purpose the individual shop data on the Exeter system was split into those units within the defined central area and those units outside the defined central area, these latter being grouped into ward collections for the operation of this algorithm. The ward collections are treated as being located at the ward centroid.

1.2.15 The algorithm is included in the end section of this chapter and is based on the same structure of allocation factor as that developed for use in VALDER 3 & 4 and described in Chapters 3 and 5.

1.2.16 VALDER 5 : The Value Derivation Model continues with a further routine based on the premise that, internally within a town, the proportion of expenditure, i.e. turnover, allocated to each individual shop is a function of the passing pedestrian flow and its floorspace as an attractor. It will be recalled that, earlier in this thesis, it was reported that a change had been made to the original specification of the

pedestrian flow/floorspace attractor. Prior to writing the algorithm further definition of this relationship was necessary. The model could not be used merely with an attractor based on α otherwise the resultant output of individual property turnovers in each retail trade group would sum to much more than the input aggregate turnover for the constituent shops in each group. The equation was, therefore, developed further and considered in several different forms as described in Chapter 3. However, for the experimental test, the general structure of the instruction set remained the same; only that section of the algorithm dealing with the allocation factor was changed as each alternative formula was tested.

1.2.17 The general structure of the computer routine is as VALDER 5, listed in the end section of this chapter. Discussion of the results of the investigation of a suitable form for the allocating factor is contained in the last section of this chapter.

1.2.18 After the data had been run through VALDER 5, the output predicted turnovers at individual shop locations were summed and checked against the

input group aggregates. The check routine used for this is included in Appendix 9 with the other supporting algorithms and intermediate files of data.

1.2.19 VALDER 6 & 7 : The model contains two individual descriptive relationships concerning profit and the derivation of tenant's rent bid but, as described in Chapter 7, the detailed information could not be obtained in order to have this part of the model function as originally specified. It was necessary, therefore, to resort to the alternative allocation factors (described in Chapter 7) to produce the tenant's rent bid based on known gross profit margins, an average of net profit proportions and an average of rent bids. The resultant sub-model computer program is fairly short. It is included in the end section of this chapter.

1.2.20 VALDER 8 & 9 : Within the model description this algorithm constitutes VALDER 8A and 8B and VALDER 9A and 9B and is intended to replicate the negotiating process. Although the theoretical statement describes a time series model based on sequential data and expected or anticipated data, it was not possible to operate in this way in the

experimental test. Minor alterations have been made, therefore, to the structure of VALDER 8 & 9.

1.2.21 The algorithm now operates on the basis that, in a negotiating situation, the tenant puts forward a rent bid slightly lower than the rent bid that he is really willing to make. The following parameters are based on my own knowledge and experience of rent review negotiations and on consultation with colleagues in the property valuation profession, and for the purpose of this experiment they seemed to present a generally useful starting point. Therefore, the rent bid has been modelled at 0.9 of the rent bid derived in the earlier stage of the model. The landlord's rent demanded has been modelled on the basis that the landlord looks at the maximum rent per square foot that has been offered or obtained for proximate shops and, in an attempt to force the rental levels upwards, demands a rent slightly higher than the maximum that has been achieved. In this test the additional amount has been fixed at 0.1 of the highest known rent per square foot and the higher rate is applied to the retail floor area of the shop property under consideration, thus producing a landlord's rent demand for the property. The routine then takes these two extremes of rent, the tenant's offer

and the landlord's demand, and, assuming equal bargaining positions, resolves a rent for the property midway between the two figures advanced. In the event that the landlord's rent demanded is less than the amount that the tenant is willing to pay, the model allows the rent to be fixed at the landlord's level; where, as a result of the property being vacant or in a group for which no retail expenditure is known, the turnover at the location (and hence the tenant's rent bid) is zero, the average of the rent per square foot of retail space for proximate shops has been used as the basis of a hypothetical rental value in order that the capital values calculated in later stages of the model could still be obtained. Without this assumption, the model would have treated empty shops as having no value: this cannot be; all properties have a value, even if temporarily vacant. The algorithm for VALDER 8 & 9 is set out at the end of this chapter.

1.2.22 VALDER 10 & 11 : For convenience the instruction sets for these two sections of the model have been combined. The first part of the algorithm derives the individual capital value of an assumed freehold interest in each of the identified retail units throughout the defined town centre. As the result of the rent

derivation sub model is a rent which is assumed to be the current open market rental of the retail unit, the full expansion of the Sykes rational valuation model (which assumes the residue of a lease term at an historic rent followed by a review at a future date to the current open market rental) reduces to the simple relationship

$$CUV_i = R_i \cdot Y_{ps}$$

where R_i = the predicted rental value of property i

and Y_{ps} = the freehold 'all risks' investment yield for property of type p in street section s

1.2.23 The second part of the algorithm, therefore, merely sums the individual capital values of the retail units derived in the first part of the program to produce the final result: the total capital value of the retail core. The computer program for VALDER 10 & 11 is included in the end section to this chapter.

1.3 The Cost and Profit Model

- 1.3.1 COSPROF1-4 : The computer routine developed for this part of the model follows the descriptions set out in Chapter 5. The algorithm is in the form of an interactive program which follows the logic of the four stages of the COSPROF model which are, themselves, descriptive of the standard calculation of costs and required developer's profit utilised as part of the development appraisal to find the residual amount available for site acquisition.
- 1.3.2 The program, COSPROF 1-4, for this section of of the model is included in the supplement to this chapter which contains the full set of computer routines for use in the model.
- 1.3.3 In the event, the developer of the Guildhall Shopping Centre provided, on a confidential basis, an account of the final cost of construction of the Guildhall Centre, fully analysed, and this enabled a single figure for gross cost to be utilised in the experimental test. An addition of 20% was made to the gross cost figure to allow for developer's profit, as had been intended in the specification of the

original model, and the resultant figure of gross cost/net profit (GCNP) was then available for use in the TRANVAL algorithms that followed.

1.4 The Translated Value Model

1.4.1 TRANVAL 1-10 : No new programs were written specifically for this part of the model as the individual capital value of the completed new development had already been calculated during the running of the computer routines, VALDER 1 to VALDER 10. The value of the individual shopping centre, the Guildhall Centre, could therefore be extracted from the results of those earlier computer runs.

1.4.2 TRANVAL 11-14 : The sequence of descriptive relationships within the TRANVAL model are readily disposed of by a fairly short program which takes the gross capital value of the completed Guildhall Shopping Centre and deducts the gross cost and net profit from that capital value to produce a residual amount available for site acquisition. This amount is then reduced by the amount of bank charges and interest payable over the two and a half year site holding period and the deduction of the amount of legal costs,

agent's fees, stamp duty and other incidental expenses incurred in the site acquisition. This latter set of deductions amounts to approximately 4% of the acquisition price and, after subtraction, the net residual development value of the Guildhall site is available. The short piece of program to produce this result is included at the end of this chapter with the other computer routines.

- 1.4.3 TRANVAL 15 : This algorithm is the concluding piece of the model that was to be used in the experimental test carried out. It is used to test for the existence of translated values and investigates the hypothesis that

$$\text{NRDV}_i - \text{CUV}_{i(t-1)} = \text{CUV}_{j(t-1)} - \sum_{i=1}^n (\text{CUV}_{it}) - \text{GDV}_{nd}$$

See Chapter 4, page 187, and Chapter 3, page 109, for the original discussion of this concept.

- 1.4.4 The program reads the capital value of the Guildhall Shopping Centre, the new shopping magnet, and subtracts the aggregate values of those properties which were present on the Guildhall site prior to the Guildhall Shopping

Centre being constructed. It also calculates the net capital value of the retail core of Exeter in 1975 and also in both 1976 and 1983 (i.e. minus the capital value of the Guildhall Shopping Centre in 1976 and 1983) and checks the reduction in value, if any, of the remainder of the retail core against the increase in value at the site of the new development. The instruction set for this computer routine is included in the set of programs attached at the end of this chapter.

2 Data Proposed and Prepared For Use in the Test of the Models

2.1 The Value Model

2.1.1 VALDER 1A, 1B & 1C : The data input prepared for this part of the model consisted of the calculated allocation factors θ_r and θ_d , and the intermediate allocation factors, θ_c . The factors were derived from data on the proportions of heads of household in each socio-economic group at the date of the Census of Population nearest to the date of the test and their average weekly earnings (assuming each to be a male adult). The

results of the calculations are included in Appendix 9 as they may be of some use to future researchers in this area. They are in the form of lists of computer generated output and it is not intended that they should be used correct to six decimal places nor is it suggested that it is necessary to use them in other than rounded integer form.

- 2.1.2 A similar exercise was done for each of the seventeen wards of Exeter to produce a further set of allocation factors, θ_w , which are similarly included in Appendix 9.
- 2.1.3 VALDER 3 & 4 : The data required for this section of the model would have been provided by the output from VALDER 1B and would consist of the retail spending per shop group arising out of each town or district in the County of Devon, together with the attraction factor of each Devon shopping centre for that range of goods/shop type, A_{gdj} . First, however, the retail expenditures would need to be apportioned into separate files to reflect the proportions travelling by different transport modes in order that different travel time factors could be used in the prior calculation of S_{gdi} . The retail spending (by travel modes) would then be re-

aggregated by shopping centre prior to proceeding to the next stage of the model.

TRANSMODES (percentages)

Year	Car	Bus	Train	Other
1966	13.0	45.0	29.0	11.0
1974	34.0	32.0	28.0	6.0
1979	52.4	22.2	22.6	2.8
1984	59.4	15.5	25.0	0.1

TABLE 9

Source: Surveys by Dawson & Shaw

2.1.4 As a preparation for the proposed run of this algorithm it was necessary to measure the lengths, and note the types, of principal roads making up the transport matrix for Devon. It was also necessary to apply travel times to these various road distances in order to obtain travel times between each town. The raw data on the road matrix can be found in Appendix 9 in the files named ROADISTS. On advice from the Royal Automobile Club, and after consultation with the traffic police, it was accepted that there had been no real change in average speeds over the different types of roads over the last fifteen years and, therefore, the following speeds were utilised in calculating average travel times by motorcar and by bus and coach travel:-

Road Type	Motorcar	Bus
Motorways	1 min/mile	1 min/mile
Dual Carriageway	1.25 min/ mile	2 min/mile
Class A Roads	1.5 min/ mile	3 min/mile
Class B Roads	2.5 min/ mile	5 min/mile

TABLE 10

2.1.5 On the basis of these figures the shortest travel time between each town and each other town in the matrix was calculated and the output of these calculations can be found in Appendix 9 in the files named CATRTIMES and BUTRTIMES. Rail travel times were extracted directly from the railway timetables for the relevant periods and these can be found in the files named RATRTIMES. A separate file exists for each of the years 1966, 1975/76, and 1983.

2.1.6 Other data extracted and prepared for input into this part of the model were the information on the total floorspace available in retail shops (and in use) in each of the towns and districts of Devon. This data can be found in the files named DEVSHOPS in Appendix 9.

2.1.7 PREVALDER & VALDER 1-4 : In view of the earlier decision to access the model, for the purpose of the experimental test, effectively after the allocation of net retail consumption expenditure to originating towns, data were required for the inputs of consumer retail spending in Exeter. As described, the early stages of the derivation model were replaced by the two routines PREVALDER and VALDER 1-4. The data requirements for the model therefore commence with details of net retail consumption expenditure at regional level and, for the purpose of analysis, details of the reported net retail expenditure in Exeter, both listed by retail trade group. Also, to facilitate the analysis, both of these data sets must be supplemented by details of the floorspace by retail trade group at each level. The retail trade group classifications used in this research are listed in Table 11.

Retail Shop Property Classifications	Description
0	Vacant Shop Property
1	Grocery, inc. general stores, etc.
2	Other Food Stores, inc. off- licences
3	Confectionery, Newsagency, Tobacconists & Bookshops
4	Clothing & Shoe retailers
5	Hardware, Electrical Goods, etc.
6	Pharmacy, Photographic dealers, etc.

Continued/

7	Furniture & Drapery Stores, etc.
8	Sports Goods, Jewellery, Toys, etc.
9	Variety & Departmental Stores
10	Shop Premises used for Catering
11	Motor Vehicle Spares, Accessories, & Sales, etc.
12	Miscellaneous Shops, inc. Post Offices
13	Retail Services, e.g. hairdressers, repairers, etc.
14	Shop Premises with non retail use

TABLE 11

2.1.8 The data utilised in the analysis were the retail expenditure figures reported in the Census of Distribution 1961 & 1971 and in Devon County Council's Survey of Shops 1981/82. The figures are, therefore, only available at regional level for the earlier years of the test and only at county level for the last test year. The original data for each of these are included in Appendix 7. It should be noted that the 1961 Census of Distribution did not include floorspace data and the 1981 data extracted from the Survey of Shops relate to a slightly different hierarchy of shopping centres and differing disaggregations within that hierarchy. This means that only at the 1971 level can a meaningful analysis take place using the PREVALDER algorithm. The data used, aggregated into the 15 groups used in the

retail floorspace utilisation survey analyses provided by the City of Exeter's Town Planning Department, were as follows:-

Shop Group	Regional Turnover £'000s	Regional Floor-space '000s sq.ft.	Exeter Floor-space '000s sq.ft.	Exeter Turnover £'000s
1	302913	4925	122	7008
2	179780	2004	62	5184
3	93925	1531	46	3245
4	150720	4517	175	7708
5	91176	2274	90	3461
6	54229	780	27	2135
7	47590	2683	102	1982
8	33300	1103	35	1509
9	101087	3934	235	6332
10	-	-	-	-
11	3318	124	2	43
12	16721	825	16	566
13	-	-	-	-
14	-	-	-	-

TABLE 12

Source: Census of Distribution 1971

2.1.9 In order to ensure a full test of the model it was necessary to adjust the regional and county level expenditures to the required test years and this was achieved using the Retail Prices Index.

The resultant adjusted expenditures are shown in
Tables 13, 14 and 15.

CEREG 66

Trade Group	Adjusted Turnover £'000s
0	-
1	186338
2	142127
3	55100
4	98748
5	49937
6	28965
7	25738
8	15753
9	69400
10	-
11	2874
12	5069
13	10749
14	-

TABLE 13

CEREG 75/76

Trade Group	Adjusted Turnover £'000s
0	-
1	552627
2	327986
3	170205
4	274970
5	166339
6	98934
7	86822
8	60752
9	184421
10	-
11	6053
12	30505
13	-
14	-

TABLE 14

* CEDEV 83

Trade Group	Adjusted Turnover £'000s
0	-
1	162211
2	71791
3	53162
4	94396
5	80538
6	39076
7	47936
8	39530
9	135971
10	-
11	7611
12	13177
13	-
14	-

TABLE 15

* Devon (not region)

- 2.1.10 The primary test on available data was at the 'before and after' dates of 1975 and 1976. It was, therefore, the data adjusted to 1975/76 that was utilised in conjunction with VALDER 1-4 to provide the computer generated input data for the next stage of the model.
- 2.1.11 VALDER 3A & 4A : The data utilised in this part of the model would, in normal course, be provided, partially by output from VALDER 3 & 4 and partially from the data obtained from the surveys carried out of floorspace in retail use within the City of Exeter. These latter data are listed in Appendix 9. The data was reorganised into files named RETFS(year) and WRETFS(year); the former being the retail floorspace in the defined city centre and the latter the retail floorspace located within each ward. In each case it is identified by range of goods sold.
- 2.1.12 Internally, within the Exeter sub system, the travel times and proportions are different to those used in the County based part of the model. The reason for this is that car and bus travel is slower within the urban area than between urban

areas. The travel times used, from ward centroid to city centre, for each mode of travel, are shown in Table 16.

XTIMODES

Ward No.	Dist. Miles	Time in Minutes		
		Car	Bus	Foot
01	2.0	11.0	15.0	40.0
02	2.5	12.5	17.5	50.0
03	2.5	12.5	17.5	50.0
04	1.5	9.5	12.5	30.0
05	2.0	11.0	15.0	40.0
06	1.5	9.5	12.5	30.0
07	1.5	9.5	12.5	30.0
08	3.0	14.0	20.0	60.0
09	1.25	8.75	11.25	25.0
10	0.25	5.75	6.25	6.25
11	2.0	11.0	15.0	40.0
12	2.0	11.0	15.0	40.0
13	1.0	8.0	10.0	20.0
14	2.5	12.5	17.5	50.0
15	4.5	18.5	17.5	90.0
16	2.0	11.0	15.0	40.0
17	2.0	11.0	15.0	40.0

TABLE 16

2.1.13 Data on expenditure for each range of goods within the Exeter sub system would normally be obtained from the output of VALDER 3 & 4, contained in the files named SPEXET, but, as in this test of the model the algorithms VALDER 1A to VALDER 4 have not been used, the input data for VALDER 3A & 4A are the output data from the substitute algorithm, VALDER 1-4. Those data are contained in the file named XTGDATA 75/76 and are

shown below in Table 17.

XTGDATA 75/76

Trade Group	Exeter Retail Turnover £'s
0	-
1	9613535
2	6087680
3	5686274
4	11339723
5	7129754
6	3807171
7	6264324
8	2683291
9	10839632
10	-
11	2124905
12	3315238
13	-
14	-

TABLE 17

2.1.14 VALDER 5 : This is the main Exeter internal allocation model and the algorithm uses data which were obtained from several surveys carried out over the test periods. The general data on shops are to be found in the files named X(year)CDATA which contain information showing, for each shop in the central area, the ward in which the property is located, a unique property reference number, details of the frontage-width and floor areas of each individual shop (floor area in terms of retail sales space and of storage space), the number of storeys, the type

of retail trade carried on at the property, the gross value for rating purposes and the rateable value. In addition, the file contains an Ordnance Survey grid reference and an orientation code to indicate in which direction the shop faces. This latter information was included so that the computer could generate a series of FS(year)ATTACH files by using the data in connection with the data on the street pattern, street connections and street lengths generated, by calculation, from the files named XPEDF(year).

2.1.15 The algorithm for the attachment of a property to the street onto which it has a frontage uses an iterative search routine and operates along a line normal to the frontage of the property (using the orientation code) until it reaches a point where the line between the two end points of the street is intersected. The shop is thus located on the street section lying between the two points.

2.1.16 In order for VALDER 5 to operate successfully it really requires an input of pedestrians into the street matrix. A proxy for the number of pedestrians, which themselves are used to represent the number of households on shopping

trips, was calculated from the number of vehicles per day using the central area car parks. Working from these, via the proportions of shopping trips by motorcar, bus, rail and on foot, representative data were constructed for the location of all these arrivals into the street matrix. The carpark arrivals logged into the matrix at the nearest pedestrian flow connection to the carpark. Those arriving by rail were assumed to log into the matrix at the nearest direct link on the route between the station and the town centre and those arriving by bus were assumed to arrive at the bus station. From there, those arriving by bus were logged into the matrix at the closest pedestrian access point. This latter assumption is not strictly correct as some of the local buses pick up and put down passengers at various points within the town centre including High Street, the main shopping street. However, short of plotting the location of each bus stop and trying to estimate the proportion of travellers alighting, the best estimate that could be made was based on the assumption that all utilised the central bus station at the north east end of the town centre. The proportion of shoppers arriving in the centre as a result of a walk from their place of

domicile was not included in the inputs to the pedestrian flow on the assumption that they would be randomly, but fairly evenly, dispersed arrivals around the periphery of the centre and that this dispersal would result in this small proportion of pedestrian arrivals not having any significant effect upon the internal distribution of the pedestrian flow, nor on the allocation of turnovers using this proxy, for the reasons discussed earlier, in Chapter 7.

2.1.17 The carparking data that were obtained were recalculated and, using linear regression and adjustments to accommodate population growth and changes in proportions of transport modes, the data, shown in Tables 18 to 21, were obtained for use in VALDER 5.

AXCPS 81

Car Park Location	Link to Street	Capacity	Day Use
Bampfylde Street	40	89	447
Smythen Street	162	54	272
Trinity Green	116	96	280
Dix's Field	48	68	277
Paul Street	108	163	872
Guildhall M.S.	213	454	1907
Broadway	68	170	690
King William St.	39	460	1112
North Street	125	406	973
Post Office St.	69	136	544
St. George's Mkt.	144	100	400
Queen Street	99	80	320

Continued/

Fairpark Road	136	236	308
Leighton Terrace	34	81	187
Triangle	26	281	385
Lower Coombe St.	186	132	188
Magdalen Street	136	92	184
Bystock Terr./			
Richmond Road	99	116	190
Ironbridge	124	65	73
Belmont Road	4	25	88
Parr Street	15	50	88
Howell Road	35	210	385
Bartholomew St.	179	35	101
Trinity Street	135	46	138
Bus Station	45	-	2716
Railway Station	100	-	18

TABLE 18

AXCPS 78

Car Park Location	Link to Street	Capacity	Day Use
Bampfylde Street	40	89	393
Smythen Street	162	54	240
Trinity Green	116	96	247
Dix's Field	48	68	244
Paul Street	108	163	767
Guildhall M.S.	213	454	1679
Broadway	68	170	606
King William St.	39	460	979
North Street	125	406	856
Post Office St.	69	136	479
St. George's Mkt.	144	100	352
Queen Street	99	80	282
Fairpark Road	136	236	271
Leighton Terrace	34	81	165
Triangle	26	281	339
Lower Coombe St.	186	132	166
Magdalen Street	136	92	162
Bystock Terr./			
Richmond Road	99	116	167
Ironbridge	124	65	64
Belmont Road	4	25	78
Parr Street	15	50	78
Howell Road	35	210	339
Bus Station	45	-	3793
Railway Station	100	-	479

TABLE 19

AXCPS 74

Car Park Location	Link to Street	Capacity	Day Use
Bampfylde Street	40	89	273
Smythen Street	162	54	166
Trinity Green	116	96	171
Dix's Field	48	68	169
Paul Street	108	163	534
Guildhall	109	200	482
Broadway	68	170	422
King William St.	39	460	681
North Street	125	406	595
Post Office St.	69	136	333
St. George's Mkt.	144	100	245
Queen Street	99	80	196
Fairpark Road	136	236	188
Leighton Terrace	34	81	114
Triangle	26	281	235
Lower Coombe St.	186	132	115
Magdalen Street	136	92	113
Bystock Terr./			
Richmond Road	99	116	118
Ironbridge	124	65	45
Belmont Road	4	25	54
Parr Street	15	50	54
Howell Road	35	210	235
Bus Station	45	-	5214
Railway Station	100	-	977

TABLE 20

AXCPS 66

Car Park Location	Link to Street	Capacity	Day Use
Bampfylde Street	40	89	169
Smythen Street	162	54	101
Trinity Green	116	96	105
Dix's Field	48	68	103
Guildhall	109	200	339
Broadway	68	170	257
Post Office St.	69	136	203
St. George's Mkt.	144	100	149
Leighton Terrace	34	81	70
Triangle	26	281	144

Continued/

Lower Coombe St.	186	132	70
Magdalen Street	136	92	68
Bystock Terr./			
Richmond Road	99	116	71
Ironbridge	124	65	27
Belmont Road	4	25	33
Parr Street	15	50	33
Bus Station	45	-	6503
Railway Station	100	-	1542

TABLE 21

2.1.18 VALDER 6 & 7 : This small algorithm uses data on the turnovers of individual properties, which are to be found in the files T/O.DATA(year), and calculates the proportion of turnover available for the rent bid. In order to do this, it utilises the data on the gross profit margins which are held in the file GMS71/80 and shown below in Table 22.

Trade	1971	1976	1980
0	29.2*	27.4*	26.9*
1	19.9	17.0	17.0
2	27.0	22.6	25.1
3	20.4	16.8	14.6
4	36.4	38.4	38.4
5	38.8	40.2	31.2
6	33.8	26.7	23.1
7	34.6	34.1	32.3
8	34.8	33.6	33.5
9	36.0	28.9	32.2
10	29.2*	27.4*	26.9*
11	30.0*	30.0*	30.0*
12	39.4	33.9	27.8
13	85.6*	85.6*	85.6
14	29.2*	27.4*	26.9*

* = averaged

TABLE 22

Source: Census of Distribution

- 2.1.19 The other required data on net profit margins and rent bid proportions are replaced by the adjusting factors 0.3 and 0.4 respectively, as described earlier.
- 2.1.20 VALDER 8 & 9 : The majority of the data utilised in VALDER 8 & 9 are generated by earlier parts of the model. The only data which are inputted from a sorted set of raw data are those on the location and description of each shop which are obtained from the files X(year)CDATA (See Appendix 9).
- 2.1.21 The other data required for use in this algorithm are obtained from the predicted rent bids generated by VALDER 6 & 7 and stored in the files named RBI.DATA(year).
- 2.2.22 VALDER 10 & 11 : Again, the majority of the data needed to run this algorithm are generated by earlier parts of the model. The exceptions in this case being the files named XYPS(year) which contain data on the analysed yields obtained from property investments in and around the Exeter

area. The data in the list, which is on a street section by street section basis, have been manually compiled from the questionnaire returns, the results of interviews with local property professionals and by intuitive interpolation based on experience and judgement.

- 2.1.23 The data input, XRI(year), is the output produced by VALDER 8 & 9 and the street locations are read in from the appropriate FS(year)ATTACH file produced for an earlier part of the model.

2.2. The Cost and Profit Model

- 2.2.1 COSPROF 1-4 : The data provided for use in the algorithm COSPROF 1-4 were provided, in detail, by the developer of the Guildhall Shopping Centre on the clear understanding that it was not to be revealed in full. As a result, the algorithm COSPROF 1-4 was not run as originally intended. Instead, the composite gross cost of development of the Guildhall Shopping Centre was used and the resultant GCNP

calculated by use of COSPROF 1-4A (see Algorithms Supplement at end of chapter).

2.3 The Translated Value Model

2.3.1 TRANVAL 1-10 : In this test it was not necessary to run a special model algorithm to obtain predicted rental values for the Guildhall site. The data utilised in VALDER 1-10 also provide results which include the projected turnover, net profits, and predicted rental for shops within the Guildhall shopping centre (in this case treated as a composite shop). From the predicted rent it is possible to calculate the capital value and VALDER 1 to VALDER 10 will, therefore, also act as the algorithms for TRANVAL 1 to TRANVAL 10.

2.3.2 TRANVAL 11-14 : No additional data were required in order to be able to run the short program TRANVAL 11-14 except, i/ to include an allowance for interest charged by the financiers on the borrowed capital for the construction of the

Guildhall Shopping Centre (or to allow for the opportunity cost of the developer using its own funds) and, ii/ to make an allowance for the amount of legal costs, agent's fees, stamp duty and other incidental expenses incurred on the site acquisition. In the mid 1970s, when the development presently under investigation was carried out, the rate of interest being charged (and confirmed by the abstract of accounts provided by the developer) was 7% per annum, charged quarterly, and the amount of legal and agent's fees, etc., was, and still is, in the region of 4% in total. These were manually inputted to the model together with the known period of the pre-construction, construction, and post construction holding of the site, i.e. two and a half years or ten quarters.

2.3.3 TRANVAL 15 : The inputs into this algorithm are all derivable from earlier parts of the model; this algorithm is merely a summation and comparison routine.

3 A Test Of The Model's Algorithms

3.1 Preliminaries

3.1.1 At this stage of the research, i.e. at the commencement of the experimental test, there was concern that each component of the model as set out in Chapter 5 should be run in order to ensure that, given adequate data, it would be effective. However, while it would have been valuable to test each component of the model as described in Chapter 5, for the reasons given in Chapter 7 the early stages of the model were not used in the test of the hypothesis.

3.1.2 However, as a precursor to the experimental test of the hypothesis, the suite of programs VALDER 1.1 to VALDER 1.4 and the check program VALDER 1.5 were run on the sets of raw data on earnings and socio-economic groups in order to produce theta factors for the South West region, the constituent counties of the region, and the towns and districts of Devon.

3.1.3 The theta factors so generated were available to be read into the first stage of the model proper,

VALDER 1A. However, the suite of programs was not run although the theta factor allocations were checked, using hypothetical inputs, for evidence of any substantial percentage error. In order to obviate the continuation and compounding of errors from this section of the model to the next, should it ultimately be brought into use, the algorithm was made to sum the inputs at each stage and to check the outputs against the inputs. The programs VALDER 1A to VALDER 4 were test run; however, it was not possible to check the outputs against any published data for the reasons discussed in Chapter 7.

- 3.1.4 Before proceeding with a description of the test results from the actual run of the model, from PREVALDER via VALDER 1-4, attention is drawn to that part of VALDER 3 & 4 which, although not run, would have required calibration. The components within VALDER 3 & 4 which would require calibration are the floorspace factor, F , and the travel time factor, Z , in the allocation part of the model. Calibration could have been achieved by checking the output from VALDER 3 & 4 against the published retail turnover data by

town/district (aggregated over trade categories) obtained from the Census of Distribution 1961 or 1971 and Devon County Council's Survey of Shops 1981/82, each suitably adjusted to the relevant test year by use of the Retail Price Index.

- 3.1.5 On considering the data available for use in the test of the intra-urban allocation part of the value derivation model it was noted that there was sufficient for a run of the algorithm to provide the principal test of the model's predictive power. However, it would also have been of considerable interest to be able to demonstrate the nature of any changes that might have occurred over time. Considerable efforts were made to try to obtain sufficient additional data from the Departments of Trade and Industry and of Employment to facilitate the further tests using 1966 and 1983 levels of net retail consumption expenditure. Unfortunately, each of these data sets was deficient in some requirement. Therefore, as the additional tests were not central to the ambition of the model and in view of there being insufficient data in

existence, it was not possible to run these additional tests.

3.1.6 However, the central part of the model could still be run, this being the principal test of the model. This would take revealed net retail consumption expenditure in Exeter City shopping system as at 1975/76 and attempt to test the effect of change in the amount and location of the magnet floorspace on an unchanging amount of consumer spending on retail goods.

3.1.7 The test would consist of an allocation of turnover to individual shop locations using the 1975 spatial data, followed by a re-run of the algorithms using the same financial input but applied to the 1976 spatial data; this last including the additional floorspace of the Guildhall Shopping Centre. It was convenient to do this as, in relation to the town under test, the retail development scheme with which the research was concerned (the Guildhall Shopping Centre) had occurred primarily during the latter parts of 1975 and the early part of 1976. Therefore, the spending allocation, which was to

be developed into a rents and capital values allocation and tested in real terms, was artificially held constant. The resultant test utilised 1975 expenditure data on, firstly, the 1975 spatial distribution of shops and then on the spatial distribution of shops (including the additional units of the new development) in 1976. Checks were also made on the same expenditure levels allocated by use of the spatial distributions in 1966 to test for stability, and the spatial distributions in 1983 to test for lagged change or recovery.

- 3.1.9 Although the Guildhall Shopping Centre actually consists of about 40 separate shops and stores, it was decided to treat the Centre as a single variety store for the purpose of the test. As a result, the separate rentals, floorspaces and Gross Values were aggregated prior to their being introduced into the data sets. This introduced into the analysis one observation whose magnitude was considerably greater than any other. This had consequences for the later regression analyses which will be discussed later in this chapter.

3.2 The Preparatory Algorithms

3.2.1 The algorithms PREVALDER and VALDER 1-4 used data provided by a Retail Price Index adjustment and re-allocation of the 1971 Census of Distribution regional net retail consumption expenditure figures. The run of PREVALDER produced adjustment multipliers that will be discussed in paragraph 3.2.3. It transpired that the determination of the multipliers was extremely expensive in terms of computer time and although it could have ensured that actual and predicted expenditures were identical the process was terminated when no prediction was more than 5% in error.

3.2.2 The multipliers obtained from the calibrating algorithm PREVALDER, were then used in a run of VALDER 1-4. This computer program was used to produce the Retail Price Index adjusted net retail consumption expenditure by trade groups for Exeter as at 1975/76. The routine uses the floorspaces obtained from the retail property survey and, therefore, produces different figures from those that might have been obtained merely

from the application of the Retail Price Index to the 1971 Census allocations to Exeter by retail trade group. The results of the run of VALDER 1-4 are as shown in Table 25.

3.2.3 It will be recalled that an explanation of the construction of the adjusting multipliers was given earlier, at page 298. An attempt was made to provide a behavioural justification for M, the multiplier; the multiplier was not included just because of a desire to constrain the actual and predicted totals of consumption expenditure. However, in looking at the varying magnitudes of results for the different product groups, it can be seen that the movements between 1971 surveyed expenditure and the 1975/76 predicted allocations give rise to multipliers that range from as low as 0.8 to as high as 1.7. It was expected that the multipliers should reflect the different ranges of product groups and, to some extent, the dominance of Exeter in the shopping hierarchy. Therefore, the results of the analysis were examined to see if, indeed, those products with smaller ranges had the lower multipliers and vice versa. Examination of Table 23 reveals that

Multipliers: Region - Exeter 1971

Trade Group	1971 Exeter Prediction	1971 Exeter Actual	Adjusting Multiplier (rounded off)	Adjusted Prediction
0	-	-	-	-
1	7503631	7008000	0.925	6939083
2	5562055	5184000	0.925	5143585
3	2803115	3245000	1.156	3241565
4	5839273	7708000	1.355	7911890
5	3608548	3461000	1.000	3608548
6	1877157	2134000	1.156	2170773
7	1809235	1982000	1.093	1978207
8	1056663	1509000	1.389	1468275
9	6038496	6332000	1.000	6038496
10	-	-	-	-
11	53516	43000	0.803	42999
12	324286	566000	1.745	565999
13	-	-	-	-
14	-	-	-	-

TABLE 23

there is a relationship between groups 1 & 2, groups 3 & 6 and groups 5 & 9. This is explained by reference to the original derivation of the expenditure figures.

3.2.4 It will be recalled that the classification of shops in the Exeter City Council use survey was different to that used in the Census of Distribution. The Exeter use groups are set out in Table 11 on page 317. The re-aggregation of the expenditure data into the Exeter groups in combination with the original disaggregations made by the Census Office explains the pairing of some of the multipliers, viz:

Groups 1 & 2	1	Grocery, inc. general stores, etc.
	2	Other Food Stores, inc. Off Licences
Groups 3 & 6	3	Confectionery, Newsagency, Tobacconists & Bookshops
	5	Hardware, Electrical Goods, etc.
Groups 5 & 9	9	Variety and Departmental Stores

TABLE 24

3.2.5 Further consideration of the appropriateness of the derived multipliers reveals that the size of the multipliers for groups, 3, 6 and 8 can be attributed to some degree of centrality and those of groups 1 and 2 to products with short ranges.

Group 11 contains DIY shops and motor accessory shops; these are predominantly in low rent premises serving local communities on an opportunistic basis. On overall consideration, the derived multipliers generally are as one would expect. Those that are less than unity relate to shop types that are highly dispersed and have low range products whereas those that are greater than unity relate to shops which have an increasing centralisation tendency. In relation to the former of these the model would, therefore, tend to over-estimate without an adjustment and, conversely, there would be a tendency towards under-estimation of the latter in the model's predictions. In general, the multipliers appear to operate logically. Their necessity indicates that the allocation model clearly contained something that did not allow sufficiently for position in the hierarchy. The model, therefore, is in need of greater definition to bring its predictions closer to the real world allocation. However, for the purpose of this research we can usefully continue with the use of the derived multipliers, even though one or two, because of their nature, are difficult to explain, e.g. group 12 which is a

VALDER 1-4 : Exeter Expenditure - Results

Trade Group	1971 Census Floorspace	1971 Census Expenditure	1975/76 RPI Adj Expenditure	1975 Surveyed Floorspace	1975 Adjusted Expenditure
0	-	-	-	3381	-
1	122000	7008000	12785220	92646	9613535
2	62000	5184000	9457560	40222	6087680
3	46000	3245000	5920097	44230	5686274
4	175000	7708000	14062282	137482	11339723
5	90000	3461000	6314162	97470	7129754
6	27000	2134000	3893216	25956	3807171
7	102000	1982000	3615911	177047	6264324
8	35000	1509000	2752982	35060	2683291
9	235000	6332000	11551942	231227	10839632
10	-	-	-	52207	-
11	2000	43000	78448	54176	2124905
12	16000	566000	1032596	51370	3315238
13	-	-	-	48329	-
14	-	-	-	600	-

TABLE 25

catch-all category for miscellaneous shops
(including sub post offices).

3.2.6 Reference to Table 25, and in particular to group 12, gives rise to the impression that the 1975 adjusted expenditure prediction is somewhat overstated. However, it must be borne in mind that Table 25 contains the results of two adjustments. The first is the adjustment of the expenditure in line with the increase in the Retail Prices Index and to the results of which the adjustment multipliers discussed above have been applied. The second adjustment allows for the changes in floorspace utilisation by product group and, therefore, the approximately threefold increase in the utilised floorspace in group 12 is reflected in the threefold increase in 1975 adjusted expenditure. Close observation reveals that the relative sizes of, and relative changes in, adjusted expenditures after their several adjustments are reasonably logical and follow national trends in retailing.

3.2.7 In fact, the changes in the floorspace utilisation themselves follow a pattern which has

Estimated Shop Numbers and Market Share of
Independent Retailers 1950-1980



Source: Based on statistics in J Dawson (1983) *Planning for local shops*,
The Planner Jan/Feb.Vol 69 No.1

FIGURE 6

been remarked upon, and reported, by many observers of the national retail scene. A typical example of these comments is shown in Figure 6. In Exeter, there has been a substantial reduction in the amount of floorspace given over to food sales (grocery, etc.) in the city centre, together with a reduction in the amount of clothing and shoe retail space. These are balanced by a substantial increase in floorspace given over to general non-food retailing and motor vehicle related goods, etc. However, with these exceptions, the remainder of the retail floorspaces remain close to the 1971 reported sizes - in particular, the size of the floorspace utilised for variety and departmental stores shows very little change. Of particular note is the growth in floorspace use in groups 5 and 7, furnishings and electrical goods.

- 3.2.8 The differences between the 1971 actual expenditures and the 1975 adjusted expenditures, therefore, is not altogether unexpected. The first multiplier allows for inefficiencies in the allocation mechanism, the second for changes since the last date that prediction was possible. The results are, therefore, in line with noted

trends. On this basis, the decision was taken to use the output data from VALDER 1-4 as an input into VALDER 3A & 4A where it would be split into spending in the wards of Exeter and spending in the city centre shopping area of Exeter.

- 3.2.9 On the run of VALDER 3A & 4A, the travel distances involved were, of course, comparatively short and the travel times were, therefore, very small. In consequence, following the operation of this segment of the model using floorspace and time as measures of attraction and resistance, the results were carefully reviewed. In looking at the results, however, the floorspace index has caused trade to be distributed according to the size of centre and it can be seen that the time patterns have not served to distort these. Therefore, within the data available there is little to shed doubt on the validity of the redistribution. The use of floorspace and travel time (in the program (F1) and (Z1) respectively) provided an extremely good fit and an apparently logical set of results. Again, the inputted aggregate expenditures in each retail trade group were checked against the summed totals of expenditure allocated to each ward and to the central area of the town. The results of that

VALDER 3A & 4A : Exeter Aggregate Expenditures - f's

Trade Group	Input Expendi- ture	Output Expenditures (Aggregate)			
		On 1966 Floor- space	On 1975 Floor- space	On 1976 Floor- space	On 1983 Floor- space
0	-	-	-	-	-
1	9613535	9613528	9613525	9613525	9613528
2	6087680	6887673	6887673	6087673	6087670
3	5686274	5686266	5686266	5686266	5686265
4	11339723	11339718	11339717	11339719	11339718
5	7129754	7129746	7129747	7129747	7129748
6	3807171	3807165	3807162	3807163	3807166
7	6264324	6264319	6264320	6264319	6264319
8	2683291	2683287	2683288	2683287	2683286
9	10839632	10839631	10839631	10839631	10839632
10	-	-	-	-	-
11	2124905	2124901	2124898	2124900	2124901
12	3315238	3315232	3315229	3315230	3315230
13	-	-	-	-	-
14	-	-	-	-	-

TABLE 26

Exeter : Expenditure By Wards & Central Area - f's

Ward No.	01	02	03	04	05	06	07	08	09
Trade									
0	-	-	-	-	-	-	-	-	-
1	74537	19181	36044	49876	25663	130422	39270	88688	121743
2	11824	17797	44150	9923	-	103704	-	12708	72665
3	7076	4835	9035	8642	-	34569	13879	15863	23762
4	-	-	9368	-	-	7206	-	-	5253
5	785	-	5041	1010	-	13180	1936	5812	36671
6	-	4741	5960	2572	-	28886	-	11379	14568
7	5111	-	-	-	-	8336	500	-	1246
8	-	-	-	-	-	11643	-	-	2643
9	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-
11	16720	-	6877	-	-	32719	-	-	23459
12	8918	-	3885	-	1873	11455	6875	3859	7292
13	-	-	-	-	-	-	-	-	-
14	-	-	-	-	-	-	-	-	-

TABLE 27 continues

TABLE 27 continued/

Ward No.	10	11	12	13	14	15	16	17	Central Area
Trade									
0	-	-	-	-	-	-	-	-	-
1	429505	45159	189622	544347	14965	84298	36831	170538	7512836
2	105816	23386	23386	282123	32628	28350	45458	28720	5245035
3	127536	33548	9669	72517	23921	11816	16261	5127	5268211
4	130933	3981	5492	35643	-	11508	3226	-	11127107
5	152328	9565	13706	58594	2232	6861	7495	-	6813901
6	16249	3587	7018	33077	4876	6504	6238	5458	3656046
7	7572	5766	5792	7297	-	2912	-	-	6219788
8	2883	1018	-	30082	-	4956	2396	-	2626667
9	745	-	-	-	-	-	-	-	10838886
10	-	-	-	-	-	-	-	-	-
11	380602	25547	73923	13069	-	12372	5544	-	1534066
12	561623	8637	5723	14868	6146	9774	5931	2799	2655471
13	-	-	-	-	-	-	-	-	-
14	-	-	-	-	-	-	-	-	-

TABLE 27

Exeter : Aggregation of Expenditures - 1975 - £'s

Trade Group	Input Expenditures	Aggregated Output Expenditures
0	-	-
1	9613535	9613525
2	6087680	6087673
3	5686274	5686266
4	11339723	11339717
5	7129754	7129747
6	3807171	3807162
7	6264324	6264320
8	2683291	2683288
9	10839632	10839631
10	-	-
11	2124905	2124898
12	3315238	3315229
13	-	-
14	-	-

TABLE 28

check are set out in Tables 26, 27 & 28.

3.2.10 An analysis of the result of the allocation shows that the re-aggregated totals, as expected, almost exactly equal the expenditure data in each of the years analysed, even though there are changes in the aggregate floor areas from test year to test year. As the allocation was constrained to sum back to the original totals the minor differences in the totals after re-allocation can be attributed to rounding errors within the allocation algorithm.

3.3 The Intra-Urban Turnover Allocation Algorithm

3.3.1 The net spending by retail trade groups allocated to the central retail core of Exeter by the use of VALDER 3A & 4A, and stored in the file SPXCEN 75.1, was then utilised as the spending input into the next algorithm, VALDER 5. Prior to the construction of the VALDER 5 routine it had become obvious that any construction that used a non-apportioning pedestrian flow factor would produce an illogical set of results. Therefore,

the form of the factor used in the model was a proportioning factor based on a linear relationship:

$$\frac{(\log \rho_s) \alpha_i}{\sum_{s=1}^n (\log \rho_s) \alpha_i}$$

details of the derivation of which are contained in earlier chapters.

3.3.2 At this stage, it should be noted that if the ρ factor is omitted from the construction, the allocating factor becomes

$$\frac{\alpha_i}{\sum_{i=1}^n \alpha_i} \quad \text{which mathematically equals} \quad \frac{F_{gi}}{F_{gj}}$$

where

$$\alpha = \frac{F_{gi}}{\sum_{i=1}^n F_{gi}}$$

This factor, as described latterly, was used in an additional test of the model designed to test its sensitivity to attenuation by the pedestrian flow factor.

3.4. The Rent Fixing Algorithms

3.4.1 The output from VALDER 5 is turnover - predicted for each individual shop. As this is not available in any form of census data, it was not possible to carry out a cross check against known data at this stage. The next check was at the end of the rent models, VALDER 6 & 7 and VALDER 8 & 9. It was possible, however, to sum the turnovers produced for each of the retail trade groups and, as a result of the apportioning structure of the allocation factor, in each test the trade group aggregates were maintained at a constant level between input and output.

3.4.2 In each of the test runs of the model, to facilitate a calibration, the 1975 consumer spending data was run through VALDER 5, VALDER 6 & 7, and VALDER 8 & 9. In each case the 1966, 1975, 1976 and 1983 spatial distributions of retail floorspace and the relevant car park data and pedestrian routes from either immediately prior to the Guildhall Shopping Centre's construction or from immediately after its opening, together with data on the proportions of

travel modes, etc., were used on the 1975 expenditures.

3.4.3 VALDER 6 & 7 merely calculated, in each case, the proportion of the predicted turnover that could be assumed to be available as a rent bid by the tenant. The predicted rent bids are listed in the data files RBI.DATA(year) enclosed in Appendix 9. VALDER 8 & 9 was an attempt to model the higgling of the market and the negotiations that might take place between the landlord and the tenant. Therefore, it took the rent bids and, unlike the model of the tenant's bid, based the landlord's rent demanded on the highest rent bid per square foot of retail floorspace (excluding storage, etc.) in proximate locations. The predicted rent demands are listed in the data files RDI.DATA(year) included in Appendix 9. The comparative evidence from proximate locations was determined as being from those shops within the same street section or in any of the street sections immediately adjoining either end of the street section under consideration. The intention, here, was to radially scan all shop

units closely located around the unit under consideration and to allow the landlord to calculate his rent demand on the basis of floor area whereas the tenant was deemed to have calculated his rent bid purely on the basis of expected turnover and profit margins.

3.4.4 A preliminary test was run using an allocation factor based only on a linear relationship between α and ρ . The results obtained using the raw values of α and ρ , as expected, were not particularly good. However, logic suggested that a log function of ρ would operate in the manner suggested by the research enquiries (see page 277), i.e. it would provide a low unit multiplier for application to the α factor. This was, therefore, the approach taken for the main test on the experimental data.

3.4.5 As a check on the functioning of the logarithmic linear form of the allocation factor, the model was run again, this time using an allocation factor without the pedestrian flow allocator. The results of the main run (using factor 2) and the check run (using factor 3) are described later in this chapter.

3.4.6 Table 29 shows the different constructions that were considered. Construction 2 was the form that was used in the main test but the table also contains other forms that were test run. They are presented in the order in which they were originally considered. Table 30 shows a summary of the results obtained from the preliminary test run of the model and also from the runs using the two different constructions of the allocation factor. It can be seen quite clearly that, as anticipated, constructions 2 and 3 produce better results than the other form of the factor. These two were, therefore, investigated further.

3.4.7 It will be noted from the summary list in Table 30 that the results from the use of construction 2 clearly demonstrate, in the R^2 , the effect of the new centre. By comparison, this is not obvious to the same extent in the results from the use of construction 3. This is because construction 3 does not make use of pedestrian flow attenuation of attractions. This will be discussed further in a later section of this chapter. Further, from the summary it can also be seen that construction 2 produces

The Forms of Allocation Factor Considered

No.	Factor Construction	Comments
1	$\frac{\rho_s \alpha_i}{\sum_{i=1}^n \rho_s \alpha_i}$	<p>Linear relationship.</p> <p>Pedestrian flow measure based on</p> <p><u>size of flow in street</u> average size of flow in centre</p>
2	$\frac{(\log \rho_s) \alpha_i}{\sum_{i=1}^n (\log \rho_s) \alpha_i}$	<p>Flow/average flow replaced by a \log^{10} multiplier to reflect the comments on shoppers/sq.ft. of floorspace made in Chapter 7.</p>
3	$\frac{\alpha_i}{\sum_{i=1}^n \alpha_i}$	<p>A special case of 1 and 2 above, where ρ is removed entirely.</p>

TABLE 29

Allocation Factors : Results Summary

Actual Rents plotted against Predicted Rents

$$A = \alpha + \beta P$$

No	Year	Equation	R ²
1	1966	6813 + 0.0591P	42.6
	1975	6944 + 0.0477P	41.4
	1976	6986 + 0.0935P	84.7
	1983	7126 + 0.0743P	87.0
2	1966	3678 + 0.439P	70.8
	1975	4911 + 0.271P	54.7
	1976	2293 + 0.578P	92.8
	1983	2968 + 0.563P	94.3
3	1966	1709 + 0.743P	80.1
	1975	2063 + 0.620P	67.2
	1976	-1435 + 0.992P	85.4
	1983	624 + 0.874P	93.3

* A more complete summary of results is available in pages 363 to 383 following.

TABLE 30

Footnote

1. Analyses based on very large numbers of observations (300 to 400 pairs of data)
2. All R² values are significant at the 0.1% level

consistent and interesting result and full details of the analysis are, therefore, set out in the following sections.

The allocation factor used is $\frac{\alpha_i (\log \rho_s)}{\sum \alpha_i (\log \rho_s)}$.

A comparable analysis for construction 3 begins on page 375.

3.4.8 As stated, the model was run and resulted in a predicted rent for each of the properties within the town centre. Table 30 indicates the results: for convenience this is the only realistic way of presenting them. The maps in Appendix 8 also present the predicted rents from the model using allocation factors 2 & 3.

3.4.9 Before going further on into the model, it was felt worthwhile pausing for a moment and looking at how the predicted rents compared with a set of rents that we shall refer to as 'actual' rents but which were, in fact, estimated from a more recent and almost complete set of Gross Value (rating) statistics. Correlation tests had

already been performed to check the reliability of the GV/Rent relationship (see Appendix 2).

- 3.4.10 The method of comparison of predicted rents with actual rents was by a regression analysis to check for correlation. The purpose was twofold:
- i/ to see whether such a comparison would shed light upon the appropriate choice between $\alpha \log p$ and α as an allocation factor, and
 - ii/ to determine whether the form of the relationship would indicate weaknesses in the method of rent prediction used in the model.
- 3.4.11 There will be difficulties in relation to the second of these objectives. It cannot be supposed that predicted rents would necessarily precisely reflect actual rents even where these were precisely known. The reason for this is that actual rents must reflect the relative abilities of individual buyers and sellers (landlords and tenants) in the negotiation process. Some actual rents may well be untypical

of the general set of rents at a particular time in a particular area. Equally it has been hypothesised that the bid rent will reflect the prospective tenant's expectation of profit. Where such expectations are unduly pessimistic it is probable that no transaction will occur. However, an over optimistic estimate of profits is likely to cause a certain rent to be artificially inflated. In some cases, therefore, actual rents must be expected to exceed predicted rents. A final further problem will concern the effect of inflation upon rents investigated in 1975/76 but negotiated at a variety of other dates.

- 3.4.12 Given this, it would be foolish to hypothesise that in a single regression the constant would be insignificant and the regression co-efficient equal to unity. The structure of the relationship between the two methods of investigation may allow speculation on the relative merits of the model's largely behavioural prediction and the more deterministic comparator.

3.4.13 A fuller explanation of the results obtained using allocation factor 2 and set out in Table 30, on page 251, follows. In the plots it will be noted that there is a point (or points) in each of the graphs that is so far away from the main mass of data that the R^2 is artificially raised. This has already been mentioned in connection with Table 30 but it should be noted that it will be examined further on pages 368 to 383 where reduced data sets are discussed.

3.1.14 In the plots that follow, each point is plotted with the symbol *. When more than one point falls on the same plotting position, a count is given. When the count is over 9, the symbol + is used. The results of the analyses are:-

Full Data Used

1975 Expenditure/(year) Spatial Data

Year	Constant	value	t	R^2
1966	3678	0.439	29.25	70.8
1975	4911	0.271	22.28	54.7
1976	2293	0.578	72.70	92.8
1983	2968	0.563	77.97	94.3

TABLE 31

1975 Expenditure/1966 Spatial Data

The regression equation is
 $C1 = 3678 + 0.439 C2$

Predictor	Coef	Stdev	t-ratio
Constant	3677.6	596.3	6.17
C2	0.43870	0.01500	29.25

R-sq = 70.8%

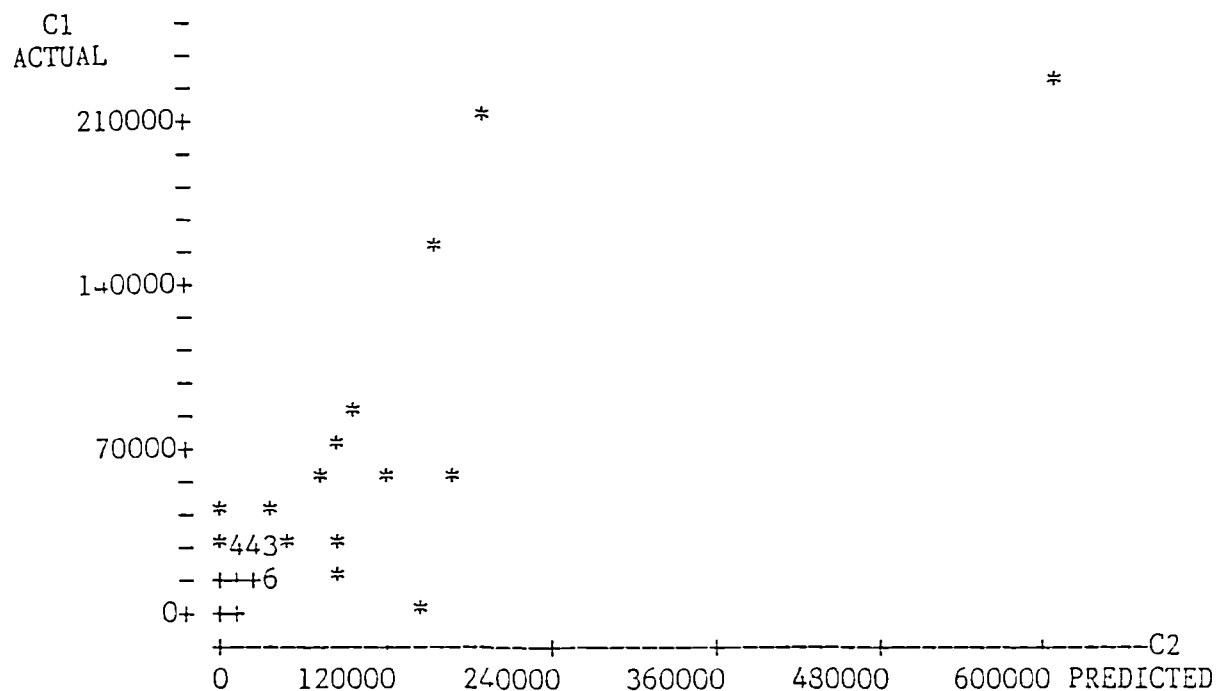


FIGURE 7

1975 Expenditure/1975 Spatial data

The regression equation is
 $C1 = 4911 + 0.271 C2$

Predictor	Coef	Stdev	t-ratio
Constant	4911.3	726.9	6.76
C2	0.27090	0.01216	22.28

R-sq = 54.8%

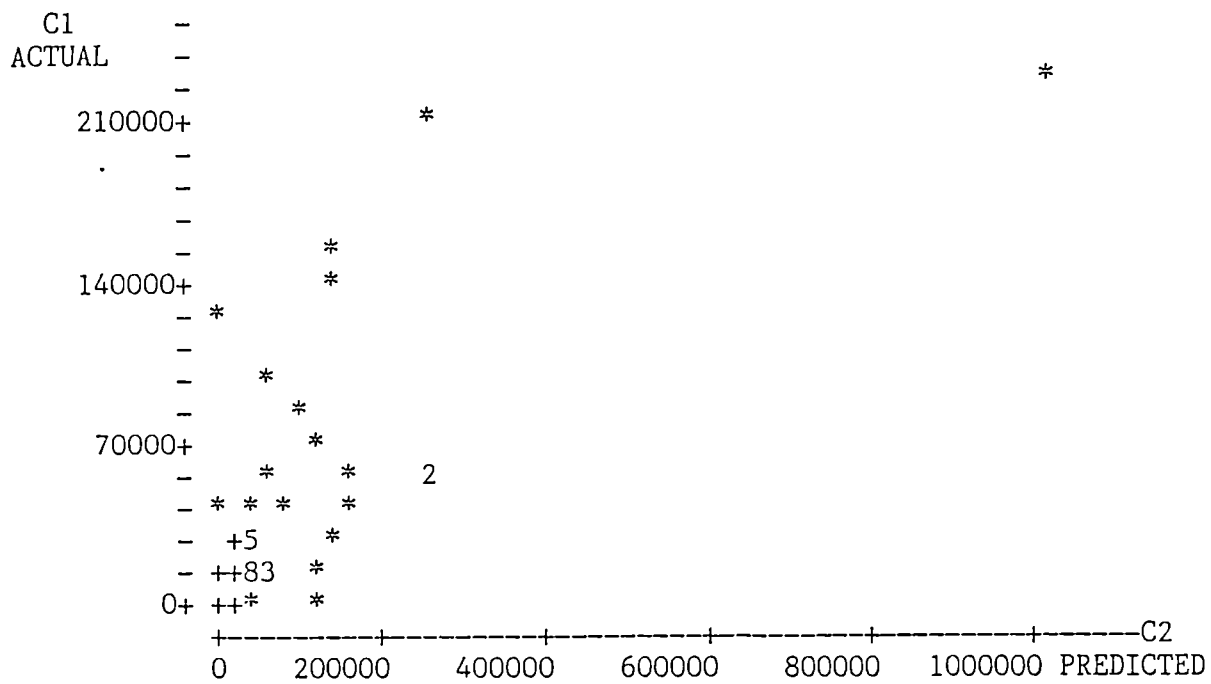


FIGURE 8

1975 Expenditure/1976 Spatial Data

The regression equation is
 $C1 = 2293 + 0.578 C2$

Predictor	Coef	Stdev	t-ratio
Constant	2293.1	609.0	3.77
C2	0.577925	0.007950	72.70

R-sq = 92.8%

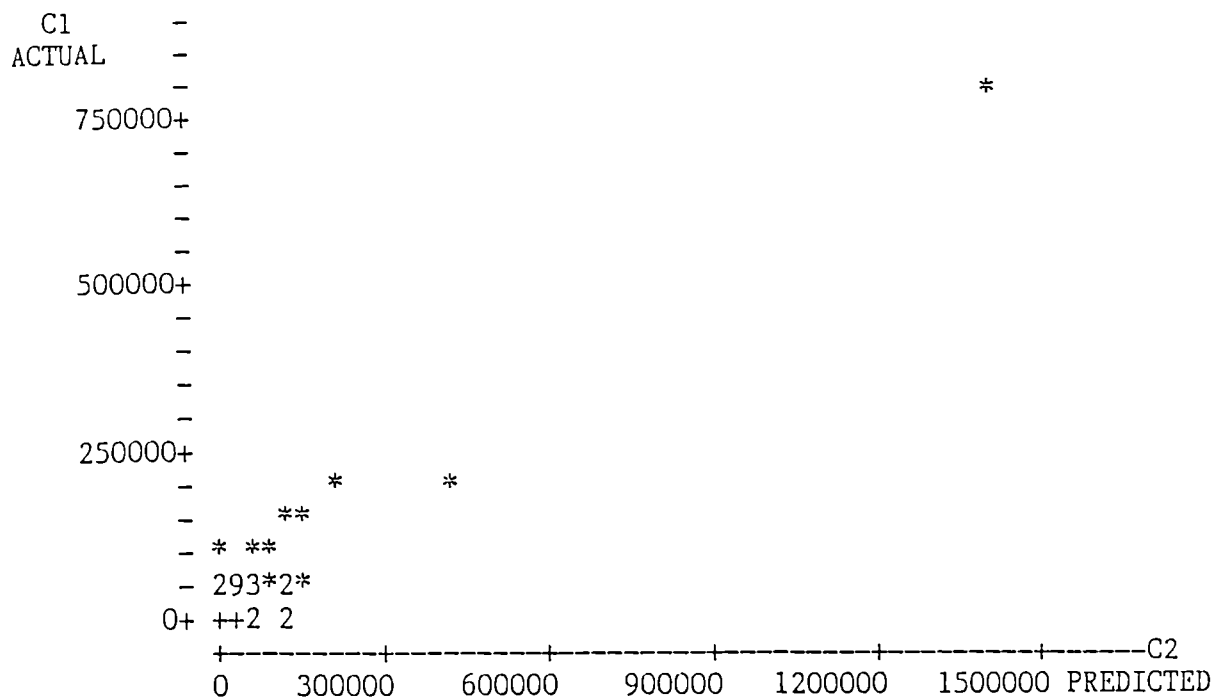


FIGURE 9

1975 Expenditure/1983 Spatial Data

The regression equation is
 $C1 = 2968 + 0.563 C2$

Predictor	Coef	Stdev	t-ratio
Constant	2967.8	585.9	5.07
C2	0.562991	0.007220	77.97

R-sq = 94.3%

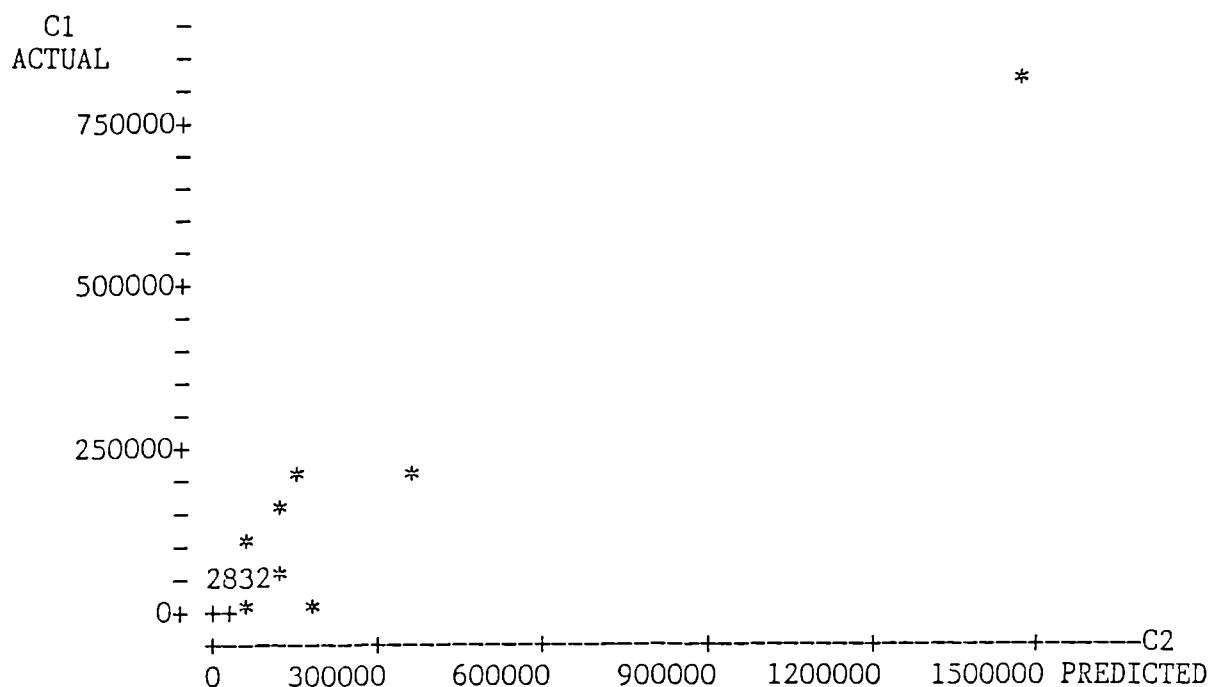


FIGURE 10

3.4.15 A full list of the predicted rents and the actual (hypothetical) rents for each set of spatial data, i.e. at each test year, is included in Appendix 9 in the file named REG.DATA (year).

3.4.16 As a check on the results, and also to test the sensitivity of the model to changes in the data, VALDER 5 to VALDER 8 & 9 were re-run using the

same expenditure data, street matrices and shop location data but, this time, allowing the car park usage and availability to change in relation to the 1966 test and the 1983 test. The results of this second analysis are set out below:-

1975 Expenditure/(year) Spatial Data (car park data unconstrained)

Year	Constant	value	t	R ²
1966	3678	0.439	29.25	70.8
1975	4911	0.271	22.28	54.7
1976	2293	0.578	72.70	92.8
1983	2968	0.563	77.97	94.3

TABLE 32

3.4.17 The regression equations and confidence limits produced by this re-run of the model are no different from those obtained by the first run and, on their face, gave rise to a suspicion that some error had been made in the selection of the input data file. However, a check of the output files of rent data revealed that, although many of the predicted rents remained the same, there were sufficient with different predicted values to confirm that different car park data had been used as an input. However, their effect on the model's formulation of proportioning values based

on the logarithm of the changed pedestrian flows was relatively insignificant compared with the effect of the floorspace and spatial data (street matrix, etc.) utilised in the test.

3.4.18 Of some significance, despite the apparently poor result of the predictions and some large disparities between the predicted rental values and the hypothetical checkrents, is the sudden change in the slope of the line of the equation around the 1975/1976 test years. The only differences in the data used in these two tests are i/ the addition of the Guildhall Shopping Centre retail floorspace and ii/ the disruption of the car park provision by virtue of the Shopping Centre's construction. These differences, of course, are very important in relation to the results obtained. However, although there is obviously a substantial change in the balance of the rental values within the central area, the model as yet did not appear to have produced any reliable, measurable prediction of the effect on individual properties. In

considering the results from the run of this version of VALDER 5, it was decided to re-run the regression analyses of the results produced using constrained car parks, but omitting the larger pairs of data. First, only the largest pair of data were omitted; a second analysis was then undertaken in which the highest three pairs of data were omitted. The results are as follows.

Largest pair of Data omitted

1975 Expenditure/(Year) Spatial Data

Year	Constant	value	t	R ²
1966	2179	0.623	25.89	65.7
1975	3066	0.429	20.12	49.8
1976	2118	0.594	28.92	67.1
1983	2466	0.617	27.99	68.1

TABLE 33

3.4.19 This shows a decreased $R^2(\text{adj})$ in all years, but the 1975 equation is brought more into line with those for other years by the omission of the largest pair of data. Interestingly, all the intercepts are lower than in the original analysis and the slope of the equation is much altered. Plots of the analyses are as follows.

1975 Expenditure/1966 Spatial Data

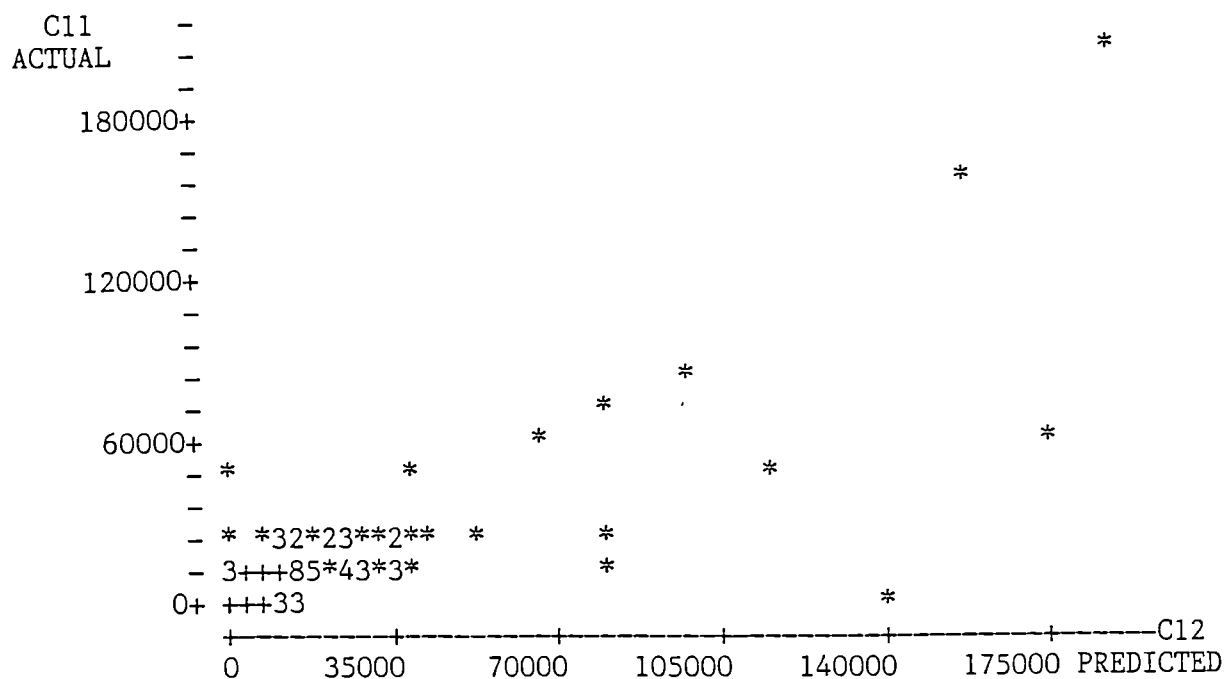


FIGURE 11

1975 Expenditure/1975 Spatial Data

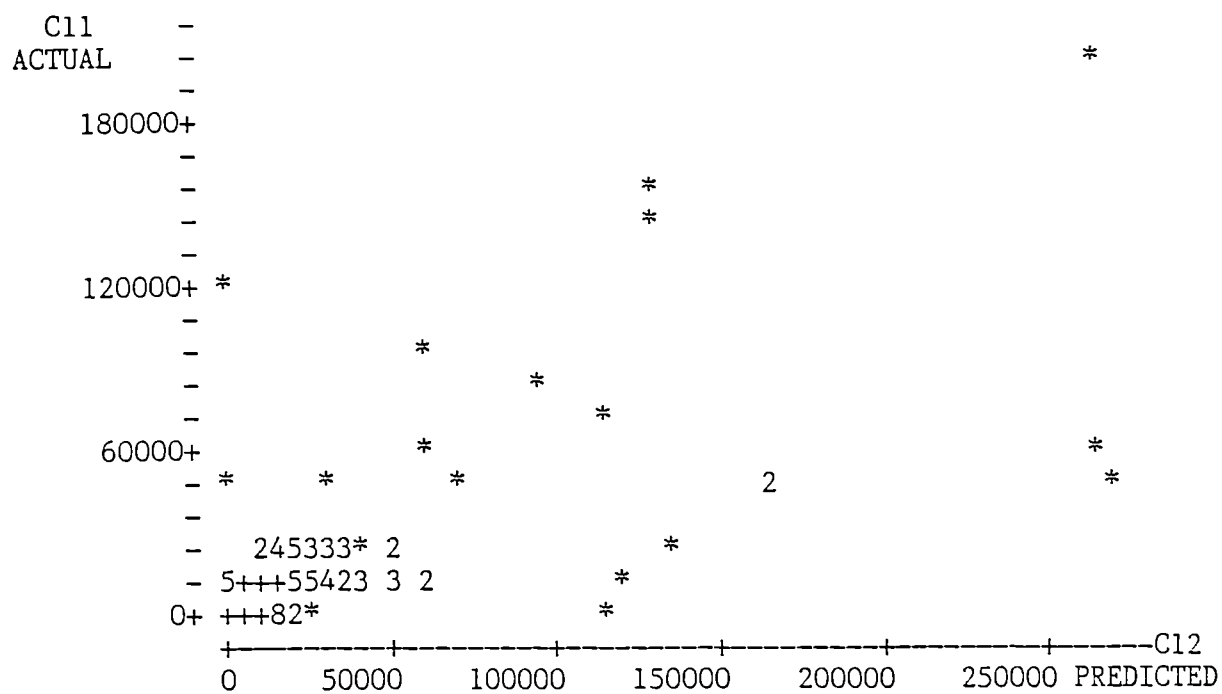


FIGURE 12

1975 Expenditure/1976 Spatial Data

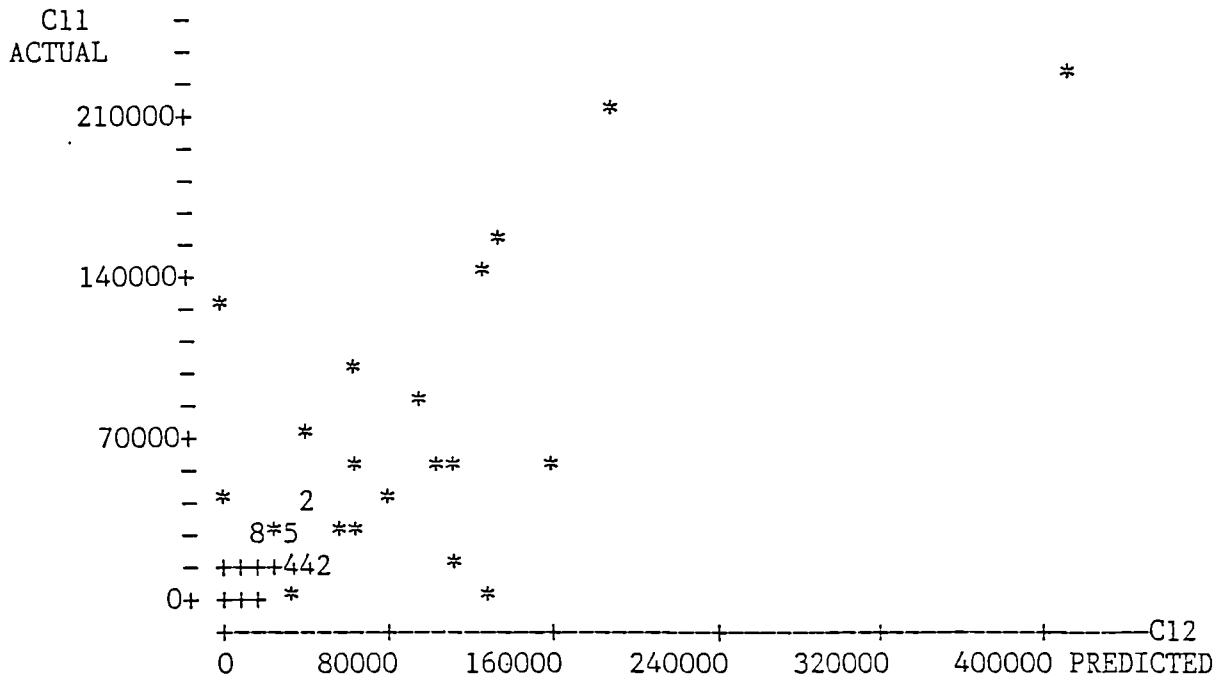


FIGURE 13

1975 Expenditure/1983 Spatial Data

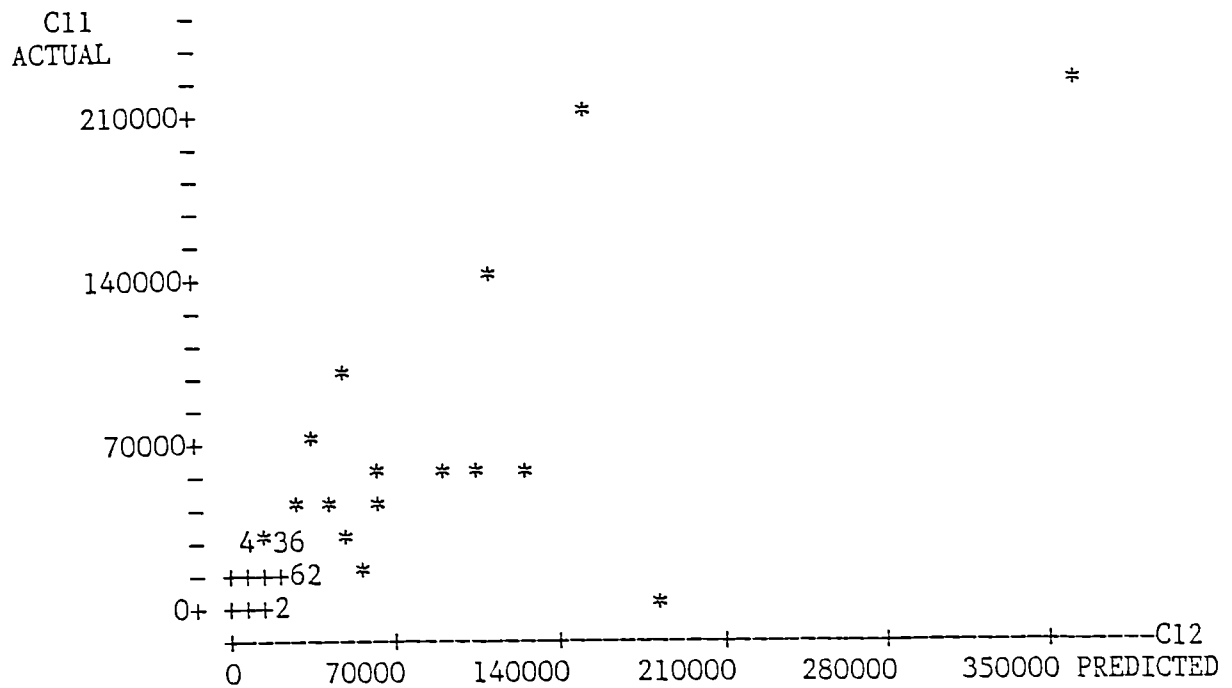


FIGURE 14

Largest Three Pairs of Data Omitted

1975 Expenditure/(Year) Spatial Data

Year	Constant	value	t	R ²
1966	3585	0.394	19.12	51.2
1975	3646	0.372	17.11	41.9
1976	2249	0.567	19.64	48.6
1983	2243	0.646	20.57	53.7

TABLE 34

3.4.20 Except for the 1983 analysis there is a general movement of the intercept upwards and a lowering of the slope of the regression line on the removal of the three largest pairs of data. The plots of the analyses are as follows.

1975 Expenditure/1966 Spatial Data

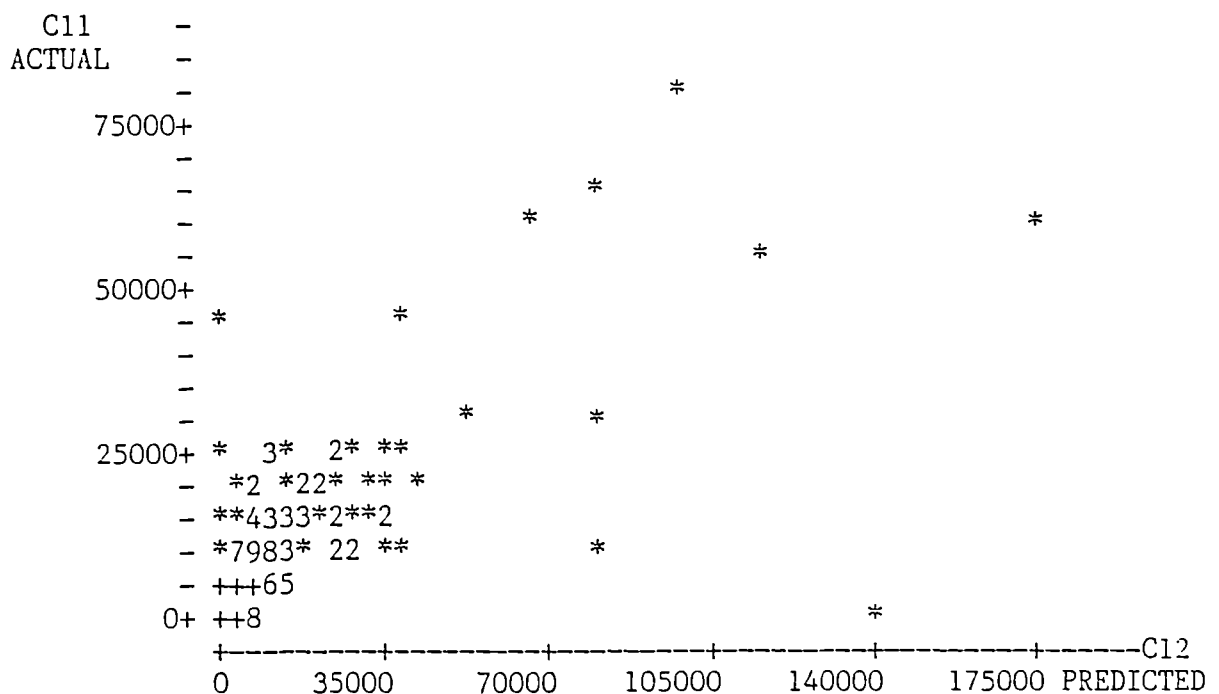


FIGURE 15

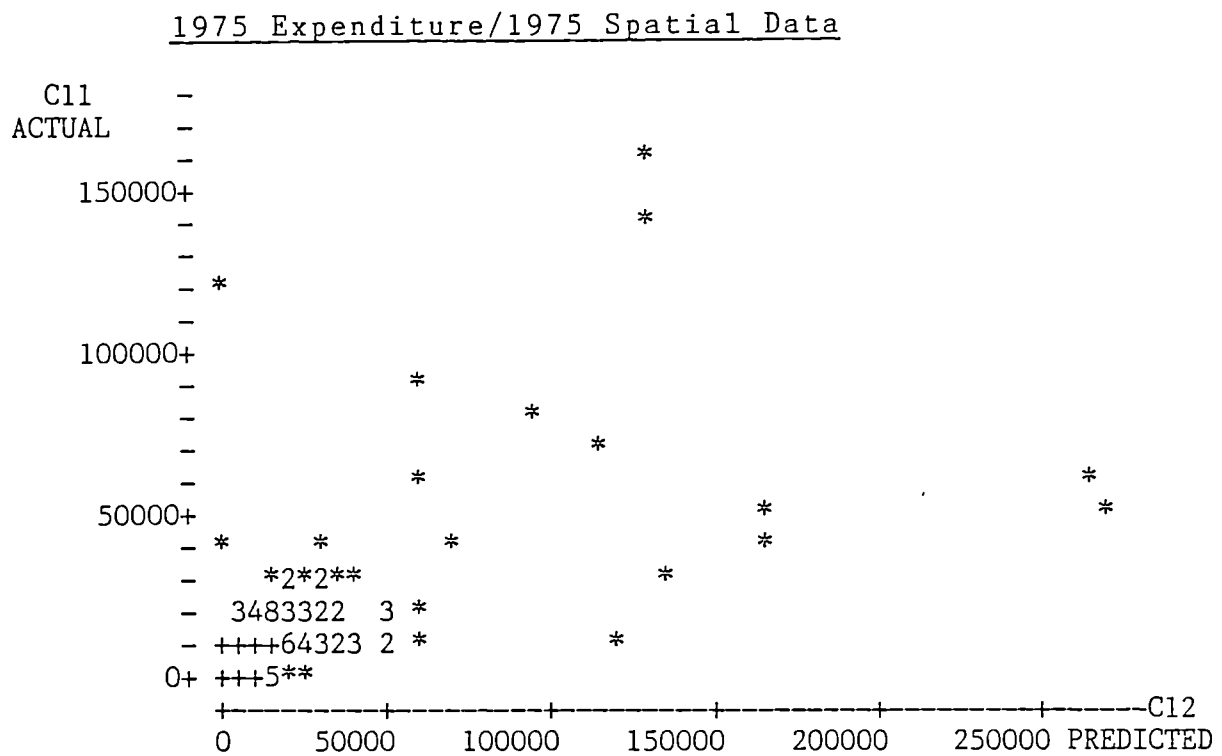


FIGURE 16

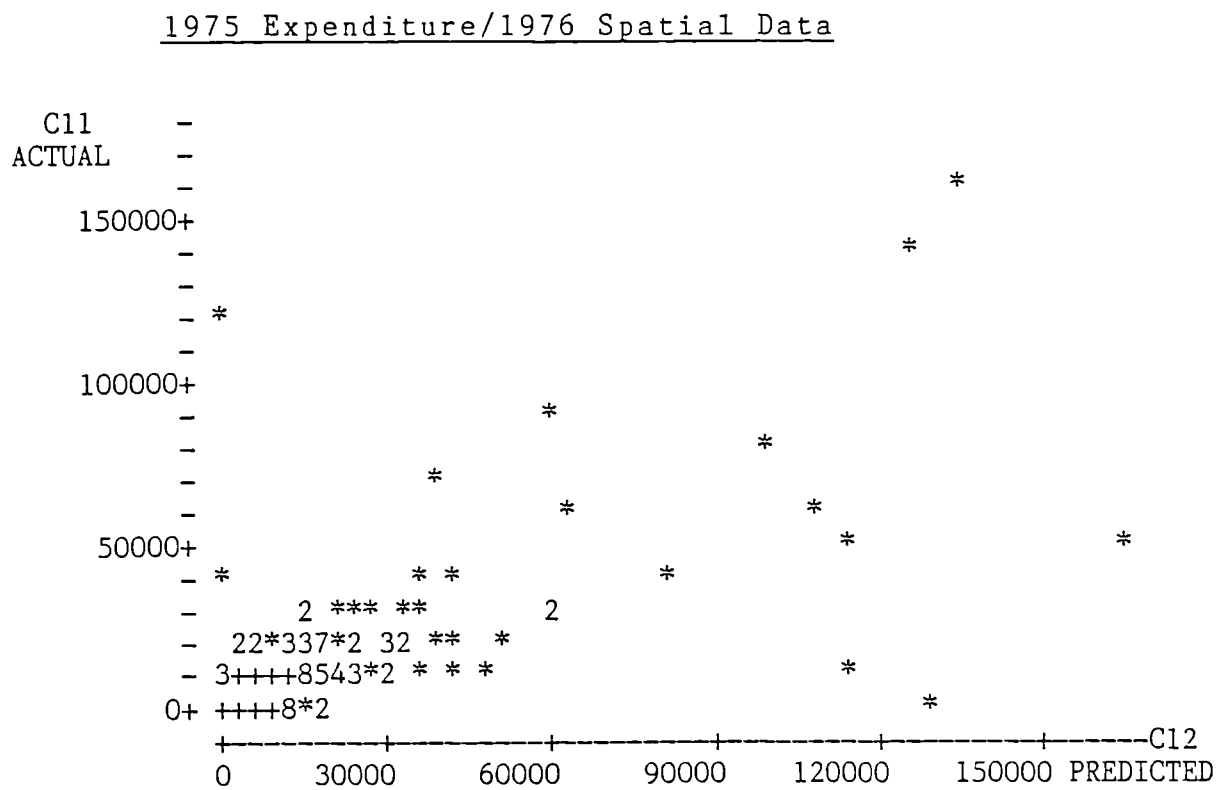


FIGURE 17

1975 Expenditure/1976 Spatial Data

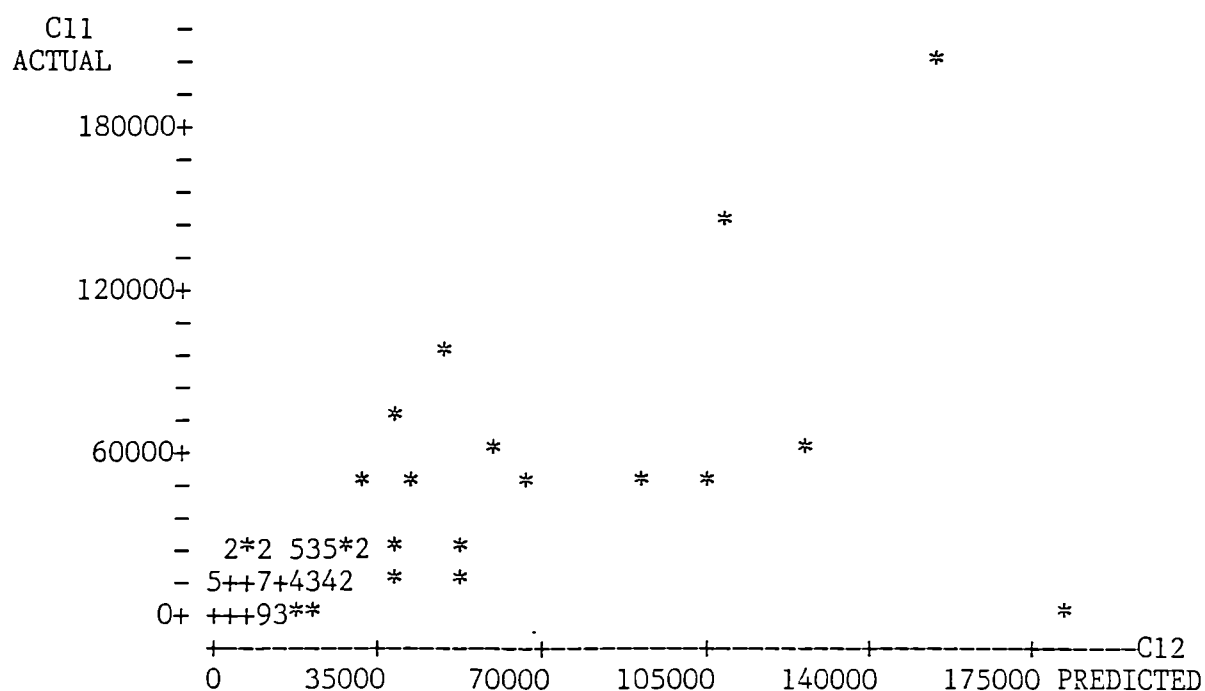


FIGURE 18

3.4.21 Again, looking at the summary results presented in Table 30, it can be seen that factor construction 3 also produced reasonably good results. This version of the allocation factor had been run without the ρ component. In this form the α factor becomes a pure attractor on the basis of the floorspace of the individual shop in relation to the floorspace utilised for the sale of the same type of goods in the

shopping centre. Although this structure of the apportioning factor did not accord with the theoretical basis of the model it was decided, during the final stages of the experimental test of the model, that an unconstrained allocation by floorspace size alone should be tried to see if the omission of the ρ factor had any effect on the results.

- 3.4.22 Using an unconstrained α factor (allocation factor 3) the following range of equations and R^2 were obtained.

Full Data Used

1975 Expenditure/(Year) Spatial Data

Year	Constant	value	t	R^2
1966	1709	0.743	37.70	80.1
1975	2063	0.620	29.01	67.2
1976	-1435	0.992	85.40	85.4
1983	624	0.874	71.67	93.3

TABLE 35

- 3.4.23 The plots of the analyses upon which these equations are based, are as follows:

1975 Expenditure/1966 Spatial Data

The regression equation is
 $C1 = 1709 + 0.743 C2$

Predictor	Coef	Stdev	t-ratio
Constant	1709.4	505.7	3.38
C2	0.74331	0.01972	37.70

R-sq = 80.1%

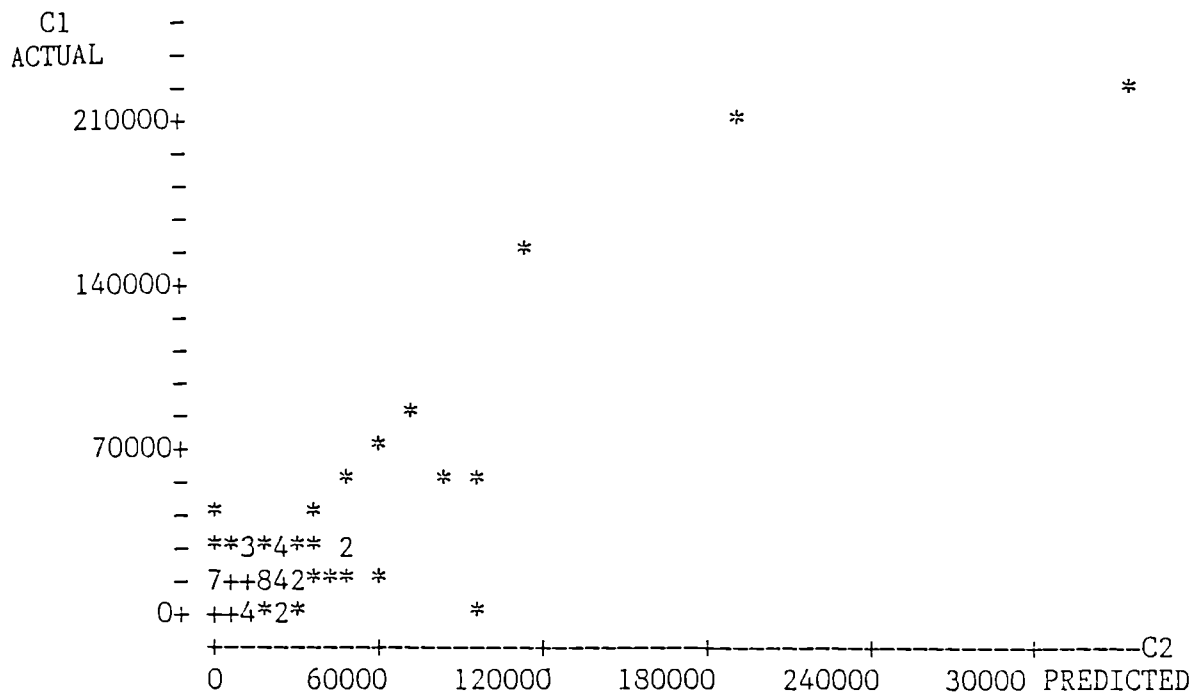


FIGURE 19

1975 Expenditure/1975 Spatial Data

The regression equation is
 $C1 = 2063 + 0.620 C2$

Predictor	Coef	Stdev	t-ratio
Constant	2062.7	644.5	3.20
C2	0.61979	0.02136	29.01

R-sq = 67.2%

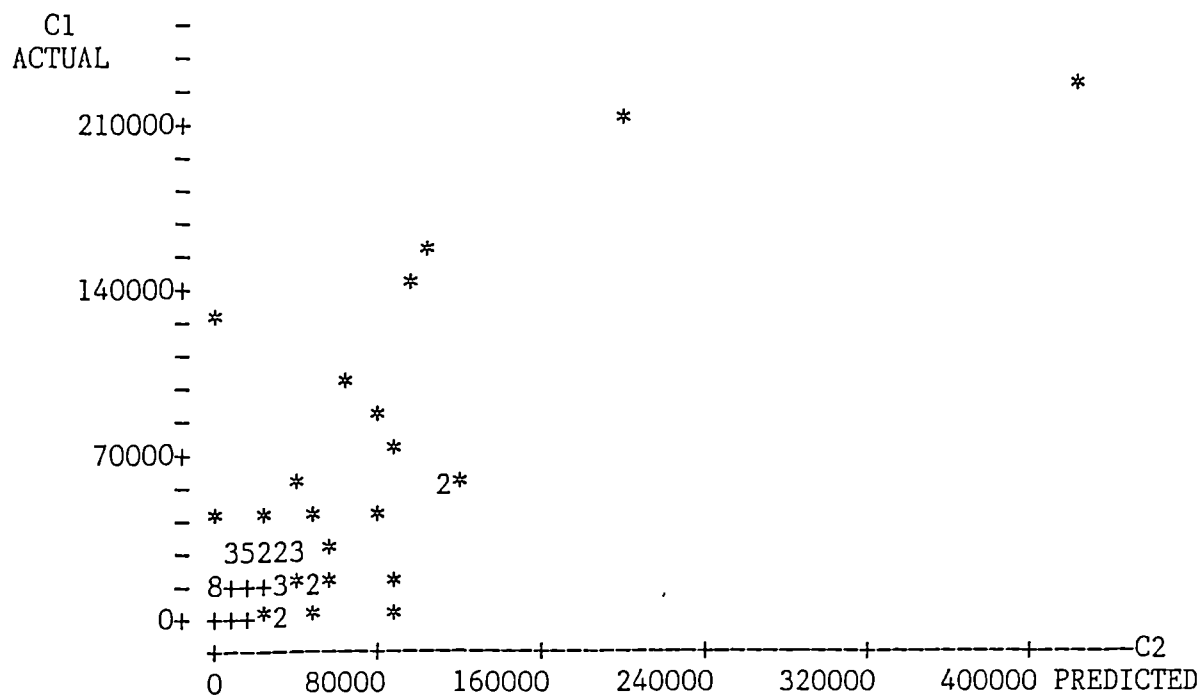


FIGURE 20

1975 Expenditure/1976 Spatial Data

The regression equation is

$$C1 = -1435 + 0.992 C2$$

Predictor	Coef	Stdev	t-ratio
Constant	-1434.7	885.5	-1.62
C2	0.99195	0.02021	49.07

R-sq = 85.4%

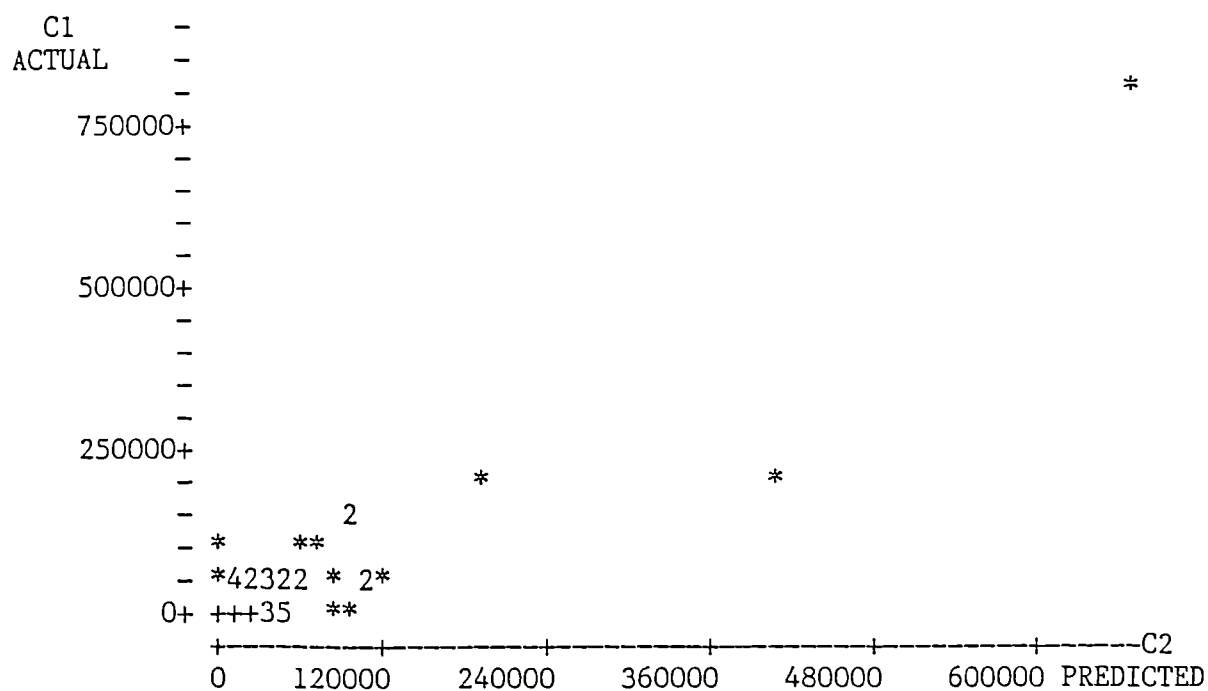


FIGURE 21

1975 Expenditure/1983 Spatial Data

The regression equation is

$$C1 = 624 + 0.874 C2$$

Predictor	Coef	Stdev	t-ratio
Constant	624.2	640.5	0.97
C2	0.87420	0.01220	71.67

R-sq = 93.3%

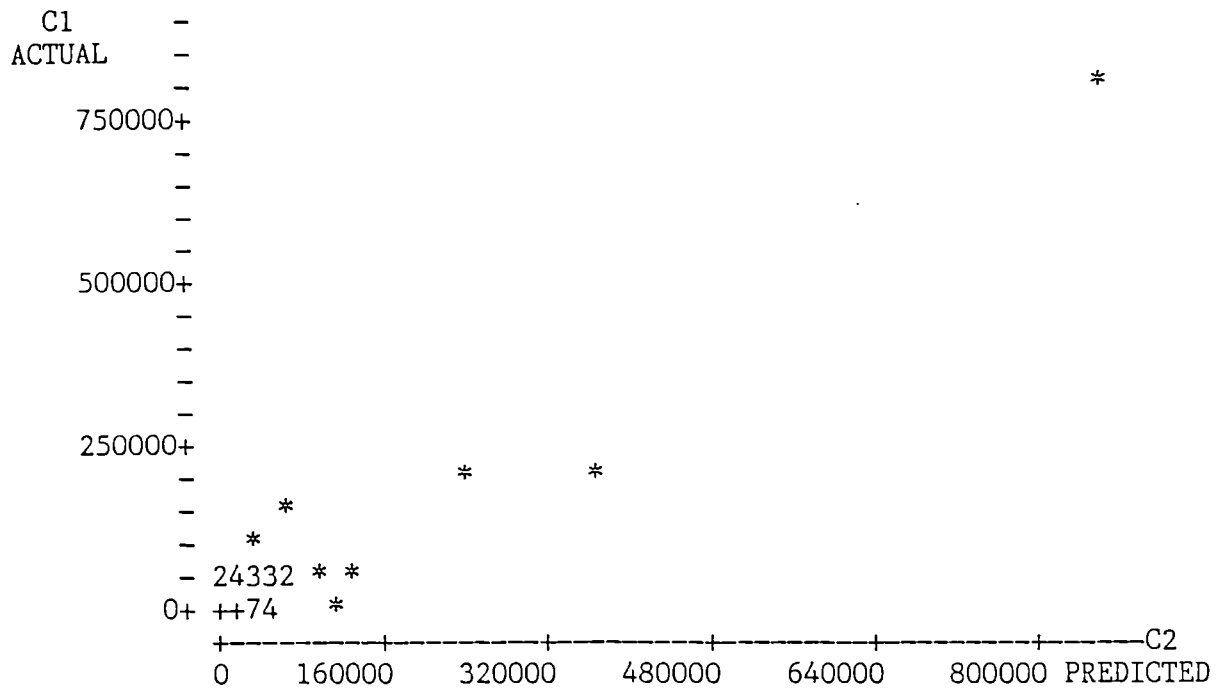


FIGURE 22

3.4.24 Again, in considering the results from the use of an unconstrained α factor, a similar line of fit is obtained as that when using the factor containing a pedestrian flow adjustment,

$\alpha \log \rho$. However, further investigation of the results of this last computer run reveals that the standard deviation, and the residuals, indicate no better fit than the previous attempt (see Table 32). Notwithstanding this result, it was decided to re-run the regression analyses of the results using factor formulation 3, again omitting the larger pairs of data. First, as previously, only the largest pair of data were omitted; the second analysis was then undertaken omitting the highest three pairs of data. The results are as follows:

Largest Pair of Data Omitted

1975 Expenditure/(Year) Spatial Data

Year	Constant	value	t	R ²
1966	998	0.843	30.68	72.9
1975	916	0.744	24.74	60.0
1976	1979	0.643	28.15	65.9
1983	2514	0.649	32.32	74.0

TABLE 36

3.4.25 In these analyses there is an improvement in

equations for the 1966 and 1975 test years' results but a converse effect on the 1976 and 1983 results, indicating that the largest pairs of data were making a major contribution to the overall correlation.

Largest Three Pairs of Data Omitted
1975 Expenditure/(Year) Spatial Data

Year	Constant	value	t	R ²
1966	2711	0.561	19.18	51.4
1975	1479	0.679	19.44	48.2
1976	1716	0.660	18.76	46.3
1983	2982	0.575	15.71	40.6

TABLE 37

3.4.26 In these analyses there is a further change in the general shape of the results. There is an upwards movement of the intercept of the regression line in the early test years whilst there is a reduction in the later years of the test. The lack of an attenuation of the model's predictions by the inclusion of a pedestrian flow variable appears to have reduced the reliability of the model. The accuracy of the rent

predictions, produced on the basis of each of the two versions of the allocation factor, are discussed in the latter part of this chapter.

3.4.28 Generally the results of both of the fully investigated sets of results are statistically reasonable. However, an inspection of the actual data produced - the predicted individual property rents - and a comparison with the hypothetical check rents reveals that there are still some large disparities between the predicted and the (hypothetical) actual figures. When these are inspected in a file of data, with the gross value for rating purposes included in the list, it is immediately quite obvious that there is a very close relationship between the gross value for rating and the hypothetical rent (that was intentional) but that there does not appear to be much consistency between either of these first mentioned figures and the last.

3.4.29 A casual observation of the files of data (produced by either of the versions of the allocation factor latterly discussed) reveals an apparently random pattern to the predicted rent results. This randomness is, however, more

apparent than real; about one eighth of the predicted rents are within 10% of the hypothetical actual rent in the sets of results obtained from the use of factor construction 2 and those from the use of factor construction 3 are similar but slightly less reliable. A plot of these results is contained within Appendix 8 , Volume 2 and the results, themselves, are examined later in this chapter.

3.5 Sensitivity Tests

- 3.5.1 On completion of the several calibrating computer runs described, and after checking the sensitivity of the results of the regression analyses to the suppression of influential data and the sensitivity of the apparent accuracies of the results from the running of the model with changed allocation factors, it was decided that further analyses and further variations of the algorithm would not significantly alter the results obtained. The predictions obtained on the basis of factor construction 2 and factor construction 3 were probably as good as could be obtained by any other variation of the simple model specified in Chapter 3.

3.5.2 Having taken the decision not to run any further variations of the allocation algorithms the operation of the last two stages of the value derivation model were still tested and the algorithms were subsequently used (this is described in the next sections of this chapter). There was, however, no attempt made to utilise the computer generated output from VALDER 5 to VALDER 9 in a test for the existence of translated value. This decision was taken, reluctantly, because of the apparent unreliability of the prediction of rents for individual property locations within the city's central shopping area. Again, the basis of, and reasons for, this decision are discussed in the next chapter.

3.5.3 Apart from the deliberate test of the model's sensitivity to changes in data input on the utilisation of car parks and to changes in the construction of the intra-urban allocation factor, no specific sensitivity tests have been carried out. The results obtained using the present theoretical construction of the internal expenditure location prediction algorithm revealed that the internal allocator is not particularly sensitive to change, in its present form. Further comment is made on this phenomenon in later sections.

4 Rents and Capital Values

4.1 The Rent Predictions

4.1.1 Bearing in mind the criticisms of the model discussed earlier in this thesis, the model used is obviously imperfect. Clearly the shift from the basis of the model originally developed in Chapter 3 (re-stated with some minor amendments in Chapter 5) to the model used and described in this chapter will have had some effect on the results obtained. Some of these are discussed in the next section of this chapter prior to explaining the concluding analyses which were carried out to complete the investigation of the translated value model.

4.1.2 These changes in the model will have produced, in various places, an over-emphasis or an under-emphasis within the results. The model, as originally conceived, required a large amount of detail at a very fine level and, even in Exeter, such detail was not, ultimately, available.

4.1.3 Notwithstanding the difficulties with data, two other changes within the model will have

contributed to the effects reported. The first of these is within the rent bid/rent demand simulated negotiation. The revised model had a much more rigid bidding process built into it. This may have introduced some inflexibilities into the second level of data. However, any bias present in the capital value constructions merely reflects any corruptions present as a result of any poor estimations of individual predicted rents. In addition, the results will have been affected by changes, over time, in i/ investment yields for the different types of property, ii/ the amounts of floorspace utilised for the different ranges of retail goods, and iii/ the change of use of the premises themselves.

4.1.4 Also, it should be noted that, in terms of the pedestrian flow allocation, both bases of the model used provide an indication of a relationship between the variables utilised and the rents predicted. However, the regression analyses indicate that there are differences, in some cases quite substantial differences, between the predicted rents and the 'actual' rents.

4.1.5 What did become clear, during the test, was that the addition of the Guildhall data in the 1976

collection caused some skewing of the results. However, after suppression of the large points, the regression equation was more in conformity with those for the test years prior to the Guildhall development.

4.1.6 It must be stressed, at this point, that the 'actual' rents (see page 282) were utilised throughout the test as a data set against which to check the model's predicted rent levels. The predicted rents distributed over, firstly, a 1975 surface of retail floorspace, secondly over a 1976 surface, and then over a 1983 surface were tested to check for further changes. Similarly, the predicted rents distributed over a 1966 spatial surface were also checked to see if any prior trend, or consistency, could be established.

4.1.7 The poorer fit in 1976, in comparison with the the 1983 distribution of rents, indicates that the Guildhall Shopping Centre has had a distorting effect upon the rental surface which has taken some time to work through the system. The reasons for this would include, typically, the delays introduced into the rent negotiation

process by the time to lease renewal or to rent review within existing leases. These latter typically being at three or five year intervals. Thus, following the construction of the Guildhall Shopping Centre and its opening in late 1976, its effects could be expected to be mainly expressed in rentals fixed during the period 1979 to 1981 as rents and leases came up for review.

- 4.1.8 There may also, of course, have been an effect on initial rents bid by traders. In the years immediately prior to the Guildhall Shopping Centre's construction, during the construction period, and immediately after its construction, traders within the existing centre may have adopted a 'wait and see' attitude. The result would be a reduction in their rent bids in anticipation that there would be a substantial effect on the trade at their location and, therefore, on their turnover and profit margins. Actual rents collected in the Survey of Rents, therefore, may have been somewhat suppressed in anticipation of an expected effect.

4.2 Additional Investigations

- 4.2.1 Following the regression analyses, a further

Rent Predictions
Statistical Analysis of Results using Factor Construction 2

	No. in Sample	Mean	Median	Tr. Mean	St.Dev.	SE. Mean	Q1	Q3
ACT. RENT on 1975 Base	354	8330	3353	5449	19998	1063	1643	7890
PRED. RENT On 1966 Spatial	354	10604	2404	5276	30368	2039	1108	6880
ACT. RENT on 1975 Base	412	8982	3287	5584	21208	1045	1588	8054
PRED. RENT on 1975 Spatial	412	15028	3886	7373	57939	2854	1909	9882
ACT. RENT on 1976 Base	414	10924	3287	5631	45136	2218	1588	8123
PRED RENT on 1976 Spatial	414	14934	4024	7006	75222	3697	1986	9608
ACT. RENT on 1976 Base	371	10631	3287	5613	46447	2411	1753	7890
PRED. RENT on 1983 Spatial	371	13611	3360	5821	80105	4159	1750	7762

TABLE 38

Rent Predictions
Statistical Analysis of Results using Factor Construction 3

	No. in Sample	Mean	Median	Tr. Mean	St.Dev.	SE. Mean	Q1	Q3
ACT. RENT on 1975 Base	354	8330	3353	5449	19998	1063	1643	7890
PRED. RENT On 1966 Spatial	354	8907	3193	5254	24086	1280	1708	6743
ACT. RENT on 1975 Base	412	8982	3287	5584	21208	1045	1588	8054
PRED. RENT on 1975 Spatial	412	11164	4435	6862	28060	1382	2559	8420
ACT. RENT on 1976 Base	414	10924	3287	5631	45136	2218	1588	8123
PRED RENT on 1976 Spatial	414	12459	4473	6680	42047	2066	2515	8419
ACT. RENT on 1976 Base	371	10631	3287	5613	46447	2411	1753	7890
PRED. RENT on 1983 Spatial	371	11447	3600	5451	51320	2664	2000	6643

TABLE 39

check was made on the two sets of results by obtaining a full statistical description of the columns of rents utilised in, and produced by, the test. The reason for the running of tests using each of these two allocation factors is outlined earlier in this Chapter at page 356. The full descriptions are set out in Tables numbered 38 and 39. The first of these tables results from the analysis of rents predicted by use of the apportioning factor $\frac{\alpha \log \rho}{\sum \alpha \log \rho}$, formula construction number 2 set out in Table 30. The second table is based on the rent predictions arising out of the use of the apportioning factor $\frac{\alpha}{\sum \alpha}$, i.e. excluding any pedestrian flow considerations, formula number 3 in Table 29.

- 4.2.2 On a consideration of the figures set out in the two tables it can be seen that there is about a 20% under-estimate in the middle years but a much lower under-estimate in the other two years. It is possible that this is to some extent a reflection of the 1973 rating revaluation, i.e. the use of newly assessed Gross Values as a facilitator in the construction of the 'actual' rental surface. However, the results reflect the

correlation levels (page 375) and indicate that in terms of absolute magnitude the results are correct. Inevitably, this will still leave some individual results with significant errors.

4.3. Spatial Distribution of Differences

4.3.1 A further check was made by mapping the spatial distribution of the differences between actual and predicted rents onto the street pattern of the town centre. In addition, an analysis of the size of these differences in relation to the size of the pedestrian flows was also made. Two sets of maps were produced; one set of four maps in respect of the predicted rents produced on the basis of each of the two formulae used in the construction of the allocation algorithm.

4.3.2 The maps are to be found in Appendix 8. Those utilising a pedestrian flow factor are numbered 1 to 4 and those which used only a floorspace allocation are numbered 5 to 8.

4.3.3 The maps were an attempt to identify a locational distribution of any differences. More specifically, to identify any general shape to

the distribution; for example whether there was a consistent under-prediction or over-prediction, and whether that prediction was grouped street by street, type by type, or at point locations. Also, in the case of the first formula construction, the existence of any relationship between the spatial distribution of the differences and the distribution of the pedestrian flow was checked.

4.3.4 In general, both versions of the model tended to over predict rents in the periphery of the town centre and to under-predict rents at the centre (with the exception of the Guildhall and proximate shops). However, a comparison between the two sets of maps reveals that there is a slightly steeper rent gradient evident in the set numbered 1 to 4 and an intrusion of more over-predicted rents into the central core. To some extent this indicates a movement inwards of the boundary between the under-prediction and over-prediction, thus indicating that the weighting of the floorspace allocation factor, by the addition of a function of the pedestrian flow, improves the model's predictive powers.

4.3.5 Even so, both sets of maps indicate a fairly random distribution of the size of deviations

within each of the groups, i.e. over-predicted and under-predicted. There is, however, a marked increase in the size of the over-predictions in the set produced by the algorithm without the pedestrian flow function, at the extremes of the peripheral approaches to the town centre, in comparison to the deviations demonstrated in the map for the same year of the pedestrian flow attenuated distribution.

4.3.6 Two matters which are highlighted by the mapping are the obvious shift of the peak of the pedestrian flow from the north east of the town centre to slightly south west of the mid point of the map and a quite obvious under-estimate of the pedestrian flow down Princesshey (points 66-70-79). This latter indicating that some improvement is necessary in the pedestrian flow simulation part of the model to replicate better the pedestrians' directional choice at street junctions and intersections.

4.3.7 It will also be noted, from the maps numbered 3 and 4 that the pedestrian flow around the Guildhall is extremely high in 1976 and that in 1983 the flow pattern, in terms of size, appears

to be more realistic. This was investigated and an over-estimation of the number of pedestrians was revealed in the 1976 simulation. This appears to have resulted from the backflow problem discussed in Chapter 7 (3.1.13). Further refinement of the algorithm to introduce more sophisticated control would entail a larger, and additional, matrix of movements. This could be incorporated in a further development of the model which could then keep track of each individual simulated pedestrian's movements. Such increased sophistication in the model would prevent the oscillation of flows and overcounting.

4.4 Turnover Predictions

- 4.4.1 In the questionnaire survey that had been carried out (discussed in Chapter 7) some information had been collected on the size of turnovers for financial years ending in 1966, 1976 and 1983. Of these data, only those relating to the 1975/76 financial year were of relevance to the experimental test of the model. The result, therefore, was that only eleven pieces of data were available for the test.

Exeter Central Area
Sample Turnovers Year Ended 1975/76

UPRN	ACTUAL TURNOVERS	PREDICTED TURNOVERS	
		Using Factor 3	Using Factor 4
7024	39000	237772	140690
703A	2743904	1058109	765324
703R	178551	377420	208915
704Y	6381	0	0
7065	32977	40251	73748
70B3	324115	134691	298382
70BN	11882	21475	40176
70JC	3318000	3532186	3087603
70JQ	98561	434854	162464
70K8	36664	161231	132747
70L1	20652	14809	13718

TABLE 40

4.4.2 However, notwithstanding this dearth of information, it was decided to at least check the relevant predicted turnovers against the small sample of turnovers where this could be done. The results of this check are set out in Table 40. The turnover check is, however, inconclusive as a result of the smallness of the sample.

4.4.3 This result notwithstanding, further analyses were made of the actual data obtained on rents and turnovers. However, these were not made until after the model's predictions had been fully investigated. They will, therefore, be reported and discussed in Chapter 9 prior to drawing the thesis to a conclusion.

4.5 Accurate Predictions

4.5.1 Referring back to the statistical description of the predicted rents and 'actual' rents to which reference was made in Section 4.2 of this chapter, it can generally be said that on a check of means and standard errors (Tables 38 & 39) for the predicted and 'actual' rents the means are, in the main, reasonably similar.

4.5.2 Furthermore, comparison of Table 39 with Table 40 would indicate that the rent predictions obtained from the algorithm utilising a function of the pedestrian flow produce a slightly worse result on a comparison of means and standard errors than the rent predictions using merely a floorspace allocator. However, it will be noted also that the trimmed means do not vary by any significant amount. Indeed, when a comparison is made of the median rents, the factor formulated as $\frac{\alpha \log \rho}{\sum \alpha \log \rho}$ produces a better comparative relationship. Further investigation of the upper and lower quartiles reveals that the use of a floorspace allocator alone produces over-estimation in the lower quartile range but reasonable approximations of rent in the upper quartile range for the middle two years of the test. Conversely, the predictions obtained using a factor with a function of the pedestrian flow produce a much better fit in the lower quartile range. However, although in the upper quartile range the middle two years are still somewhat over-estimated, the result in the upper quartile range taken over the whole four years of the test are much more consistent.

4.5.3 The last check carried out on the accuracy of the

predicted rents consisted of merely counting the numbers of rents that were predicted to within 10% of the hypothetical actual rent. This was done by counting the number of unique property reference numbers (UPRN's) in this range shown in green on the map plots of the distribution of differences. The result of that count is shown in the following table.

YEAR of Spatial Data	No. of Predictions Accurate to $\pm 10\%$	
	Using Factor 2	Using Factor 3
1966	55	41
1975	41	37
1976	41	39
1983	45	34

TABLE 41

4.5.4 From this table it can be seen that up to one third more accurate predictions of rent were obtained from the model using an allocation factor including a measure of pedestrian flow than from the model using an allocation factor using floorspace alone.

4.6 Capital Values

4.6.1 For the next stage of the model, and as a conclusion to the experimental test, the assumption was made that the results up to this

Exeter Central Area Retail Floorspace (sq.ft.)

	1966	1975	1976	1983
	970865	1086403	1247680	943035

TABLE 42

Centre Capital Value (Predicted) £'s

	1966	1975	1976	1983
Factor 2	72129361	104323481	117307853	106369743
Factor 3	56347235	73447390	89936750	82957951

All values on 1975/76 base

TABLE 43

point were valid and that the predicted rents could be reliably used in the capital value prediction part of the model VALDER 10 & 11.

4.6.2 In the discussion that follows, it should be noted that the capital values, constructed from the predicted rents, are subject to the distortions already discussed in relation to rents. Any distortions may, however, be further compounded by any inaccuracies in the estimation of property investment yields but, having discussed the problems in relation to rents, it is not intended to rehearse them again. In the interests of brevity comments in this section of the thesis will be restricted to other effects. As will be seen later, any problems with yield estimates were minor.

4.6.3 The capital values were calculated on the further assumption that all the properties were freehold. The yields obtained from the questionnaire survey and the canvass of local property professionals were utilised as the basis of the calculation of the capital value of each individual property. The total capital values predicted for the town centre as a whole, for each of the test years,

are shown in Table 43 and the total retail floorspace, to which these capital values relate, is shown in Table 42.

4.6.4 The individual property capital values produced by this further element of the model were then converted into capital values per square foot of retail floorspace for each location and an additional set of maps was produced showing their distribution. Those derived from rents based on allocations using a factor including a function of pedestrian flow are included in Appendix 8 as Maps 9 to 12, and those produced from rents predicted using an allocation factor based on floorspace alone are Maps numbered 13 to 16.

4.6.5 In each case there is a coalescence of capital values into street patterns and street groupings. As expected, there are high capital values in the centre with lower values located towards the periphery of the town centre. Again, the capital values tend to be higher at the edges of the centre than they should be and, conversely, they are probably under-estimated at the centre. The Guildhall centre and proximate shops are an exception to this last statement. The general estimation problem obviously results from the

inadequacies of the rent predictions but the under-estimations or over-estimations are further exaggerated by the use of the yields obtained in respect of the various areas of property location. These yields are, to some extent, affected by the analytical decisions of the providers but they do represent an objective analysis of comparable property transactions (sales and/or lettings) by third parties. In this sense they are appropriate and consistently used. If they are flawed, the flaws result from the general practices adopted by the analysts and, as such, are not relevant to this thesis.

4.6.6 It will, be noted, however, that the total capital values set out in Table 43 indicate rising values per square foot of retail floospace between 1966 and 1975. On the basis of allocation factor 2 there is a reduction in value between 1975 and 1976 of £2 per sq.ft. from £96 to £94 and by 1983 this has risen to £112.7 per sq.ft. It might be thought that this increase in value is due to a rise in real disposable incomes as show in Figure 23, i.e. a release of latent value. However, as the input financial data have not been changed throughout the test of the

United Kingdom
Annual percentage changes at constant 1970 prices



The changes shown in this chart are based on figures which have been revised in *National Income and Expenditure, 1965–1975*.
Source: *National Income and Expenditure*, Central Statistical Office



Year by year percentage changes in household income, after
allowing for tax and inflation

Source: Central Statistical Office

Annual changes in real household disposable income per head

FIGURE 23

Graph of Average Rental Levels – 1974-1982



FIGURE 24



FIGURE 25

model, this cannot be. It is more probable that the reducing investment yields shown in Figure 25 and reflected in the exogenous 1983 yields, used in the model to capitalise the predicted rents, have caused a slight increase in the inner-centre capital values. Similarly, the continuous upward trend in the capital values per square foot resulting from the use of the alternative allocation factor 3 can be explained by the same exogenous phenomenon of lower investment yields and additionally by the endogenous problem of more over-estimation of predicted rents in the outer areas of the town centre (explained in 4.4.4). In neither of the situations described is the increase in total capital value considered to be conclusively indicative of the non tenability of the translated value hypothesis; the results from using a pedestrian flow attenuated allocation factor indicate an overall reduction in capital value per square foot around the test years 1975/1976.

- 4.6.7 Notwithstanding that the capital value plots are not fully accurate it was, however, still possible to make useful comparisons from one year to another in view of the fact that the basis of

the capital value constructions was the same for each year of the two separate sets of four maps. An examination of the mapping of the capital values both prior to and after the construction and opening of the Guildhall Shopping Centre reveals a quite obvious shift of the peaks of capital value from the north east end of the town centre to the south western part of the town centre. The move is away from the section of Sidwell Street which runs to the north east of the original crossroads focus of the centre. At this point there was, and still is, a grouping of large variety stores and adjacent to these is the Bus Station. The section of High Street which ran to the south west of this junction appears only to have been marginally affected but there is a quite obvious rise in the level of capital values in and around the area of the Guildhall Shopping Centre. These capital values are more exaggerated in the set of maps based on the rent predictions using the pedestrian flow based allocation factor than in the other set of maps, but this is only to be expected in view of the higher rent predictions utilised as the basis of the capital value computations.

4.7 Property Market Background to the Test

4.7.1 In order to place the foregoing review of the results of the experimental test of the model into context, it should be explained that the development of the Guildhall Shopping Centre took place during a period of two and a half years culminating in late 1976. The actual scheme to develop the Guildhall site, however, was originally conceived at some time during the period 1971 to 1972, presumably following the development reports put forward by consultants acting on behalf of the City of Exeter during the preceding two years. The initial development feasibility studies and viability studies were carried out, therefore, during early 1972 in a period of frantic activity in the property market. 1972 and early 1973 was a period of rapid inflationary growth with attendant rapid rises in rental values and, therefore, also rapid rises in capital values. The latter part of 1973 and into 1974 saw, firstly, a rapid rise in construction costs due to both the rising cost of imported materials and significant rises in labour rates. Secondly, there was a sudden rise in interest rates and the imposition of

strictures on lending. These two in combination led, in mid 1974, to an unprecedented collapse of the property market and to the bankruptcy of many firms in the construction and property development industries.

- 4.7.2 It was not until 1978/1979, i.e. after the construction of the Guildhall Shopping Centre, that any noticeable recovery took place within the investment market for property. The graph shown in Figure 24 shows that from 1977 onwards there is a substantial increase in the slope of the plot of rentals obtained for retail property. This is indicative of the renewed interest in the retail economy from 1977 onwards and, to some extent, explains yet again the reasons for the quite obvious lags in the rental predictions of the model when compared with the reality of rents obtained. A similar graph of yields obtained on property investments is also included (Figure 25) and it will be noted that, in the years following the construction of the Guildhall Shopping Centre, there has been, nationally, a general lowering of the yields obtained on prime retail property investments and, thus, an increase in real capital values.

4.7.3 One further aspect of the changing retail scene is worthy of mention in this review. From the beginning of the 1970's there has been a slow but obvious change in the composition of retail trade uses. A distinct interaction between trade groups together with a combining of some previously separate retail trades has resulted in a substantial change in retailing approach and in the interaction of consumers with retailers. These changes have been both locational and modal. Consumers now spend much more of their retail consumption expenditure in supermarkets, multiple trade retailers, and departmental type stores and many of these are not located within the recognised retail core. These changes, together with changing yields on property investments, account for some of the problems encountered in the test of the model.

CHAPTER EIGHT
(Supplement)

THE ALGORITHMS

THE VALUE DERIVATION ALGORITHMS

VALDER 1A

```
10INPUT"NO. OF COUNTIES =",CO
15Z1=0
20Z2=0
25Z3=0
30DIMC2(14,7),T2(7),C1(14),C$(7)
50DEFINEREADFILEF2="THETA-C61"
60DEFINEREADFILEF3="CEREG66"
70DEFINEFILEF4="CECOUN66"
80DEFINEFILEF5="CEDEV66"
110FORC=1TOCO
120READF2,C$(C),T2(C)
125T1=T1+T2(C)
130NEXTC
150FORG=OTO14
160READF3,G,C1(G)
161C1(G)=C1(G)*1000
165NEXTG
166FORC=1TOCO
167FORG=OTO14
170C2(G,C)=C1(G)*(T2(C)/T1)
180WRITEF4,C$(C):"GROUP ":G,C2(G,C)
190Z2=Z2+C2(G,C)
200IFC=1THENZ1=Z1+C1(G)
210NEXTG
220NEXTC
230PRINT"CALC. ERROR = ":ABS(Z1-Z2):" = ":(Z1-Z2)*100/Z1:"%"
240A=1+((Z1-Z2)/Z1)
250FORG=OTO14
260C2(G,1)=INT((C2(G,1)*A)+.5)
270Z3=Z3+C2(G,1)
280WRITEF5,G:","C2(G,1):","
290NEXTG
300CLOSEF2,3,4,5
```

VALDER 1B

```
10INPUT"NO. OF DISTRICTS =",DO
18Z1=0
22Z2=0
30DIMC2(14,50),T2(50),C1(14),D$(50)
50DEFINEREADFILEF2="THETA-D61"
60DEFINEREADFILEF3="CEDEV66"
70DEFINEFILEF4="CEDIST66"
80DEFINEFILEF6="CEEXET66"
100FORD=1TODO
110READF2,D$(D),T2(D)
115T1=T1+T2(D)
120NEXTD
130FORG=OTO14
140READF3,G,C1(G)
```

```

142Z1=Z1+C1(G)
145NEXTG
150FORD=1TODO
155FORG=1TO14
160C2(G,D)=C1(G)*(T2(D)/T1)
170Z2=Z2+C2(G,D)
195NEXTG
200NEXTD
210PRINT"CALC. ERROR = ":ABS(Z1-Z2):" = ":(Z1-Z2)*100/Z1:"%"
220A=1+((Z1-Z2)/Z1)
230FORD=1TODO
240FORG=0TO14
250C2(G,D)=INT((C2(G,D)*A)+.5)
260WRITE#4,D$(D):"GROUP ":G,C2(G,D)
270NEXTG
280NEXTD
285FORG=0TO14
290WRITE#6,G:",":C2(G,14):",",
295NEXTG
300CLOSE#2,3,4,6

```

VALDER 1C

```

10INPUT"NO. OF WARDS =",WO
18Z1=0
22Z2=0
30DIMC2(14,20),T2(20),C1(14),W$(20)
50DEFINEREADFILE#2="THETA-W61"
60DEFINEREADFILE#3="CEEXET66"
70DEFINEFILE#4="CEXWAR66"
100FORD=1TOWO
110READ#2,W$(D),T2(D)
115T1=T1+T2(D)
120NEXTD
130FORG=0TO14
140READ#3,G,C1(G)
142Z1=Z1+C1(G)
145NEXTG
150FORD=1TOWO
155FORG=1TO14
160C2(G,D)=C1(G)*(T2(D)/T1)
170Z2=Z2+C2(G,D)
195NEXTG
200NEXTD
210PRINT"CALC. ERROR = ":ABS(Z1-Z2):" = ":(Z1-Z2)*100/Z1:"%"
220A=1+((Z1-Z2)/Z1)
230FORD=1TOWO
240FORG=0TO14
250C2(G,D)=INT((C2(G,D)*A)+.5)
260WRITE#4,W$(D):"GROUP ":G,C2(G,D)
270NEXTG
280NEXTD
300CLOSE#2,3,4

```

VALDER 2

```
10INPUT"NO. OF DISTRICTS =",DO
20DIMS1(14,DO),H1(DO),T1(DO),C2(14,DO),C3(DO)
30DEFINEREADFILEF1="CDEVT"
40DEFINEREADFILEF2="HSPDIST"
50DEFINEREADFILEF3="TSPDIST"
60DEFINEREADFILEF4="CDISTG"
70DEFINEFILEF5="SGDIST"
80READF1,Z
90FORD=1TODO
100C3(D)=0
110READF2,H1(D)
120READF3,T1(D)
130FORG=0TO14
140READF4,G$,C2(G,D)
150C3(D)=C3(D)+C2(G,D)
160S1(G,D)=(C3(D)-H1(D)-T1(D))*(C2(G,D)/C3(D))
170WRITEF4,"TOWN ":D:" GROUP ":G,S1(G,D)
18ONEXTG
19ONEXTD
200CLOSEF1,2,3,4,5
```

PREVALDER

```
10DIMK(14),A(14),T(14),C(14),M(14),CO(14)
20DEFINEREADFILEF1="RCE71"
30DEFINEFILEF2="RE/F71"
40READF1,G,E,F
45IFE=0THENF=1
50K(G)=1000*(E/F)
60ONENDE1GOTO200
70GOTO40
200FORG=0TO14
210WRITEF2,G:",":INT(K(G)):", "
22ONEXTG
230CLOSEF1,2
240DEFINEREADFILEF1="CHEKXSHOPS71"
250DEFINEFILEF2="XE/F71"
260READF1,G,G,E,F
270ONENDE1GOTO310
280WRITEF2,G:",":INT(K(G)*F)):", "
285T(G)=(K(G)*F)
290T=T+(K(G)*F)
300GOTO260
310CLOSEF1,2
320DEFINEFILEF1="E*71"
330WRITEF1,INT(T)
340CLOSEF1
350DEFINEFILEF1="MULTIPLIERS71"
360DEFINEREADFILEF2="CHEKXSHOPS71"
```

```

370E=0
380FORG=OTO14
390M(G)=E/T
395READF2,X,X,A(G)
396PRINTG:A(G)
397CO(G)=T(G)
400NEXTG
410E=0
411FORG=OTO14
412IFF=0ANDT(G) $\frac{3}{4}$ .95*A(G)THENE=E+A(G)
413IFF=1ANDT(G) $\div$ 1.05*A(G)THENE=E+A(G)
414NEXTG
420FORG=OTO14
430C(G)=0
445IFA(G)=0THENGOTO470
450IFF=0ANDT(G) $\frac{3}{4}$ .95*A(G)THENGOTO500
460IFF=1ANDT(G) $\div$ 1.05*A(G)THENGOTO500
470E=E-T(G)
480C(G)=1
490PRINTG:C(G)
500NEXTG
510E1=0
520FORG=OTO14
530IFC(G)=1THENGOTO550
540E1=E1+T(G)
550NEXTG
560FORG=OTO14
570IFC(G)=1THENGOTO600
575PRINTG:A(G)-T(G),E/E1
580T(G)=T(G)*(E/E1)
590M(G)=M(G)*(E/E1)
595PRINTG:A(G)-T(G)
600NEXTG
610FORG=OTO14
620IFC(G)=0THENGOTO410
630NEXTG
632F=1-F
635IFF=1THENGOTO370
640FORG=OTO14
650WRITEF1,G:",":INT(CO(G)):",":M(G):",":INT(T(G)):",":A(G):",
660NEXTG
670CLOSEF1,2
680END

```

```

100DIMZ1(100,100),Z2(100,100),Z3(100,100),Z4(100,100),T1(100),T2(100),T3(100)
110DIMT4(100),F(100),E(100),C(100,15),C1(100,15),C2(100,15),C3(100,15)
120DIMC4(100,15),S(15,100),X1(100,100),X2(100,100),X3(100,100),X4(100,100)
130DIMA1(100,100),A2(100,100),A3(100,100),A4(100,100),CO(100),SO(100)
140DEFINEREADFILEF1="CONVERSION"
150READF1,CO,C
160CO(C/10)=CO
170ONENDEF1GOTO190
180GOTO150
190CLOSEF1
200DEFINEREADFILEF1="CATRTIMES75/76"
210DEFINEREADFILEF2="BUTRTIMES75/76"
220DEFINEREADFILEF3="RATRTIMES75/76"
230READF1,A,B,Z1(A,B)
240E(A)=1
250E(B)=1
260ONENDEF1GOTO280
270GOTO230
280READF2,A,B,Z2(A,B)
290ONENDEF2GOTO310
300GOTO280
310CLOSEF1,2
320FORD1=1TO100
330FORD2=1TO100
340Z4(D1,D2)=999999999
350IFD1=D2THENZ1(D1,D2)=1
360IFD1=D2THENZ2(D1,D2)=1
370IFD1=D2THENZ4(D1,D2)=1
380NEXTD2
390NEXTD1
400READF3,A,B,Z3(A,B)
410ONENDEF3GOTO430
420GOTO400
430CLOSEF3
440DEFINEREADFILEF1="DEVSHOPS75"
450READF1,D,N,T,F
460F(CO(D))=F(CO(D))+F
470ONENDEF1GOTO490
480GOTO450
490CLOSEF1
500FORD1=1TO100
510IFE(D1)=OTHENGOTO660
520FORD2=1TO100
530IFE(D2)=OTHENGOTO650
540X1(D1,D2)=(F(D2)**2.75)/(Z1(D1,D2)**1.5)
550X2(D1,D2)=(F(D2)**2.75)/(Z2(D1,D2)**1.5)
560IFZ3(D1,D2)≠0OTHENGOTO590
570X3(D1,D2)=0
580GOTO600
590X3(D1,D2)=(F(D2)**2.75)/(Z3(D1,D2)**1.5)
600X4(D1,D2)=(F(D2)**2.75)/(Z4(D1,D2)**1.5)
610T1(D1)=T1(D1)+X1(D1,D2)
620T2(D1)=T2(D1)+X2(D1,D2)

```

```

630T3(D1)=T3(D1)+X3(D1,D2)
640T4(D1)=T4(D1)+X4(D1,D2)
650NEXTD2
660NEXTD1
670DEFINEFILEF4="ATTRACT75"
680FORD1=1TO100
690FORD2=1TO100
700IFE(D1)=OORE(D2)=OTHENGOTO790
710A1(D1,D2)=X1(D1,D2)/T1(D1)
720A2(D1,D2)=X2(D1,D2)/T2(D1)
730IFT3(D1) $\frac{1}{2}$ OTHENGOTO760
740A3(D1,D2)=0
750GOTO770
760A3(D1,D2)=X3(D1,D2)/T3(D1)
770A4(D1,D2)=X4(D1,D2)/T4(D1)
780WRITEF4,D1:",":D2:",":A1(D1,D2):",":A2(D1,D2):",":A3(D1,D2):",":A4(D1,D2):", "
790NEXTD2
800NEXTD1
810CLOSEF4
820DEFINEREADFILEF1="CEDISTS75/76"
830YO=1974
840READF1,N,G,C
845 C(CO(N),G)=C(CO(N),G)+C
850ONENDE1GOTO870
860GOTO830
870DEFINEREADFILEF2="TRANSMODES"
880READF2,Y1,M1,M2,M3,M4
890TO=M1+M2+M3+M4
900T1=M1+M2+M4
910IFY1=YOTHENGOTO940
920ONENDE2GOTO940
930GOTO880
940CLOSEF1,2
950FORD1=1TO100
960IFE(D1)=OTHENGOTO1160
970FORD2=1TO100
980IFE(D2)=OTHENGOTO1150
990FORG=OTO14
1000IFZ3(D1,D2)=OTHENGOTO1060
1010C1(D1,G)=C(D1,G)*M1/TO
1020C2(D1,G)=C(D1,G)*M2/TO
1030C3(D1,G)=C(D1,G)*M3/TO
1040C4(D1,G)=C(D1,G)*M4/TO
1050GOTO1100
1060C1(D1,G)=C(D1,G)*M1/T1
1070C2(D1,G)=C(D1,G)*M2/T1
1080C3(D1,G)=0
1090C4(D1,G)=C(D1,G)*M4/T1
1100S(G,D2)=INT(S(G,D2)+(C1(D1,G)*A1(D1,D2)))
1110S(G,D2)=INT(S(G,D2)+(C2(D1,G)*A2(D1,D2)))
1120S(G,D2)=INT(S(G,D2)+(C3(D1,G)*A3(D1,D2)))
1130S(G,D2)=INT(S(G,D2)+(C4(D1,G)*A4(D1,D2)))
1140NEXTG
1150NEXTD2
1160NEXTD1
1170DEFINEFILEF1="SPDIST75"
1180DEFINEFILEF2="STDIST75"

```



```

1190DEFINEFILE#3="SPEXET75"
1200FORJ=1TO100
1210IFE(J)=OTHENGOTO1290
1220SO(J)=0
1230FORG=OTO14
1240WRITE#1,J:","G:","S(G,J):","
1250IFJ=10THENWRITE#3,G:","S(G,J):","
1260SO(J)=SO(J)+S(G,J)
1270NEXTG
1280WRITE#2,J:","SO(J):","
1290NEXTJ
1300CLOSE#1,2,3
1310END

```

VALDER 1-4

```

10DIMK(14),A(14),T(14),C(14),M(14),CO(14)
20DEFINEREADFILE#1="CEREG75/76"
30DEFINEFILE#2="RE/F75/76"
33DEFINEREADFILE#3="RCE71"
37READ#3,G,E,F
40READ#1,G,E
45IFE=OTHENF=1
50K(G)=1000*(E/F)
60ONEND#1GOTO200
65ONEND#3GOTO200
70GOTO37
200FORG=OTO14
210WRITE#2,G:","INT(K(G)):","
220NEXTG
230CLOSE#1,2,3
240DEFINEREADFILE#1="GTOTFS75"
250DEFINEFILE#2="XE/F75/76"
260READ#1,G,F
270ONEND#1GOTO310
280WRITE#2,G:","INT(K(G)*F):","
285T(G)=(K(G)*F)
290T=T+(K(G)*F)
300GOTO260
310CLOSE#1,2
320DEFINEFILE#1="E*75/76"
330WRITE#1,INT(T)
340CLOSE#1
350DEFINEREADFILE#1="MULTIPLIERS71"
360DEFINEFILE#2="XTGDATA75/76"
370READ#1,G,A,M(G)
380ONEND#1GOTO400
390GOTO370
400CLOSE#1
410FORG=OTO14
420T(G)=T(G)*M(G)
430WRITE#2,G:","INT(T(G)):","
440NEXTG
450CLOSE#2
460END

```

VALDER 3A & 4A

```

100DIMS(15),F(16,20),N(16,20),X1(20,20),X2(20,20),X3(20,20),X4(20,20)
110DIMT1(20),T2(20),T3(20),T4(20),Z1(20,20),Z2(20,20),Z3(20,20),Z4(20,20)
120DIMA1(20,20),A2(20,20),A3(20,20),A4(20,20),S0(20,20),S1(20,20)
130DIMS2(20,20),S3(20,20),S4(20,20)
140DEFINEREADFILEF1="SPEXET83"
150READF1,G,S(G)
160ONENDEF1GOTO180
170GOTO150
180CLOSEF1
190DEFINEREADFILEF1="RETFS83"
200DEFINEREADFILEF2="WRETFS83"
210DEFINEFILEF3="XCENTOTS83"
220READF1,R1,R2,Z,A,B,C,D,E,F,G,H,I,J,K,L,M,N,O,P,Q,R,S,T,U,V,W,X,Y,Z,
230ONENDEF1GOTO600
240F(0,18)=F(0,18)+A
250N(0,18)=N(0,18)+B
260F(1,18)=F(1,18)+C
270N(1,18)=N(1,18)+D
280F(2,18)=F(2,18)+E
290N(2,18)=N(2,18)+F
300F(3,18)=F(3,18)+G
310N(3,18)=N(3,18)+H
320F(4,18)=F(4,18)+I
330N(4,18)=N(4,18)+J
340F(5,18)=F(5,18)+K
350N(5,18)=N(5,18)+L
360F(6,18)=F(6,18)+M
370N(6,18)=N(6,18)+N
380F(7,18)=F(7,18)+O
390N(7,18)=N(7,18)+P
400F(8,18)=F(8,18)+Q
410N(8,18)=N(8,18)+R
420F(9,18)=F(9,18)+S
430N(9,18)=N(9,18)+T
440F(10,18)=F(10,18)+U
450N(10,18)=N(10,18)+V
460F(11,18)=F(11,18)+W
470N(11,18)=N(11,18)+X
480F(12,18)=F(12,18)+Y
490N(12,18)=N(12,18)+Z
500F(13,18)=F(13,18)+A1
510N(13,18)=N(13,18)+B1
520F(14,18)=F(14,18)+C1
530N(14,18)=N(14,18)+D1
540F(15,18)=F(15,18)+E1
550N(15,18)=N(15,18)+F1
560GOTO220
570FORG=OTO15
580WRITEF3,F(G,18):N(G,18)
590NEXTG
600CLOSEF1,3
610FORW1=1TO17

```

A1,B1,C1,D1,E1,F1

```

620READ£2,W0,A,B,C,D,E,F,G,H,I,J,K,L,M,N,O,P,Q,R,S,T,U,V,W,X,Y,Z,
630F(0,W0)≈A
640F(1,W0)≈C
650F(2,W0)≈E
660F(3,W0)≈G
670F(4,W0)≈I
680F(5,W0)≈K
690F(6,W0)≈M
700F(7,W0)≈O
710F(8,W0)≈Q
720F(9,W0)≈S
730F(10,W0)=U
740F(11,W0)=W
750F(12,W0)=Y
760F(13,W0)=A1
770F(14,W0)=C1
780NEXTW1
790CLOSE£2
800DEFINEREADFILE£1="XTIMODES"
810READ£1,W1,W2,D,Z1(W1,W2),Z2(W1,W2),Z4(W1,W2)
820ONENDE1GOTO840
830GOTO810
840CLOSE£1
850DEFINEFILE£1="WATTRACT83"
860FORG=0TO14
861 T1(18)=0
862 T2(18)=0
863 T4(18)=0
870FORW1=1TO18
880IFW1=18THENZ1(W1,18)=1
890IFW1=18THENZ2(W1,18)=1
900IFW1=18THENZ4(W1,18)=1
910X1(18,W1)=F(G,W1)/Z1(W1,18)
920X2(18,W1)=F(G,W1)/Z2(W1,18)
930X4(18,W1)=F(G,W1)/Z4(W1,18)
940T1(18)=T1(18)+X1(18,W1)
950T2(18)=T2(18)+X2(18,W1)
960T4(18)=T4(18)+X4(18,W1)
970NEXTW1
980FORW1=1TO18
990A1(18,W1)=X1(18,W1)/T1(18)
1000A2(18,W1)=X2(18,W1)/T2(18)
1010A4(18,W1)=X4(18,W1)/T4(18)
1040WRITE£1,"18 ","":W1:",":G:",":A1(18,W1):",":A2(18,W1):",":A4(18,W1):
1050NEXTW1
1060NEXTG
1070CLOSE£1
1080DEFINEREADFILE£1="SPEXET83"
1090Y0=1984
1100READ£1,G,S(G)
1110ONENDE1GOTO1130
1120GOTO1100
1130DEFINEREADFILE£2="TRANSMODES"
1140READ£2,Y1,M1,M2,M3,M4
1150T1=M1+M2+M4
1160IFY1=Y0THENGOTO1190

```

```

1170ONENDE2GOTO1190
1180GOTO1140
1190CLOSE#1,2
1200DEFINEREADFILE#1="WATTRACT83"
1210READ#1,W1,W2,A,A1(A,W2),A2(A,W2),A4(A,W2)
1220ONENDE1GOTO1240
1230GOTO1210
1240CLOSE#1
1250FORW2=1TO18
1260FORG=0TO14
1270S1(G,W2)=(S(G)*M1/T1)*A1(G,W2)
1280S2(G,W2)=(S(G)*M2/T1)*A2(G,W2)
1290S4(G,W2)=(S(G)*M4/T1)*A4(G,W2)
1300S0(G,W2)=INT(S1(G,W2)+S2(G,W2)+S4(G,W2))
1310NEXTG
1320NEXTW2
1330DEFINEFILE#1="SPXWAR83"
1340DEFINEFILE#2="SPXCEN83"
1350FORW=1TO17
1360FORG=0TO14
1370WRITE#1,W:",":G:",":S0(G,W):",",
1380NEXTG
1390NEXTW
1400FORG=0TO14
1410WRITE#2,"18",":G:",":S0(G,18):",",
1420NEXTG
1430CLOSE#1,2
1440END

```

[illegible]

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200E(P2)=1
210GOTO110
220CLOSE#1
230DEFINEREADFILE#1="X83CDATA"
240READ#1,G$,U$,G$,G$,G$,G$,G$,G$,G$,F1$
250ONENDE#1GOTO310
260IFF1$=""THENGOTO240
270F9=F9+VAL(F1$)
280Q=Q+1
290A=F9/Q
300GOTO240
310REWIND#1
320FORN=1TO500
330U$(N)="GGGG"
340RO(N)=999999
350NEXTN
360Z=0
370N=1
380READ#1,G$,U$,G$,Y$,G$,X$,G$,G$,G$,F1$,G$,T
390ONENDE#1GOTO540
400IFF1$ $\frac{3}{4}$ =""THENGOTO430
410F1=A
420GOTO440
430F1=VAL(F1$)
440U$(N)=U$
441 T(N)=T
450IFY$=""ORX$=""THENGOTO380
460X(O)=VAL(X$)
470Y(O)=VAL(Y$)
480IFF1 $\div$ ZTHENU$(O)=U$(N)
490IFF1 $\div$ ZTHENZ=F1
500FO(T,N)=F1
510F7(T)=F7(T)+FO(T,N)
520N=N+1
530GOTO380
540FORT=OTO14
550FORN=1TO500
560IFFO(T,N)=OTHENGOTO580
570RO(N)=FO(T,N)/F7(T)
580NEXTN
590NEXTT
600CLOSE#1
610DEFINEREADFILE#1="FS83ATTACH"
620READ#1,U$,M1,M2
630ONENDE#1GOTO3000
640IFU$ $\frac{3}{4}$  $\div$ U$(O)THENGOTO620
650FORP1=OTO215
660FORP2=OTO215
670D1(P1,P2)=D(P1,P2)
680F1(P1,P2)=F(P1,P2)

```

```

690N1(P1,P2)=N(P1,P2)
700NEXTP2
710NEXTP1
720X9=0
730DEFINEREADFILEF2="XPEDF76/83"
740READF2,P1,Y,X,L1,L2,L3,L4,L5
750ONENDE2GOTO3000
760IFP1 $\frac{3}{4}$ ÷M1THENGOTO790
770D1(O,P1)=INT(SQR(((X(O)-X) $\frac{2}{3}$ 2)+((Y(O)-Y) $\frac{2}{3}$ 2)))
775D(O,P1)=D1(O,P1)
776D(P1,O)=D1(O,P1)
780X9=X9+1
790IFP1 $\frac{3}{4}$ ÷M2THENGOTO820
800D1(O,P1)=INT(SQR(((X(O)-X) $\frac{2}{3}$ 2)+((Y(O)-Y) $\frac{2}{3}$ 2)))
805D(O,P1)=D1(O,P1)
806D(P1,O)=D1(O,P1)
810X9=X9+1
820IFX9=2THENGOTO840
830GOTO740
840CLOSEF1,2
850F(O,M1)=F(M1,M2)
860F1(O,M1)=F(M1,M2)
870N(O,M1)=N(M1,M2)
880N1(O,M1)=N(M1,M2)
890F(O,M2)=F(M1,M2)
900F1(O,M2)=F(M1,M2)
910N(O,M2)=N(M1,M2)
920N1(O,M2)=N(M1,M2)
930F(M1,M2)=0
940F(M2,M1)=0
950N(M1,M2)=0
960N(M2,M1)=0
965T9=D(M1,M2)
970D(M1,M2)=999999
980D(M2,M1)=999999
990LO=0
1000FORB1=1TO215
1010IFD1(O,B1)=999999THENGOTO1230
1020D1=D1(O,B1)
1030F1=F1(O,B1)
1040N1=N1(O,B1)
1050FORB2=1TO215
1060IFD1(B1,B2)=999999THENGOTO1220
1070D2=D1+D1(B1,B2)
1080F2=F1+F1(B1,B2)
1090N2=N1+N1(B1,B2)
1100IFD2 $\frac{3}{4}$ D1(O,B2)THENF1(O,B2)=F2
1110IFD2 $\frac{3}{4}$ D1(O,B2)THENN1(O,B2)=N2
1120IFD2 $\frac{3}{4}$ D1(O,B2)THEND1(O,B2)=D2

```

```

1130FORB3=1TO215
1140IFD1(B2,B3)=999999THENGOTO1210
1150D3=D2+D1(B2,B3)
1160F3=F2+F1(B2,B3)
1170N3=N2+N1(B2,B3)
1180IFD3 $\frac{3}{2}$ D1(0,B3)THENF1(0,B3)=F3
1190IFD3 $\frac{3}{2}$ D1(0,B3)THENN1(0,B3)=N3
1200IFD3 $\frac{3}{2}$ D1(0,B3)THEND1(0,B3)=D3
1210NEXTB3
1220NEXTB2
1230NEXTB1
1240R=0
1250DEFINEFILE#1="XOUTFILE83"
1260FORB1=1TO215
1270IFD1(0,B1)=999999THENGOTO1290
1280WRITE#1,B1:","",D1(0,B1):","",F1(0,B1):","",N1(0,B1):",""
1290IFD1(0,B1)=999999ANDE(B1)=1THENR=1
1300NEXTB1
1310CLOSE#1
1320IFR $\frac{3}{4}$ OTHENGOTO1400
1330NO=0
1340FORB1=1TO215
1350IFE(B1)=0THENGOTO1370
1360NO=NO+D1(0,B1)
1370NEXTB1
1380IFNO=LOTHENGOTO1460
1390LO=NO
1400DEFINEREADFILE#1="XOUTFILE83"
1410ONENDE1GOTO1440
1420READE1,P1,D1(0,P1),F1(0,P1),N1(0,P1)
1430GOTO1410
1440CLOSE#1
1450GOTO1000
1460FORP1=0TO215
1470P(P1)=0
1480FORP2=0TO215
1490S(P1,P2)=0
1500NEXTP2
1510NEXTP1
1520DEFINEREADFILE#1="AXCPS81"
1530A1=0
1540READE1,C$,P1,C,S
1550ONENDE1GOTO1590
1560P(P1)=P(P1)+S
1570A1=A1+S
1580GOTO1540
1590FORP1=1TO215
1600IFP(P1)=0THENGOTO1990
1610B=0

```

```

1620FORP2=OTO215
1630IFD(P1,P2)=999999THENGOTO1660
1640B=B+1
1650W(B)=P2
1660NEXTP2
1670TO=0
1680FORP=1TOB
1690P2=W(P)
1700IFF(P1,P2)=OTHENF(P1,P2)=1
1710IFN(P1,P2)=OTHENN(P1,P2)=1
1715IFN1(O,P2)=OTHENN1(O,P2)=1
1720IFD(P1,P2)+D1(O,P2)=D1(O,P1)THENGOTO1750
1730M=((F(P1,P2)/N(P1,P2))+(F1(O,P2)/N1(O,P2)))*(1/((D(P1,P2)+D1(O,P2))-D1(O,P1)))
1740GOTO1760
1750M=(F(P1,P2)/N(P1,P2))+(F1(O,P2)/N1(O,P2))
1760IFD1(O,P2)-D(P1,P2)=D1(O,P1)ANDF(P1,P2)/N(P1,P2)=1THENM=0
1765IFC1÷10ANDD1(O,P2)-D(P1,P2)=D1(O,P1)THENM=0
1770PO(P)=M
1780TO=TO+M
1790NEXTP
1800FORP=1TOB
1810P2=W(P)
1820IFTO=OTHENTO=1
1830M=INT((PO(P)/TO)*P(P1))
1835IFD1(O,P2)-D(P1,P2)=D1(O,P1)THENGOTO1850
1840S(P1,P2)=S(P1,P2)+M
1845S(P2,P1)=S(P1,P2)
1850P(P1)=P(P1)-M
1860P(P2)=P(P2)+M
1870NEXTP
1880IFP(P1)=OTHENGOTO1990
1890MO=0
1900P2=0
1910FORP=1TOB
1920IFPO(P) $\frac{3}{4}$ =MOTHENGOTO1950
1930MO=PO(P)
1940P2=W(P)
1950NEXTP
1960S(P1,P2)=S(P1,P2)+P(P1)
1965S(P2,P1)=S(P1,P2)
1970P(P2)=P(P2)+P(P1)
1980P(P1)=0
1990NEXTP1
1992C1=C1+1
1995 PRINTC1:P(O):A1
1997FORP1=1TO215
1998IFP(P1) $\frac{3}{4}$ ÷OTHENGOTO1590
1999NEXTP1

```



```

2000IFP(0)=A1THENGOTO1590
2010CLOSEF1
2020S(M1,M2)=S(M1,0)+S(M2,0)
2030S(M2,M1)=S(M1,M2)
2040S(M1,0)=0
2050S(0,M1)=0
2060S(M2,0)=0
2070S(0,M2)=0
2075D(M1,M2)=T9
2076D(M2,M1)=T9
2080DEFINEFILEF1="XRHO83"
2090FORP1=1TO215
2100FORP2=1TO215
2110IFD(P1,P2)=999999THENGOTO2130
2115S(P2,P1)=S(P1,P2)
2120WRITEF1,P1:","P2:","S(P1,P2):","S(P2,P1):","S(P1,P2)/A1:","S(P2,P1)/A1:","
2130NEXTP2
2140NEXTP1
2150CLOSEF1
2160DEFINEFILEF1="XALPHA83"
2170FORN=1TO500
2180IFRO(N)=999999THENGOTO2210
2190IFU$(N)="GGGG"THENGOTO2210
2200WRITEF1,U$(N):","RO(N):","
2210NEXTN
2220CLOSEF1
2230DEFINEREADFILEF1="FS83ATTACH"
2240READF1,U$,P1,P2
2250ONENDE1GOTO2320
2260FORN=1TO500
2270IFU$(N)=LEFT(U$,4)THENGOTO2300
2280NEXTN
2290PRINT"ERROR°"
2300C(N)=S(P1,P2)*RO(N)
2310GOTO2240
2320CLOSEF1
2330FORN=1TO500
2340IFU$(N)="GGGG"THENGOTO2360
2350S1(T(N))=S1(T(N))+C(N)
2360NEXTN
2370DEFINEREADFILEF1="SPXCEN83"
2380FORG=OTO14
2390READF1,X,T,TO
2400TO(T)=TO
2410NEXTG
2420CLOSEF1
2430DEFINEFILEF1="XITO83.1"
2435DEFINEFILEF2="XITO83.2"
2440FORN=1TO500
2450IFU$(N)="GGGG"THENGOTO2470
2455 IFS1(T(N))=OTHERS1(T(N))=1
2460WRITEF1,N:","U$(N):","T(N):","INT((C(N)/S1(T(N)))*TO(T(N))):","
2465WRITEF2,N:","U$(N):","T(N):","INT(C(N)*TO(T(N))):","
2470NEXTN
2480CLOSEF1,2
2490END
3000PRINT"DATAERROR"
3010END

```

VALDER 6 & 7

```

10 DIMF(14)
20 DEFINE READ FILEF1="GMS71/80"
30 FORG=OTO14
40 READF1,X,X,F(G),X
50 NEXTG
60 CLOSEF1
70 DEFINE READ FILE F1="XITO66.1"
80 DEFINE FILEF2="XRBI66"
90 READF1,N,U$,G,TO
100 ONENDEF1GOTO130
110 WRITEF2,N:","U$:","G:","INT(TO*F(G)*.01*.3*.4):","
120 GOTO90
130 CLOSEF1
140 CLOSEF2
150 END

```

VALDER 8 & 9

```

10 DIMU$(50),F(50),P1(50),P2(50),R(50)
20DEFINEREADFILEF1="X76CDATA"
30DEFINEREADFILEF2="FS76ATTACH"
40DEFINEREADFILEF3="XRBI76"
50DEFINEREADFILEF4="XRDI76"
60ONENDEF1GOTO520
70READF1,G$,U$,G$,G$,G$,G$,G$,G$,F$
75PRINTU$
80UO$=U$
90FO=0
100IFF$ $\frac{1}{4}$ ÷""THENFO=VAL(F$)
105 REWINDEF2
110READF2,U$,P1,P2
120ONENDEF2GOTO999
130IFLEFT(U$,4) $\frac{1}{4}$ ÷UO$THENGOTO110
140REWINDF2
150N=0
160READF2,U$(N),P1(N),P2(N)
170IFU$(N)=UO$THENGOTO160
180ONENDEF2GOTO210
190IFP1(N)=P1ORP1(N)=P2ORP2(N)=P1ORP2(N)=P2THENN=N+1
200GOTO160
210N=N-1
220IFN $\frac{1}{4}$ ÷-1THENGOTO260
230PRINT"NO PROXIMATE SHOPS"
240WRITEF4,UO$:"," 999999 ,"

```

```

250GOTO480
260FORX=OTON
270REWIND3
280READ3,G$,U$,G$,R
290ONEND3GOTO1999
300IFLEFT(U$,5) $\frac{3}{4}$ ÷U$(X)THENGOTO280
310R(X)=R
320NEXTX
330FORX=OTON
340 REWIND1
350 READ1,G$,U$,G$,G$,G$,G$,G$,G$,F$
360 ONEND1GOTO999
370 IFU$ $\frac{3}{4}$ ÷U$(X)THENGOTO350
380 F(X)=0
390 IFF$ $\frac{3}{4}$ ÷""THENF(X)=VAL(F$)
400 NEXTX
410 HO=0
420 FORX=OTON
430 IFF(X)=0THENGOTO460
440 IFR(X)=0THENGOTO460
450 IFR(X)/F(X)÷HOTHENHO=R(X)/F(X)
460 NEXTX
470 WRITE4,UO$:",":FO*HO
480 REWIND1
490 READ1,G$,U$
500 IFU$ $\frac{3}{4}$ ÷UO$THENGOTO490
510 GOTO60
520 CLOSE4
530 DEFINE READ FILE4="XRDI76"
540 DEFINE FILE5="XRI76"
550 READ4,UO$,RO
560 ONEND4GOTO800
570 REWIND3
580 READ3,U$,R
590 ONEND3GOTO999
600 IFU$ $\frac{3}{4}$ ÷UO$THENGOTO580
610 IFR=999999THENR=RO
620 RO=RO*1.1
630 R=R*.9
640 A=INT((R+RO)/2)
650 WRITE5,U$:",":A:","
660 GOTO550
800 CLOSE1,2,3,4,5
810 END
999 PRINT"ERROR 000":UO$
1000 END
1999PRINT"ERROR3 000":U$(X)

```

VALDER 10 & 11

```
10 DEFINEREADFILE1="XRI83"
20 DEFINEREADFILE2="FS83ATTACH"
30 DEFINEREADFILE3="XYP83"
40 DEFINEFILE4="XCUVI83"
45 DEFINEFILE5="XCUVJ83"
50 READ1,U$,RO
55 ONEND1GOTO2000
60 REWINDE2
70 READ2,U$,P1,P2,T
80 ONEND2GOTO999
90 IFU$1=UO$THENGOTO70
100 REWINDE3
110 READ3,M1,M2,L,Y
120 ONEND3GOTO999
130 IFM1=P1ANDM2=P2THENGOTO16
140 IFM2=P1ANDM1=P2THENGOTO160
150 GOTO110
160 RO=RO/Y
165 TO=TO+RO
170 WRITE4,UO$:",":T:",":RO:", "
180 GOTO50
999 PRINT"ERROR"
1000 STOP
2000 WRITE5,TO
2005 CLOSE1,2,3,4,5
2010 END
```

THE COST & PROFIT ALGORITHMS

```

10 DEFINE FILE #1 ="GCNP"
20 INPUT"NO. OF TYPES OF FLOORSPACE",N
30 FORT=1TON
40 PRINT"AREA OF FLOORSPACE TYPE ":N:
50 INPUTA
60 PRINT"COST OF FLOORSPACE TYPE ":N:
70 INPUTC
80 F=F+(A*C)
90 NEXTT
100 INPUT"NO. OF TYPES OF ROAD ",N
110 FORT=1TON
120 PRINT"LENGTH OF ROAD TYPE ":N:
130 INPUTL
140 PRINT"COST OF ROAD TYPE ":N:
150 INPUTC
160 F=F+(L*C)
170 NEXTT
180 INPUT"NO. OF TYPES OF SEWER ",N
190 FORT=1TON
200 PRINT"LENGTH OF SEWER TYPE ":N:
210 INPUTL
220 PRINT"COST OF SEWER TYPE ":N:
230 INPUTC
240 F=F+(L*C)
250 NEXTT
260 INPUT"NO. OF TYPES OF EXTERNAL WORKS ",N
270 FORT=1TON
280 PRINT"AREA OF WORKS TYPE ":N:
290 INPUTA
300 PRINT"COST OF WORKS TYPE ":N:
310 INPUTC
320 F=F+(A*C)
330 NEXTT
340 INPUT"NO. OF TYPES OF SERVICES ",N
350 FORT=1TON
360 PRINT"COST OF SERVICE CONNECTION ":N:
370 INPUTC
380 F=F+C
390 NEXTT
400 INPUT"NO. OF PROFESSIONAL FEES RELATING TO CONSTRUCTION ",N
410 FORT=1TON
420 PRINT"DECIMAL % RATE FOR FEE ":N:
430 INPUTP
440 C=C+P
450 NEXTT
460 F=F*(1+C)
470 INPUT"ADD CONTINGENCY ALLOWANCE AS A DECIMAL % (ENTER 0 IF COSTS ARE ACTUAL ",C
480 F=F*(1+C)
490 INPUT"DECIMAL % RATE OF INTEREST TO BE USED ",R
500 INPUT"NO. OF INTEREST CONVERSIONS PER YEAR ",C
510 INPUT"CONSTRUCTION PERIOD - START TO COMPLETION (IN YEARS) ",N1
520 INPUT"ESTIMATED VOIDS PERIOD (IN YEARS) ",N2
530 F=1.2*(F*(((1+R/C)**(C*N1/2))*((1+R/C)**(C*N2))))
540 PRINT"GROSS COST INC. DEVELOPER'S PROFIT =" :F
550 WRITE#1,F
560 WRITE#1,R
570 WRITE#1,C
580 CLOSE#1
590 END

```

COSPROF 1-4A

```
10F=4302452
20F=1.2*F
30DEFINEFILE£1="GCNP"
40WRITE£1,"XXXX,":F:", "
50END
```

THE TRANSLATED VALUE ALGORITHMS

TRANVAL11-14

```

10DEFINEREADFILEE1="XCUVI76"
20DEFINEREADFILEE2="GCNP"
30READE1,U$,X,V
40ONENDE1GOTO999
50IFU$ $\frac{1}{2}$ ÷"XXXX"THENGOTO30
60READE2,X$,F
70R=V-F
80R=R/((1+(.07/4))*10)
90R=R/1.04
100CLOSEE1,2
110DEFINEFILEE1="NRDVI"
120WRITEE1,X$:",":R:", "
130CLOSEE1
140END
999PRINT"ERROR1"
1000END

```

TRANVAL15

```

10DEFINEREADFILEE1="XCUVI76"
20READE1,U$,X,V
30ONENDE1GOTO999
40IFU$ $\frac{1}{2}$ ÷"XXXX"THENGOTO20
50DEFINEREADFILEE2="GHUPRNS"
60READE2,U$,V1
70ONENDE2GOTO100
80S0=S0+V1
90GOTO60
100REWIND1
110READE1,U$,X,V1
120ONENDE1GOTO150
130S6=S6+V1
140GOTO110
150CLOSEE1
160DEFINEREADFILEE1="XCUVI75"
170READE1,U$,X,V1
180ONENDE1GOTO210
190S5=S5+V1
200GOTO170
210CLOSEE1
220DEFINEREADFILEE1="XCUVI83"
230READE1,U$,X,V1
240ONENDE1GOTO270
250S3=S3+V1
260GOTO230
270CLOSEE1

```

```
280S6=S6-V
290S3=S3-V
300N1=S5-S6
310N2=S5-S3
320DEFINEREADFILEE1="NRDVI"
330READE1,X$,NO
340CLOSEE1
350DEFINEFILEE1="TRANSVALS"
360WRITEE1,"1976","N1:",1983,"N2:",
370CLOSEE1
380END
999PRINT"ERROR XCUVI76"
1000END
```

CHAPTER NINE

SOME FURTHER CONSIDERATIONS

1 A Review of the Experiment

1.1 Introduction

1.1.1 The secondary title to this thesis on the real cost economics of retail development in town centres is 'an exploration of shifts in real property values following major retail development'. The hypothesis was that 'where the total demand is already satisfied and remains at a constant level, the amount of real property value available for distribution is constant in real terms and the effect of a successful major retail development in a town centre can only be to reduce the values of some existing retail properties whose catchment areas are in the surrounding area of its influence: that is to say translated values should sum to zero'. Can this hypothesis now be substantiated by what amounts to only a partial investigation of the

predictive powers of a model as constructed during this research?

1.1.2 Notwithstanding the doubts expressed about some of the results, it should be noted that in the experimental test, consumption expenditure was a constrained variable within the model. It was redistributed over different spatial and temporal surfaces in order to test the statement that 'all value is translated value'. At the end of the tests it was noted that the fit was not all that poor but that it was not in any sense perfect. However, as an alternative, let us suppose that the data base had been perfect and that we obtained the same results. We could then argue that many of the rents would appear to be as predicted, had all the assumptions in the model worked, but others were not properly aligned. Partly the reason for this might be statistical but it could also be because either the ceteris paribus assumption did not hold up (as expected) or that the suggestion that all value is translated has failed.

1.1.3 There is no obvious explanation of why the exogenous ceteris paribus condition should fail

to hold. These exogenous factors are concerned with the physical structure of the market and not the demand structure. During the period of the test, there were no substantial changes in the location of major transport termini, the location and capacity of car parks, the structure and distribution of population, etc. We are left, therefore, with the assumption that some part of the difference is as a result of a release of latent value. This is discussed further in Chapter 10.

1.2 Some Preliminary Conclusions

1.2.1 The investigations carried out during, and subsequent to, the test did reveal that on the basis of the model, provided that more accurate information could be obtained and put into it, it should be possible to measure the shifts in capital value following a redevelopment. It should also be possible, therefore, to predict the changes that might be precipitated by a proposed development. However, the strictures imposed by the lack of data, or the poor quality of data, point to there being little possibility of pursuing modelling in this particular area at the present time. If, therefore, the professions

are to continue to rely on the 'latent value' argument, and it is to be justified by scientific research, there will need to be a determined effort towards the provision of the creation of adequate data bases from which to test the hypotheses.

- 1.2.2 Despite a major sieve of data from virtually the whole set of local authorities in England, Wales and Scotland, it was not possible to find a data set that was sufficiently complete to allow a proper investigation of the phenomena of latent value and translated value. This research has established, quite clearly, that the latent value arguments are suspect at the very least, and that the ignoring translated values on the argument that 'all rents rise' is unacceptable. The case normally put by surveyors and valuers (in a consideration of the development potential of a site or property) has dangers for several groups. These include not only the potential developer but also the owners and/or occupiers of other properties in the area, shoppers using the facilities and local authorities raising local revenue from property-value-based taxation. All would be affected by the over-estimation of the potential value surface.

1.3 Available Data

1.3.1 It was felt, however, that the research should not be concluded without an attempt to reinforce this assertion. Some of the data that had been collected was in a form that might be usefully analysed. The masking effect of inflation often makes it difficult to see, on casual observation, whether value shifts are occurring. It was decided, therefore, to use the data on rents and turnovers that had been collected by survey and questionnaire and to carry out some simple analyses in an attempt to throw further light on the phenomenon under investigation.

1.3.2 During the experimental test, data had been collected on the actual turnovers of some of the shops in the Exeter system and questionnaires had produced data sets of actual rents passing at various points in time. In addition, the physical shop count was a source of information on the numbers of shops and their retail floorspace provision. Therefore, in addition to simple counts of changes in numbers of shops and analyses of the percentage changes in turnovers and rents, where these were known at two different points in time, it has also been possible to find properties spread throughout the Exeter system for which there are known rental

values both before and after redevelopment.

- 1.3.3 As the location of these properties is known these actual rental values could be used as a sample from which to build an aggregate rental value surface for a series of zones around the centre of Exeter. From that information it should then be possible to estimate the percentage change in values in each of these zones.

2 Alternative Indicators

2.1 Geographic Changes

- 2.1.1 As a first, and simple, indication of what geographic changes have taken place in the period 1975/76 to 1983, i.e. in the seven years following the construction of the Guildhall, it is possible to count the number of shops (excluding the Guildhall Shopping Centre itself) in the Exeter system. Simple though this may be it indicates that, over the seven year period, 68 individual shops have been lost and all have been lost from areas outside the town centre. By contrast, only 8 of the 23 shops gained within

the system are located in areas other than the town centre. The net loss in numbers of shops to the Exeter retail system over the period under investigation was 45 and this represents a reduction of 4.2% in the number of shops available. The full analysis is shown in Table 44.

Changes in No. of Shops 1975 to 1983
(excluding Guildhall Shopping Centre)

WARD	1975/76	1983	Gain/ Loss	% change
TOWN CENTRE				
10	263*	272*	+ 9	+ 3.4
11	27	29	+ 2	+ 7.4
12	122	126	+ 4	+ 3.3
OUTER AREA				
1	22	20	- 2	- 9.1
2	7	6	- 1	-14.3
3	19	18	- 1	- 5.3
4	11	8	- 3	-27.3
5	8	15	+ 7	+87.5
6	73	75	- 2	- 2.7
7	13	11	- 2	-15.4
8	20	22	- 2	-10.0
9	52	42	-10	-19.2
10	112	96	-16	-14.3
11	38	33	- 5	-13.2
12	44	44	0	0
13	125	108	-17	-13.6
14	16	17	+ 1	+ 6.3
15	56	52	- 4	- 7.1
16	31	30	- 1	- 3.2
17	16	14	- 2	-12.5
TOTAL LOSSES			68	
TOTAL GAINS*			23	
NET CHANGE			-45	- 4.2

* + Guildhall Shopping Centre

TABLE 44

Numbers of Empty Shops 1975 to 1983

WARD	1975/76	1983	CHANGE
TOWN CENTRE			
10	1*	16*	+15
11	0	2	+ 2
12	0	9	+ 9
OUTER AREA			
1	0	0	0
2	0	0	0
3	0	1	+ 1
4	0	0	0
5	1	1	0
6	0	2	+ 2
7	0	0	0
8	0	0	0
9	0	1	+ 1
10	2	11	+ 9
11	0	1	+ 1
12	1	3	+ 2
13	0	3	+ 3
14	0	1	+ 1
15	3	6	+ 3
16	0	2	+ 2
17	0	1	+ 1
	8	60	+52

* excluding Guildhall Shopping Centre

TABLE 45

Summary of Tables 44 & 45

ALL SHOPS

	1975/76	1983	% Change
Shop Losses (net)	-	68	-
Total Shops	1075	1030*	- 4.2
Empty Shops	8	60	650
Occ. Shops	1067	970*	- 9.1

* + Guildhall Shopping Centre

TOWN CENTRE

Shop Losses (net)	-	+15	-
Total Shops	412	427*	+ 3.6
Empty Shops	1	27	260
Occ. Shops	411	400*	- 2.7

* + Guildhall Shopping Centre

OUTER AREAS

Shop Losses (net)	-	60	-
Total Shops	663	603	- 9.0
Empty Shops	7	33	371
Occ. Shops	656	570	-13.1

TABLE 46

Comparative Average Rent Levels per sq.ft.

WARD	1975/76				1983				% Change
	Pop	Sample No.	Sample %	Av. Rent p.s.f.	Pop	Sample No.	Sample %	Av. Rent p.s.f.	
Town Centre									
10	263	55	20.9	3.51	272	41	15.1	3.50	0
11	27	1	4.0	-	29	4	13.8	1.00	-
12	122	27	22.1	2.38	126	22	17.5	2.55	+7.1
Outer Areas									
1	22	0	0	-	20	0	0	-	-
2	7	4	57.0	1.25	6	4	67.0	1.00	-20.0
3	19	6	32.0	1.83	18	7	38.9	1.00	-45.4
4	11	0	0	-	8	0	0	-	-
5	8	0	0	-	15	0	0	-	-
6	73	1	1.4	1.00*	75	2	27.0	3.00	+200*
7	13	0	0	-	11	0	0	-	-
8	20	2	10.0	1.00	22	2	9.1	1.00	0
9	52	0	0	-	42	1	2.4	2.00	-
10	112	1	0.1	-	96	5	5.2	0.40	-
11	38	0	0	-	33	0	0	-	-
12	44	0	0	-	44	4	9.1	1.00	-
13	125	17	13.6	2.41	108	25	23.0	1.56	-35.3
14	16	2	12.5	2.00	17	9	52.9	2.11	+ 5.5
15	56	0	0	-	52	1	1.9	2.00*	-
16	31	0	0	-	30	1	3.3	-	-
17	16	0	0	-	14	1	7.1	-	-

TABLE 47

Nominal Aggregate Rental Values

Zone	1975/76	1983	% Change
1	381836	1134649	+197
2	3147371	5184819	+ 65
3	713454	1158734	+ 62
4	676538	1321756	+ 95
5	148275	280286	+ 97
6	12103	85732	+608*
Totals	5079557	9165976	
Growth	-	+4086399	+ 80

TABLE 48

RPI Adjusted Aggregate Rental Values

Zone	1975/76	1983	% Change	Amount
1	381836	494187	+ 29	+112351
2	3147371	2258202	- 28	-889169
3	713454	661472	- 7	- 51982
4	676538	575695	- 15	-100843
5	148275	122075	- 18	- 26200
6	12103	37322	+208*	+ 25219
Totals	5079557	4148953		
Growth		-930624	- 18	

* Caused mainly by addition of one food supermarket

TABLE 49

2.1.2 In addition to the numbers of shops lost to the system it has also been possible to extract from the data collection a summary of the numbers of shops standing empty at the dates of survey. In 1975, prior to the Guildhall shopping centre development, the Exeter system showed only 8 empty shops. By 1983 the system had not only lost the shops mentioned earlier but also contained some 60 empty shops, the majority of which were in the areas outside the town centre. Table 45 shows the numeric count and Table 46 shows a summary giving the percentage changes that have occurred over the period.

2.2 Rental Changes

2.2.1 A further simple analysis of the rental information collected by questionnaire produced average rents per square foot for each of the ward areas, separated into town centre and outer areas. The Guildhall shopping centre, itself, was excluded from this analysis and it can be seen from Table 47 that with the exception of Ward 6 (which contains the Heavitree neighbourhood shopping area) where data is available for both test dates the tendency is towards reduction of rental values in the outer

areas and static or slightly increased rents in the central area. However, the data contained in this analysis are insufficient for any proper conclusions to be drawn.

2.2.2 It was at this stage that a final analysis of the sparse data available was made using an aggregation of the data into a series of zones in order that percentage shifts in value could be identified. Figure 26 shows the ward structure of Exeter; it is the ward boundaries that were used during the initial data collection to isolate and group the retail properties. Figure 27 shows a series of zones constructed around the city centre which approximate to collections of wards, i.e. which schematically show the areas within which the wards may be aggregated to provide zonal collections of retail properties of similar types. Table 50 shows the ward composition of the 6 zones utilised in the test.

Zone 1	Guildhall Shopping Centre
Zone 2	Central Shopping Area
Zone 3	Outer Central Shopping Area
Zone 4	WARDS 1, 13, 11, 12, 9, 10, 7
Zone 5	WARDS 17, 4, 6, 2, 16, 14, 3, 5
Zone 6	WARDS 8, 15

TABLE 50



WARD BOUNDARIES IN EXETER 1975/76



EXETER SHOPPING ZONES USED IN RESEARCH

- 2.2.3 An analysis of the data available for each of these zones was then made by aggregating the ward data to find total retail floorspace in each of the zones. To this was applied the average zone rent per square foot of retail floorspace analysed from the aggregate samples for the zone.
- 2.2.4 The results of the analysis are shown in Table 49 and this information should be contrasted with the apparent aggregate growth in rental values over the whole surface of 80% which results when non inflation adjusted rentals are used (Table 48).
- 2.2.5 Table 49 demonstrates that, with the exception of a rise in rentals in zone 1 (the Guildhall Shopping centre), rentals have not risen in the other zones. There has been, however, an overall reduction, in real terms, in the rental value surface. This is indicative only of the fact that rental values have not risen as fast as general prices. Therefore, the adjustments from nominal values to real values using the Retail Price Index has over-compensated for the inflationary effect.
- 2.2.6 Although this analysis does not identify which of the changes in rental value are intrinsic and

which are translated there is an inevitability that there has been a translation of value from the outer zones to the central zone, zone 1. Looking at the map of the zones (Figure 27) it will be noted that zone 3 is the peripheral areas of the retail core. The reduced loss in rental value in zone 3, therefore, may be explained by accessibility of the shopping area to local residents for non-postponable purchases. It is more immediately accessible to a greater number of people than, for example, the St. Thomas Shopping Centre in zone 4. It would, therefore, be more likely to attract some shoppers from the adjacent zones. This is entirely consistent with the theory advanced in this thesis. The large increase in rental value in zone 6 is caused by the addition of a single food supermarket, and in view of the very small number of shops in the zone, is a meaningless statistic.

2.3 The Causes of Observed Changes

2.3.1 In looking at the results of the analyses of actual data thus far, we might now speculate as to the cause or causes of the observed changes. Of the many potential explanations available, the following are likely possibilities:-

- i the changes result from the imposition of the Guildhall Shopping Centre on an established and settled shopping system
- ii the changes result from a change in the location of the residences of shoppers
- iii the changes result from a change in traffic management systems and in the location and capacity of transport termini

2.3.2 If we are to believe that the advent of the Guildhall Shopping Centre has had no effect on the established shopping system in Exeter then we must believe that its construction released only value that was 'latent within the site'. We must believe, therefore, that without the Guildhall Shopping Centre similar changes may have taken place as a result of propositions ii or iii above. That is to say that, predominantly, changes in accessibility account for the changes observed. We are unable to accept these alternative arguments because, if the cause is merely a change in transportation or residence, then an improvement in accessibility to zone 1 should have also improved zone 2 by the same extent. Similarly, a movement of population away

from zones 1 & 2 and towards zones 3, 4 & 5, in excess of the car park capacities of those zones, would reduce accessibility in those zones. This is clearly nonsense. In addition, zones 3, 4, 5 & 6 have predominantly low densities of shopping available.

- 2.3.3 As a result of this digression, we are led to the inevitable conclusion that the changes that have taken place are mainly as a result of the construction of the Guildhall Shopping Centre. The apparent loss in the overall size of aggregate rentals is a reflection of the fact that rentals have not grown as fast as other prices have increased during the period of our investigation and there has been a loss of some shopping facilities from the Exeter system as a whole.

2.4 Turnover Changes

- 2.4.1 The only way of testing these last two points is to look at the rate of change of turnovers in relation to the number of shops and the amount of floorspace available.

Random Sample of Turnovers

WARD	1975/76	1983	% Change	Adj. 1983	%
ZONE 2					
10	2743904	7578150	+176	3300600	+ 20
10	178551	744950	+317	324457	+ 82
ZONE 3					
10	20054	64590	+222	28132	+ 40
10	18000	60000	+233	26132	+ 45
10	14725	30725	+109	13382	- 9
11	324115	638501	+ 96	278094	- 14
11	11882	31867	+168	13879	+ 17
11	146443	368373	+152	160442	+ 10
12	3318000	7287268	+120	3173909	- 4
12	98561	264559	+168	115226	+ 17
12	20652	45159	+119	19669	- 5
ZONE 4					
13	8100	12300	+ 52	5357	- 34
ZONE 5					
6	113082	145274	+ 28	63273	- 44
14	50259*	238247	+374	103766	+106
17	94228	167892	+ 78	73124	- 22
ZONE 6					
8	60000	105000	+ 75	45732	- 24
8	113082	145274	+ 28	63273	- 44

* New Pharmacy (1st year trading)

TABLE 51

Comparison of Turnover Data

ZONE	1975/76			1983 (RPI adjusted to 1975/76)					% Change p.s.f.
	Fl. Area sq.ft.	Sample sq.ft.	Turnover per sq.ft.	Est. Total Turnover £'000s	Fl. Area sq.ft.	Sample sq.ft.	Turnover per sq.ft.	Est. Total Turnover £'000s	
1	161277 ⁺	23500 [*]	73.78 [*]	11900	162829	35270	97.78	15921	+32.5
2	488580	22520	133.25	65104	475602	39310	102.24	48628	-23.3
3	295900	80430	49.19	14555	304607	83374	48.40	14743	- 1.6
4	214792	1500	62.32	13386	219529	3532	47.09	10337	-24.4
5	65772	1110	167.60	11024	59923	2140	140.15	8397	-16.4
6	26978	1090	158.79	4284	33611	1120	167.52	5630	+ 5.5
TOT.	1253299	(24 Obs)		£120253	1256101	(43 Obs)		£103658	

* single unit sample in first year of trading

+ new Guildhall Shopping Centre (opened at end of 1976)

TABLE 52

2.4.2 It will be recalled that, earlier in this chapter it was reported that the questionnaire survey on shop turnovers had produced a sample of actual turnovers of shops at the several points in time over which the experimental test was made. Of these random samples some 17 observations were available at both 1975/76 and at 1983 and, therefore, a last analysis of actual data was made on these few observations to see if, in the main, they followed the trends apparent from the rental data. Zone 1, the Guildhall Shopping Centre, is not included as any sample rents would only be available at 1983. Therefore, no comparison could be made nor any conclusions drawn.

2.4.3 It can be stated, in general, that the majority of observations of turnover showed movement generally in the same direction as the movements observed in rentals, i.e. where turnover had increased in real terms, rentals had increased also. When turnovers had decreased in real terms, rentals also had decreased. A list of the observations is contained in Table 51 and has been grouped into zones for comparison with the rental information shown in the earlier tables in

this chapter. Of particular note are two observations each of which is in respect of the largest store for which data could be obtained closest to the former centre of Exeter, i.e. prior to the development of the Guildhall and subsequent shift. These two observations fall one each side of the boundary between zone 2 and zone 3 and, interestingly, that on the Guildhall side of the zone boundary shows an increase in turnover and that on the opposite side of the road junction forming the boundary shows a decrease in turnover in real terms.

2.4.4 This last analysis, as stated previously, in general reveals trends compatible with earlier observation, but there are three anomalies. One of these occurs in zone 3, another in zone 4 and the third occurs at the outer boundary of zone 6 (see Table 53). In each case the turnovers are observed as having reduced but the rentals have increased, both in real terms. It is suggested, therefore, that this can only be because of either a poor negotiating ability on behalf of the tenant and/or its professional advisor or that the rent reviews are at wide intervals and, therefore, the lagged effect of the reduction in turnover had not worked its way through at the date of the last rent review.

Anomalous Observations

	1975/6	1983	% change	1983 Adj.	% change
UPRN 730J, ZONE 4					
Rent	324	1100	+240	479	+ 48
Turn- over	8100	12300	+ 52	5357	- 34
UPRN 732S, ZONE 3					
Rent	272	1800	+562	783	+188
Turn- over	14725	30725	+109	13382	- 9
UPRN 70T8, ZONE 6					
Rent	248	1050	+323	457	+ 84
Turn- over	60000	105000	+ 75	45732	- 24

TABLE 53

2.4.5 It will be noted from Table 53 that all three properties are let at very low rents. The landlord's strong negotiating position and 'irrefutable' evidence of nominal rent increases in non-local comparable properties will therefore cause any created anomalies to be exaggerated when considered as percentages of the original rental.

CHAPTER TEN

CONCLUSIONS AND RECOMMENDATIONS

1 A Review of the Research

1.1 Introduction

1.1.1 This research was commenced with the objective of testing a hypothesis based on the underlying proposition adopted by surveyors and valuers, that in a property development appraisal, market comparables can be used as a source of data on which to base the estimated rental value of the proposed development. Any increase in the residual value of the existing site or buildings over and above current use value, i.e. after gross development cost and net profit have been subtracted from the estimated gross development value, is a release of value which is 'latent within the site'. As a result, the hypothesis indicated in Chapter 1 was proposed. Briefly this was that an attempt would be made to

investigate the assertion that the carrying out of a major town centre development would release only latent value at the location of the development and that there would be no adverse effect on the value of surrounding properties within its sphere of influence.

1.1.2 In order to test this assertion it was necessary to look at the alternative argument which said that in such circumstances values were neither created nor destroyed but were, in fact, translated from one location to another by the efforts of the developer and applications of capital, etc. A model of the derivation of value, argued on the basis of the clearly identifiable retail expenditure/retail property areas, was constructed and an effort was made to obtain sufficient data to run an experimental test. The majority of this thesis has been concerned with the derivation model and with the attempts to obtain sufficient data. However, after a major search for suitable research locations that might provide the necessary data, the data bases proved to be inadequate.

1.1.3 As described in the introduction to Chapter 9

the endogenous ceteris paribus assumption required by the hypothesis did not hold up in the test. Presumably, therefore, some part of the difference in values was as a result of a release of latent value. Such a statement could, however, be made only where it is possible to be entirely confident of the data base - but this is not the case here. After an extensive survey a small set of apparently suitable research locations was identified and the one that appeared to offer a set of circumstances closest to those required for the test and to offer the best data base was chosen. Even so, the results of the investigation provide only a weak suggestion, on the basis of the data available, that a latent value effect must also exist. However, this theory cannot be advanced with any confidence and it must be concluded, with the present availability of data bases, that the hypothesis put forward to test the proposition that all value changes are translated value changes, is untestable.

- 1.1.4 As a result, the professional surveyors' and valuers' assertion, the second of the alternative propositions put forward in Chapter 1, still remained a possibility. But the original

contention and the hypothesis put forward for test were alternatives and, as such are mutually exclusive. An alternative approach, therefore, was to look again at the original contention, i.e. that both latent value and translated value exist and are released by development. Although this could not be done in any great detail, an attempt was made, as described in Chapter 9, to review the observed data. Some simple analyses of the observed data were made and, although no definite conclusions could be drawn from that data, it was clear that value changes have occurred. Everything described in Chapter 9, although not testable in terms of the translated value model, suggest that value has been lost from the surface. It also suggests that value has been gained at the site of the development, the Guildhall Shopping Centre. It now needs to be asked whether the value shifts would have occurred had there been no redevelopment of the Guildhall site. With the exception of the Guildhall location and, mainly, contiguous or adjacent properties in Zone 2, all the other rental value changes, except one, are effectively negative. In zone 6 there is a positive change (discussed in Chapter 9) resulting from either a

local translation of value to the later small development or indicative of a localised release of latent value or both. However, if the value shifts over the entire surface do not sum to zero, i.e. if almost everything has gone down in value with the exclusion of the Guildhall, then the effect can only be indicative of the existence of a translation of values.

1.1.5 Although it cannot be proved conclusively that translated value exists, everything that has been looked at and considered points in one direction. The results from the investigations of the hypothesis and of the original contention cannot, strictly, be proved. But, as an alternative, what can be said about the proposition that all value is latent is that clearly such a hypothesis cannot be allowed to stand until the hypothesis put forward in this thesis and the original contention that values are both latent and translated, have both been conclusively disproved.

1.1.6 Further, all the evidence in this research, weak though it may be, points in the same direction - supporting the contention that the effect of

development is both to release latent value and to translate existing values. If this were the truth and it was possible to obtain a perfect ceteris paribus condition, then the hypothesis put forward for testing in this research is entirely consistent with that contention.

- 1.1.7 Under these circumstances it is not possible to state that the professionals' assumption regarding latent value releases is inevitably wrong and, therefore, for the reasons mentioned, it is necessary to demand caution. A professional's assumption, if wrong, is immensely damaging not only to the urban fabric but even to the individual client-developer. Until an experimental situation can be established that permits the proper testing of the contention and the hypothesis then arguments based upon the proposition that all value is released by the development and is latent within the site should not be acceptable evidence.

1.2 Conclusion

- 1.2.1 The research project can, therefore, be

summarised by saying that it was not possible to prove the hypothesis put forward but that observation of the actual data available and philosophical argument point towards the existence of a translated value effect. Some evidence of a redistribution of values can be seen in the final analyses. These translated value effects were discussed in Chapter 1 where the theory of translated value was introduced. However, it should be noted that in the results obtained from the run of the model the value shifts were measurable only in qualitative terms. In reality, changes in capital value and shifts of rental value in and around a development site are masked, to a large extent, by inflationary effects. It is again worth digressing, at this point, to take note of the professions' use of the term 'rental growth'. Invariably, in the years following any development, the professional valuer will point to rental growth having occurred within the shopping centre generally. Unfortunately, the generic term 'rental growth' has been substituted for a combination of true rental growth resulting from changed economic relationships (supply/demand, etc.) and inflationary 'growth' induced by the changing

value of money. It is usually this latter phenomenon that is the larger part, if not the total of any change described as 'rental growth'.

1.2.2 Such observations are indicative of the professions' treating all value as latent. The consequences of only considering the effect of a development, or a proposed development, in terms of value released at the site of development and of assuming that such released value is 'latent within the site' are that:-

- i The total value surface will be over-estimated on the basis of a single appraisal.
- ii Where multiple appraisals are carried out there will be continual double counting as no account is taken of the effects of one development or proposed development upon another.
- iii The property developer client will be continually presented with an over optimistic view of the potential of the development proposed and will not be adequately warned of the consequences of other possible changes in the retail surface, i.e. of the possible effects of other future developments on that proposed.

- iv The interaction of site values being ignored as the retail surface is developed and redeveloped over time will exacerbate i to iii above because value decisions will be ad hoc and static.
- v The failure to respond to the social costs of development, these being the cost to competitors in terms of loss of trade and cost to the general public in terms of the over-provision of new retail facilities, will ultimately precipitate decay in the value surfaces.

It must, therefore, be stressed to developer-clients that the level of consumer demand, from which all rental values, ultimately, are derived, may be very slow to increase and, in the short term, therefore, values will be translated from location to location as a result of their actions.

- 1.2.3 In conclusion of this review it should be stated that, even though a satisfactory run of the full model could not be achieved, there were several points of interest which came from those sections which were operated. Indications of shifts in turnover were observable within the results and

the shape of the capital value distributions in and around the town centre, as predicted by the model, were logically in the right locations. Analyses of actual data also gave an insight into movements within the value distributions and changes within the retail surface. All of these are indicative of the existence of a translation of values.

2 Recommendations for Further Research

2.1 Generally

2.1.1 The investigations of the model and the results of the experimental test discussed in the previous sections point to the hypothesis being wrong. However it can be equally said that they do not fully justify an alternative hypothesis that all value is latent within the development location. At this point any further discussion of the correctness or appropriateness of an alternative approach is not possible without further assumptions, additional work and further evidence.

2.1.2 There are several different ways in which the

model could have been handled. There are equally several different areas of the model where, after further investigation, a different construction of the algorithm could enhance the model's predictive powers. In any reconstruction of the algorithms, consideration should be given to the inclusion of additional variables. For example those that have already been mentioned involving aspects of pedestrian flow, i.e. congestion, and aspects of consumer psychology such as attempting to construct a better model of the route decision making of the perambulating shopper.

2.1.3 Another area that is not considered in the model construction that was used, is the possibility that alternative routes are used by shoppers on the return trip from the location of primary purchase to the originating car park or bus station, etc. Again, this would need a much more sophisticated approach to the modelling of the internal pedestrian flow simulation and it is suggested that further work in this area could result in a considerable improvement of the model's predictions.

2.1.4 However, in order to be able to investigate adequately internal shopping pedestrian flows, it

will be necessary to carry out a large scale survey of shoppers and shopping habits in order to formulate a suitable set of variables for substitution in the pedestrian flow simulation model.

- 2.1.5 At the same time, it is recommended that the survey by questionnaire, canvass, and by flow count, should include questions designed to identify the consumers' shopping trip thresholds at an inter-urban area level. On arrival at centres, the consumers' car park utilisation should be investigated in detail prior to, or as part of, the pedestrian flow survey described. In addition, a survey of household incomes and expenditures should also be made in order that the earlier parts of the value derivation model can be properly implemented.
- 2.1.6 Mention has already been made in the earlier part of this chapter of a possible differential calibration of the relationships between pedestrian flows, internal destinations, and the turnovers of different types of retail shop. Again, detailed survey is necessary if differential calibration is to be carried out on

pedestrian flows and perambulating shoppers' decision psychologies.

2.2. Data Requirements

2.2.1 In general, there is an overall requirement for much more detail and for a much finer level of investigation. If adequate surveys can be carried out, the access to additional information should enable much of the deficiency within the model to be eradicated. However, in addition to the surveyed information it is of paramount importance that local authorities, statutory undertakers and government departments be encouraged to make available more of the data that is already collected. In those areas where data is not presently collected, e.g. internal pedestrian flows, local planning authorities and highway authorities should be encouraged to start to collect this type of data in order that models such as that contemplated by this thesis can be constructed, calibrated, and used in the future for predictions of the effects of major developments.

2.2.2 In looking at rental values and capital values in a central area it is, again, quite obvious that

the imperfections of knowledge about the state of the local market, the tenures of properties, the terms of occupancy, etc., make it difficult for any researcher to check adequately the results of predictive models. To this end, it must be said that the open and publicly accessible property register currently being proposed for England and Wales would make this type of research much easier. A property register already exists in Scotland and data can be extracted quite easily on the levels of values, tenures, etc. In many other countries overseas, public registers of land ownership, etc., are already available for inspection. However, in England and Wales there has been, and there probably still is, considerable resistance to the making public of details of transactions which are regarded as private and confidential.

- 2.2.3 Privately, there is a move within estate management circles towards computerised data bases. Over the next few years land owning companies, together with those owners using the larger firms of managing agents, will build up quite considerable data banks containing useful property-related information. Provided that the

present requirement for confidentiality can be overcome, further research work in the area investigated by this thesis could be fruitful when additional and reasonably accurate information is available.

2.2.4 In fact, with the availability of sufficient real data on rents, turnovers and net profits, etc., it might be possible to investigate the whole of the theoretical concept presented in this thesis from a different point of view. A regression analysis on sufficient available data could provide a structure and calibration for the necessary equations and thereby facilitate the proving of the contention put forward in Chapter 1.

2.3 Concluding Remarks

2.3.1 In relation to the investigations carried out in this research and, in particular, noting that the research town was the City of Exeter, it cannot pass without comment that Exeter is in a peculiar geographic location. There is, by virtue of Exeter's unique position, a possible tourist effect which could have worked its way through

the model. There are imports and exports of consumer expenditure through the external cordon of the city's residentially based catchment area. As a result, the absolute level of consumer expenditure utilised in the model could possibly have been wrong due to these imports and exports. In consequence, therefore, there may have been several elements for which no allowance has been made. The spatial distribution of expenditures could, therefore, differ from reality in the early part of the model as a result of some over-estimation of the allocation of consumer expenditures between the central area and the surrounding wards. There would be a tendency, in the situation just described, for an over-estimation of the amount of expenditure allocated back to the Wards, for example. The maximum over-estimate would, of course, be of a factor based on the amount of tourist income as a proportion of Exeter's gross domestic product. The percentage of tourist income and its locational distribution in and around the Exeter shopping system would, therefore, be an area for further research if the specific location investigated in this thesis were to be further researched in the future.

2.3.2 One last point, which has already been mentioned within the earlier part of this chapter, is worthy of reiteration. The investigations carried out in the experimental test described in this thesis have all been on the basis that inflationary effects and other physical changes were held steady at a base year during the operation of the model. Once a suitable form of the value derivation model can be established by the further research described in the preceding paragraphs a further area of research can be opened up. It should be noted, however, that the survey requirements and the data source requirements for a proper investigation of the phenomena described in this thesis are quite large and will require adequate funding.

2.3.3 In conclusion, it must again be stated that the form in which the translation of value takes place could not be fully identified. The experiment posed the questions i/ does total value increase or decrease, and ii/ does the location of value change? It was not possible to prove the precise form within which the value shifts occur even though it was possible to identify that there had been shifts in the

location of value. It was also not possible to prove the extent to which the noted changes in the total capital value of the shopping centre were due to a release of latent or frustrated demand or to an improvement in the conditions of supply. However, 'proof' is a restrictive word- there are strong indications in the results of the experiment that i/ a translation of values had occurred, ii/ the locations of the translated values were predictable in a localised market, and iii/ the size of the value shifts were measurable. From these it can be concluded that with further refinement and sophistication of the model, and with the collection of more extensive and more accurate data, the model's predictive capacity could be improved. Further research is, therefore, strongly recommended.

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