STUDIES IN THE THEORY AND APPLICATION

OF

REGIONAL MULTIPLIERS

By

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CHAPTER 1

Introduction

The thesis has two main objectives; firstly, to develop a theoretical framework to estimate the regional income and employment effects of different types of project and, secondly, to demonstrate the use of the model thus developed in case studies of a particular region: the Highlands and Islands of Scotland. The work was stimulated by the recent U.K. literature on regional multipliers, which indicated that regional impact analysis was an area in need of further research. It was felt that an analysis of the impact of specific projects might illuminate some aspect of the discussion that was being conducted at a more general level. Moreover, if the model could be made operational, it could act as the basis for similar studies elsewhere and, by measuring the multiplier impact of certain activities, add to our understanding of the forces of regeneration at work in the Highland economy. The analysis and estimates of the thesis could also aid in the formulation of a development strategy for the Highlands and contribute to the wider regional policy debate.

When attempting to study the impact of various types of activity on regional development, two broad lines of approach have been used by regional analysts, either an input-output approach or some form of regional multiplier approach. While the use of input-output techniques would give a more comprehensive coverage, it was thought that, for an individual with limited financial resources, the construction of a transitions matrix for the Highlands and Islands would be an almost impossible task without the use of an unacceptable amount of surrogate data. Hence it has been decided to use a regional multiplier approach and attempt to incorporate the main inter-industry linkages of the input-output approach, without incurring the cost of building a complete matrix.

Accordingly, chapter two surveys the literature on the regional multiplier; dealing with both export base and regional income multipliers. There are some advantages in the use of the export base approach, the main ones being the ease of calculating employment multipliers and the limited data requirements. In general, though, the survey is critical of the concept, and the numerous empirical and theoretical shortcomings of the approach are noted. The lack of a sound theoretical foundation is the most serious criticism of the technique. The remainder of chapter two concentrates on the concept of the regional income multiplier. The concept is based on the theoretically sound Keynesian foreign trade multiplier; modified to acknowledge the more open nature of the regional economy. By considering the recent U.K. literature on the subject, it is shown how the concept has been developed and clarified by practical application.

Above all, this debate illustrates the relevance of regional multiplier estimates to a wide range of policy issues. However, it is evident that the empirical work which has been done in the U.K. to date is still some way from being able to answer many of the questions posed by regional policy makers. It is this background of tentative empirical estimates and challenging policy issues,that lead to a belief that the subject is worthy of further analysis. Hence, the rest of the thesis is centred on the regional income multiplier concept. In this course of the work, an attempt is made to develop the regional multiplier as a theoretical framework and to demonstrate its flexibility as a practical tool of regional analysis.

The problems encountered in estimating the impact of an individual project, led to the formation of the theoretical model of chapter three. Certain features of this model distinguish it from those discussed in chapter two. As far as the technique of the regional multiplier is concerned, the model encompasses an employment as well as an income multiplier. In addition, by expanding the multiplicand the main input-output linkages of a project can be incorporated.

By building these features into the model, it is possible to get some of the advantages of the export base and input-output techniques. A novel theoretical feature of the model, is the attempt to incorporate inter-regional migration into the formulation of the regional multiplier.

The generalised model of chapter three is then used in two case-studies. These case studies are intended to perform several functions: (i) to show that the model can be made operational for different types of project, (ii) to illustrate the effect of the proposed modifications to the 'standard' regional multiplier, (iii) to highlight the advantages and limitations of the approach and, (iv) to make a small contribution to our knowledge of the Highland economy.

The first of these studies is discussed in chapter four, this considers the impact of a major new investment in the Highlands and Islands;[1] the pulp and paper mill at Corpach near Fort William. Chapter five is concerned with the portfolio of small scale fisheries developments sponsored by the Highlands and Islands Development Board. These studies have one important similarity, namely, some fairly strong input-output linkages in the region. In another respect, they present a useful contrast in regional development; between one large concentrated project, the pulp mill, and the relatively thin spread of impact along the littoral of the area from the fisheries projects. Chapter six briefly highlights these and other comparisons between the studies. Finally, chapter seven draws the study to a conclusion. Emphasis is placed on the policy implications of the analysis; within the context of the Highland economy and for regional analysis and policy generally.

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1. Defined as the counties of Argyll, Caithness, Inverness, Orkney, Ross and Cromarty, Shetland and Sutherland.

CHAPTER II

A Survey of Regional Multiplier Literature

This chapter provides a relatively brief survey of the literature on regional multipliers; the analytical technique used in later chapters. In discussing this literature, three factors have been borne in mind: first, a need to appraise the theoretical and operational suitability of the multiplier techniques that have been used previously; second, the desirability of sketching the important features in the development of these techniques; and third, a need to provide a background, against which the discussion of later chapters can be seen in context.

Broadly speaking the literature on the regional multiplier can be divided into two parts, that on the export base multiplier and that on Keynesian or'foreign trade' multipliers. To some extent this is an artificial distinction, in as much as the approaches seek to achieve the same ends by broadly similar methods and, in their fuller development, the two approaches have been linked fairly closely. Nevertheless, for the purpose of this chapter,they will be treated separately.

The survey is sub-divided as follows:

A. Export base multipliers

1. The concept
2. Problems of estimation of the base: (i) the assumption approach, (ii) the location quotient approach, (iii) the minimum requirements approach.
3. Further empirical difficulties
4. Theoretical and conceptual problems.

B. Keynesian multipliers

1. Origins and early development of the regional multiplier
2. Development of the regional multiplier as applied to the U.K.: (i) the multiplicand, (ii) the development of the model, (iii) problems of estimation and estimates of multipliers for the U.K., (iv) policy implications and uses of the model

A. Export base multipliers

No attempt will be made to survey the vast literature on this subject in its entirety. However, an appreciation of the main developments of the technique, its application, and above all, its defects will be necessary.

1. The concept

In essence the concept of the export base multiplier is a very simple one, namely, that there exists a stable functional relationship between the levels of activity in the basic (or export) sector and the non-basic (or service) sector of a region's economy. Stated in its most elementary form; if for the region, employment in exports = X and total employment = E; then the employment multiplier is taken to be $\frac{E}{X}$. Thus an increase in employment in the export trades (ΔX) will result in an increase in service employment in the region of $(\frac{E}{X} - 1)\Delta X$. The logic of the relationship is that the basic sector in some sense generates the 'wealth' of the community and that the non-basic sector develops in order to service the needs of these employees in the basic sector.

It has long been recognised that a relationship exists between basic and non-basic employment (see e.g. Sombert or Aurosseau). However, the formal statement and refinement of the concept is usually attributed to urban planners working in the U.S.A. in the 1930's.[1]

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1. It is interesting to note that this work paralleled the development of the Kahn (1931) multiplier in mainstream economic theory.

In particular, the work of Hoyt (1939) did a great deal to formalise and develop the concept. In his early writings Hoyt envisaged a simple 1:1 relationship between basic and non-basic activities but later he discussed and calculated differential intra-city multipliers. The multipliers he derived could, he argued, be used as a forecasting tool at the city level.

2. Problems of estimation of the economic base

The empirical application of the technique to urban forecasting raised a number of problems, the most significant of these being that of actually identifying the economic base. The choice of activities which export directly from the city or region is the most obvious one but is unsatisfactory for three main reasons. First exports may not be the only source of autonomous stimulation of the region's economy. Some part of Government expenditure, private investment in the 'service sector'[1] or even construction activity, may be autonomously determined in just the same way as direct exports (see Tiebout, 1956). Secondly, some part of the produce of the export industries may be sold within the region. Thirdly, component suppliers to the export industries are as much part of the 'export base' as are those companies which actually do the exporting. Though not stated in these terms (initially), the argument is that the direct backward input-output linkages should be treated as part of the export base. For example, a car component firm supplying all its output to an assembly plant which subsequently exports all of its output should be treated as part of the base.

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1. The obvious example which springs to mind is the financial sector.

This much is clear, but the problem arises when one considers the lawyers who serve the assembly and component plants, should part of their services (traditionally part of the 'service' sector) also be treated as 'basic'? If so, than it appears that an input-output transactions table is necessary to separate out the components, in which case the export base approach would be redundant. Proponents of the base concept have used considerable ingenuity to surmount these problems of definition of the base.

i) The assumption approach

Early attempts were made to allocate employment to basic and non-basic sectors on an ad hoc basis. Usually manufacturing was classified as basic and services as non-basic. This was clearly unsatisfactory and a dis-aggregated approach was taken, for example, in one of the first attempts to calculate an export base multiplier in the U.K., Daly (1940) allocated each industry to the basic or the service sector according to its characteristics. However, such a division is likely to be impressionistic and unreliable unless a considerable degree of dis-aggregation is possible and local knowledge available. Alternatively, time-consuming and expensive surveys would need to be undertaken; hence an indirect means of allocating employment was sought.

ii) The location quotient method

Hoyt (1944) proposed a method which might provide a means of over-coming the second and third problems of estimating the economic base mentioned previously. He suggested that the proportion of a region's activities which were truly basic could be identified by calculating location quotients for the industry, for the region and for the nation as a whole i.e.

$$\frac{e_\ell}{e_r} \Big/ \frac{E_\ell}{E_r}$$ where e_ℓ = regional industry employment, e_r = total regional employment

E_ℓ = national industry employment, E_r = total national employment

The inference being that when the value of the index is unity, then regional production is just sufficient to satisfy regional consumption and therefore that the region neither imports nor exports the commodity. If the value of the index is > 1 then the commodity is exported and if < 1 imported. Such a method would be relatively inexpensive to undertake and, on the assumptions stressed below, would take into account the proportion of the export industries output sold locally and, more significantly, identify the backward input-output linkages. Unfortunately, to infer such specialisation from location quotients requires some very strong assumptions, the most important of these being:[1]

a) a closed economy,

b) no commodities are both imported and exported,

c) that local productivity in each industry is the same as national productivity,

d) that the demand patterns are identical.

Clearly these are very restrictive assumptions which are most unlikely to be met. An early attempt to surmount one of the problems was made by Hildebrand and Mace (1950) in their study of Los Angeles County. They argued that a location quotient of > 1 in raw materials, capital and intermediate consumer products, was likely to reflect a regional comparative advantage and hence these could be designated as export industries. While industries producing consumers' goods and services would be market based and hence a location quotient of > 1 would reflect the region's pattern of demand.

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1. For a more detailed discussion of these problems and of alternative location quotient formulations, see Mattila and Thompson (1956).

Such an argument is superficially plausible but it does not deal with the problem of the demand for services directly generated by the basic industries, nor, in the Highland context, would it cater for the problem of a potentially high location quotient in hotels, catering and retail trade, which is only partially generated by local spending patterns but also by the spending of tourists; such tourist expenditure is, of course, part of the export base of the area.

Tiebout (1962) has also attempted to answer the critics of the location quotient method. He argues that some idea of local expenditure patterns can be obtained from expenditure surveys, e.g. in the U.K. the Family Expenditure Surveys would allow some crude adjustment of the location quotient. Secondly, differences in regional productivity can be taken into account by weighting regional employment by an index of regional productivity. This is provided a reasonably accurate index could be calculated, a difficult task for a U.K. sub-region. Even so, the problems of a region importing and exporting the same commodity would remain. If it does so, then the use of a location quotient will tend to understate the export base. The use of more detailed classification of industries would help to eliminate the problem. For example, if a region imports cars and exports buses, then sub-classification will show this up, but the region may still export Ford cars and import all other makes. Only by taking a very detailed firm-by-firm survey would the true export position be made clear. Once such a detailed (and time consuming) survey had been undertaken it would be possible to contemplate a more satisfactory method of analysis, for example, input-output analysis - even if it were a simplified input-output framework (see Hansen and Tiebout, 1963 or Bonner and Fahle, 1968).

If the location quotient method is to be used, it should be recognised to be a relatively crude estimate which has the considerable advantage of being inexpensive and rapid.

iii) Minimum requirements technique

The shortcomings of the location quotient technique led to the search for other indirect ways of distinguishing between basic and non-basic activities. The 'minimum requirements' idea had been suggested by Hildebrand and Mace (1950) but it was developed by Morrissett (1958) and Ullman and Dacy (1960). The technique as defined by Ullman and Dacy (1960, Page 176) is an attempt to quantify the 'minimum percentage of the labour force required in various sectors of its economy to maintain the viability of an urban area'. They maintain that this employment approximates to the service or non-basic sector, other employment being export or basic. They stratify U.S. towns and cities according to size and for each of the cities in the sub-group they provide a percentage breakdown of employment and select the minimum entry in each sub-group. Thus for cities of > 1 million inhabitants the minimum percentage employment in retailing was 14.8% and this is taken to be the 'minimum requirements for retailing in any city of > 1 million population'. The sum of these components for each industry expressed as a percentage of total employment is taken to be the minimum non-basic component in the cities employment, and from this a multiplier can be calculated. The method produces differential employment multipliers, which range from 1.33 for the smallest (2,500 - 3,000) town to 2.4 for the largest (> 1m.) cities. While Ullman and Dacy apply the method to urban areas, in principle, there is no reason why the method should not be used for sub-regions or indeed regions were there sufficient numbers in each class or if the regions are of roughly the same size.

The technique has been criticised as providing no real advance on other means of identifying the economic base. Pratt (1968) is highly critical. He argues that if the city with the minimum number of workers in an activity is self-sufficient then the logic of the methodology is that all other regions must have a surplus and hence export. Hence we have a situation where all cities export and none import, which is clearly impossible. Other writers do not use absolute minimums, for example, Morrissett (1958) eliminates the lowest 5% of cities in each industrial category, this eliminates some of the possibility of special cases, but it does introduce an arbitrary cut-off point and does little to meet Pratt's criticism. To the best of the author's knowledge, no response to this criticism has been forthcoming from the supporters of the minimum requirements technique.[1]

Pratt (1968) also points out that in using the minimum requirements technique it is necessary to make similar assumptions to those made in the location quotient technique about the pattern of demand and productivity. For example, if two cities have identical demand patterns and national average productivities in each industry, then in order to satisfy their requirements they must have the same number of workers employed in these industries as the national average and not the minimum number as suggested by Ullman and Dacy. The point is, presumably, that once it is admitted that different cities may have widely differing productivities then the technique looks rather shaky. Pratt draws a further unfavourable

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1. Part of the answer may lie in the import capacity of rural areas, which could imply that all cities be net exporters of some goods and services.

comparison with the location quotient technique, the accuracy of which can be improved by disaggregation (see above), whereas the reverse is true of the minimum requirements technique. If broad groupings are taken (e.g. S.I.C. orders), then it is likely that all cities will have at least some representation. Whereas, if the grouping is finer, then it is more likely that at least one city will fail to have a particular activity (say M.L.H. order). Hence a lower estimate of minimum requirements will be produced by a finer gradation of industrial groupings.

These criticisms suggest that the technique offers little advance over the location quotient method, which was itself seen as a relatively crude measure of the economic base of the city or region. It appears then that the critical empirical question of how to identify the economic base cannot be satisfactorily answered by such indirect means. This is not the only difficulty with the approach and these further empirical and conceptual difficulties must now be considered.

3. Some further empirical difficulties

This section and the one which follows can do no more than outline the main difficulties which have been raised by the extensive literature on the subject.[1] Archibald (1967) criticises the simple export base approach on the grounds that even if all the relationships are linear, with constant coefficients, $\frac{dE}{dX} \neq \frac{E}{X}$, if there is any element of autonomous expenditure, for example, autonomous elements in I or G. While this is correct, Archibald does appear to be attacking a straw man, for most

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1. Isard (1960, chapter 6) has an extensive bibliography on the subject.

empirical studies of the export base try to estimate $\frac{dE}{dX}$ from time series data, allowing for some autonomous element in their regression equations.[1] While Archibald's point can be overcome in principle by the use of time series data, there are a number of problems (relating to base studies) associated with the use of such time series data. For example Hildebrand and Mace (1950) found that the employment multiplier for Los Angeles County in the 1946-7 period was double that of the 1940-1 period, mainly reflecting the excess capacity which existed in the earlier period and the rapid expansion of service employment with the end of wartime shortages. While this is an exceptional case, it highlights the point that the time period chosen for the study can be crucial and data calculated for one period only may be suspect. Employment in services will not respond instantaneously to an increase in employment in basic activities. Hence the specific starting/closing points on the trade cycle chosen for the regression analysis may have an important influence on the results, and for this reason represent a potential source of error in export base multiplier calculations.

Another source of difficulty has been the emphasis placed on exports in the base analysis, which has tended to ignore the role of import substitution. Other things being equal, the establishment of an import substituting industry in the region will have the same multiplier impact on the region as an export industry of the same type and size, however, the exports of the region will not increase and a simple export base multiplier will register no change. Calculating the basic/non-basic ratio for a region in a period of extensive import substitution would overstate the multiplier

1. Even some relatively early studies such as that by Hildebrand and Mace (1950 use this methodology. For a more sophisticated modern approach, see Weiss and Gooding (1968)

vis à vis another time period or region in which no import substitution took place. Hence by concentrating on the export multiplier the role of import substitution may be ignored.[1]

The use of a base multiplier for regional and urban forecasting involves a number of problems, some of which we have already hinted at above. Can the use of a linear relationship (even with a constant element) between basic and non-basic activities be justified as a forecasting tool?

As discussed above, multipliers calculated on a single year or even time series data may be suspect because of (i) cyclical and hence excess capacity problems, (ii) lengthy adjustment lags. Obviously the longer the time period for which the forecast is being made, then the less likely is the base/non-base ratio to be linear. Even if it is assumed that the same industries expand and demand patterns do not alter, then there still remains the possibility of differential changes in the technical coefficients due, e.g. to economies of scale. Moreover, over time the pattern of demand may alter in such a way as to favour home produced products (or the reverse), with the same impact on the multiplier as has been discussed above (page 9).

Even in the short run it is highly unlikely that the growth of demand for exports[2] will have exactly the same pattern as in the time period chosen to calculate the multiplier. A different pattern of export growth may influence the level of the multiplier in several ways; first, different

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1. This problem could, presumably, be overcome if the 'import substitution' industries could be identified and included in the definition of the economic base.

2. Assuming no import substitution.

industries will have widely differing local input-output linkages (even the average figure given by the location quotient method will not encompass these disparities). Secondly, even assuming constant 1-O linkages per £ of export demand, different industries will have different labour productivities. Thirdly, different industries will pay different wages and the expansion of a high wage industry would clearly have a greater effect than the expansion of a low wage industry, but this would not be reflected in the average employment multiplier. An associated and fourth point is that different groups of workers have different tastes. These problems are clearly serious when a limited expansion of a region's activities is being considered. It is one of the advantages of the approach suggested in Chapter 3 that it can go some way towards answering these criticisms.

4. Theoretical and conceptual problems

In a fundamental sense the export base concept provides only a partial explanation of the economic development of a region. This issue was raised by Blumenfeld (1955) who, with reference to urban development, argued that for a large city the service sector may in a sense be considered to be 'basic'. It is the existence of business and personal services of all kinds, and also the skill of the labour force which provide the true 'base' (really comparative advantage) of the city. Blumenfeld argues that it is this base which provides the stable factor within the city, since the export activities which sustained it can decline and new ones be attracted in.

This points to the somewhat artificial nature of the distinction between export and service activities made by the advocates of the export base technique. The weakness of the distinction from the development point of view can be illustrated more vividly by considering a closed economy (e.g. the world economy).

In this case there are no 'export' activities, yet economic growth is still possible, e.g. by technical progress. The essence of this argument seems to be that in the long term the economic development of a region depends heavily on developments in the supply side of the equation. While this is a valid criticism of the export base approach,[1] there is still an important role for such shorter term studies based on aggregate demand. But there still remain important theoretical qualifications which must be made to the export base concept even as a short term analytical tool.

The treatment of exports as autonomous is hardly realistic in a large region, for the expansion of the region will increase imports from other regions of the country and the expansion of the exports and incomes of these other regions will have repercussions on the first region considered. These repercussions mean that exports are not truly autonomous, therefore the assumption made in the export base theory is not justified theoretically. Even if the export base model were to try to take account of these repercussions, the use of an employment multiplier would be an indirect way of doing so. Imports are primarily a function of the level of expenditure in the region and only indirectly a function of the level of employment; cet. par., if employment were constant and income rose, then the level of imports would rise. Thus income is a more appropriate measure for estimating these intra-regional repercussions.

A further difficulty with the use of an export base multiplier formulated in terms of employment, is that the impact of unearned income, whether this be property or investment income or government transfer payments, cannot

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1. And, it may be added, of the Keynesian approach, see Wilson (1968).

easily be incorporated into the model. Moreover the use of income data would enable the differential effect of the expansion of high or low wage industries to be calculated.

For these reasons then, it would seem theoretically more satisfactory[1] to formulate the export base multiplier in terms of income and not, as has been done in practically all of the empirical work, in terms of employment. Even if income were substituted for employment in the export base multiplier, a further problem remains. Based as it is on the measured statistical relationship between basic and non-basic employment (income), the technique gives no clear idea of the process by which an increase in direct employment (income) gives rise to an increase in indirect employment (income). Since the approach fails to illuminate the process of change, then this lack of understanding hinders the appreciation of how, why or when the ratio changes. This is a serious defect of the approach and when considered with the problem of identifying the 'basic' sector and the other problems mentioned above, has made many economists critical of the export base approach.[2] Fortunately the criticism has been constructive and an alternative has been proposed which demonstrates theoretical advantages, and it is this alternative multiplier formulation which is considered in section B of this chapter.

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1. Though in practice more difficult to collect data.

2. This is not to say that it does not have a place as a relatively crude, but rapid method of calculating multipliers for, say, a city but the qualifications mentioned above must be borne in mind.

B. Keynesian Multipliers

1. Origins and early development of the multiplier

As an alternative to the export base multiplier it is possible to modify the standard Keynesian multiplier, originally designed as a national multiplier, to operate on a regional basis. Keynes' (1936) investment multiplier is too well known to require detailed summary. It may be useful to note, however, that Keynes formulated his multiplier model in terms of a closed economy with no government sector. The multiplier showed the relationship between the increase in the level of investment and the increase in the level of income, i.e. $\Delta Y = k\Delta I$. The value of the multiplier depended on the level of leakages from the flow of income, in this case $1 - \frac{dC}{dY}$. Hence the emphasis was placed on the functional relationship between the increase in consumption from an increase in income, which Keynes called the marginal propensity to consume. While he did not build international trade into the formal model, he did acknowledge the impact of the marginal propensity to import - as a leakage in the multiplier (Keynes, 1936 pp 120-2).[1] In fact it is not difficult to incorporate the leakage due to international imports into the model, this was quickly achieved and developed by international trade theorists. The theoretical work on the foreign trade multiplier can be seen to be directly relevant to a regional trade multiplier, in principle the only distinction would be to treat imports from other regions of the country as a leakage in the multiplier in the same was as international imports are treated in the foreign trade multiplier.

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1. Harberler (1941) attributes the first formal statement of the marginal propensity to import to Paish (1936).

International trade theory has mainly been concerned with the multiplier process in so far as it influences the balance of payments. Nevertheless, there are close links with regional income theory, whether one treats such theory explicitly in regional balance of payments terms or not. The foreign trade multiplier literature added considerably to the knowledge of the mechanism by which the expansion (or contraction) of one country (or region) is transmitted to other countries (or regions). When considering the expansion of the level of income of a country (A), it is clear that one of the important leakages in the multiplier will be the marginal propensity to import. Thus exports, and hence income and imports of the rest of the world (B) will expand. This expansion of B's imports will have repercussions (possibly very small) on the level of A's exports and income, which in turn will have some small impact on B and so on. While the theory was first worked out in an international context, it is obvious that it can be applied directly in an inter-regional context. While a more formal treatment of such an inter-regional multiplier will follow, it is appropriate at this stage to consider whether this international trade multiplier, which was initially worked out for a two country model (see e.g. Clark (1940), Harberler (1941), Metzler (1943) and Machlup (1943)), is appropriate for an n country world. This is of importance since the recent work in inter-regional repercussions in the U.K. (Brown, 1967 and Steele, 1969) makes a comparable assumption of a two region world. Metzler (1950) investigates such a multiple country (or region) system. He makes the assumption that all prices costs and exchange rates remain constant and that there is a free market in foreign exchange.[1]

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1. Subsequent discussion in international trade theory has relaxed these assumptions. Particularly significant, in this context, is the attempt to synthesise the price and income effects. While this is natural in view of the greater possibility of price changes in an international context, it is nevertheless interesting to note that the role of price changes have been ignored in the regional multiplier literature.

On these assumptions he does not find any basic flaws in the two country model. 'There are no processes of income adjustment in the n country model which are not also revealed in the simple two country model' (Metzler, 1950, page 252).

As noted above there are no great conceptual difficulties in modifying the foreign trade multplier to a regional context, but it may be of interest to consider one of the earlist (possibly the first) works to use the multiplier in such a context. Subsequent models have closely followed this early work of Vining,which first appeared in Econometrica in 1946. The essence of his model was as follows: For the region -

$$Y = C + \overline{E}_c - M_c + \overline{I} + \overline{E}_i - \overline{M}_i$$

where, C = consumption; I = investment; E_c and M_c are the values of exports and imports of consumption goods and E_i and M_i are the values of exports and imports of investment goods. E_c, I, E_i, and M_i are all taken to be autonomously determined.

Then if $\frac{dC}{dY} = C'$ and $\frac{dM_c}{dC} = q'$

Then the marginal propensity to consume local goods = $C'(1-q')$

and $\Delta Y = \frac{1}{1-C'(1-q')} \quad \Delta(I - M_i + E_i + E_c)$

i.e. that the regional multiplier $k_r = \frac{1}{1-C'(1-q')}$

Vining then goes on to estimate the value of this multiplier for a small region.

The most economical way of summarising the further developments in the regional multiplier literature which are relevant to the discussion of the rest of the thesis, is by looking at the recent U.K. literature on the subject in some detail.

2. Development of the regional multiplier as applied to the U.K.

The recent work which has been done on the regional multiplier in the U.K. has been primarily empirical in intent but it has resulted in a clarification and synthesis of ideas, some refinement of the model and has produced some interesting policy developments. These can be considered under the following headings:

i) the multiplicand
ii) development of the model
iii) problems of estimation and estimates of multipliers for the U.K.
iv) policy implications and uses of the model

i) The multiplicand

In their discussion of the impact of an investment project, both Archibald (1967) and Wilson (1968) single out the first-round multiplier effects as being unique and they discuss how the initial investment injection must be modified to provide an appropriate regional multiplicand. The appropriate multiplicand is not the total increase in investment, but the local expenditure fraction of this investment, hence the import content of the investment must be removed and any loss of transfer payments (mainly unemployment benefits) considered. Since on an average project, plant and machinery and also some building material and equipment will need to be imported, the regional impact of an investment project will be considerably reduced. This initial investment injection is the 'standard' multiplicand used in the estimation of indirect effects and for some projects, e.g. road construction, for practical purposes represents a once-and-for-all effect as far as demand in the region is concerned. However, investment in, say, a factory will not only have a temporary construction effect but will also create a permanent increase in employment. The earnings of these people will contribute to regional income over a number of years and represents a separate but highly

important second multiplicand. Archibald isolates this type of multiplicand when dealing with the third type of multiplicand, that for induced investment. This induced investment multiplicand results from increased income spent in the area and from any inflow of population which occurs. Both Archibald and Wilson consider this multiplicand to be potentially very important but stress the extrmeme difficulty of estimating its effect. Such a distinction between the three types of multiplicand is not only useful conceptually but has implications for the type of multiplier to apply. It will be convenient to call the initial investment multiplicand the 'primary multiplicand', the ongoing multiplicand which results from increased permanent employment in the region the 'secondary multiplicand', and the induced investment the 'tertiary multiplicand'.

Brownrigg (1971) has provided a valuable synthesis of the work which has been done on the multiplicand and of the way in which this fits in to an integrated multiplier model. His summary formulation (Brownrigg, 1971, page 10), sets out clearly the role of the three components of the multiplicand.

Let the primary multiplicand = J_1, the secondary = J_2 and the tertiary = J_3;[1] J_3 is taken to be a function of the level of immigrants earnings (ΔZ);[2] m_1 and m_3 are the marginal propensities to import in the primary and tertiary multiplicands;[3] k_r = regional multiplier and ΔY_r = increase in regional income.

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1. Brownrigg, following Archibald (1967), calls this component ΔN.

2. Archibald made this assumption to avoid making induced investment a function of the level of income and thus incorporating induced investment into the multiplier formation. Such a formulation, e.g. $\Delta Y = 1/1-((J_3+(c-m)(1-t))\Delta Z$, may raise difficulties, for the denominator could become negative. While Archibald's formulation has practical advantages, its theoretical limitations should be borne in mind, for an increase in regional income could stimulate an increase in investment, even if net migration is zero.

3. Brownrigg points out that m may differ for J_1 and J_3 but due to lack of data he is forced to make the simplifying assumption that $m_1 = m_3$.

Then the full impact on regional income of an investment project which creates permanent employment has three components:

$$\Delta Y_r = k_r J_1(1-m_1) + k_r J_2 + k_r J_3(1-m_3)$$

$$\text{i.e. } \Delta Y_r = k_r (J_1(1-m_1) + J_2 + J_3(1-m_3))$$

Such a clear formulation focuses attention on certain issues. For example, the import content of J_1 and J_2 may significantly reduce the impact of these multiplicands. Again the timing of the multiplier is somewhat clarified. Consider the construction of a single new industrial project in a region; then in this case, J_1 and J_3 will produce a once-and-for-all stimulus to the region's economy, whereas J_2 will raise regional income to a higher equilibrium level. Different reaction lags would be expected from the three components of the multiplicand and so on. Above all it focuses attention on the need for a clear specification of the multiplicand.

ii) Development of the regional multiplier model

Since the work in the U.K. has been largely empirical and policy oriented, no major theoretical breakthroughs have been achieved. The standard international trade multiplier model has been adapted for use in a regional and inter-regional context in the U.K. In the process some valuable insights have been achieved into the operation of such a model at a regional level. All of the writers who deal with the topic, formulate multiplier models to estimate secondary regional effects.[1] They are based on an open economy Keynesian multiplier and, as noted previously, the major difference is in the coefficient of the marginal propensity to import, which includes imports from other regions as well as international imports. Other variables are introduced into the model to deal with the regional situation in the U.K.

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1. See Allen(1969), Archibald (1967), Brown (1967), Steele (1969) and Wilson (1968).

Since the models are broadly similar, little advantage would be gained by setting out each in turn, instead Brown's (1967) model will be considered. This is clearly specified and incorporates most of the features found in the other models. The detailed specification of the model is outlined in appendix 2:1, however the final multiplier he derives has the following components:

$$Y_a = \frac{G_a}{1-c(1-t_d-u)(1-m_a-t_i)} \qquad \text{i.e. } k_r = \frac{1}{1-c(1-t_d-u)(1-m_a-t_i)}$$

where Y_a = change in GNP in region A; G_a = change in government expenditure in A; c = marginal propensity to consume out of disposable income; t_d and t_i are direct and indirect tax rates (the latter assumed to fall on consumption); m = marginal propensity to import (consumer's goods); u = government transfers.[1]

Brown was concerned in his article with the impact of a change in government expenditure on value added. The multiplier formulation which he derived could, however, be applied equally well to changes in value added in investment or exports, to estimate the change in region income i.e. provided the import coefficient of the expenditures are excluded from the multiplicand.

Brown's model is formulated in broadly the same way as those of the other authors mentioned.[2] One different feature of his model is the introduction

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1. See Wilson (1968) for a valuable exposition of the assumptions on which the analysis rests.

2. Steele's (1969) model is the exception. He uses the Family Expenditure Survey data on personal expenditure which includes income tax, national insurance contributions and also savings of various kinds. Steele uses the difference between this figure and total personal income as his estimate of the average and marginal tax rates and makes the assumption that the average and marginal savings rates differ by the same percentage. (There would seem to be little theoretical justification for this assumption even if it is not too far out empirically). However, the assumption does allow the application of a single average/marginal coefficient to the average savings figure S (which includes direct taxes). Thus the model, excluding indirect taxes and imports, is simply $k = 1/\alpha S$, and the complete formulation is $k_r = 1/1-(1-\alpha S)(1-t)(1-m))$.

of government transfer payments into the formulation. Such transfer payments will, of course, reduce the size of the multiplier impact, since they act as automatic stabilisers, falling when regional income rises and vice versa.

Brown goes on to extend the model to deal with inter-regional repercussions in the same way as international repercussions have been dealt with by international trade theorists. The detailed formulations are set out in appendix 2:1, the strength of the impact will depend, of course, on the size of the regional multipliers and the importance of region B's exports in region A's imports and vice versa. It is interesting to note that this article was the first appearance in the U.K. literature of an attempt to quantify these repercussions. Steele (1969) has also attempted to estimate such repercussions and the model which he uses bears a close resemblance to Brown's.

The treatment of the company sector presents a difficult problem for all of the models mentioned and this sector has not been satisfactorily incorporated into any of the formal models. While distributed profits are not mentioned by any of the authors, there are some special problems associated with such profits. First, a considerable proportion of these profits is likely to be distributed to shareholders living outside the region in which they were earned and secondly, distributed profits may be subject to double taxation. Undistributed profits initially represent a leakage from the multiplier process. However, in so far as they are retained in order to finance the investment programme of the company in the region, then it may be somewhat misleading to treat them as such. None of the models mentioned include undistributed profits as a multiplier leakage. Steele (1969) explicitly avoids the difficulty by : (a) considering a 'standardised'[1] personal income

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1. "Standardised" in the sense that he excludes the first round effects of the investment injection, i.e. the primary multiplicand, and concentrates on a personal expenditure multiplier.

multiplier and not a multiplier of GDP, and (b) by excluding them from his personal income multiplier. He treats such profits as exogenously determined, 'dependent more on investment than income', therefore he reduces the multiplicand by the extent of the undistributed profits.

This treatment of the company sector in the regional multiplier models seems to be rather unsatisfactory. In principle there is no reason why a more sophisticated company sector should not be built into the models. In practice, as always, the problem is one of a lack of regional data. For example, a regional breakdown of the profit distribution of nationally owned companies would not be readily available. Even for local companies it would be a difficult task even to split profits into their component parts. Moreover, isolating the determinants of profits reinvested in a region would be a major study in its own right depending, as Wilson (1968) has pointed out, on such factors as the existence of a regional Macmillan gap and the willingness of firms to accept outside finance.

The final point to be considered in this section is the question of whether the regional inter-industry matrix multiplier generates income in addition to the regional income multiplier considered above. Steele (1969, page 269) considers the impact of an increase in the exports of a particular commodity (A) from a region and points out that this will have repercussions on those industries in the region which supply industry A and that these linkages can only be satisfactorily examined by means of an input-output table for the region. However, the selling price of the article will reflect the value added in all the previous stages of production. Hence the 'matrix multiplier does no more than show the path taken to arrive at the selling price of the export which is what we start of with as a datum'.

[illegible] multiplicand, then he is correct in pointing out that there is no further process of income generation involved in the matrix multiplier.[1] However, as Steele (1969, page 270) admits, the constant coefficients assumption of the regional income multiplier would be unlikely to hold for each round of the multiplier and an input-output multiplier would allow each round of the multiplier to be individually determined. While such tables would clearly be desirable for these reasons, Steele points to the difficulties of their calculation, particularly the industry destination of inter-regional import flows. He also points to the dangers of using national coefficients, for they would take no account of regional product mix and underestimate the extent of cross-hauling of commodities. For the purposes of this thesis which deals with the impact of different types of industrial expansion, the use of a 'standardised' personal income multiplier would be an unjustifiable over-simplification. Some account must be taken of the individual input-output linkages associated with the expansion of any given sector; these problems are considered in more detail in chapter 3.

(iii) Problems of estimation and estimates of multipliers for the U.K.

The absence of appropriate regional statistics in the U.K. makes the task of estimating the value of the multipliers, even for planning regions, a very difficult one. This lack of data probably explains why it is only recently that sustained attempts have been made to estimate such multipliers. The major stumbling block to such attempts has been the absence of data on inter-regional trade flows, which makes the calculation of the region's marginal propensity to import (m) extremely difficult. For other coefficients such as the direct and

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1. It is not entirely clear why he chooses the selling price as the multiplicand and not the sum of the L.V.A. elements in the selling price. Moreover, for the results of the matrix multiplier to equal those of the Keynesian multiplier exactly (given some stimulus to export demand) - further conditions would seem to be needed: (i) the export good, or bundle of goods, should be identical in each case. (ii) the matrix should be specified so that the type of leakages correspond exactly to those of the multiplier model and (iii) an appropriate weighting system must be selected to guarantee that the weighted sum of the sectoral leakage coefficients will be equal to the appropriate multiplier leakage coefficients.

indirect tax rates (t_d and t_i) and marginal propensity to consume (c), plausible figures can be obtained by using national data. These empirical difficulties led Archibald (1967) in his pioneering work on the U.K. data, to attempt to construct a minimum estimate of the multiplier for any region, rather than estimates for individual regions. He used a simple model of the type, $k = \frac{1}{1-(c-m)(1-t_d)}$. By theorising about the likely value of the coefficients, he was able to narrow the plausible range of the multiplier for a U.K. region from about 1.2 to 1.7 He then tried to calculate a likely minimum value for $\beta = (c-m)$, which he called the propensity to add value locally (L). He included in L only those components of household expenditure which must constitute L.V.A.[1] Archibald calculated these L values for each industry for the period 1952-63 and regressed this L series on personal income to arrive at an estimated value for β of 0.23. He made use of Prest's (1962) national 'best estimate' value of the marginal rate of personal tax of 0.185 (he recognises that this involves the assumption that there is no change in employment and hence the national insurance contribution rate will be zero, whereas if employment increases, then t_d will be > 0.185). With $\beta = 1.23$ and $t_d = 0.185$, then the value of the regional multiplier = 1.23. However, taking a generous margin of two standard errors on each side of β, produces a range for k of 1.13 to 1.34.[2] While still producing an uncomfortably wide range, the attempt to provide a minimum estimate of the multiplier for any region does give some guidance. Archibald considers that 'one might reasonably

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1. He assumes that regions import all their food, fuel and manufactured goods and only the L.V.A. in their distribution is included, other L.V.A. components are in such sectors as: housing, utilities, travel and communications and certain personal services.
2. The value of k is less sensitive to changes in t, for example, at t = 0.25 the value of the above range is 1.12 to 1.30.

take 5/4 as a "best guess" at the level below which it is extremely improbable that the multiplier for any region can lie.'

In discussing the impact of the regional employment premium, Brown, (1967) also attempted to estimate the appropriate regional multiplier. His main aim was to estimate what the multiplier might be for the development areas as a whole and not for any particular region. He was forced to rely on national estimates of the coefficients of his model (see Appendix 2:1). These are: $c = 0.8$, $t_d = 0.18$ (Prest's (1962) marginal estimate), $t_i = 0.16$ and u (government transfers) = 0.2 The estimate of m is more difficult, he takes Archibald's figure for L.V.A. (expressed as a percentage of consumption) as about 0.3 i.e. $m = 0.7$. Taking as the other limiting case the national propensity to import of 0.2, he concludes that the 'mobile U.K. content' is 0.5. If this mobile content came from inside or outside the development areas in relation to their output (roughly 1/5 of U.K.) then m would be 0.6 (or nearly 0.7 for a single small region). Since there is likely to be a bias towards local production[1] then Brown makes a generous assumption that this will account for half the difference between the (adjusted) maximum and minimum values i.e. 0.4 for the development areas and 0.45 for a small region. These coefficients give an estimate of k of 1.28 for the development areas as a whole and 1.24 for a small region. These are remarkably close to Archibald's 'best guess' minimum estimate of 1.25. The lower import coefficient which Brown used has been offset, to some degree, by the inclusion of a u component, which is negatively related to the level of income. In fact, it would be possible to criticise Archibald (1967), Allen, (1969) and Steele (1969) for not including such a variable into their models. Although Archibald did include such a term when discussing the multiplicand, this would not cover the ongoing effects. The difficulty of incorporating such a term into the income multiplier model, is that the loss or gain of transfer payments

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1. Presumably due to transport costs, perishability, localised demand patterns etc.

is related to the level of employment and therefore an employment multiplier is more appropriate (see Chapter 3).

Brown's estimate of the impact of inter-regional repercussions between the development areas and all other regions is very low, reflecting the relatively low import coefficient which he used for all the development areas. In terms of his model (see Appendix 2:1) repercussions depend on M_b i.e. the increase in B's imports as a result of an increase in consumption in B (in turn as a result of an increase in A's imports). M_b has two components, M_{bf} = foreign imports, which Brown takes to equal 0.2 (i.e. an equiproportional share of U.K. imports) and M_{br} = imports from other U.K. regions, this would be 0.1 on the 'perfect mobility' hypothesis but 0.05 on the compromise adopted for local bias. This gives an overall value of M_b of 0.25. The low value assigned to M_{br} means, of course, that the repercussion effects are going to be very small, and after the first round, minimal. Thus, on these assumptions the introduction of inter-regional repercussions only raises the estimated value of the multiplier from 1.28 to 1.29.

The estimates of Archibald and Brown which are considered above, made no attempt to quantify the multiplier for any specific region, nor did they attempt to investigate differences in the size of the multiplier for different planning regions. Archibald (1967, p 33) did discuss how these estimates might be made and both authors were, of course, aware of the influence of the size of the region (in economic terms) on the possible value of the multiplier. Later empirical studies have concentrated on estimating the multiplier for an individual region (Allen, 1969) and inter-regional differences in the multipliers (Steele, 1969).

Allen's (1969) article is concerned with the difficulties of estimating the multiplier for a region and, in the course of the discussion, he produces various estimates of the multiplier for Scotland. Using a very simple multiplier model, i.e. $k = \frac{1}{s+t+m}$, he calculates both an average and a

marginal multiplier. His estimates of s, t and international m are based on average national coefficients. In calculating m from other regions he makes use of a form of location quotient (cf. methodology and criticisms, p 4 of this chapter). He calculates the ratio of employment in Scottish consumer goods industries to that in Great Britain as a whole. Setting this percentage against Scottish population[1] as a percentage of Great Britain's population, gives a crude measure of self-sufficiency. The estimate makes no allowance for bias towards local production (cf. Brown) but on the other hand the propensity to import figure does not include intermediate goods. Applying these leakages to his estimate of Scottish personal income (for 1962) produces the 'average' regional multiplier estimate of 2.2. For his 'marginal' estimate, which he thinks is rather more reliable, he makes the assumption that $t_d = 0.33$, i.e. the marginal earned income rate for standard tax payers. This would seem to be an over-estimate in view of Prest's (1962) findings. He points out that the marginal import and indirect tax coefficients will depend on whether increased expenditure is made on: a) goods with a lower than average retail mark-up, (b) goods with a higher than average rate of indirect tax, and (c) goods in which Scotland has a lower than average rate of self-sufficiency.

He argues that since expenditure patterns do not change rapidly over time, then the marginal rate of leak to imports and direct taxes may not differ significantly from the average. He tested this hypothesis by calculating leaks from increases in expenditure on various categories of goods shown in the Family Expenditure Survey (FES) between the years 1953 and 1962, and compared the results with the estimates for 1962 alone. The COMBINED ~~continued~~

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1. Deflated to take account of a lower expenditure on consumer goods.

leakage coefficient was 32% for the 1953-62 period and 35.4% for 1962 alone. While these results are not likely to be very reliable, they are surpirsingly close.[1] Applying these marginal leakages reduces the estimated value of k from 2.2 to 1.8. However, neither of these estimates includes imports of intermediate goods. By including an estimate of such leaks at 30-50% of production costs[2], the value of k is reduced to 1.4-1.52. While these estimates cannot be considered very accurate, they are substantially higher than the 1.25 and 1.28 estimates of Archibald and Brown.[3]

Steele (1969) has made the first courageous attempt to estimate multipliers for each of the U.K. regions. In doing so, he had to rely heavily on the FES and on some rather slender data on inter-regional trade flows. Given these data limitations, he has produced some very interesting results which suggest that there may be marked differences between the multipliers for the U.K. planning regions.

Estimates for each region of the average propensity to save and the average tax rate (combined in a savings coefficient S) were taken from the FES. An approximation to the marginal rate was obtained by assuming that marginal rate was 29% higher than the average.[4] This produced a range of S between the lowest and highest regions from 0.11 to 0.17. Estimates of the indirect tax coefficients were derived from some knowledge of household income and

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1. This result is interesting in view of the difficulty of calculating the marginal propensity to import for the Highlands (see chapter 4).
2. The 30% estimate is derived from the figure for the Falkirk/Grangemouth Study (1968). The upper estimate is Allen's 'generous error factor'.
3. Admittedly no u coefficient is included but on the other hand the t_i (0.3 estimate is far higher than Brown's (0.18) and no allowance is made for bias towards total production.
4. Obtained by taking the average proportion of direct taxes for the income range £800 - £1,000 (the 1963 average income range), comparing this with the marginal rate for the income range £1,000 - £1,500 and assuming that this ratio would also apply to savings.

indirect taxes and of regional income distribution. The range of t_i, expressed as a percentage of consumers expenditure, was narrow - 19.86% to 20.5%.

A notable feature of the Steele paper was the attempt to piece together information on the inter-regional and international import coefficients from various direct surveys which have been undertaken. In addition to the variability of its quality, the data suffered from a further defect for Steele's personal income multiplier. It related total regional imports to final demand and not personal consumption, with the obvious problem that the import content of investment and export demand may be quite different, and probably significantly higher, than that of consumer's goods.[1] The data sources on road transport were the Ministry of Transport Road Goods Survey (1966) and the Martech (Consultants) Report (1966). The former data did not provide any data on the value of goods traded and the value/weight ratios derived by Martech for internationally traded commodities were used. These value/weight ratios were applied on a regional basis. They varied widely between regions: from £470 per ton[2] for Scotland to £1,471 for the next lowest region (Wales) and £11,544 for the highest region, the South East. Information on movements by rail were available from the Beeching Study but again value/weight ratios (for commodities other than coal) had to be taken from the Martech study. Further reliance was placed on the Martech study for knowledge of the distribution of international imports.

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1. In defence, Steele argued that investment goods are only a small proportion of final demand and, in any case, no other data was available.
2. For this estimate the international value/weight ratio was used, but since this was suspect, Steele reworked the figure with the value/weight ratio for the Northern and N.W. regions. This appears plausible since 68% of Scottish imports originate in these two regions, however, the fact that this is 68% by weight may still mean that there is some downward bias.

A rough estimate of imports of services was obtained by estimating potential regional service exports by a form of 'assumption' export base method and then distributing these according to regional employment weighted by per capita income. The total of international imports of services were distributed between regions the same way.

The results of these calculations and also of the multipliers they produce are summarised in table 1.

Table 2:1[I]

	m	regional multiplier	multiplier (feedback)
North	0.61	1.37	1.42
Yorkshire & Humberside	0.74	1.19	1.26
E. Midland	0.60	1.37	1.45
E. Anglia	0.72	1.22	1.33
S.E.	0.55	1.41	1.57
S.W.	0.59	1.37	1.42
Wales	0.64	1.33	1.38
W. Midland	0.72	1.20	1.33
N.W.	0.67	1.27	1.39
Scotland (1)	0.32	1.89	1.92
(2)	0.41	1.70	1.71

The range of estimates of the value of m (excluding Scotland) is relatively high, from 0.55 to 0.74, certainly higher at the top end than that suggested by any of the authors previously considered. However, apart from the possibility of inaccuracy or bias in the data, the point which must be stressed again is that these estimates of m out of final demand and not out of consumers' expenditure.

These high import figures produce some relatively low estimates of the value of the simple multipliers (again the Scottish figures are the notable exception). Three estimates are actually lower than Archibald's 'best guess' minimum estimate of 1.25, but on the other hand five are higher than 1.35.

I. Adapted from Steele (1969) tables IX and XI. Scotland (2) refers to the Scottish figure incorporating the modified value/weight ratio, see footnote 2, on previous page)

Precisely because the import coefficients are high, the inclusion of inter-regional repercussions in the value of the multiplier has a substantial effect, much higher than Brown estimated. This impact is operative even where the region itself (Scotland or the S.E.) has a relatively low import coefficient This is because the feedback effect from other regions is still stronger. The inclusion of these feedback effects raises the value of the multiplier above 1.25 for all of the regions and for all but three regions above 1.35, i.e. higher than Archibald or Brown's[1] estimates.

The above discussion of the findings of the authors who have tried to measure the value of regional multipliers in the U.K. has gone a long way to improve our knowledge of the likely values of such regional multipliers. However, it is equally clear that the empirical work which has been done, based as it is on surrogate national data or doubtful regional information, could hardly be thought to be completely accurate. To summarise the findings to date, they would suggest that the likely range of value of the regional multiplier for a U.K. planning region have been narrowed from Archibald's (1967, page 27) first estimate of 1.2 - 1.7 based on casual empiricism, to perhaps 1.25 - 1.55, although Steele's figures for Scotland may cast some doubt on even this generalisation. Steele's work on the differential regional multiplier, suggests that the values of the multiplier may vary considerably from region to region. Steele himself stresses the very crude nature of his estimates but his interesting findings suggest that further work on the magnitude of inter-regional trade flows would be rewarding.

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1. Even if the u coefficient were excluded from Brown's model.

To conclude the section it may suffice to say that a great deal of work remains to be done before one is able to say with confidence what the appropriate multiplier is for any region.

iv) The policy implications and uses of regional multipliers

All of the U.K. authors mentioned above have discussed the possible policy uses of multipliers and the following discussion attempts to summarise the main points they make.

Regional policy to date has relied to some extent on the direction of Government expenditure to the development areas and, perhaps to a greater extent, on the maipulation of fiscal incentives. Such policies require some measure of their impact on income in the development areas, in order to provide a (partial) measure of their effectiveness and to judge the strength of the stimulus that is required.[1] Clearly regional multipliers provide a possible measure.

In discussing the impact of the 'public works Treasury pound' (Archibald, Wilson and Brownrigg) stress the extent of the leakages from such an investment, leakages which could be so great that the final multiplied expansion of income could well be less than the original investment injection. Of course if the investment (public or private) creates permanent employment, then there will be a further stimulus through the secondary multiplicand. This suggests that it is important to distinguish between the type of investment and the type of project, and it will be argued later,that different types of project will have multiplier effects which are significantly different. In turn this raises the question of whether it is good policy to direct

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1. In so far as these objectives are formulated in terms of employment generation, then obviously an employment multiplier is required.

incentives towards projects which have a high multiplier impact. Again this will be discussed later (in chapter 7), but it is interesting to note that Wilson (1968, pages 392-3) does not think this a wise policy whereas Allen (1969, page 95) suggests that there may be advantages in thinking along these lines.

Estimating the impact of differential tax incentives will also require regional multipliers. For example, Brown was concerned with estimating the impact of the regional employment premium, on the assumption that all of the £100m. R E P payments went to increase pre tax personal incomes in the development areas.[1] He was able to forecast, using his multiplier model, that regional income would rise by a further £25-30m. Moreover, the increase in income in the development areas will have repercussion effects on the rest of the U.K. This is an important point which is stressed by Wilson and Allen,[2] namely that the low estimates of the value of the regional multiplier, mean that regional policies directed to the development regions will have a significant impact on other U.K. regions as well.[3] Wilson argues that this does not mean that no regional policies should be adopted, but that it should be borne in mind that they involve a real cost to other parts of the country. In addition, the low estimated values of the regional multiplier mean that such regional policies

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1. The need for this assumption points to an important difficulty, for had the R E P payments been reflected in lower prices or higher profits, then the multiplier effect would have been different. Note that even if the £100m. additional profits were reinvested in the development areas the multiplier effects would have been different because the different and probably higher m content in the primary multiplicand, a point which Brown does not appear to have considered.
2. Allen's argument that if the Scottish multiplier = 1.5 then 66% leaks into other regions seem slightly misleading, for not all of the taxation and savings leakages (even if they are spent immediately) are spent in other regions, clearly some will be channelled back or reinvested in the region of origin.
3. Since the data on the origin of imports is doubtful, the precise regions may be difficult to tie down.

have a limited effect. In fact, regional policy can be compared with pouring money through a very fine sieve, the lower the multiplier, the greater the number of holes in the sieve.

Wilson also raises the important question of whether estimates of the regional multipliers are sufficiently accurate at present to be used as a guide to short run stabilisation policy. The problem is not only one of estimating the exact value of the multiplier, but is also complicated by the difficulty of forecasting investment plans (particularly private investment) for more than about twelve months ahead. Even if these two factors were known, the timing of the multiplier effects themselves would still present problems. Wilson indicates the likely difficulties in estimating the timing: the existence of lags, the expenditure lag, the entrepreneurial reaction lag and the production lag;[1] and capacity considerations, primarily the possibility of stock adjustment and the existence of excess capacity. These problems lead Wilson (1968, page 386) to question the short run nature of the model, 'it does not, therefore, seem very helpful simply to describe the multiplier as a short run model. It is based on a combination of assumptions some of which look a good deal more short run than others.' He goes on to point out that in the long run the importance of such problems will diminish but that a further problem will arise over the stability of the coefficients of the model. He draws the conclusion that further work is required on the timing of the regional multiplier before an inter-regional short run stabilisation policy could be operated with any confidence. Were such information available on the timing of the multiplier, then the sort of policy one could envisage would be one

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1. And, it may be added, the employment adjustment lag.

of restimulating the economy through the development regions some months in advance of the date at which it would be thought appropriate to apply such stimulus nationwide.

Even if such attempts at 'fine tuning' are still some way off, another policy usage of the regional multiplier is suggested by the work of Steele. If more accurate regional multipliers could be derived for individual regions, then it may be possible to suggest a differential regional policy, i.e. applying different policies to different regions to maximise the multiplier effects. Apart from the obvious administrative difficulties of operating such policies, there would be the problem that attempts to increase the multiplier could conflict with other objectives for the region. It would seem that a considerably improved knowledge of each region's economy would be necessary before such policies would be advisable. On the other hand, it could be argued that we are equally ignorant of the long run impact of present 'blanket' regional policies.

Another, less ambitious use of regional multipliers would be as a practical guide to regional physical planners. Here regional multiplier estimates should provide improved estimates of secondary repercussions. Two needs come to mind, first the need to have an employment multiplier in addition to an income multiplier in order to assess the demand for housing, schools etc. Secondly to quantify the induced investment effects mentioned by Archibald and Wilson, these effects have been discussed and broadly quantified by Brownrigg (1971).

To conclude this discussion of the policy implications of the regional multiplier, it will be necessary to discuss Archibald's (1967) work on the impact of inter-regional migration, which has important implications for the strategy of regional development. His argument is that the debate in regional policy, whether 'moving the bodies' or 'moving the jobs' will be more effective in curing regional imbalance, contains an important and possibly

unjustifiable assumption. This is that the movement of labour from one region to another in response to market forces will act as the natural equilibrating force of pure neo-classical equilibrium theory.

As evidence he cites Brechling's (1967) findings on the structure of unemployment in the U.K. and also his own work on the level of unemployment in the U.K. regions;[1] neither of which suggest that the classical equilibrating mechanism has been very effective despite the heavy migration which has taken place. He accepts that this failure to respond in the predicted manner could be due to some exogenous change (or changes) which continually tend to depress some regions relative to others but argues that even if this were true, then it would not be a complete explanation of the failure of the equilibrating mechanism. This is because inter-regional migration flows in response to economic incentives do not have a wholly stabilising effect, in fact there are 'definite destabilising offsets'.

If an unemployed man[2] leaves a development region then there are two effects on demand in that region. The first is the loss of his unemployment benefit and the second is that this reduction of original income will lead to a reduction in induced local investment, and each of these effects will have multiplier repercussions. There are corresponding effects on demand in the receiving region, from an increase in personal expenditure and the induced investment (public and private) which his presence calls for.

Archibald (1967, pp 35-6) indicates the likely impact on the area losing population by calculating how many unemployed persons must leave the area before one man loses his job. He stresses that the multiplier effects of

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1. Archibald (1967, page 23) presents evidence that if the percentage rate of unemployment in the individual U.K. regions is either above or below the U.K. average then this state tends to persist.
2. It makes no difference if an employed man leaves the region, as long as his place is taken by someone who was previously unemployed.

the loss of £1 of unemployment benefit will be higher than the loss of £1 of personal earned income, for the unemployed pay no direct tax, it is 'inconceivable' that they save at all, and their expenditure pattern, and hence their marginal propensity to import will be different (and perhaps lower) than an employed person. Thus if α is the local expenditure coefficient of the unemployed, h is the incremental transfer payment in the region, Y_o = average weekly earnings and r = number of men who must leave the area before one or more men becomes unemployed. Then

$$r = \frac{1}{\frac{h}{Y_o} k\alpha}$$

For Archibald's very low estimates of k (1.2) and α (0.3), then r = 6.9 i.e. that no more than about 7 men need leave the area before one more man becomes unemployed. The estimates are not insensitive to the value of the regional multiplier, e.g. if k = 1.7 and α is unchanged at 0.3, then r is reduced to 4.9. Should the value of both these coefficients be high, e.g. α = 0.5 and k = 1.6,then r = 3.1 and it would be difficult to reduce unemployment in a region by emigration, for the required emigration would be one and a half times as high as the desired reduction in the level of unemployment.[1]

When looking at immigration, Archibald was interested in whether such migration would remove the excess demand for labour in a region of low unemployment. He concludes that, while the initial inward movement of labour clearly removes some of the excess demand, the multiplier effect of the earnings of the migrant restore some part of this excess demand.[2] In addition,

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1. Note that these are multiplier effects only, Archibald does not make an estimate of negative induced investment effects.

2. For example, if one additional job becomes vacant in a region whose labour market is in equilibrium, and this is filled by an immigrant earning the average wage for the region, then the excess demand for labour falls from 1 to k-1.

when the induced investment requirements, mainly for social capital (public and private), are taken into account, the net effect may well be to add to the excess demand for labour in the short run.[1] Overall, he finds no a priori grounds for believing that inter-regional migration will be stabilising; nor is he able, given the data deficiencies, to prove that it is definitely not so.

It is hoped that even this relatively brief survey of the U.K. literature has indicated the contribution that regional multiplier analysis can make in the formulation of regional policy and in regional analysis and planning. Moreover, that the subject is worthy of and would repay further study.

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1. Archibald's (1967, page 37) armchair estimates of the likely effect of induced investment would suggest that such immigration would be inflationary in the short run (for three years after immigration $\frac{\Delta Y}{\Delta Z} = 2.5$ for a value of k of only 1.25). However, Brownrigg (1971) has pointed out that the import leakage in the induced investment component will reduce the value of this coefficient substantially and this leads one to a cautious formulation of Archibald's conclusions.

CHAPTER 3

The Development of the Regional Multiplier Model

This chapter sets out to adapt and develop the basic regional income multiplier model, discussed in the previous chapter, for use in estimating the impact of an individual project at a sub-regional level. The nature of the sub-region chosen for study, with its long history of emigration, drew attention to the importance of migration flows in a sub-regional context. A consideration of this problem, led to the view that some account should be taken of the influence of such inter-regional migration in the formulation of the regional multiplier itself. Since such migration flows are a distinctive feature of regional analysis,[1] their influence on the regional multiplier is treated in some detail. Hence, the initial part of this chapter discusses the impact of such migration on the regional multiplier in general terms, while the model developed later in the chapter indicates how these features can be incorporated into a more formal framework.

In addition to the modifications to encompass inter-regional migration, the other features of the model which distinguish it from those discussed in chapter two are: (i) the model is designed to measure the impact of a specific project at a sub-regional level, (ii) the model generates estimates of employment as well as income multipliers and (iii) the use of an expanded multiplicand allows the main regional input-output linkages of a project to be incorporated into the model. These features are developed in sections B and C of the chapter; section A contains the more general discussion of the impact of migration.

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1. Distinguishing regional macroeconomics, for example, from the pure theory of international trade, which traditionally (and distinctively) assumes zero inter-country factor mobility.

A. Inter-regional migration and the regional multiplier

The influence of migration on the value of the regional multiplier can, perhaps, be most clearly illustrated by considering the impact of a project which creates a permanent addition to employment in a region. The effects discussed will be present to some degree in the operation of the multiplier on the primary and tertiary multiplicands (see above pp 21, 22), but are stronger and more easily demonstrated when considering the secondary multiplicand.

If it is assumed initially for illustrative purposes, that a project which creates new jobs is initiated in a region which has no reserves of unemployed labour and that the entire labour force for the project are immigrants from other regions of the country.[1] What effect will this assumption have on the value of the regional multiplier?

Two significant effects come to mind. A consideration of the first-round impact of the increase in earnings[2] going entirely to immigrants, suggests that their contribution to regional expenditure will depend on their average propensity to consume, their average tax rate and the import content of their average expenditure pattern. That is, the appropriate leakages to apply in the first round of the multiplier are average and not marginal as normally applied in the 'standard' regional multiplier.[3] A similar argument can be applied to subsequent rounds of the multiplier, since most of the increase in local expenditure will go to employ additional labour which must come from outside the region.[4]

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1. The theoretical argument would not be altered if the immigrants were from overseas.
2. Strictly speaking, this should include the unearned income (including government transfer payments) of the immigrants.
3. A similar argument is presented by Tiebout (1962).
4. There may be underutilisation of labour in some trades. This labour could be more efficiently employed, resulting in increased piecework or overtime earnings or higher profits. However, in the long-run it may be more reasonable to assume an equilibrium rate of under employment in the region.

The argument has less force in this case, since some of the expenditure generated by the subsequent round multiplier will go as additional profit (mainly in local service trades). Naturally, some proportion of this profit will remain in the region as additional personal income of the existing inhabitants and hence its impact will depend on those persons' marginal propensities. Since the local expenditure from this source is unlikely to represent more than a small proportion of the income received in wages and salaries, then for practical purposes average propensities may represent a more reasonable approximation, even in subsequent rounds of the multiplier.

The second possible influence of immigration on the value of the regional multiplier arises through the employment multiplier effect of immigration. Since the immigrants to the region represent a permanent addition to the labour force of the area, they and their dependants add permanently to the demand for services in the area. The increase in the private sector service employment is implicitly included in the income multiplier effect. Previous U.K. authors, however, have considered government expenditure as autonomous in their simple income multiplier. This is not very realistic in a region which is gaining in population, as both Archibald (1967) and Wilson (1968) acknowledge when dealing with the tertiary multiplicand, because immigration requires the provision of additional social capital. Though not considered by Archibald and Wilson, there will be a corresponding increase in current expenditure on employment, mainly in the social services and in local government. The provision of these services is not truly market based but is more likely to be related to the size of the population,[1] and hence to the rise in employment.

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1. While this is likely to be a good approximation for services provided from Central Government funds, it may be less valid for some Local Authority Services the provision of which may be more closely related to the local rate revenues and thus indirectly to the income of the immigrants. Hence, the use of population is a proxy for a more complex relationship, where the income of migrants is likely to be the other main variable. It also follows that if public service employment is included in the regional multiplier, then, to avoid double counting, it is necessary to treat rates as part of the average tax rate.

This process would add to the value of the regional multiplier in the following way: associated with the initial rise in income and employment will be a rise in public service income and employment. The multiplier effect of the joint expenditure of both public and private employees will create additional employment in private services. This will result in further demands on and employment in public services and so on. Given that each succeeding immigrant[1] will add to the demand for public services, this interaction of the income and employment multipliers will add to the overall regional multiplier impact of the income generating project.

Given the assumptions made about immigration, the use of average propensities and the inclusion of public service employment could add significantly to the value of the regional multiplier which is appropriate to apply to the secondary multiplicand. While immigration has a clear impact on the secondary multiplicand, there are also implications for the primary and tertiary multiplicands. The argument for the use of average propensities is essentially the same as that used for the subsequent rounds of the secondary multiplicand (see above.) In both the primary and tertiary multiplicand, the main first round impact of an increase in investment, public or private, on demand in the region will be through an increase in construction activity and hence in employment in that industry.[2] In principle, the subsequent rounds would have exactly the same impact as that already considered for the secondary multiplicand. The argument for additional public service employment must be modified for the primary and tertiary multiplicands. If an individual investment project is considered, then the increase in regional employment will be temporary and the response of public service employment to a temporary increase in demand is likely to be, at best, partial.

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1. Including the public service employees themselves.

2. It seems reasonable to assume that employment in construction tends to adjust fairly rapidly to changes in demand.

On the other hand, if investment in the region rose to a higher equilibrium level, then the increase in the labour force, and hence the population of the region, would require an adjustment in the level of public service employment.

Up to this point, the argument has been solely concerned with the impact of immigration on the receiving area but what of the regions which lose population? Archibald has reasoned through the likely implications of the emigration of unemployed persons from a region. He stressed that the multiplier effects of the loss of £1 of unemployment benefit will be higher than the loss of £1 of personal earned income, for: the unemployed pay no direct taxes, they probably pay a lower rate of indirect tax, it is 'inconceivable' that they save at all, and their expenditure pattern, and hence their marginal propensity to import, would be rather different (and perhaps lower) than that of an employed person. Archibald does not consider the impact of an employed person leaving the area,[1] but it is obvoius that the multiplier impact on the area of an employed person leaving, whose job is not filled, would depend on the coefficient of his average tax rate and average propensity to consume and import. The multiplier effects of the loss of income of the emigrant will also excercise a depressing effect on the level of investment, public as well as private, in the region. In addition, the long-run impact of emigration from a region will result in a reduction in the level of public service employment in that region. This latter factor will add to the secondary depressing effects of emigration discussed by Archibald and make the task of reaching inter-regional equilibrium by the migration of the unemployed yet more difficult.

So far it has been assumed that all additional employment opportunities created in a region have been filled solely by migration to that region. This is clearly unrealistic and the following brief discussion considers some of the implications of relaxing the assumption.

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1. He assumes that if an employed person leaves the area, then his place will be taken by someone who was previously unemployed.

When considering the impact of an individual investment project on a region with a below-average rate of unemployment in relation to the U.K. as a whole, then it is evidently not true that all labour for the project must be migrant. As Davies (1967) has pointed out, there may be a considerable reserves of labour in such regions despite the low percentage rate of unemployment. In the case of an isolated project then, the case for modifying the multiplier may not be very strong.[1] However, if the increase in the demand for labour is sustained, then it seems unlikely that more than a small proportion could be met from the labour reserves of the region and hence the case for the use of average propensities and a public service multiplier remains intact.[2]

At first sight the arguments used above, which relate to areas where there is a high level of economic activity, would seem to be relatively weak in an area of above-average unemployment, where it might be thought that immigration would not be significant. This is not necessarily the case; consider, for example, the siting of a specific new industrial or commercial enterprise in a development region. Such a project will need a supply of skilled and experienced managers and workers, many of whom may have to be recruited from outside the area. The extent of these requirements may be very significant in some cases, but on average will probably represent a very low proportion of labour requirements.[3] Secondly, and of greater importance, is the fact that the halting of

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1. For planning purposes an estimate of the likely employment pattern should be available for most projects and hence a disaggregated approach could be taken. For example, if a project employed mainly female labour, of whom very few had been registered as unemployed, then the use of average propensities could be justified.
2. The statistical evidence is not very conclusive. However, a study by Oliver of the causes of regional migration in the 1951-61 period found that there was a steady tendency for migration to be related to the difference between national and regional unemployment. F. Oliver, 'Interregional migration and and employment, 1951-61',Journal of the Royal Statistical Society, series A, vol. 1217, part 1, 1964.
3. Their regional impact may be rather greater than the numerical weighting would suggest, since on average they are likely to earn more than indigenous workers, on the other hand, they may have a higher average propensity to import.

emigration has the same impact as immigration as far as the income and employment multiplier effects of an investment project on the region as a whole are concerned.[1] Thus, if the creation of employment in a region with above-average unemployment halts emigration from that region,[2] then it is justifiable to apply the modifications suggested to the 'standard' multiplier.

While the impact of inter-regional migration on the value of the regional multiplier is likely to be significant at planning region level, it will be even more significant at sub-regional level. A new development in a sub-region is likely to draw immigrants from other parts of the planning region as well as from other planning regions; similarly it may halt emigration to other parts of the planning region as well as to other regions. The smaller the region, the more likely is immigration (or lack of emigration) to be important. This will tend to offset the higher propensity to import which the small region will have. Hence the regional multiplier will not necessarily decline as rapidly in a small region as might be expected from a consideration of its propensity to import alone.

It now remains to introduce these factors in a more formal way. The specific formulation of the model is intended to be used to calculate the ongoing income and employment multiplier effects of a new project.[3] As noted in chapter two, the first problem to be faced when dealing with the impact of a new project, is the specification of an appropriate multiplicand.

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1. Though the induced investment effects may be somewhat different, at least in their timing.

2. A priori one would expect this effect to be substantial in view of Oliver's findings but further empirical verification would be necessary.

3. Although little modification would be required to handle other situations, for example, to measure the impact of the run-down of an existing activity.

B. The Multiplicand

In chapter two, three separate multiplicand sources of income generation were identified. The initial investment or 'primary' multiplicand (J_1), the ongoing effect which results from the income earned by the permanent employees of the project, this was designated the 'secondary' multiplicand (J_2), and the induced investment or 'tertiary' multiplicand (J_3). The overall impact on income and employment in a region of a project which has all three elements will be:

$$\Delta Y_r = [J_1(1-m_1) + J_2 + J_3(1-m)]k_r$$

where k_r = the regional income multiplier and m = the appropriate marginal propensity to import coefficient.

It has been decided to limit the analysis of this thesis to the ongoing influence of an activity on income and employment in a region. The influence of the construction of the project (often considered as the first round of the multiplier) is normally a temporary one and hence is not quantified. Nor is the temporary, and in the Highland context, limited stimulus to induced investment quantified.[1] Hence the main ongoing income and employment generation effects of a project are confined to the secondary multiplicand (J_2) and the overall effects to $(J_2)k_r$.[2] How precisely is this J_2 multiplicand to be defined? A standard, but narrow definition would be as wages, salaries and locally distributed profit elements generated directly by the incoming project.[3] But this definition may understate the ongoing regional impact of the project. What if the project purchases some of its inputs, in addition to labour services, locally? If these purchases cause firms in

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1. Limited in this context because of the excess productive capacity in the area. A further reason why these effects were not studied further was to avoid duplicating the work of a colleague (M. Brownrigg's work on the University of Stirling).
2. Obviously, some oversimplification is involved here, for in some projects construction activity may be protracted (see Brownrigg, 1972) or the temporary stimulus to construction activity may have some permanent influence on the level of such activity in the area.
3. With 'direct' employment in the project as the employment multiplicand.

the region to expand or maintain their activities at a higher equilibrium level than they would otherwise have done,[1] then it would seem to be legitimate to include the additional local value added (L.V.A.) generated in these activities, as part of the ongoing impact of the project, i.e. as part of the secondary multiplicand. That is to say, that in these circumstances, the secondary multiplicand should be expanded to include the impact on value added of the backward leakages of the project. Another interesting possibility arises where a new project started in a region not only purchases some of its inputs locally, but also sells its production for further production by firms in the region. If this expansion of the processing sector represents a net addition to this activity in the region, then the contribution to regional value added from this source is also attributable to the initial project and should, therefore, be included in the secondary multiplicand.

This argument can be stated in more general terms. If the project purchases from and sells to many sectors, then the overall impact would depend on the net addition to L.V.A. in each sector of the firm's purchases vector and in each sector of the firm's sales vector. More formally, the secondary multiplicand for a multi-establishment activity which has both forward and backward linkages will be as follows:

If for the project: A_j = personal earnings generated by establishment j

B_{ij} = value of purchases by establishment j

C_{ij} = value of sales by establishment j

and, J^a, J^b, J^c = increase in L.V.A. for each of the above sectors A to C.

Where: α_i = i'th component of a vector of L.V.A. coefficients for each item of purchases or sales

β_i = i'th component of a vector of local purchases coefficients for each item purchased or local processing coefficient for each item of sales

k_r = regional income multiplier and k_e = regional employment multiplier.

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1. This problem of the alternative case is considered in more detail in the case studies.

Then the secondary multiplicand (J_2) will have three components:

$$J_2 = (J^a + J^b + J^c)$$

where: $$J^a = \sum_{j=1}^{n} \alpha^a A_j$$

$$J^b = \sum_{j=1}^{n} \sum_{i=1}^{m} \alpha_i^b \beta_i^b \beta_{ij}$$

and $$J^c = \sum_{j=1}^{n} \sum_{i=1}^{m} \alpha_i^c \beta_i^c C_{ij}$$

Then the overall increase in regional income (ΔY_r) will be:

$$\Delta Y_r = (J^a + J^b + J^c)k_r$$

The employment multiplicand will depend on the addition to the regional income necessary to create one further job in each of these sectors. Thus, if the ℓ^a, ℓ^b and ℓ^c are the increases in L.V.A. necessary to create an additional job in each of the sectors A to C, then the overall increase in employment ΔE is given by the employment multiplicand times the employment multiplier (k_e).

i.e. $$E = \left(\frac{J^a}{\ell^a} + \frac{J^b}{\ell^b} + \frac{J^c}{\ell^c}\right)k_e$$

This procedure of expanding the multiplicand, has allowed the inclusion of the 'first round' backward and forward input-output linkages of a project, without incurring the cost of providing a full transactions table for the region. To aid this comparison, it is possible to restate the main features of the model in input-output terminology, and it is worth digressing slightly from the main theme of the chapter to do so. The terminology chosen is that used by Hirch (1959), in his excellent and influential study of the St. Louis region. Hirch distinguishes between three different impact effects: (i) the 'direct' effect, which corresponds to the impact of the actual project on L.V.A., i.e. J^a; (ii) the 'indirect' effect which takes account of the production adjustments in sectors linked directly and indirectly to the initial project,[1] assuming no change in consumers' expenditure.

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1. Derived by inverting the processing sector matrix after moving the household secctor into final demand.

The inclusion of the direct linkages of a project (J^b and J^c) in the multiplicand, is equivalent to the inclusion of the first round only of this process. (iii) the 'induced'income change, which makes allowance for adjustments in consumers' expenditure; the analogous process in our model being the application of the personal income multiplier to the final change in L.V.A.

Thus, the model developed above includes the same processes of income generation as the full input-output multiplier, with one essential simplification, namely that only the first round of the 'indirect' effect is included. This simplification is thought to be justified on two grounds; firstly, that it is a great deal easier to obtain data for the first round impact of a project[1], than to construct a processing sector matrix for a region. Secondly, that the subsequent rounds of the matrix multiplier are unlikely to be significant in a region like the Highlands[2]. Nevertheless, the technique is incomplete in this respect, and hence there will be some degree of understatement (probably very slight) deriving from this source. This factor should be remembered when interpreting the results of the case studies of chapters four and five.

As well as facilitating these comparisons, Hirch's (1959) distinction between 'direct', 'indirect', and 'induced' effects is a useful one conceptually. This terminology will be used in distinguishing the elements of our model. Thus the <u>direct</u> employment in a project - $(\frac{J^a}{\ell^a})$ may be designated E_d. The <u>indirect</u> employment $(\frac{J^b}{\ell^b} + \frac{J^c}{\ell^c})$, corresponding to the first-round linkages of a project, is termed E_i. E_n will be the <u>induced</u> employment resulting from the personal

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1. See chapters four and five.

2. A pragmatic approach is recommended, and the main second round effect could easily be estimated, if these were thought to be important for any particular project.

spending of these two groups, i.e. $(E_d + E_i)(k_e - 1)$. Then the total increase in employment as a result of the siting of a new project in a region will have these three (direct, indirect and induced) components i.e. $E_d + E_i + E_n$. This terminology will be used in the multiplier model which follows.

C. The Regional Multiplier Model

This section discusses the formulation of the regional income and employment multipliers, that are to be applied to the multiplicand developed in the previous section. The model is an application of the standard income multiplier model, discussed previously, to the problems of estimating the impact of a single project or series of projects in a sub-regional context. Emphasis is placed on the special features of the model which are necessary in order to incorporate the influence of inter-regional migration and also to produce an employment multiplier. In order to clarify the theoretical issues involved in incorporating the influence of such migration, the model is developed (initially) on the simplifying assumption used in section A; namely, that 100% of all employment generated will be immigrants to (or potential emigrants from) the region in question. This limiting assumption of the generalised model will be relaxed in the case studies which follow.

1. First Round Multiplier

The 'first round' of the multiplier will be specified separately. This procedure has been chosen, partly because the model needs to be specified in a slightly different way in this round. But the main reason for the division is that the strength of the argument for modifying the model may vary between the first and subsequent rounds. In many cases, the argument for modifying the model may only apply with any strength in the first round; thereafter, it may be appropriate to revert to a more conventional multiplier formulation. A simple example may clarify the point. Suppose a new activity, say oil exploration, is instigated in a region and that this activity (because of its specialised skill requirements) uses all immigrant labour, then the argument for the use of the proposed

'migration modifications' in the first round is sound. However, if all subsequent (induced) employment opportunities were filled by immobile local labour, then there is no argument for the modifications in the subsequent round multiplier. Even in this case, the inclusion of the modifications in the first round only, may represent more than a trivial change. This is because the first round is likely to be the most significant in a small region (in economic terms) like the Highlands, where the leakages in the multiplier are probably very large.[1]

Such a distinction between the first and subsequent rounds can easily be undertaken given the separate formulation adopted. In practice, of course, it is unlikely that the issues will be as clear-cut as in the example given above and careful judgement will need to be exercised to decide whether the modifications are justified in a particular case. Alternatively, if sufficient information is available, it would be possible to undertake separate calculations for immigrant and non-immigrant groups. But these practical matters are more appropriately discussed in the case studies which follow.

To return to the specification of the multiplier model. Given the assumption that 100% of the persons employed on the project are either immigrants or potential emigrants, then it has been argued (see section A) that the migrant's contribution to regional income would depend on his average propensity to save and import and his average tax rate. Moreover, some employment may not be related to increased income but to increased population and hence to the increase in employment. In particular, employment in education, health and local authority services (henceforward known as 'public service' employment) would be likely to be related to the size of the work force. This introduces an

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1. This point is illustrated in chapter four.

element of interaction between the income and employment multipliers in the first and subsequent rounds. In addition to the usual first round multiplier, the following processes add to first round and employment generation: firstly, the direct employment will create additional employment and income in public services; secondly, spending of direct employees will generate extra jobs (mainly in private service trades); these people and their dependents will also require education, health and local authority services; thirdly there is a small internal multiplier, for public service employees themselves require public services. One means of estimating such an interaction is to take an average ratio of public service employment to total employment and assume that the same ratio would apply to an increase in employment. This procedure is used below but it is, of course, open to some criticism as any type of 'export base' approach[1].

These relationships may be expressed more formally; if for the project and the region:

E = total employment

E_d = direct employment

E_i = indirect employment

E_t = total of direct and indirect employment

E_n = induced employment

w_t = average earnings of direct and indirect employees.

w_ρ = average earnings of public service employees

ℓ_s = increase in local value added necessary to create one extra job in the service trades.

θ = ratio of public service employees to other employees

s = average propensity to save

t = average direct tax rate[2]

m = average propensity to import (from other regions and abroad)

v = proportion of an increase in income which is local value added, i.e. $v = (1-s-t)(1-m)$

ΔV = increase in local value added created by direct and indirect employees i.e. $\Delta V = E_t w_t v$

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1. See chapter two.

2. Indirect taxes are allowed for in the calculation of m.

Then the increase in induced employment (ΔE_1) at the end of the first round is

$$\Delta E_1 = E_t \theta + \frac{\Delta V}{\ell_s}(1 + \theta)$$

and the first round income multiplier is

$$k_1 = 1 + v + \frac{(E_t + \frac{\Delta V}{\ell_s})\theta w_p}{E_t w_t}$$

Subsequent Round Multiplier

Given the theoretical migration assumption, there is still a strong argument for the incorporation of the proposed modifications in the subsequent rounds of the multiplier. However, even with 100% immigration, the argument is less clear-cut in this case. As argued in section A (p 45), some proportion of the income generated will go to the existing inhabitants of the region and hence its impact will depend on these persons' marginal propensities. However, the a priori assumption was that this would represent a small proportion of income generation and hence for the purpose of specifying the model the problem will be ignored and average propensities used throughout the formulation.[1]

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1. The question only arises with regard to average and marginal propensities. The public service ratio is self-regulating, in that the existence of local profits will raise the value of ℓ_s and lower that of λ (see below).

It is assumed that investment (I) and exports (X) are autonomous. Treating X as autonomous seems reasonable, since it is extremely unlikely that Highland exports are sensitive to small changes in income in the rest of the country. The treatment of I as autonomous reflects the earlier decision to ignore all induced investment effects. That part of government expenditure (G) which goes as income to public sector employees, is considered endogenous (G'), other G is regarded as autonomous.

If for the region, Y = income, C = consumption, M = imports, Y^d = disposable income, c = average propensity to consume, and λ = income of public sector employees expressed as a proportion of total income.

Then: $Y = G + G' + I + C + X - M$

where: $C = cY^d$, $Y^d = (1-t)Y$

$M = mC$, $G' = \lambda Y$ and $\lambda = (\frac{v}{\ell_s})\theta w_p$

Substitution and rearrangement gives the income multiplier as:

$$k_2 = \frac{1}{1 - \lambda - c\,(1-t)(1-m)}$$

(iii) Regional Income Multiplier

Having estimated the first round income multiplier (k_1) and subsequent round multiplier (k_2), then the overall regional income multiplier (k_r) is simply:

$$k_r = 1 + k_2(k_1 - 1)$$

and hence the overall increase in regional income (ΔY) is:

$$\Delta Y = E_t w_t k_r$$

(iv) Regional Employment Multiplier

The overall increase in induced employment (ΔE_n) generated by the direct employment is the first round increase in employment (ΔE_1), plus subsequent round income generation, divided by the weighted average of income increases (ℓ_s and w_p) necessary to create one extra job in private and public services.

If the terms in the equation retain their previous meaning and θ_1 becomes the ratio of public service employment to total employment i.e.

$$\theta_1 = \left(\frac{\theta}{(100 + \theta)}\right) \times 100$$

Then:
$$\Delta E_n = E_1 + \frac{V}{\ell_s}(1 + \theta) + \frac{E_t w_t (k_1 - 1)(k_2 - 1)}{\ell_s (100 - \theta_1) + w_p \theta_1}$$

And the final employment multiplier is quite simply:

$$k_e = 1 + \frac{\Delta E_n}{\Delta E_t}$$

(iii) 'Effective Multipliers'

The income and employment multipliers (k_r and k_e) formulated above, are those to be applied to the income and employment multiplicands derived in section B of this chapter. Together, they give the overall increase in income and employment in a region as a result of establishing a new project. The above multipliers correspond,with modifications, to the 'standard' regional multiplier discussed in chapter two. However, in the model, the multiplicand itself includes not only the 'direct' impact of a project, but also the further 'indirect' linkage components generated by these direct effects. Since the stimulus in the case of the 'indirect' and 'induced' effect is provided by the increase in output in the initial project; then it is possible to relate the overall increase in income and employment to the initial stimulus. The relationship between the initial (direct) stimulus of the project and the final (direct, indirect and induced) impact on income and employment in the region, is designated as the 'effective multiplier' effect. For example, if a new project employs 150 men 'directly' in a region and as a result of its output, 50 men are employed 'indirectly' in component suppliers and a further 100 men as an 'induced' result of the expenditure of these two groups, then the simple employment multiplier (k_e) will be 1.5; but the 'effective multiplier', showing the relationship between the numbers employed directly and the final employment total, will be 2.

More formally the effective employment multiplier (distinguished by an *) will be:

$$k_e^* = 1 + \frac{\Delta E_i + \Delta E_n}{E_d}$$

And the corresponding effective income multiplier will be:

$$k_r^* = 1 + \frac{(J^b + J^c)k_r}{J^a}$$

These definitions of regional multipliers and 'effective' regional multipliers will be used throughout the thesis. The usefulness of distinguishing such 'effective' multipliers becomes apparent in a policy context. An example would be where a policy maker is faced with a choice of several alternative projects as a means of stimulating employment in a depressed region. To take an extreme case: suppose two projects employ the same number of men,[1] with the same average earnings, then the 'standard' employment multipliers would be equal and therefore provide no basis of choice. But if one project has stronger local linkages than the other, then this would be highlighted by the 'effective multiplier' estimates, which would thereby provide a basis of choice between the projects.

This concludes the development of the model in its generalised form. The presentation up to now has been intended to illustrate the distinctive features of the model. In the case studies which follow, the extreme simplifying assumptions which have been made for these purposes will be relaxed. The case studies show how the model can be adapted to estimate the impact of different types of project. As well as dealing with the operational problems which inevitably arise in such empirical work, certain theoretical and methodological problems which were mentioned in this chapter, will be discussed in a practical framework.

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1. To avoid complication, it is assumed that they are the same men.

CHAPTER 4

The Economic Impact of a Major Industrial Project.

This chapter presents the first of the two case studies. These studies were chosen to present a contrast between different types of development in the Highlands, and thereby to illustrate how the model operates under differing circumstances. The study in this chapter is of the impact on the region of a major new project; the £15m. pulp and paper mill built by Scottish Pulp and Paper Mills Limited at Corpach, near Fort William. At the time of construction, the project represented by far the largest single commercial enterprise initiated in the Highlands and Islands in the post-war period. Employment in the mill alone representing an increase of some 9.5% in the manufacturing labour force of the region over the total for 1965, the year before the mill started production.[1]

In order to evaluate the ongoing influence of this major new development on income and employment in the region, it is necessary to consider how the model of chapter three can be applied in this case and to estimate the parameters of this model.

A. The Multiplicand

Given the conceptual framework developed previously, the specification of the components of the multiplicand for the pulpmill is straightforward. In addition to the obvious impact from income and employment in the mill itself, the important regional input-output linkages of the project must be traced. In the mill's

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1. Manufacturing labour force (including registered unemployed). This represented 8.7% of the manufacturing labour force, and 1% of the total Highland labour force in 1968 (H.I.D.B., 1969).

purchases vector, one item stands out as being of great importance, namely, the purchases of timber made in the region; these represent the mill's basic raw material input.[1] Other important raw material inputs, such as fuel and chemicals were all imported into the region. With the exception of transport services, other regional purchases made by the mill were so small that they could safely be ignored. Hence, the purchases vector can be collapsed to two items. The sales vector presents no problem whatsoever, since 100% of the mill's output was shipped out of the region for direct sale or further processing i.e. $J^c = 0$. Hence, the multiplicand for the project is simply; $(J^a + J^b)$, where the J^b vector only contains two items.[2]

1. Estimates of the employment multiplicand

(i) Direct employment (E_d)

In January 1969, 'direct' employment in the pulp and paper mill alone was some 850 persons.

(ii) Indirect employment (E_i)

Data limitations necessitate some departure from the standard multiplicand procedure in this case. Information was available on the physical input (but not the value) of timber delivered to the pulp mill from regional sources.[3] From this information, it was possible to calculate the 'indirect' employment effect and then the 'indirect' income effect i.e. a reversal of the order of calculation proposed in chapter 3. To make virtue of necessity, it is possible to point out that the multiplicand could still be calculated despite the data shortfall; a potentially useful device where the researcher has limited data.

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1. In 1969, the mill was purchasing roughly 2/3 of its pulpwood requirements in the Highlands.
2. The full range of operation of the multiplicand will be demonstrated in the second case study.
3. For competitive reasons, S.P.P.M. were unwilling to give information on the total value of timber purchases, which could, indirectly, reveal the price they were paying for their timber.

As noted above, the important 'indirect' employment effects of the project in the region were generated in forestry and transport. However, it would be misleading to attribute all of the employment generated in forestry and transport to supply the mill's needs,to the existence of the mill. The true impact of the mill is the net increase in employment, that is, the increase in employment over and above the number who would have been employed even if the mill had not been built. This complication means that two estimates have to be made; the first of the number of persons actually employed to supply the mill's needs and the second-'alternative case'-of the numbers who would have been employed in these trades had no pulp mill been built.

Total Employment Generated in Forestry and Transport

The discussion of forestry employment will be solely concerned with employment in logging. Employment in afforestation will not be considered, since decisions in this area appear to be made primarily on the basis of political considerations and the availability of land. Even so, the exclusion of afforestation may not be completely justified, since the political decisions are likely to be influenced, to some extent at least, by the existence of a ready market.

The employment required in logging to supply the mill's input requirements can be gauged from 1969 productivity levels, which were approximately 15,000 hoppus feet per man year.[1] At full capacity the proposed intake of home timber is 8 million hoppus feet per annum, requiring some 530 men in felling and extraction. However, in early 1969 the mill was working at less than full capacity, so employment requirements in logging at that time were some 430 men.[2]

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1. I am grateful to Messrs. J.L. Davidson and A.J. Grayson of the Forestry Commission for their help with this section.

2. Unfortunately, it was impossible to separate out the relatively small proportion of this employment that was in the forests of Perthshire, so to this extent there is some overestimation.

In addition to this direct employment in logging, approximately 55 men are required in supervision and clerical capacities and in vehicle maintenance, 70 men in road transport of the timber and a further 15 in all classes of rail transport.[1] This estimate of employment in rail transport does not include any allowance for the possible closure of the West Highland line to Fort William had the pulpmill not been built; it could be argued that were it not for the 20 year contract signed by S.P.P.M. with B.R., the continued existence of the line might have been in doubt. If the line would otherwise have been closed, it would be reasonable to attribute the regional employment on the line to the pulp mill, though a deduction would have to be made for additional employment in road transport. However, since the line was never actually scheduled for closure, this possible source of employment will not be included in the estimate.

The production of pulpwood has another effect on forestry employment. More men are needed to handle sawmill logs which are produced concurrently with the pulpwood. This employment is estimated to be roughly 250 men.[2]

In total these estimates indicate that the numbers required in forestry and transport to supply the mill's January 1969 requirements of timber were of the order of 800 persons; this figure is likely to rise to about 900 persons when the mill is operating at full capacity. This is considerably less than the estimate made at the time the project was announced in 1963, when the total increase in employment was estimated at 1,530 persons. The earlier estimate was based on the then existing productivity in the production of pitprops.

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1. This estimate was provided by British Rail.

2. A proportion of these logs will be processed on a site adjacent to the pulp mill, according to a recent announcement ("The Scotsman", 12th July, 1972.)

However, pulpwood is of a simpler specification and special studies, instigated as a result of the Corpach project, helped to double the rate of productivity increase from the trend rate of 3 per cent per annum.

Alternative Employment

How many of these 800 would have been employed had the mill not been built depends on the market for Scottish timber in the absence of the mill. The assumptions made (see Appendix 4.1) indicate that in the absence of an alternative major user, fewer thinnings would have been cut and fewer associated sawlogs produced. Hence, in the short-run, it is thought that timber output would have been considerably lower in the absence of the mill.

Since this is extremely difficult to quantify, the increased employment in forestry and transport attributable to the mill is expressed as a fairly wide range, 300 persons in the lower estimate and 500 in the upper. This is by no means the only point at which a range of plausible assumptions could be made, hence this procedure of presenting the estimates as a range will be continued throughout the empirical section of the thesis.

2. Estimates of the income multiplicand

The 850 'direct' employees of the mill earned just under £1m. in wages and salaries in 1968. Since S.P.P.M. are part of a large group of companies,[1] locally distributed profits will be negligible, therefore direct income generation (J^a) will be taken to be £1m. The earnings of the 300-500 forestry and transport workers are not known exactly. But if it is assumed that their average earnings were £20 per week[2], then their total earnings (J^b) would be in the range £312,000 - £520,000 per annum. Thus the gross estimate of the income multiplicand will

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1. S.P.P.M. are wholly owned by the Wiggins Teape Group, this group is itself controlled by B.A.T.

2. Average earnings of forestry workers in the area in 1968 were £19-20 per week. (Scottish Council, 1969)

be ($J^a + J^b$), that is some £1.3m. to £1.5m. per annum.[1]

However, this does not necessarily mean that income in the region will have increased by £1.3 - £1.5m., since some of the people may already have been contributing to regional income. Roughly 60 per cent of the mill's employees are immigrants, therefore all of their incomes present additional regional income. Of the remaining 40 per cent of mill employees and forestry and transport workers, some may have previously been unemployed, some may have come from other jobs in the area and some may have been potential migrants. Since Highland unemployment is high, it is likely that jobs vacated in the area by these new employees of the mill, would be filled by other persons previously unemployed or by other potential migrants. Hence for the purposes of this exercise the important distinction is between those previously unemployed and potential migrants.[2]

Two possible breakdowns between the categories are considered: for the upper estimate it is assumed that there would have been 100 per cent emigration and for the lower case 50 per cent would have emigrated and 50 per cent would have been unemployed. The upper estimate assumes that there is some (high) equilibrium rate of unemployment in the Highlands, any tendency for unemployment to lie above this level would be offset by higher emigration. While this direct link between unemployment opportunities and emigration is unlikely to exist in the short-run, it may be a reasonable approximation in the long-run. The lower estimate chosen is not the other limiting case of zero emigration, since it is considered that a considerable section of the population will always choose emigration to unemployment.

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1. Unfortunately no information is available on the unearned income of these individuals.

2. An increase in the female activity rate is treated in the same way as emigration, since no loss of unemployment benefit is assumed.

In the upper case then, the gross estimate of $(J^a + J^b)$, i.e. the £1.5m. earned by the direct and indirect employees of the project, can be treated as additional income. In the lower case, those previously unemployed will lose their unemployment benefit. Hence the multiplicand must be modified in this case to allow for the loss of unemployment benefit in the region. If this loss of unemployment benefit is called u, then the revised multiplicand is simply $(J^a + J^b - u)$. Taken with the assumption of fewer forestry workers, the inclusion of this u component[1] would reduce the income generated in the lower case from £1.5 to £1.2 million per annum.

B. The Regional Multiplier Estimates

Before attempting to calculate multiplier values, it is necessary to consider whether the theoretical model of chapter three can be applied without modification to the project.

The migration assumption made in the 'upper case' corresponds precisely to that made in the theoretical model and thus presents no further difficulty. In the 'lower case', it is assumed that 50% of the locally recruited employees of the project would previously have emigrated and 50% would previously have remained in the region (drawing unemployment benefit). In the 'first round' effect of the project, some 60% of the direct employees are immigrants to the region and, on the above assumption, 50% of the remainder would previously have emigrated; hence, on balance, the use of the proposed modifications seems justified. However, for the purposes of producing a lower estimate of the subsequent round effects, the decision has been made to revert to a more conventional formulation with marginal propensities.[2] Moreover, it is necessary to allow for any loss

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1. For a discussion of the assumptions made about the loss of unemployment benefit (u), see appendix 4.2

2. In practice, the marginal propensity to import could not be calculated

of unemployment benefit. Thus the model of chapter three must be slightly reformulated to include marginal propensities and any such loss of unemployment benefit.[1]

If the terms of the subsequent round multiplier formulation (see page 58) retain their previous meanings and we introduce the following terms; c* = the marginal propensity to consume, s* = the marginal propensity to save, t* = the marginal tax rate and u = the rate of unemployment benefit to income and υ^*= proportion of an increase in income which is LVA. i.e. $\nu = (1 - s^* - t^* - u)(1 - m)$

Then for the region; $Y = C + I + G + G' + X - M$

Where $C = a + c^* Y^d$, $Y^d = (1 - t^* - u)Y$

$M = b + m\,C$, $G' = \lambda Y$ and $\lambda = (\frac{\upsilon^*}{\ell})\ \theta W_p$

and the 'lower case' subsequent round multiplier (k_2) is:

$$k_2 = \frac{1}{1 - \lambda - c^*(1 - t^* - u)(1 - m)}$$

It is now necessary to estimate the parameters of this model.

1. Parameters of the Income and Employment Multipliers

(i) Propensities to Save and Tax

Calculations (see appendix 4.2) indicate that the average income tax rate of the employees is just under 12 per cent. of gross income and the average national insurance and graduated pension contribution rate about 6 per cent. This gives an average tax rate (t) of 18 per cent of gross income. The estimate of the average propensity to save (s), 6 per cent., is an average of the Scottish figure for the period 1965 -67 obtained from the Family Expenditure Survey. The marginal tax rate (t*) is taken to be 20 per cent. of gross income and the marginal propensity to save (s*) as 10 per cent. of gross income.

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1. Note that λ is self regulating.

While these estimates cannot be considered to be very precise, the final value of the multiplier is not very sensitive to a change of, say, 10 per cent. in either propensity. The estimation of the average propensity to import from other areas (m) is of greater significance, for in an area like the Highlands the import content of consumption expenditure is obviously very large.

(ii) Average Propensity To Import (m)

The method of estimating m made use of the Family Expenditure Survey. It is assumed that the expenditure pattern will be approximately the same as the Scottish expenditure pattern[1] estimated in the family expenditure data for 1965-1967. The use of this data makes it possible to take account of the fairly marked differences which exist in regional expenditure patterns in the U.K., though no account is taken of any possible variation in expenditure patterns within Scotland.

Given a detailed estimated breakdown of personal consumption, it is possible to estimate local value added (as a proxy for 1 - m) in each category. This is not meant to imply that disaggregation allows the achievement of complete accuracy, however, it may allow a more accurate estimate than could be made for a complete industry or subgroup (Archibald, 1967). In many cases, the only L.V.A. component is in retailing and in this case nationally available data on average gross retail margins are used; in other cases detailed information is available for the trade. However, in some cases there was no alternative but to guess a likely minimum L.V.A. (see appendix 4.3). From appendix 4.3, table 1, it can be seen that an estimate of the average L.V.A. component of 28.87 per cent is obtained, i.e. that the value of m is roughly .71.

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1. Roughly 90 per cent. of the mill's employees and probably an even higher proportion of the other workers are Scots.

In the absence of information on inter-regional trade flows, no attempt has been made to estimate the marginal propensity to import. The inability to calculate this propensity is obviously a serious one for regional multiplier approach.[1] However, the shortcoming is less serious in this work; for in a region where migration flows are of importance, it has been argued that the use of average propensities is actually desirable.

(iii) Increase in L.V.A. Necessary to Create One Extra Job (ℓ)[2]

The first problem involved is to estimate what average earnings would be in the jobs created. Since most of the employment generated will probably be in the service trades and particularly in retail distribution, an attempt was made to assess average earnings in these industries. To this figure must be added S.E.T. and employers' contribution to national insurance, to arrive at the full cost to the employer of an additional employee. The calculations indicate that the average cost per adult employee would be about £830 per annum.

For the upper case, a £830 per annum increase in L.V.A. is assumed to create one extra job. This is clearly a limiting case and is based on a number of simplifying assumptions (see appendix 4.4), the most crucial of these being that there is a constant equilibrium degree of under-capacity in the area i.e. on average, firms in the area will not reduce the level of their initial excess capacity, so that increased turnover will result in increased employment.

In the lower case, ℓ is taken to be £1,200 per annum. While this cannot be considered a precise estimate, it is based on the idea that facilities in the Fort William area are overstretched, whereas capacity utilisation elsewhere in the Highlands is such that the fairly thin spread of increased expenditure in these areas could be absorbed in increased productivity.

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1. Though other approaches face similar difficulties.

2. For a more detailed discussion of this section, see appendix 4.4.

(iv) Ratio of Employment in Public Services to Other Employment (θ)

Estimates of employment in these sectors are made by applying the Scottish average of the ratio of total workforce : workforce in public services, to the estimates of all other employment created. Using this average ratio in the context of the heavy concentration of additional demand for these services in the Fort William area, reflects the view that in the long-run there will be little change in any underutilisation of capacity which may exist in the area.[1]

The estimates (see appendix 4.5) suggest that the appropriate ratio to apply to other employment is 15.6 per cent. in the upper case. In the lower case it is 11.0 per cent., this lower estimate reflects the earlier assumption about the pattern of migration or unemployment, i.e. that those persons who would have remained in the area would need public services whether the mill was built or not. The average earnings of public service employees (W_p) is taken as £970 per annum. (see appendix 4.5).

C. The Results

In view of the degree of uncertainty involved in many of the assumptions made, the results have been presented as a relatively wide range. Given that the assumptions made about employment in afforestation and the West Highland line are correct, then it is thought unlikely that the income and employment multipliers will lie outside the upper and lower limits suggested. The results are summarised

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1. Clearly this assumption may result in some overstatement of employment in public services, depending on the extent to which the increase in demand for these services does lead to the utilisation of spare capacity. On the other hand, there may be some increase in employment in nationally provided services, other than education and health services.

in Table 4.1

TABLE 4.1

The Income and Employment Multipliers

Estimate	k_1	k_2	k_r	k_r^*	k_e	k_e^*
Upper	1.4	1.35	1.54	2.3	1.67	2.66
Lower	1.35	1.25	1.44	1.85	1.41	1.90

In absolute terms, these multiplier estimates imply a very substantial impact in the area. The pulp and paper mill alone provides jobs for almost double the number of people employed in new manufacturing enterprises in the crofting counties in the entire 1950 - 1961 period (Simpson, 1963). The direct, indirect and induced effects of the mill are summarised in Table 4.2

TABLE 4.2

Forecast Increase in Employment and Income

Lower

	DIRECT	INDIRECT		INDUCED		TOTAL
	(Mill)	(Forestry & Transport)	Sub Total	(Public Service)	(Other)	
Employment	850	300	1,150	160	310	1,620
Income	£920,000	£260,000	£1,180,000	£150,000	£370,000[a]	£1,700,000

Upper

	DIRECT	INDIRECT		INDUCED		TOTAL
	(Mill)	(Forestry & Transport)	Sub Total	(Public Service)	(Other)	
Employment	850	500	1,350	300	610	2,260
Income	£1,000,000	£500,000	£1,500,000	£290,000	£510,000	£2,300,000

Employment figures have been rounded to the nearest 10 and income to the nearest £10,000. (a) includes a proportion of unallocated income.

1. The Income Multipliers

Two features of the income multiplier (k_r) are of particular interest, the high value of the first round multiplier (k_1) and the dominant influence of this round in the relatively high value for the regional income multiplier effect of the project (k_r). The estimate of k_r is surprisingly high in view of the small size (in economic terms) of the region. The inclusion of average propensities and of the income/employment interaction, raises the range of k_r (1.44 - 1.54) well above the 'best guess' estimate of Archibald (1968, p.32) of 1.25 for the minimum value of the multiplier for a standard region. It is also higher than that suggested by the National Institute's study (Brown, 1967) which indicated a multiplier of 1.24 for a very small region and 1.28 for the development areas as a whole.[1] To highlight the importance of the modifications proposed, it is possible to recalculate k_r on the same basis as Brown (1967).[2] Omitting the influence of migration, produces a very low estimate of the income multiplier for the sub-region of only 1.18.

The 'effective'multiplier estimates (k_r*), indicate that when the indirect income generation effects of pulpmill project, through backward linkages in forestry and transport, are included, then the overall multiplier effect of the project is raised even more dramatically to the range 1.85 - 2.3. Thus a project that has such strong linkages in the region, may contribute very substantially indeed to overall income generation. Given these linkages, the income generation effect could still be considerable for a region even if there were no migration effects and the leakages associated with the 'standard' regional multiplier were large.

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1. The National Institute estimate, excluding inter-regional repercussions.

2. That is, the lower case 'subsequent round' multiplier, with marginal propensities, $u = 0.2$ and $\lambda = 0$

2. The Employment Multipliers

For regional policy, the striking feature of the employment multiplier estimates, is the very high values of the effective multipliers (k_e*). These indicate that for every job created in the pulpmill, something of the order of 1 to 1½ jobs is generated elsewhere in the Highlands. This high employment multiplier is associated with the low extra-regional import content of the mill's inputs. This is likely to be considerably higher than the multiplier which would apply to many other large plants located in development areas. The effective multiplier range for a project with a high import content[1] e.g. an aluminium melter, would be likely to be in the range of the k_e estimate i.e. roughly 1.4 - 1.7.

Overall, these estimates indicate that where immigration or potential emigration are significant, the use of a standard form of regional multiplier will tend to understate the income and employment effects of a project which creates permanent employment, moreover, that where such a project has strong regional linkages, the impact can be very substantial indeed.

Further comments on these results will be made in chapter 6, where the two case studies are compared; while comments on the broader policy implications will be made in chapter 7. The following chapter reinforces the findings of this case study, and extends the analysis by a consideration of the impact of a complex of projects which have extensive regional linkages.

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1. But with similar migration effects.

CHAPTER 5

The Economic Impact of the Highlands and Islands Development Board's Investment in Fisheries

Introduction

The H.I.D.B. have now been in existence for six years and hence it is possible and also desirable to start to review the impact they have had on the Highland economy. It is the aim of this second case study to show how the model developed above can be used to quantify the impact which H.I.D.B. investment in one sector of the economy has had on the overall level of income and employment in the region. The sector chosen for study, fisheries, is one on which the Board have concentrated a considerable proportion of their investments[1] and therefore it is important to try to measure how successful this investment has been. For the purposes of this chapter, investment in fisheries covers not only investment in the actual fishing boats but also fish processing and boat building.[2] In addition to measuring the impact on the region as a whole, an attempt is made to indicate the impact of the investment in fishing boats, on each of four separate sub-regions within the Highlands region.

A study of the impact of the industry is thought to be important in its own right, not only as a step in the measurement of the impact of the Board and development of a regional policy strategy but also because of the special characteristics of the industry. On the whole, the industry is one of small units, widely dispersed throughout the Highlands and Islands. As an industry

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1. Fishing boats and fish farms alone accounted for some 29% of total grants and loan approvals 1965-1970 (H.I.D.B., 1970).

2. But not in the ancillary trades more loosely linked with the fishing industry.

based on natural resources, it is capable of providing a livelihood for people in island or other communities distant from the main centres of population, areas which by the very nature of their isolation are unlikely to be attractive to many industrial and commercial concerns. In this respect, the study provides an interesting contrast with the pulp and paper mill.

Since the methodological problems of estimating the impact of the fishing fleet are more complex than those of estimating the impact of boatbuilding and fish processing, the chapter will be divided into two main sections: section A deals with the impact of the fishing fleet and section B with the impact of the boatyards and processing factories. In each case, the model and data used are discussed before any results in terms of the impact of the investment are presented. Section C of the chapter aggregates the results of the earlier sections and also draws some tentative conclusions.

A. The Impact of the H.I.D.B. Sponsored Fishing Fleet

1. The Multiplicand

Previous chapters[1] have stressed the need to specify the multiplicand clearly. This need is reinforced when discussing the impact of additional fishing boats, for there are three distinct effects on income and employment in the region. These are:

i). the personal income of the skipper and crew of the boat,

ii) the Local Value Added on the purchases made by the boat, e.g. fishing gear and repairs and,

iii) the additional Local Value Added stemming from the increase in local landings in the region.

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1. See chapters two and three.

The impact on local income and employment of the first two components is fairly obvious. The third component, i.e. the impact of the increased landings of fish on the region, must also be included in the analysis, because it will generate a net addition to employment and income, mainly in local processing but also, to a lesser extent, in handling and transport, where the catch is shipped straight out of the region. In these respects, it represents a separate source of increased Local Value Added over and above that generated by the boat itself. For each of these components in the multiplicand it is necessary to estimate how much of the expenditure is in the Highlands and, also, what proportion of it is Local Value Added.

The expansion of the multiplicand which is necessary to estimate the full impact of the fishing boats is set out formally below. This specifies in detail for this case study the factors discussed in general terms in the theory chapter.

If for each H.I.D.B. boat operating in 1970:

A_j = personal earnings of the skipper and crew of the j'th boat,

B_{ij} = expenditure of the j'th boat (i.e. running costs)

C_{ij} = value of sales of fish of the j'th boat

J^a, J^b, J^c, = increase in local value added in each of the above sectors A to C.

α_i = i'th component of a vector of L.V.A. coefficients for each item of expenditure or sales.

β_i = i'th component of a vector of local expenditure coefficients for each item of expenditure or local landings coefficient for sales.

k_r = regional income multiplier: k_e = regional employment multiplier.

Then the upper case multiplicand for all the boats is:

$$(J^a + J^b + J^c)$$

and the overall increase in regional income:

$$\Delta Y = (J^a + J^b + J^c)k_r$$

where:

$$J^a = \sum_{j=1}^{53} \alpha^a \beta^a A_j$$

$$J^b = \sum_{j=1}^{53} \sum_{i=1}^{13} \alpha_i^b \beta_i^b B_{ij} \quad \text{and} \quad J^c = \sum_{j=1}^{53} \sum_{i=1}^{m} \alpha_i^c \beta_i^c C_{ij}.$$

In the lower case this multiplicand must be modified to take account of any loss of unemployment benefits. For consistency, the assumption made is the same as that made in chapter four, namely, that in the upper case there would previously have been 100% immigration or potential emigration, but in the lower case that 50% of persons would previously have been drawing unemployment benefit in the area. Hence in the lower case the multiplicand must be reduced by the extent of the loss of unemployment benefit. This modified income multiplicand is:

$$(J^a + J^b + J^c - U).$$

The increase in total employment in the area, (ΔE), depends on the addition to regional income necessary to create one further job in each of the above sectors.

Thus

$$\Delta E = \left(\frac{J^a}{\ell^a} + \frac{J^b}{\ell^b} + \frac{J^c}{\ell^c}\right) k_e$$

where ℓ^a, ℓ^b, ℓ^c, are the increases in L.V.A. necessary to create an additional job in sectors A to C.

This technique of expanding the multiplicand to include the sectors for boat servicing and fish processing, allows the main input-output linkage effects of the fishing fleet to be incorporated into the model, without the expensive and very time-consuming task of constructing an input-output table for the Highlands.

The Alternative Case

Having specified the components of the income and employment multiplicands, it must next be decided whether these will provide estimates of the gross or the net effects of the Board's policy in sponsoring the additional boats. In fact, the models can only provide estimates of the gross impact on income and employment levels; to obtain estimates of the net effects of the Board's sponsorship, the models' estimates must be adjusted for the alternative case, i.e.for the growth in income and employment which would have taken place in the absence of the Board's activities in this sphere. Given the nature of the multiplicands, this leaves two questions to be answered:

a) How many boats would have been built in the absence of Board assistance? This has obvious repercussions on the net income and employment effects of employment in the boats and in the industries servicing the boats.

b) What would have happened to landings of fish in the Highlands in the absence of Board sponsored boats? The answer to this question will obviously determine the net effects from employment in the processing and carriage of the landings.

In the case of new boats, the Board concentrates its aid on two main categories of applications. The first of these is from potential skippers lacking the experience or financial resources to qualify for assistance from the White Fish Authority (W.F.A.) or Herring Industry Board (H.I.B.). The second category of assistance from the Board is aimed to encourage the development in areas which do not have a tradition of fishing (these boats do not necessarily fall into the previous category).

Whereas the W.F.A. and H.I.B. are charged with the selection of the most suitable candidates on commercial grounds, the Board have a duty to consider the broader social and regional economic development factors as well. This leads the Board to provide assistance to 'higher risk' candidates, who would not normally be qualified to receive W.F.A./H.I.B. grants. As a check on

this, W.F.A./H.I.B. personnel 'sit in' on the selection of the candidates by the Board.[1] This is reasonable and necessary since the W.F.A./H.I.B. actually give the grant to the larger boats[2] while the Board provides the loan element.

If the application does not fit into the categories on which the H.I.D.B. concentrates then it can be referred to the W.F.A./H.I.B. In short, in theory[3] none of the boats sponsored by the Board would qualify for the W.F.A. or H.I.B. assistance and hence it seems very unlikely, given the high capital cost involved, that they would otherwise have been built.

In the case of second-hand boats, the Board are the main Government agency which gives loans to this category of boat in the Highlands; the W.F.A. are empowered to do so but have concentrated their limited resources on new boats, while the H.I.B. have only sponsored a small number of boats in this category. Persons who are given loans to purchase second-hand boats seldom have sufficient financial resources to contemplate buying anything like the same size or age of boat, nor have they sufficient security to raise a commercial loan for this purpose. It may be that some of these persons could have entered the industry by raising funds from another (probably more expensive) source or on a much smaller scale. However, the impression gained from interviewing a number of skippers is that relatively few persons would have been in a position to enter the industry as boat owners in their own right, certainly not in the short-term.

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1. This procedure was less rigidly adhered to in the original stages of the scheme.

2. The level of the grant fluctuates; from December 1966 to December 1968 it was 45%, from then until October it was 40% and now rests at 30%. The grant money for the larger boats (the 'Fisheries Development Scheme') is provided from a special earmarked fund. In the case of the smaller 'dual purpose' boats the Board gives both grant and loan.

3. In practice of course, it is possible that one or two boats may just have met the W.F.A./H.I.B. conditions.

Assuming an unchanged Government policy, the arguments presented above suggest that it may not be unreasonable to attribute all of the increase in income and employment to the activities of the Board. Yet this remains an oversimplification, for although the rate of return on capital employed on most of the boats does not suggest that alternative commercial sources of finance would be readily available, the possibility of some fishermen raising sufficient finance to buy a smaller or older boat cannot be ruled out. This possibility cannot be quantified with any precision; however, the view held is that its impact would be small relative to the total effect measured.

The second main problem can be examined by considering what the landings of fish in the Highlands would have been had the Board not sponsored the additional boats. It is certainly possible to argue that with fewer boats fishing, the landings of other Highland boats would have been higher and that the marginally improved catches might have attracted boats from other areas, these boats in turn may have landed part of their catch in the region. This latter possibility does not seem too important, for these (larger) boats tend to land their catch outside the Highlands in order to take advantage of the higher prices obtainable elsewhere e.g. in the Buchan ports. Even when they do land in the area, e.g. on the N.W. coast, then the sales are seldom to local processors, but are shipped directly out of the region. The possibility of increased landings by local boats of herring and white fish is also unlikely to be very important, since in most areas the H.I.D.B. sponsored fleet is too small to materially reduce the stocks of these species. Though this argument is perhaps less convincing in the case of shellfish.

Again it seems almost impossible to quantify these effects, but the presumption is that they are not very significant in relationship to total landings.

Thus on the grounds that, firstly, it would be extremely difficult, if not impossible, to quantify the effects of growth in the absence of H.I.D.B. sponsorship, and that, secondly, such growth would be very marginal since few boats are

likely to have been built or purchased without H.I.D.B. assistance, it was decided that no estimate would be made of the alternative case. Rather, in view of the above argument, it has been decided to make the simplifying assumption that in this case the net impact of the Board's policy will equal the gross impact.

2. The Multiplier Model

As was the case in the Corpach study, it is necessary to consider whether the model of chapter three needs to be modified to take account of the migration pattern associated with the fisheries projects. It is estimated that only about 5% of those employed on H.I.D.B. fishing boats are immigrants to the region. This low proportion of immigration is not surprising, for fishing is a traditional activity of much of the region; moreover, the Board have instigated a special training scheme, primarily to increase local participation in the industry. How then, does this migration pattern influence the model?

In the upper case, the assumption made throughout, is that 100% of the local people involved would be potential emigrants, this assumption corresponds to that made in chapter three and hence no modification is necessary. In the lower case, the assumption was that only 50% of locally recruited employees would have been potential emigrants. In the Corpach study, where a clear majority[1] of employees fell into the 'migrant' category, it was decided that the use of average propensities was correct. In the fisheries study, where only a bare majority are migrants, the issue is obviously less clear-cut. It could be argued that, for the purpose of producing a lower estimate, marginal propensities should be used. However, in order to maintain compatability with

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1. Some 60% of 'direct' employees were immigrants to the region.

the Corpach study, it has been decided that a bare majority is just sufficient to justify the use of average propensities in the first round.[1] In the subsequent rounds, marginal propensities are used, and the formulation is the same as that in the Corpach study (see pp 67).

3. Data

(i) General Comments

The aim was to collect information on the costs and earnings of as many as possible of the 85 H.I.D.B. sponsored boats which were fishing in 1970. With the assistance of the H.I.D.B., the Department of Agriculture and Fisheries, W.F.A., Fish Salesmen and personal interviews, accounting data was collected for 53 of the boats, an overall sample size of some 63%. However,the attempt to collect information on all boats meant that the realised sample was non-random, with two obvious sources of bias. The coverage of'Fisheries Development Scheme'boats (new boat of over 50') was very good - 90%, whereas that of new dual purpose boats (shellfish/sea angling boats of less than 50') was relatively poor - 25%. Coverage of second-hand boats (of all sizes) was 66%. Hence the obvious bias towards the larger of the new boats.[2]

Detailed earnings, costs and sales data was obtained for each of the boats. These records, which are supposed to be submitted to the Board, and in some cases to the D.A.F.S., are usually compiled by the fish salesmen who often acts as agent to the boat. As such, their records present as accurate a picture of the accounts of the boat as could reasonably be obtained. Attempts were made

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1. The lower case estimate of θ is adjusted according to actual immigration (see appendix 5.2)

2. This bias resulted from the fact that these boats usually use an agent to keep their accounts, whereas the smaller boats do not. The bias was not without advantage, since the larger boats employ more men and hence the coverage of total employment and income generation was better than that suggested by the sample size.

to obtain similar information for some boats by personal interview with the skippers. While the response was almost unanimously helpful, on the whole they were unable to recall details of such records, although their recollections did, in the main, confirm the picture given by the costs and earnings statements. This understandable inability to recall such detail led to the belief that sole reliance on this verbal source of information to extend the sample could lead to inaccuracies. However, information gained from interviews was used in three cases to increase the coverage of small dual purpose boats; here some check was available from another source. In general, though, interviews were used as a check on other sources and as a means of gaining further information and background knowledge.

While the official accounting record for the boat is as accurate as could be obtained, it would be naïve to suggest that such records are completely accurate. In some areas it is known that cash sales are possible. Also there is the possibility of increasing the reported 'costs' of the boat at the expense of personal earnings, with obvious tax advantages. Clearly it was impossible to quantify such inaccuracies but their possible existence means that sales and personal earnings should probably be treated as conservative estimates.

ii) Coefficients of the Income Multiplicand

Estimates of Local Value Added (α) and the proportion of total expenditure or sales made in the Highlands (β), were made on a disaggregated basis for each category of the multiplicand and for each sub-region.[1] Taking the various components of the multiplicand in turn, then, firstly, personal earnings of those working on the boats are entirely L.V.A. by definition. That part of

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1. The coefficients marked prime (') relate to the sub-region, others to the Highland region. See appendix 5.1 for details of the estimates.

the personal expenditure of the crew of the boat which was spent outside the Highlands ($\beta\alpha$ or sub-region $\beta\alpha'$) was extremely difficult to estimate without a detailed expenditure survey; nevertheless from discussions with the individuals concerned, it would seem to be an extremely low proportion of gross income.[1]

The second component of the multiplicand related to expenditure made in respect of the purchases of the boat. Estimates of L.V.A. (α^b), the proportion of purchases made in the Highlands (β^b) and in the sub-region ($\beta^{b'}$) were made for each of the 13 categories of expenditure. The quantitively important L.V.A. (α^b) components were estimated either by direct enquiry to firms during visits to the areas or from their trading accounts. In some cases, e.g. fuel or food, the mark-up was assumed to be uniform throughout the Highlands, whereas in others, e.g. repairs, the L.V.A. coefficient was estimated separately for each sub-region. In cases of relatively minor importance, such as miscellaneous expenditure, a conservative guess was made of the likely minimum value of this component. The item which caused most trouble was that for dues, cartage and labour, where it was impossible to separate each item for the purpose of producing an estimate. In this case a rather tentative combined estimate was made.

Estimates of the proportion of local expenditure (β^b) were also made for each item. For some important items, e.g. the purchases of gear or repairs, data was obtained directly from the local fish salesmen for each boat. For other items, e.g. commission, dues or fuel, expenditure was allocated in proportion to the destination of the total sales of the boat. This procedure may in fact

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1. Note that the coefficient estimated here is an attempt to allow for the increased expenditure made by these men outside the area as a consequence of their mobile job, and is thus in addition to the standard expenditure made outside the area which is included in the estimate of the propensity to import.

tend to understate local purchases of some items[1], if, as is likely, there is some local bias in purchases. For this reason most food purchases and all insurance and hire charges are assumed to be incurred locally.

To provide figures for the third component of the multiplicand, i.e. the additional stimulus to L.V.A. from the increase in local landings, estimates of local landings (β^{c}') and L.V.A. in processing (α^{c}') were made on a sub-regional basis. For most areas it was possible to get information from local sources on landings by the boats in the sample; those were divided as follows: (i) herring, (ii) white fish,(iii) lobster and crab, (iv) other shellfish (mainly scallops). For each area visited, data was collected for almost all of the processing factories. This enabled the L.V.A. generated by the additional landings of fish to be estimated on a disaggregated basis by the ratio: $\frac{\text{total labour costs and local profits}}{\text{total purchases of fish}}$. However, in areas other than Shetland, the majority of fish landed by local boats is shipped straight out of the region[2] and the only L.V.A. in this case is that in transport and handling. Here the effects on income and employment in the region are very much less than where processing is involved (see Appendix 5.1).

Information on the proportion of fish landed in the region (β^{c}) or sub-region (β^{c}') was obtained from fish salesmen, local Fisheries Officers or from the skippers themselves. However, fish landed locally is not always processed there. Thus the above sources,augmented by further discussions with processors, were used to estimate the percentage of local landings by the boats in the sample which were processed locally (termed γ^{c}, see appendix 5.1).

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1. Particularly in the case of the sub-regional estimates where distances are less.

2. This includes 'klondiking'.

Such estimates must be treated with caution, for few detailed records are kept of the destination of sales of individual boats. Nevertheless the broad picture is clear, with a very high proportion of local landings being processed in Shetland, roughly 95%, against under 25% for the other areas.

(iii) Coefficients of the Employment Multiplicand.

Having gathered data for the income multiplicand, the next step is to repeat the data collection for the multiplicand of the employment multiplier. This multiplicand, it will be remembered, had three components, consisting of employment in the boats themselves, in the industries servicing the boats, and finally in processing their catch. The first component can be taken directly from records which show that, in 1970, 214 men were employed on the 52 boats in the sample. For the remaining two components, numbers employed must be estimated from a calculation of the increase in L.V.A. needed to create an additional job in these sectors (ℓ^b and ℓ^c).

The employment generated by the expenditure on the servicing of the boats was particularly difficult to estimate, since 13 different sectors were involved. In itself, this need not present an unsurmountable difficulty as long as the sectors have broadly similar characteristics. Unfortunately, this is not the case and the L.V.A. necessary to create an additional job is likely to vary considerably between sectors. To take two examples at opposite ends of the spectrum, in sales commision (which is the most difficult to estimate) the amount of L.V.A. required may be double or even treble that in repairs and maintenance. Further uncertainty existed about some other items, hence it was thought that a cautious approach should be taken. To allow for all this, a generous margin was added to the estimate of the L.V.A. needed to create an additional job in the service trades.[1]

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1. See appendix 5.2.

The estimation of numbers employed in processing the catches was made far less uncertain by the generous assistance of the Department of Employment, who provided aggregate estimates of average earnings for each area. Since the wage and salary component of L.V.A. was known from the survey made of processors, such average earnings figures could be used to provide disaggregated sub-regional estimates of L.V.A. necessary to generate an additional job in processing (ℓ^{c}'). Such a disaggregation was worthwhile since earnings did vary fairly markedly between areas. (See appendix 5.1)

(iv) Coefficients of the Regional Multiplier Model

The coefficients of the multiplier model which were calculated for the first case study for 1969, were updated and recalculated on similar assumptions for 1970 (see appendix 5.2). Not very surprisingly, the values of the coefficients did not vary greatly between the two years. One important difference was in the 'lower case' ratio of public service to other workers (θ), which was considerably lower in the second case study, reflecting the lower level of direct immigration associated with the fisheries projects. In addition to the coefficients estimated for 1969, a separate estimate was made of the propensity to import of the sub-regions within the Highlands. The nature of the L.V.A. component for the region (mainly in distribution and local service provision), led to the view that the propensity to import would not be substantially larger for these smaller areas. The average propensity to import for these smaller areas (m') was estimated to be 0.75 as against the comparable figure for the Highlands (m) of 0.71. (See Appendix 5.2)

4. Results

(i) General Comments and Multiplier Calculations.

From the data collected it appears that, on the whole, fishing does provide an adequate standard of life for those engaged in the industry. The recorded average income per crew member of the boats in the sample was some £1,100 in 1970. In addition to this, a further £200 profit on average was distributed per man employed. This was distributed to the owners of the boat, who may

be the whole or part of the crew, or just the skipper of the boat; certainly outside shareholding is rare in H.I.D.B. sponsored boats. Even ignoring the possibility of unrecorded income, this total will be further enlarged by Government transfers, mainly unemployment benefit, which share fishermen are entitled to draw in bad weather, and by other sources of earned and unearned income.[1] By providing reasonably highly paid employment (by Highland standards) the existence of the boats enables many families to continue to live in their original, often remote, communities.[2]

Through the multiplier model which has been constructed, it can be seen that the effect of the personal earnings of skippers and crews is extended through the backward and forward linkages which the fishing industry has in the area, so that the overall expenditures, including these linkages, provide a substantial stimulus to the region.

From the model and the data collected for its use, it is estimated that the value of the income multiplier (k_r) for the Highlands and Islands is in the range 1.38 - 1.53 and the value of the employment multiplier (k_e) in the range 1.31 - 1.64. It must be remembered, however, that these multiplier values are applied, both in the case of income and of employment, to multiplicands which include not only the component for employment in the fishing boats, but also the further components generated by this in employment and income in boat servicing and fish processing. Since the stimulus in each case is provided by the income from employment in the Board sponsored boats, it is meaningful to relate the overall multiplied effects to this single component. Here it is estimated that the final overall increase in income will be between 2.07 and 2.27 times greater than that paid to the employees of the boats, and that

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1. The classic example would be that of the crofter/fisherman, but few of these were included in the sample.

2. One example of the sort of remote community can be kept alive by fishing is the Outer Skerries off the coast of mainland Shetland, where almost the entire population is engaged in fishing or processing the catch of the local boats.

the overall increase in employment will be between 1.85 and 2.55 times greater than this original increase in employment in the region; these figures represent the 'effective' multiplier values (k_r* and k_e* respectively) of the Board's activities in sponsoring the boats. In other words, it is estimated that, for the Highlands and Islands as a whole the creation of one job on a fishing boat will generate a further 1 to 1½ jobs on shore. In the case of income, for every £1 of income directly attributable to the boats catch, a further £1 of income will be added on shore.

Overall, as a result of the addition of the 53 boats for which data was available, total employment in the region has increased by some 400-440 jobs and regional income by some £460,000 to £630,000 p.a.[1] by no means an insubstantial impact.

Interesting and important though it is to know the multiplier impact on the Highlands as a whole, we are able to go further than this, for the results suggest that these multiplier effects are not uniform throughout the region. The results of these disaggregated calculations are presented in Tables 5.1 and 5.2.

Table 5.1

Differential Multipliers

Region		Income Multiplier (k_r) Values		Employment Multiplier (k_e) Values	
		For the sub-region	For the Highlands	For sub-region	For the Highlands
Argyll	U	1.42	1.48	1.65	1.75
	L	1.31	1.36	1.35	1.38
Orkney and Mainland	U	1.44	1.50	1.61	1.68
	L	1.34	1.38	1.31	1.38
Outer Isles	U	1.50	1.55	1.50	1.59
	L	1.36	1.40	1.24	1.27
Shetland	U	1.48	1.54	1.52	1.61
	L	1.34	1.38	1.27	1.31
Highlands and Islands	U		1.53		1.64
	L		1.38		1.31

1. See appendix 5.3

The income and employment multipliers (k_r and k_e) are calculated on two bases, one for the estimated impact on the Highland region as a whole and one for the impact within the sub-region itself. The lower estimates of the sub-regional income multipliers reflect the higher average propensity to import assumed for these areas. It will be observed that the estimated values do not vary greatly between sub-regions, with such variations as do exist, mainly reflecting differences in personal earnings in the individual areas.

Table 5.2

Differential Multipliers: 'Effective Multipliers'

Region		Income Multiplier k_r* Values		Employment Multiplier k_e* Values	
		For the sub-region	For the Highlands	For the sub-region	For the Highlands
Argyll	U	1.79	1.86	2.31	2.45
	L	1.64	1.69	1.74	1.78
Orkney and Mainland	U	1.83	1.90	2.17	2.26
	L	1.71	1.76	1.65	1.70
Outer Isles	U	1.84	2.18	1.86	2.24
	L	1.69	2.02	1.45	1.66
Shetland	U	3.23	3.36	3.30	3.50
	L	3.06	3.15	2.35	2.40
Highlands	U		2.27		2.55
	L		2.07		1.85

On the other hand, effective multipliers for the impact of the boats, both on the sub-region and on the Highlands as a whole, vary considerably. These variations have two sources. Firstly, there will be some variations in the income and employment generated in the industries servicing the boats. The local income and employment generated by the expenditure of the boat depends partly on the type of fishing done and partly on the location, size and age of the vessel, which in turn determines the extent of the pattern of expenditure, e.g. only some 50% of the expenditure of the Outer Isles boats is in the Isles themselves, compared with nearly 100% local expenditure in Shetland. However, since the ratio between additional income:additional employment is so high in

this sector, this has a greater effect on the income than the employment multiplier.

The second and key linkage explaining the considerable differences in local income and employment generation is the degree of local processing. Outer Isles and, to a lesser extent, Orkney and Mainland boats chose to land a considerable proportion of fish outside the local area,[1] whereas in Argyll and Shetland, the proportion landed locally was over 90%. Further, even if the fish were landed locally, they were not necessarily processed there, so that the proportion processed locally varied from about 95% in Shetland to about 10% in Argyll.[1] On the other hand, the average L.V.A. coefficient in processing does not vary widely between regions.[2] Therefore it is the difference in the proportion of the catches landed which are processed locally which provides the major variation in the effective multiplier values.

The combined influence of the above factors produces an interesting range of estimated values for the sub-regional income and employment multiplier effects. Taking the mid-point of the upper and lower estimates for ease of exposition, the average k_e^* figure for impact on the Highland region was 2.2 The employment multiplier impact of the Outer Isles boats was the lowest at 1.95, while that

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1. See Appendix 5.1

2. This average figure does, however, disguise some farly marked differences between species of fish or types of processing e.g. the estimated L.V.A. coefficient for Orkney and Mainland of 0.19 compared with 0.36 - 0.39 elsewhere, is the result of the higher proportion of lobster landings in the former (where 'processing' involves only storage in ponds). The aggregation of the Orkneys boats with those from the mainland is in any case, a somewhat clumsy procedure, however, too few H.I.D.B. boats were operating in Orkney for the full year 1970 to make it worthwhile to calculate separate multipliers for these islands. Hence Orkney and the rest of the Highland mainland (excluding Argyll) were classified together to bring the number of boats in the sample in each area into double figures.

for Shetland was highest at 2.95. The Orkney and mainland boats have only a marginally higher impact multiplier effect than those from the Outer Isles, whereas the Argyll boats have a k_e^* value of 2.1. For the reasons mentioned above, the income multiplier estimates are rather more disparate, with the k_r^* value for the highest region, Shetland, being almost double that for the lowest region, Argyll.

The impact on the individual sub-regions as opposed to the impact on the Highlands is not very much lower, except in the Outer Isles. The explanation of this lies in the fact that the Outer Isles boats land in the adjacent mainland ports to take advantage of higher prices offered there, whereas in other areas, landings outside the local region are also outwith the Highlands.

The impact which the 53 boats in the sample have had on total income and employment in the Highlands and Islands and in each sub-region is calculated in Appendix 5.3.

(ii) Impact of each category of boat sponsored by the Board

Income and employment multipliers are calculated for each main category of boat sponsored by the Board, i.e. Fisheries Development Scheme (F.D.S.), dual purpose and second hand boats. The results of these multiplier calculations are summarised in table 5.3 below:

Table 5.3

Differential Multipliers: by category of boat

Multiplier	F.D.S.		Dual Purpose		Second-Hand	
	Upper	Lower	Upper	Lower	Upper	Lower
Income k_r	1.51	1.38	1.5	1.37	1.53	1.38
k_r^*	2.20	2.02	1.94	1.77	2.33	2.13
Employment k_e	1.65	1.31	1.64	1.38	1.62	1.30
k_e^*	2.55	1.84	2.3	1.8	2.57	1.85

Somewhat surprisingly, the income and employment multipliers do not vary greatly between categories of boat. This is largely due to a series of compensating forces. Personal earnings do vary between the different types of boat in the sample, from an average figure for crew share plus profit of £1,240 per man in second-hand boats, £1,370 per man for F.D.S. boats and £1.600 per man in dual purpose boats.[1] The multiplier effects of the high earnings of the dual purpose boats were offset, partly by a lower percentage expenditure on running costs, but also by the nature of their catch. Their catch was mainly composed of lobsters and crab, which are only stored in the region; such storage obviously has a very limited impact on L.V.A. compared with fish processing. The multiplier impact of the F.D.S. boats was limited by the high proportion of this section of the fleet centred on the Outer Isles.[2] As noted earlier, these boats land a considerable proportion of their catch on the Mainland and this is subsequently shipped directly out of the region with no further processing. In contrast, the second-hand boats have a higher impact than their earnings would suggest. To a minor degree this was due to higher proportionate running costs, but the main factor was the high proportion of second-hand boats in the sample from the Shetlands. As noted earlier almost all of the catch of these Shetland boats was processed locally. Hence the location of the boat was as important, or even more important, as the category of the boat, in determining the size of the multiplier repercussions.

From a policy viewpoint, the similarity in multiplier impact of the different types of boat, conceal very considerable differences in the cost to the exchequer in providing additional employment in the region. The F.D.S. scheme representing a far higher short-term cost per job created than either of the

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1. Since there were only five dual purpose boats in the sample, the results for this category must be treated with caution.

2. In addition, two of these larger boats were able to steam to ports outside the region in order to take advantage of the higher prices offered.

other two categories of boat. However, a discussion of the cost of providing additional employment represents a digression from the main theme of the study and hence will be relegated to a brief appendix. These cost calculations are discussed in appendix 5.4, which discusses the role of multipliers in such calculation and also some implications and limitations of the 'cost per job' approach.

(iii) Projected total impact on the Highlands and Islands

An estimate of the total impact on the region of all 85 H.I.D.B. boats that were operating in 1970 can be obtained by extrapolating the results of the 53 boats in the sample. Total income and employment estimates were estimated by applying the differential multipliers (derived above) to income and employment in those boats which were not covered by the sample. Employment on each boat was known and hence projections could easily be made for each of the three categories of boat. The income generated by each boat was not known and in this case it was taken that each person on board the boat would earn the average income for that category of boat.

These projections by category of boat suggest that between 550 and 760 direct and indirect jobs have been created in the region by the enlargement of the fleet. Also, that regional income has risen by between £660,000 and £880,000 per annum (see table 5.4 below)

Table 5.4

Projected impact of boats operating in 1970

Category of boat	Number of Boats		Total Employment	Total Income Generation		Total Employment Generation	
	Sample	Total	in boats	Upper	Lower	Upper	Lower
F.D.S.	17	19	91	£268,800	£201,700	232	167
Dual Purpose	5	19	40	£126,000	£97,000	92	72
Second-Hand	31	47	169	£487,400	£356,500	434	313
TOTAL	53	85	300	£882,200	£655,200	758	552

Any such extrapolation is obviously open to criticism. The main qualifications to be made are, firstly, that the sample of dual purpose boats is rather small; this is clearly a weakness but fortunately the overall impact of such boats is limited. Secondly, that the impact of the different types of boat will vary according to their geographical distribution. This problem could have been avoided had the projections been made on a sub-regional basis, but these, in turn, would have been open to criticism on the grounds that earnings vary between boats. In defence of the overall estimates, it is possible to point to the satisfactory overall sample size.

B. The Impact of Board Assisted Boatyards and Fish Processing Factories

The Board have reinforced the impact of their investment in the fishing fleet by a closely linked series of investments in boatbuilding and repair yards, fish processing factories and other industries ancillary to the fishing industry. It is the aim of the second section of the chapter to estimate the impact of this further investment. The measured impact excludes employment in 'ancillary' trades, which border on and sometimes go beyond the limits of the fishing industry and hence would only serve to confuse the results. Nevertheless it should be noted that some of these ancillary trades, such as ice-making plants, are very closely linked with the industry and provide a vital service to, and add, perhaps only marginally, to the overall impact of the industry on the Highlands and Islands.

1. The Model

The isolation of the multiplicand effects of boatbuilding yards and fish processing factories does not present many serious new theoretical problems other than those already considered. The income multiplicand used for the fish processing factories was the wages and salaries paid and local profit distributed by each plant in 1970, i.e. only the J^a component. J^c is zero, since all of the processed fish is sold for direct consumption. Other than labour services, the only purchses made in the region that would have any substantial effect on income and employment are those of fish itself; other

local purchases being minimal. If the extension of fish processing facilities in the region stimulated a net expansion of the local fleet or increased fishing effort by the existing fleet, then this net ~~expression~~ could be attributed to the processing factories, i.e. J^b would be positive. Such an expansion of fishing effort would mainly come about through the stimulus of higher prices for fish landed locally. However, given the market structure of the industry, it is thought unlikely that any price rise would be large, nor would supply be sensitive to small price changes. Hence, for the purposes of this study, any such 'net expansion' effects will be assumed to be negligible and J^b is taken to be zero. The multiplicand for boatyards is also taken to be only J^a, since 'other' local purchases are negligible and the 'finishing' activities are completed in the boatyard, i.e. J^b and $J^c = 0$.

Given this simple multiplicand, there is no 'effective multiplier' complication and standard income and employment multipliers (k_r and k_e) can be applied to estimate the total increase in income and employment. Since the migration pattern is similar in these factories to that in the fishing boats, then the model will be applied using the same assumptions as were used in the earlier part of the fisheries study. (see section 2).

One additional problem which arises when dealing with fish processing factories, is that of deciding how to treat part time and seasonal workers. No problem arises in the initial enumeration of 'direct' employees, where these categories can simply be shown separately,[1] but a problem does arise in estimating their multiplier effect. The difficulty here is that a migrant seasonal worker does not create a permanent addition to demand for public services in a region, while part-time workers may not have the same impact on demand for these services as full-time workers. It is tempting to argue that the effect of such

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1. Though data, particularly on seasonal workers, is likely to be less reliable.

workers can be ignored and therefore reduce the ratio of public service to 'other workers' (θ) accordingly. But this may be misleading, for example, it is possible that the existence of part-time or seasonal work could be the 'balancing factor', which keeps a family in a region, perhaps by enabling them to achieve their 'target' minimum acceptable standard of living. In this example, the impact could be substantial. Unfortunately, no simple solution to this problem has been found. The approach taken is to assume that five part-time and seasonal workers[1] are equivalent to one full-time worker, from the point of view of generating demand for and hence employment in public services. The multiplicand is adjusted accordingly. This is obviously not a very satisfactory solution, However, it is felt that such a conservative estimate is unlikely to overstate the impact on employment in these services. Since the inclusion of such part-time and seasonal workers influences the employment multiplier results fairly significantly,[2] then these results are shown in two ways, the first including such workers in the multiplicand, and the second excluding them.

A second problem in the relationship between parts A and B of the fisheries case study arises. It is possible that there may be some double counting, because some of the impact of the boats may be included again in the impact of the factories. A gross estimate of the impact of the processing factories sponsored by the Board takes no account of the fact that some of the throughput of these factories (and hence some of the employment in them) is generated by landings of H.I.D.B. boats. The processing of such landings of H.I.D.B. boats is included in the estimate of the impact of the boats (see section A). However, there will only be double counting to the extent to which this is a net addition to the work done by these factories. It is not possible to quantify the extent

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1. No breakdown of the categories is available.

2. Obviously such workers earn much less, on average, than full time workers.

of such possible double counting, because no data is available on the destination of the sales of individual boats. However, there is reason to suppose that this double counting will not be important; (i) H.I.D.B. boats are not tied in any way to H.I.D.B. factories, and (ii) Board sponsored boats only land a small proportion of the total fish landed in the region.

The Alternative Case

Following the procedure adopted for estimating the impact of the boats (see section A.1), the estimates which follow are of the gross impact on income and employment of the Board's investment in boatyards and processing factories. No attempt is made to project the possible growth of these sectors of the regional economy had assistance not been available from the Board. The presumption again being that any such expansion would have been marginal.[1] An advantage of this procedure is that all estimates in the fisheries study are presented on a comparable basis. Obviously if some reliable method were available to estimate the hypothetical alternative case, then this would have been calculated. Three possible methods of projecting the alternative case could be suggested but none were thought to be practicable. Direct questioning of the factory owners/managers was tried and rejected on the grounds that the results were heavily biased. Projections of the trend rate of growth prior to the Board's intervention was rejected, partly because of a lack of suitable data, and also because of the downward bias which would be implicit in such a method. The third possibility, the inspection of the financial position of each firm prior to the granting of assistance,was ruled out through lack of data. However, if time and resources were available at some future date, such investigation of the alternative case would be warranted.

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1. This view is endorsed by at least one author, see Russell (1972, p.24)

2. Data

Information was sought for all boatyards and processing factories that fulfilled two basic requirements; firstly, that they had received substantial (in relation to their total size) help from the Board and secondly, that they had been operating for the full year 1970. Accounting data was available from Board records for 50% of boatyards and 80% of processing factories assisted, and where possible this data was backed up by personal interviews.[1] Although only 50% of the boatyards are included, this represents 80% of total employment and in fact all of the larger firms, both boatyards and processing factories, are included in the sample.

The main problems which arose with the data were; firstly, that of allocating any distributed profit element between regional and extra-regional distribution. This was overcome by a study of the ownership of each firm, if the firm was locally owned, then profit distribution was assumed to be 'local', whereas, if it was owned by an outside (non-Highland) group, then profits were assumed to be distributed outside the region. Given the type of companies involved, this seems likely to give a tolerably accurate result. However, in some cases this procedure must be considered somewhat arbitrary.

A second problem arises in the presentation of the gross estimate of the impact of the factories. If a completely new factory is built with substantial Board assistance, then no problem arises; for current employment can be used as an indication of the gross impact. But if the assistance was given to provide additional employment in an existing factory, then it is difficult to decide exactly how much additional employment this assistance has actually created.

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1. To factories in Argyll, Orkney, Shetland and the Outer Isles.

In this case, the Board's own estimate of the additional employment created was used, except when this looked totally unreasonable. For example, in one case a grant of £400 was estimated to create 9 jobs, the capital/labour ratio this implies did not seem reasonable, whereas a loan of £17,000 to create 10 jobs looked quite reasonable. This is obviously an arbitrary judgement, and hence factories were only excluded from the sample if, as appeared in a few cases, the data looked completely out of line. This unsatisfactory procedure was adopted on the grounds that it was better to reduce the scope of the survey than to include highly implausible data.

Fortunately the picture is not as black as it is painted, for it is mainly in the case of small firms with only a handful of jobs involved that such improbable cases arose. In the case of large firms, personal interviews and other sources were used in an attempt to eliminate any gross errors. Nevertheless, the data used in this section is less reliable than that used elsewhere in the study.

3. Results

(i) Boatbuilding and repair yards

The investment in boatyards is complementary to the Board's investment in fishing boats in the Highlands. This investment in boatyards increases the regional impact of the expansion of the fishing fleet, since all of the smaller new boats and some of the larger boats sponsored by the Board were built in Highland yards.

The secondary impact of the boatyards is mainly felt through their direct purchases of labour services, since their purchases of other materials from the Highland region are very limited. Since the boatyards' employees are, on average, paid in the region of £1,000 per annum, then the multiplier effects of their expenditure are not insubstantial. The employment multiplier estimate

is 1.46 and the income multiplier estimate is 1.47.[1] Thus the 65 men employed in the 5 yards in the sample are estimated to generate an increase in total employment of about 95 men and of regional income about £100,000.

The aggregate impact of all 10 yards assisted by the Board has been estimated by applying the income and employment multipliers calculated for the yards in the sample. It is known that these five extra yards employ only 19 men. If it is assumed that they earn the average income for the yards included in the sample, then the overall increase in employment generated is estimated to be about 120 persons and the total increase in regional income to about £130,000 These estimates for the sample and total impact are presented in table 5.5 below.

Table 5.5

Impact of Board Sponsored Boatyards

Sample Data : 1970

Number of yards	Income		Employment (full-time)	Income Multiplier (k_r)		Employment Multiplier(k_e)	
	Upper	Lower		Upper	Lower	Upper	Lower
5	£74,600	£59,000	65	1.54	1.41	1.62	1.3

Estimated Total Impact on Highlands and Islands: 1970

Number of yards	Employment	Income Generation		Employment Generation	
		Upper	Lower	Upper	Lower
10	84	£148,000	£107,400	135	110

1. This estimate, and those which follow, are the mid-point of the range indicated in table 5.5 and later of table 5.6.

(ii) Impact of Board sponsored processing factories

The sample included twelve of the fifteen processing factories that had received substantial help from the Board up to December 1969. These factories employed a total of 460 persons in 1970, of whom, some 220 were part-time and seasonal workers. While full-time male employees were relatively well paid, usually in the income range £1,000 to £1,500 per annum depending upon the area,[1] women were less well paid, sometimes only averaging less than half of the male earnings; on average, part-time and seasonal workers only earned a fraction of full-time earnings. Hence the overall earnings in 1970 of the 460 workers was a relatively modest £277,000. Because of their distorting influence, it would have been desirable to exclude seasonal workers from the sample, however, since earnings data was only available for each factory on a total annual basis, it was impossible to do so.

As noted in the methodology section above, the calculation of the secondary repercussions is further complicated by the presence of these part-time and seasonal workers. Their expenditure in the area has an income multiplier effect in the normal way,[2] but their impact on employment is less certain. The inclusion of these part-time workers in the multiplicand considerably reduces the employment multiplier effects of such factories, the mid-point estimate being only 1.25. It is possible to indicate the extent of this influence by attributing all of the impact of the factories to full-time workers, in which case the employment multiplier estimate is 1.48, i.e. roughly comparable to that in the boatyards. Clearly this inability to isolate the impact of full-time workers is unsatisfactory, and recalculation of the multipliers would be necessary should further data become available.

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1. See appendix 5.1 (table C)

2. But they may spend a lower proportion in the Highlands.

Table 5.6

Impact of Board Sponsored Processing Factories

Sample Data : 1970

Number of factories	Income		Employment		Income Multiplier(k_r)		Employment Multiplier(k_e)	
	Upper	Lower	Part-time	Full-time	Upper	Lower	Upper	Lower
12	£276,600	£217,000	220	240	1.56	1.42	1.34	1.15

Estimated total impact on the Highlands and Islands : 1970

Number of factories	Employment		Income Generation		Employment	
	Part-time	Full-time	Upper	Lower	Upper	Lower
15	233	269	£475,400	£339,700	675	580

Data derived from the 12 factories in the sample (see table 5.6 above) suggests that employment in the region has risen by about 570 workers (of whom 220 are part-time) as a result of their existence. Extrapolating these relationships to the other factories raises the overall impact on employment in the region to about 630 workers and the overall impact on income to about £410,000 per annum.[1]

C. Conclusions

By assisting individuals with limited experience and financial resources and by concentrating their attention on areas with no tradition of fishing, the H.I.D.B. have involved themselves in the 'high risk' end of the fishing fleet. One might, therefore, expect the performance of these boats, and hence the impact of this policy, to be rather limited. However, the results of this

1. Again the mid-point of the estimated range is given for ease of exploitation.

study suggest that not only have the boats provided fairly remunerative employment for those who work on them, but also that the multiplier repercussions on income and employment in the Highlands have been quite substantial.

The overall or 'effective' income multiplier effect on the Highlands is estimated to be in the range 2.1 to 2.3 and the corresponding 'effective' employment multiplier is estimated to be in the range 1.9 to 2.5. Within this average impact on the Highlands, it has been suggested that the income and employment multiplier effects vary considerably from one area to another, with the highest (mid-point) k_e* value, that for Shetland, being more than half as great again as that for the Outer Isles. The income multipliers are even more disparate. With the (mid-point) k_r* value for Shetland being almost double that for Argyll.

On the other hand, the multipliers for the different categories of H.I.D.B. assisted boats do not vary greatly. Earnings vary between different categories of boats, but these differences have been offset, at least for the boats in the sample, by other factors such as the pattern of landings of the boats, or the degree of development of processing in the sub-region in which they are operating. Thus, in the short period, the location of the boat appears to be the dominant influence as far as its total multiplier impact is concerned.

Investment in the fishing fleet has been reinforced and complemented by a related series of investments in boatbuilding yards and fish processing factories. The expansion of the boatbuilding yards has enabled all of the smaller dual-purpose and some of the larger boats to be built within the Highlands and Islands, thus maximising the impact of the expansion of the H.I.D.B. assisted fishing fleet. The employment multiplier impact of such boatyards is not insubstantial at a value of 1.46, but rather more limited than in the case of the fishing boats because of the weak linkages which these yards have with other industries in the Highlands.

The Board's investment in fish processing helps to maximise the impact of the fishing effort in the region, with a vivid contrast being drawn between the impact of the fishing fleet in Shetland and that in Lewis. This investment has a considerable impact in terms of direct labour requirement. However, given the employment pattern and relatively low average earnings in these factories, the employment multiplier impact is limited. When full-time, part-time and seasonal workers are included, then the employment multiplier is only 1.25, attributing all of the impact to full-time workers produces an employment multiplier of 1.48.

Finally, it is possible to use the multiplier estimate to calculate the overall impact of all H.I.D.B. investment in fisheries. The aggregate results in terms of income and employment generated in 1970[1] are presented in table 5.7 below.

Table 5.7

Forecast Total Impact of all Board Assistance to Fisheries Projects - 1970

Category of Project assisted by H.I.D.B.	Direct employment in boats or factories	Total Income Generated		Total Employment Generated	
		Upper	Lower	Upper	Lower
Fishing Boats	300	£882,000	£655,000	758	552
Boatyards	84	£148,000	£107,000	135	110
Processing Factories	502	£475,000	£340,000	675	580
TOTAL IMPACT ON HIGHLANDS AND ISLANDS	886	£1,505,000	£1,102,000	1,568	1,242

Overall, the results indicate that almost 900 jobs were created directly by assistance to fisheries projects and that total employment in the area rose by some 1,250 to 1,550 jobs; while total regional income rose by £1.1 to £1.5 million per annum.

1. In boats or factories that were operating for the whole of 1970. It should also be noted that 1970 was an above trend year as far as landings in the Highlands were concerned, which will obviously have a favourable impact on the results.

Thus the original objective of this case study has been achieved by the use of the regional multiplier model developed in chapter three. The technique has provided a framework, which enables the direct and indirect effects of the H.I.D.B.'s portfolio of investments in one important sector of the Highland economy to be isolated and quantified. Clearly, the technique could also be applied to estimate the impact of the Board's investment in other sectors in the region's economy.

It remains to compare the multiplier estimates of these projects with those made for the Corpach study, this will be done in the next chapter.

CHAPTER 6

Comparison of the Case Studies: The Pulp and Paper Mill and the Fisheries Projects

Both case studies were intended to illustrate the use of the regional multiplier model developed in chapter three. It is now possible to reflect on how this model has been adapted to measure the impact of different types of project and to provide a brief comparison of the results of the two studies.

A. Comparison of Techniques

Since the initial stimulus to income and employment in the region was quite different in each study; a major single investment against a portfolio of dispersed investments. Then it is evident that a clear specification of the multiplicand is necessary and the framework of the model helps to achieve this. The pulp mill and the fishing fleet both have strong regional input-output linkages. The case studies illustrate how the main backward linkages of the pulp mill and backward and forward linkages of the fishing boats, can be incorporated into the regional multiplier model. Thus one important feature of the studies is to illustrate how, by this device, the regional multiplier can be enhanced as a tool of regional analysis. The boatyards and fish processing factories have very weak regional linkages and hence, by providing a contrast, these studies help to highlight the effect of such linkages.

The most obvious difference between the projects is in the dispersion of their initial impact; the fishing boats are sited along the entire littoral of the region, whereas the impact of the pulp mill itself is concentrated on the Fort William area. The distinction is not quite so clear cut, since the

since the purchases of pulpwood are made from a fairly wide radius[1] and hence activity in forestry is stimulated over a fairly wide area. Nevertheless there is a considerable difference between the dispersion of the two projects; not only are the existing fishing boats more widely spread but new investment in boats can be channelled to particular communities. Both these features are attractive from a policy viewpoint, since in many remote communities there are a limited number of alternative means of providing employment.

The geographical dispersion of the fishing fleet suggested another line of investigation, to test the hypothesis that the multiplier impact of the boats might vary between areas of the Highlands and Islands. Investigation confirmed that this was in fact the case and that the differential in multiplier effects was quite marked between areas. This attempt to provide a sub-regional breakdown of multiplier effects in the Highlands and Islands is a second important distinguishing feature of the fisheries study. The technique of providing a sub-regional breakdown of the multiplicand alone is thought to be a useful one, for in many industries the main inter-regional differences are likely to be in the degree of first-round input-output linkages.[2] Such differences in the extent of local linkage effects are, in many cases, likely to outweigh differences in personal income multipliers between regions (c.f. Steele, 1969). Certainly this is thought to be the case in the study of the sub-regional impact of the fishing fleet, and no attempt was made to estimate separate personal income multipliers for each sub-region. While such variations undoubtedly exist,[3] it is questionable how significant they would be

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1. The average 'haul' to the mill was some 80 miles in 1969, however, Scottish Pulp and Paper Mills hope that this figure can be halved.

2. For example, it would be interesting to apply the analysis to a £1m. change in demand for a range of products in different regions of the U.K.

3. Especially in view of the large 'catchall' region - Orkney and Mainland.

and not easy to see how they could be isolated without the use of expensive, time-consuming surveys. Any such differences are in any case likely to be dwarfed by the major differences in the input-output linkages.

The multiplicand was estimated in a very different way for each study. For the pulpmill, indirect income and employment generation was estimated from a knowledge of physical import requirements of the plant[1], whereas for fisheries projects, expenditure data was used according to the conventions of the model. A feature of this second case study is that, in the main, good data could be obtained even for the very complicated multiplicand involved. This augers well for future studies, for few projects would be likely to present such heavy demands on data.

A problem which arose in estimating the multiplicand for both projects was that of estimating the likely alternative course of the industry in the absence of the project whose impact was being considered - the so-called 'alternative case'. In the Corpach study, the estimation of the alternative use of timber was thought to be vital, since it is clear that the stock of growing timber would have been utilised to some degree if no pulp mill were built. This required a number of assumptions to be made as to future trends in demand for timber. On the other hand, no attempt was made to estimate the alternatives in the case of the fisheries projects. The assumption was made that, without H.I.D.B. intervention, any spontaneous developments along similar lines would have been so small that they could be ignored with safety. Given that this is a justifiable assumption, then the results of the two studies are strictly comparable, both providing estimates of the net effect of the project.

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1. A further difference being in the inclusion of ~~factory~~ FORESTRY employment in Perthshire. While this definitional problem means that the effective multiplier estimates are not strictly comparable, the result would not be changed very much by the exclusion of Perthshire.

To facilitate comparisons, the regional multiplier estimates (k_r and k_e) have been made on the same basic assumptions. In addition to the assumptions which underlie the multiplier at a national level (see Wilson, 1968), further assumptions need to be made for this study. The most important of these are concerned with the pattern of emigration in the absence of the project under consideration (p.66) and also with the degree of capacity utilisation in the regional labour force in public and private services (see p.70 and p.71).

A complication which arises when comparing the studies is that the multiplier coefficients for the pulp mill were estimated for 1969, while those for the fisheries projects were for 1970. In fact the estimated values of the coefficients did not vary greatly between the two years.[1] Apart from increased earnings in private and public services, which broadly cancel each other out, the only substantive changes in the coefficients reflect the different nature of the two projects. These differences were, firstly, that in the lower case in the fisheries study, a higher degree of excess capacity was assumed to exist in utilisation of the labour force in private services. Employment in services is less likely to be responsive to a thin spread of additional demand, than to a concentration of additional demand, such as that in the Fort William area. The second main difference between the studies, was in the ratio of public servants to total workforce (θ). The ratio was considerably lower in the second study because there was little actual immigration to the region to the region to work in this sector.[2] Taken together, these two factors reduce slightly the value of the value of the 'lower case' estimates of the regional multipliers in the fisheries study.

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1. Had they varied widely, then doubt would have been cast on the usefulness of the technique as a forecasting device.

2. This results in a 27% fall in the value of θ in the lower case, which, in turn, reduces the 'lower case' value of k_r by some 2.4% and of k_e* by some 2.7%.

B. Comparison of Results

It is necessary to bear the above remarks in mind when comparing the results of the studies. To facilitate comparisons, the results, which are set out in table 6.1 below, are presented as the mid-point of the upper and lower range of estimates.[1]

Table 6.1 Comparison of Multiplier Estimates

Project	Income Multipliers		Employment Multipliers	
	k_r	k_r^*	k_e	k_e^*
Pulp and Paper Mill	1.49	2.08	1.54	2.28
Fishing Fleet	1.46	2.18	1.48	2.20
Boatyards	1.48	1.48	1.46	1.46
Fish Processing Factories	1.49	1.49	1.25	1.25
Shetland Boats	1.46	3.26	1.46	2.95
Argyll Boats	1.42	1.77	1.56	2.11
Orkney & Mainland Boats	1.44	1.83	1.53	1.98
Outer Isles Boats	1.47	2.10	1.43	1.95

The regional income multiplier estimates (k_r) for the projects are clustered in the range 1.4 - 1.5. The differences which exist between the estimates for each project reflect differences in earnings per head in the individual

1. Other than for comparative purposes, no special significance is attributed to the mid-point of the range.

projects. Since income generated by public service employment is based on a fixed relationship between initial employment (not income) and public service employment, then, other things being equal, the smaller the initial income base, the larger the income multiplier. No such complication arises in the employment multiplier (k_e),where, ceteris paribus, a higher income per head in the multiplicand will produce a higher employment multiplier value. Again, such differences as exist in income per head between the projects account for most of the divergences which exist between the simple employment multiplier values. All but one of these estimates being in the relatively narrow range 1.43 - 1.56. The striking exception being the low employment multiplier value for fish processing factories, of only 1.25. This exceptionally low value reflects the high proportion of part-time and seasonal workers in this trade. These workers depress the already below average earnings per head in the factories, and on the assumptions made, have a relatively small effect on employment in public services. On the whole, though, the simple income and employment multiplier effects of the projects are not too dissimilar.

Quite a different picture emerges when the overall 'effective multiplier' impact on the region is considered. The sharp division is between the impact of the pulp mill/fishing fleet and the boatyards/processing factories, this division is evident in both the income (k_r*) and employment (k_e*) multipliers. It is, of course, caused by the strong input-output linkages which the former projects have in the area; while the linkages of the latter projects are minimal and hence the effective multiplier effect (k*) is taken to be equal to the simple multiplier effect (k). Thus the studies indicate how important these regional linkages can be. In these cases, they raise the mid-point value of the income multiplier (k_r*) from about 1.5 to over 2.0. The contrast is even more marked in the employment multipliers, with the (mid-point) k_e* values for the fishing fleet and pulp mill being substantially above 2, whereas the k_e* value for boatyards is 1.46 and that for fish processing

factories (with their part-time employees) of only 1.25. Thus, there is a very considerable difference in the overall impact on income and employment in the Highlands of the creation of an additional job or £1 of personal income in these separate activities.

Somewhat surprisingly, the effective multiplier estimates for the impact of the pulp mill and fishing fleet are very close. As noted above, the high overall values of the estimates are produced by the strong regional linkages of each project. In fact, the gross backward linkages of the pulp mill are stronger than the combined backward and forward linkages of the boats. However, it is estimated that a number of people employed in forestry and transport would have been employed in these activities even if no pulp mill had been built. By chance, the removal of employment from the gross impact, produces a net impact of roughly the same strength as the fishing fleet. Even this broad similarity ends when the impact of the fishing fleet is disaggregated on a sub-regional basis. For the effective multiplier estimates vary between the different parts of the region; with the k_e^* value for the region with the strongest linkages, Shetland, being roughly half as great again as those for the other regions.

CHAPTER 7

Conclusions

The conclusions to the thesis are drawn in four sections. Section A briefly outlines the main objectives of the thesis and the methods used to achieve these objectives. Section B reviews the case studies and their results. Section C discusses some possible policy uses of the analysis, and section D outlines some of the problems which remain and, in doing so, indicates areas in need of further research.

A. Objectives and Techniques

The initial objectives of the thesis were; firstly, to develop an analytical framework to estimate the economic impact of various forms of development in the Highlands and Islands and, secondly, to use the model thus developed in case studies of the impact of investment in different sectors of the region's economy. The work was stimulated by the recent U.K. literature on regional impact analysis, which raises a number of interesting and important theoretical and policy issues. It was felt that a detailed study of the impact of specific projects could possibly illuminate some of these theoretical issues. Further, if the model could be made operational, it could make some contribution to the policy debate and act as a general framework for similar studies elsewhere.

In order to achieve these objectives, the first task undertaken was a review of the various tools of regional analysis that could be used to measure the impact of a specific project. Regional input-output analysis was rejected, mainly on the grounds that the amount of data collection involved in the construction of an input-output matrix for the Highlands would be completely impracticable for an individual. Some form of regional multiplier analysis appeared to be much more promising. Consideration of the export base

multiplier concept indicated that, while such a method would have been rapid and relatively simple to calculate, there were serious theoretical and empirical difficulties associated with the approach. The regional income multiplier method was shown to be far more satisfactory theoretically. Moreover, recent work in the field had raised a number of interesting questions, suggesting that further work could prove rewarding, and hence this approach was the one adopted. However, in constructing the model, an attempt was made to retain some of the attractive features of the other techniques. The ease of calculating an employment multiplier using an export base approach was thought to be a major advantage, particularly in policy context. Furthermore, it was noted that the caluclation of the income and employment multiplier impact of the personal expenditure in the region of the employees of a project could seriously understate the effect of a project which had strong regional input-output linkages. For these reasons, an attempt was made to incorporate these two features into the regional income multiplier analysis and, from a methodological viewpoint, these are two distinctive features of the model developed.

The first-round input-output linkages of a project have been incorporated into the analysis by expanding the multiplicand. This simple device is a flexible feature of the model, for such effects can be isolated separately for different activities. The device is potentially important, for local linkages are likely to vary considerably from activity to activity and, for any given activity, between regions or sub-regions. The technique complements the work of Brownrigg (1972), who has shown how the impact of the construction and induced investment effects of a project can also be incorporated into the multiplicand. By expanding the multiplicand in these ways, it should be possible to isolate the main individual features of the regional impact of any expanding or contracting activity.

A second distinctive feature of the model, lies in the attempt to incorporate inter-regional migration as a factor in the computation of the regional multiplier itself. The nature of the region chosen for study, with its long history of emigration, drew attention to the potential influence of this factor. The conclusion reached was, that where inter-regional migration flows are significant, modifications are necessary to the standard regional multiplier. It is argued that the modifications could, in some circumstances, be necessary in the regional multiplier applied to the primary, secondary and tertiary multiplicands and to regions losing population as well as those gaining population. Above all, since migration flows are likely to be more important at a sub-regional level, the modifications are especially relevant in sub-regional impact analysis. In the formal model developed, the modifications proposed are; that where there is 100% immigration or potential emigration, average propensities should be substituted for marginal propensities in the regional income multiplier, in addition, that the influence of migration on the level of current government expenditure in a region should be acknowledged. The impact that additional demand for public services has on income and employment in a region is incorporated in the model initially by means of a simple export base formulation, this is then reinforced by the subsequent interaction of the income and employment multipliers.

B. The Case Studies

The model thus developed is used in two case studies, these demonstrate how the model can be made operational. It is seen how some slight reformulation may be necessary in order to tailor the model to the individual characteristics of the project studied.

The studies indicate how the theoretical modifications to encompass the influence of migration can be incorporated in practice. The amount of immigration associated with a particular project and the nature of the region chosen for study, determine the extent of the modification required and the

strength of the argument for their inclusion. In general, a pragmatic approach is recommended in the use of the modifications, with the disaggregation of the multiplier effects of immigrant and non-immigrant groups as a possibility where sufficient data is available.

The studies also give a practical illustration of the incorporation of the main regional linkages of a project in the multiplicand. A variety of problems are presented in the studies; the pulp mill has strong backward linkages in the region, the boatyards and fish processing factories have negligible linkages, while the fishing boats have a complex of backward and forward linkages. As a further refinement of the technique, disaggregation of the multiplicand on a geographical basis shows how the impact of the fishing fleet varies between different areas of the Highlands and Islands.

The novel features of the analysis are, of course, reflected in the results of the case studies. The importance of the modifications made to incorporate the influence of migration, is demonstrated by the relatively high values of the income multipliers (k_r). To reflect the inevitable uncertainty involved in many of the assumptions made, the estimates for each project have been presented as a relatively wide range. The k_r estimates for the projects are, in fact, fairly narrowly clustered, with the lowest estimate, that for the Argyll boats, being in the range 1.36 - 1.48 and the high estimate, that for the pulp mill in the range 1.44 - 1.54. These estimates made for the Highland sub-region, are above most previous k_r estimates made for the standard planning regions of the U.K., for example, Archibald's (1967) 'best guess' estimate of the minimum value for k_r of 1.25, or the National Institute's (1967) estimate of 1.28, as being the value appropriate to the development areas. That the relatively high estimates for the Highlands stem from the modifications proposed, can easily be demonstrated by recalculating the income multiplier for the region in a conventional formulation this produces a k_r estimate of about 1.2, against the much higher range of

(mid-point) estimates of 1.4 - 1.5, produced by including the modifications. Even allowing for possible data inaccuracies, the influence of the modifications is clearly a substantial one.

The model also produces employment multiplier estimates, again these are influenced in an upward direction by the proposed modifications. With one exception, the mid-point employment multiplier estimates (k_e) were close to 1.5. The exception is the much lower k_e estimate for fish processing factories of 1.25. In part, this lower estimate reflects the influence of the migration pattern, for a high proportion of the workforce of these factories are part-time and seasonal workers, who are thought to have a very limited impact on employment in public services.

The 'effective multiplier' values illustrate the potential importance of the regional linkages of a project in overall income and employment generation. The projects with strong regional linkages, the pulp mill and fishing fleet, have (mid-point) effective income multipliers (k_r^*) of over 2.0., whereas the projects with negligible linkages, the boatyard and fish processing factories, have k_r^* values (= k_r) of only about 1.5. The same striking contrast is noted in the effective employment multipliers, where the projects with strong linkages have k_e^* values substantially above 2.0, whereas the k_e^* value for boatyards is 1.46 and that for fish processing factories is only 1.25. The usefulness of the technique of isolating the first-round input-output linkages of a project in the multiplicand is further illustrated by the sub-regional breakdown of the impact of the fishing fleet. By this procedure, it is shown that the impact of the fleet is far from uniform throughout the Highlands and Islands. The clearest contrast is provided by the impact of the Shetland fleet, which has a k_e^* value of more than half as great again and a k_r^* value of almost double that of the boats from the areas of lowest impact.

The results of the case studies highlight the importance of the modifications proposed, for, where a project has both migration and local linkage effects, its overall impact on income and employment in a region can be very substantial indeed. The studies have demostrated that the analytical framework can be made operational as a means of isolating the regional impact of different types of project. Naturally, this is not meant to imply that all the problems associated with the use of the technique have been solved, and certain conceptual and empirical problems which remain are outlined later in this chapter.

C. Regional Policy

From the review of the literature, it became clear that regional multiplier analysis can play an important role in several aspects of the formulation of regional policy. The specific policy implications of the analysis of this thesis are illustrated in two ways. First, it is suggested that the case study estimates may play a role in the formulation of a regional policy for the Highlands. Secondly, the wider policy implications of the analysis are discussed in the context of the recent U.K. debate.

1. Regional Policy in the Highlands

The important informational role which regional multiplier estimates may play in the formulation of a development strategy for the Highlands may be illustrated quite simply as follows:

Suppose,to take a narrow view, that the sole objective of regional policy in the Highlands is to maximise short-run employment generation, subject to some overall constraint on Government expenditure. Given this single objective, which seems to underline a good deal of policy thinking, then a

knowledge of the relevant multipliers would obviously be crucial. Assuming that the cost to the exchequer was exactly the same in each potential activity, then activities could simply be ranked according to their effective employment multipliers, the 'cut-off' point being decided by the budget constraint. In terms of the results of chapters four and five, this would mean assisting the pulp mill, then fishing boats, then boatyards and, finally, fish processing factories. Naturally, policy could not be based on an analysis of only part of the portfolio of potential employment generating activities, and multipliers would need to be calculated for each sector of the Highland economy. Further, disaggregation within sectors would aid the decision process; thus while tourism may have a lower overall multiplier effect than fisheries, some types of tourist project may have a greater impact than some types of fisheries project. Another basis for such disaggregation would be geographical, and the study of the fishing fleet, indicates how a policy which aimed to maximise total regional employment would necessitate a concentration of investment on certain areas within the region where the multiplier effects are highest. Though caution is necessary here, for the marginal impact would probably diverge from the average for a major expansion of activity in any one area.

Relaxing the assumption made above, that the cost to the exchequer of providing a job is equal in each activity, presents no particular difficulties. All that is required is a ranking of projects according to the amount of development assistance given per job created (directly and indirectly) in each activity. Such a calculation may well change the ranking provided by the employment multipliers above. For example, while the employment multiplier impact of each type of fishing boat sponsored by the Board are roughly comparable, the cost per job created (direct and indirect), is almost four times as high in the F.D.S. scheme as in second-hand boats, with obvious policy implications

given a single objective.[1]

The employment multiplier estimates alone provide a basis for choice given this limited objective of regional policy, but since, in practice, there are several policy objectives for the region, the employment multiplier estimates can provide only a starting point for such a strategy.

An additional short-run consideration may be to maximise regional income generation.[2] Here the regional income multipliers will obviously perform the same informational role as the employment multipliers. In many cases, it seems likely that the income multipliers will be closely related to the employment multipliers and thus there would be no conflict of objectives. However, it is likely that some activities will have greater income generating capacity (direct and indirect) than other activities, in this case a conflict of objectives arises. The problem is one with two policy targets and, following the analysis of Tinbergen (1952), requires two policy instruments. In this simple case, provided acceptable targets can be agreed for each objective, the problem can be resolved by assigning one set of activities to the income generation target and the others to employment generation. This oversimplified

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1. An interesting theoretical question arises as to whether a ranking according to employment multiplier effects would lead to the stimulation of labour intensive industries in the region (see Wilson, 1969). While such a tendency would be present, this is not necessarily the case, since the employment multiplier depends, inter alia, on the earnings in the activity concerned and the degree of local input-output linkages. These are not necessarily associated with the labour intensity of the activity.

2. If the objective is to maximise real income per capita then the policy maker would not be indifferent between projects employing local or immigrant labour, though an argument of the thesis is that employment of the latter may have a greater overall multiplier impact.

example indicates the type of policy mix that can be used and the role which the income and employment multipliers play in the decision process.

To broaden the analysis, it is possible to expand the objective function. For example, if it is thought desirable to satisfy the locational preferences of individuals or to maintain certain communities at a 'viable size', then it is no longer acceptable to maximise total income and employment in a region. For, in the Highland context, this could involve the exclusive concentration of aid in certain 'growth centres', with the partial depopulation of the more remote areas of the region. To deal with this problem, a constraint could be placed on the maximum acceptable degree of concentration of population. The technique of disaggregating the linkage effects at a sub-regional level, means that the regional multiplier technique is capable of providing valuable information to aid in this decision also. For example, the calculations indicate that fisheries projects are ideal in their dispersion of impact, not only of the direct effect, but also of the indirect effect on the sub-region. Of course, fishing is not alone in demonstrating this property, but it may differ in degree from manufacturing industry, which typically finds greater advantage in agglomeration. A priori the policy solution would again seem to be one of assignment, for example, the establishment of growth points to attract manufacturing enterprises, while assigning the responsibility for geographical dispersion to sectors such as tourism and fisheries. But clearly, further analysis would be necessary to justify such a presumption.

Other factors may enter the objective function. In addition to a concern about the dispersion of income and employment, there may be targets for the inter-personal distribution of income, for the stability of that income stream, and for an optimum growth rate of social real income. Comparative static multiplier analysis can only play a limited informational role in such considerations.

In short, this brief discussion suggests that a knowledge of the relevant income and employment multipliers is extremely valuable in formulating a regional development strategy in an area like the Highlands. However, given that the policy maker is likely to have broader objectives than just maximising the level of short-run income and employment in the region, then the multipliers can be seen to be one of several important considerations in the formulation of such a strategy.

2. General Policy Implications

The more general policy conclusions of the thesis stem from the incorporation of the influence of inter-regional migration on the operation of the regional multiplier itself. The conclusion drawn was that, where immigration or potential emigration are significant, the use of standard form of regional multiplier will tend to understate the full income and employment generation effects of a project which creates permenent employment. Three main policy conclusions follow from this:

The multiplier estimates for U.K. regions made in the latter half of the 1960's (see chapter two), may have caused a certain amount of 'multiplier pessimism' in regional policy thinking. However, the case studies have shown that, where a project attracts immigrants to or halts emigration from a region or sub-region, then the regional multiplier effect will be higher than that suggested by previous estimates of the 'standard' regional multiplier. In addition, the effective multiplier estimates indicate the potential of local input-output linkages for generating further regional income and employment. This suggests that by concentrating on the 'standard' personal income multiplier, the previous U.K. authors may have tended to draw excessively pessimistic conclusions. The analysis and estimates of this thesis have shown that policies which create permanent employment may, in some circumstances, be much more effective than was suggested by these earlier estimates.

The second policy implication, which may be even more significant for planning purposes, is the sub-regional impact. While the impact of migration on the value of the multiplier is likely to be significant at planning region level, it may be even more important at sub-regional level. A new development in a sub-region is likely to draw immigrants from other parts of the planning region as well as from other regions; similarly it may halt emigration to other parts of the planning region as well as other regions. At least up to the point where daily commuting becomes prevalent, the smaller the region chosen for study, the more likely is immigration (or lack of emigration) to be important. This will tend to offset the higher propensity to import which the small region will have. Hence the regional multiplier will not necessarily decline as rapidly in a small region as might be expected from a consideration of its propensity to import alone.

The third general point to be made, is relevant to the debate as to whether to 'move the bodies' or 'move the jobs'. A study of the regional multiplier effects indicates that inter-regional migration flows do not necessarily act as the pure equilibrating force of neo-classical static equilibrium theory. In addition to the 'definite distabilising offsets' mentioned by Archibald (1967), it is necessary to add a further consideration. Namely, that when such migration takes place, the regional multiplier effect itself will be greater than the standard multiplier effect when no migration is involved. This will obviously make the task of reaching inter-regional equilibrium through the migration of labour even more difficult.

D. Limitations and Problems

The nature of the projects and of the region studied, led to a decision to concentrate on the lasting income and employment multiplier effects of the secondary multiplicand. The stimulus from the construction of a project was ignored because of its temporary nature. As were any induced investment effects; such effects were thought to be relatively unimportant in the region

because of the degree of underutilisation of productive capacity. A new development in the Highlands is unlikely to produce the same stimulus in terms of induced investment, as would occur in a region where capacity is fully utilised. For the most part, the situation is one where new projects prevent a rundown of population, this may sustain facilities which would otherwise have closed and, in the short-term at least, have a minimal effect on the level of investment in the region. In the long run, the facilities which are kept in operation in the 'excess capacity' region will wear out or become obsolete and there will be a need for replacement investment, hence the investment which takes place in the nature of 'induced replacement investment'. This is obviously somewhat different in character, and certainly different in timing, from the type of investment considered by Archibald (1967) or Brownrigg (1972). It would seem that no successful work has been done on the complicated lag structure which would be involved in isolating induced investment effects in a region where capacity is underutilised, suggesting an area for further analysis.

Similar remarks are appropriate when considering the timing of the regional multiplier itself. No attempt has been made to estimate the likely lags in the operation of the regional income or employment multiplier. Such knowledge would be of particular value in regional policy, for example, in estimating the lag between the granting of Government assistance to a development region and the impact on other regions of the country. A knowledge of the strength and timing of this impact on the relatively overheated regions of the country would be necessary before attempts at inter-regional fine tuning, such as those suggested by Wilson (1968), could be contemplated. In view of the difficulty of estimating such reaction lags at a national level, one might expect that a satisfactory answer to this problem is still some way off.

Timing apart, several other problems remain in the analysis of the thesis and in the estimation of the value of the multiplier for the region. Some

important problems are outlined below. The lack of adequate regional data in the U.K., makes the estimation of income and employment multipliers for any region a difficult task. A particular problem as far as this thesis was concerned was the complete absence of data on inter-regional trade flows between the Highlands and the rest of the U.K. This necessitated the use of indirect means of estimating the propensity to import of the region; such indirect estimates are obviously somewhat unsatisfactory. On the other hand, the task of collecting data on inter-regional trade flows is daunting. Even if such information on trade flows were available,this would still leave the problem of estimating the marginal propensity to import. One benefit arising from the earlier argument of the thesis, is that in some circumstances it may even be desirable to use average and not marginal propensities. Such average propensities are, of course, easier to estimate and may also be more stable.

An empirical problem which arises when calculating an employment multiplier from an income multiplier, is to estimate by how much value added in a region must increase on average before one further job is created. On the assumptions made in the 'upper case' estimate, the most important of which being an equilibrium degree of undercapacity in the region, an increase in L.V.A. equal to average earnings plus the payroll taxes, will suffice to create an additional job in the service trades. The assumption about the degree of capacity utilisation is obviously critical. Observation suggest that in the Highland context there is some degree of underutilisation in the existing employed labour force. Hence in the 'lower case' estimate,an 'allowance' has been made for an improvement in labour productivity resulting from an increase in aggregate demand in the region. Obviously this rather arbitrary procedure is unsatisfactory and further work is necessary. However, it is equally clear that empirical work on the degree of labour utilisation and the reaction of employment to an increase, or slower rate of decline, of demand, would involve an extremely difficult and delicate excercise.

sited, say 10-15 miles from a large city, if only because there is less likelihood of direct purchases from the city. The thin spread of population in the region also suggests that there will be a higher than average employment in transport and distribution and that the scope for local production will be improved to the extent that transport costs confer a certain local monopoly effect. There would seem to be scope for further research here; integrating the spatial analysis of regional microeconomics into the macroeconomic framework of the regional multiplier.

Overall, it is hoped that despite these limitations and problems, the model developed in the thesis will provide a useful and flexible instrument of regional analysis. The technique offers an advance over the relatively crude export base approach and compliments the more comprehensive technique of regional input-output analysis. In the form developed, the model is relatively straightforward to operate and less demanding in terms of data, technical expertise and time requirements than input-output analysis. Hence its operation should not be outwith any regional, or most local, planning authorities who wish to estimate the income and employment impact of the expansion (or contraction) of a project, or of a sector of their region's economy. Naturally, the approach is not without its limitations but the other approaches also have their weaknesses. Whichever technique is used, it is evident that the results will be influenced by the pattern of regional migration and it is hoped that the analysis of this thesis will draw attention to the need to consider such migration flows as a factor in the computation of the regional multiplier and in regional impact analysis generally.

THE STATISTICAL APPENDICES TO CHAPTER 2

APPENDIX 2:1

Regional Multipliers: A J Brown and Associates

The following model is an abbreviated version of the model developed by Brown, Bowers and Lind of the National Institute. It is set out to illustrate the type of regional multiplier model that has been used in the U.K. and acts as a reference point for other models of its type.

If for a region A:

Y_a = change in GNP (factor cost)

C_a = change in consumers' behaviour (market prices)

T_{da} = change in direct tax payments

T_{ia} = change in indirect tax payments (net)

G_a = change in government expenditure on value added in A

M_a = change in imports for consumption (from outside regions)

R_a = change in net transfers to households in the region.

Then if exports and investment are unchanged

$$Y_a = C_a + G_a - M_a - T_{ia}$$

If $C_a = c(Y_a - T_{da} + R_a)$

$T_{da} = t_d Y_a$

$T_{ia} = t_i C_a$

$R_a = -uY_a$

and $M_a = m_a C_a$

Then: $Y_a = cY_a(1-t_d - u)(1-m_a-t_i) + G_a$

and k (the regional multiplier) $= \dfrac{1}{1-c(1-t_d-u)(1-m_a-t_i)}$

The repercussions on (and from) the rest of the country are as follows:

If: M_b = B's extra imports for consumption from outside itself

= M_{bf}, foreign imports = $m_f C_b$

+ M_{br}, imports from the rest of the country (i.e. from A)

= $m_{br} Y_b (1-t_a-u)$

Hence, $$Y_a = \frac{G_a + m_{br} Y_b (1-t_a-u)}{1-c(1-t_d-u)(1-m_a-t_i)}$$ (call the denominator leakage L_a)

and $$Y_b = \frac{m_{ar} Y_a (1-t_d-u)}{1-c(1-t_d-u)(1-m_b-t_i)}$$ (call the denominator leakage L_b)

Then the full repercussions formulation is:

$$Y_a = \frac{G_a L_a}{L_a L_b - (m_{ar}(1-t_d-u))(m_{br}(1-t_d-u))}$$

THE STATISTICAL APPENDICES TO CHAPTER 4

APPENDIX 4.1

Alternative employment in Forestry and Transport

Not all of the 800 jobs estimated to be created in forestry and transport can be considered as new employment generated by the pulp mill. The question of what would have happened to forestry employment had the mill not been built remains unanswered. No precise answer is possible, since it relies on a hypothetical assessment of the market for Scottish timber in the absence of the mill.

The majority of the initial year's intake of Scottish pulpwood is the result of thinning forests which were planted in the pre-war period. The mill started at a time when the traditional demand for Scottish thinnings for pitprops was declining rapidly, almost halving in the period 1962 - 1968. This may suggest that at existing prices, no ready market would be found for the present volume of thinnings in the absence of a pulp mill. It is possible that another fairly large user of thinnings might have been found, e.g. a chip-board mill, but this is unlikely to have used the same volume of timber. Again, at a lower roadside price, thinnings could have been shipped to pulpmills in England. Sawmills may also have used more timber in the absence of a pulp mill.

Againstthis background an estimate is attempted on the following assumptions:
a) that no major user(s) of thinnings on a scale comparable with the pulp mill would be found. This would weaken the price of thinnings.
b) Lower prices would reduce the attractiveness of the thinnings; instead many forests would be clear-felled at a later date.
c) That all timber would be felled eventually, so that the fall in demand for labour would, in part, be a temporary one.

On these assumptions the production of thinnings would have been lower had the mill not been built. As a result of this there would also be a fall in the

production of sawmill timber, which is a joint product. The extent of the fall in the demand for timber, and hence in the demand for labour to extract such timber is extremely difficult to judge. As a first estimate, it is suggested that somewhere between 300 and 500 can be considered as a figure for additional employment created by the pulp mill. The first figure is used as a lower estimate of employment generated, the latter as an upper figure.

APPENDIX 4.2

Average Tax Rate (t) and Ratio of Unemployment Benefit to Income(u)

Average National Insurance and Graduated Pension Rates

Rates were calculated on the basis of the following assumptions:

(i) The percentage breakdown into male and female employment is 83:17 in the mill and 95:5 in forestry and transport.

(ii) No allowance is made for juniors (under 18) or part-time workers.

(iii) In calculating the graduated pension contribution, no employees are contracted out and all are assumed to earn the mean income of £1,140 per annum.

On these assumptions, the average rate of insurance and pension contribution payable is some 6 per cent. of mean earnings. If anything, these assumptions would seem to introduce a slight upward bias to the estimate.

Average Income Tax Rate

The assumptions made in this case were:

(i) That 75 per cent. of employees would be married men and 25 per cent. single or married women. This split is based on marriage patterns in the pulpmill.

(ii) Since most married men in the pulpmill are young, it is assumed that on average they will have 1.5 children (the national average for those married 5 years.)

(iii) That the average income for single and married couples was £1,140 per annum.

(iv) Other allowances, e.g. mortgage interest or life assurance, are ignored. After these allowances had been subtracted, the average tax rate for a married couple worked out at 8.9 per cent and for a single person at 20.3 per cent. An overall average tax rate (t) of 11.9 per cent.

Ratio of unemployment Benefit to Income

The upper case emigration assumption applies implies no loss of unemployment benefit.

In the lower case, the assumption was that 50 per cent of the workers were previously unemployed. If it is further assumed that only male workers in the industries concerned would have been drawing unemployment benefit and that the benefit drawn by each male worker was for a household of four persons, then, at the rates of benefit payable on January, 1969 and the average earnings of service workers calculated in appendix D, the estimated value of u is 0.1.

APPENDIX 4.3

Calculation of the Local Value Added Component in Consumers' Expenditure

Family consumption expenditure in Scotland, broken down by category of expenditure and averaged over the period 1965-1967, was obtained from the D.E.P. Estimates of L.V.A. component were made for each of the 94 categories of expenditure; these fall into three basic types:

(i) Items in which the only L.V.A. component was in retail distribution. For most of these, it was possible to find national figures for average retail margins.[1] In this case L.V.A. was taken to be retail margin expressed as a percentage of selling price (including purchase tax). The main source of information on retail margins was the N.B.P.I. The use of retail mark-up information is thought to be justified in the Highland context for two reasons; firstly, because it is most unlikely that price cutting will be more prevalent in the region than nationwide and secondly, because of the distances involved, people are unlikely to do much of their shopping outside the area. For a smaller (geographical) area, this second problem could become serious. Even in the Highlands, an analogous problem does exist, for mail order purchasing may be more prevalent.

(ii) For an intermediary non-retail group, such as electricity supply, where the Highland L.V.A. component was not thought to be significantly different from the national average, estimates made by Archibald (1967) of minimum L.V.A. were used.

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1. Sources: N.B.P.I. Report No. 55: Distributors' margins in relation to manufacturers' recommended prices, February, 1968, and also reports 13, 20, 21 and 97.

(iii) For a third grouping, no national estimates were available. In these cases estimates were made as to a likely minimum L.V.A. value. A considerable proportion of the food sector and most personal services fell into this category.

Since public service employment will be considered separately, the L.V.A. component in expenditure on rates, rents to local authorities, educational expenses and medical dental fees is assumed to be zero.

A summary of the results of the detailed analysis is given in Table A4.1

TABLE A4.1

Estimated L.V.A. by Category of Expenditure

Category	Percentage of Scottish Expenditure A	Estimated L.V.A. for each category B	AB
Housing*	8.67	.18	1.56
Fuel light and power	6.68	.19	1.27
Food	28.49	.41	11.68
Drink and tobacco	11.53	.09	1.04
Clothing and footwear	10.21	.33	3.37
Durable household goods	7.43	.31	2.30
Other goods	6.07	.27	1.64
Transport and vehicles	11.05	.22	2.43
Services (inc. holidays)	9.43	.37	3.49
Miscellaneous	0.44	.2	0.09
Total	100.0		28.87

* Private sector rent, repairs and maintenance.

APPENDIX 4.4

Calculation of Additional L.V.A. Necessary to Create One Extra Job in the Service Industries

(a) Average Incomes in Distribution and Miscellaneous Services.

No comprehensive statistics are available for earnings in distribution and other services. However, special studies have been undertaken nationally for selling staff in retail distribution and the latest of these is used to calculate average earnings in distribution.

A weighted average earnings of male and females over 21 was calculated for stores employing under 100 persons. These national figures were deflated to Scottish levels by assuming that Scottish average earnings in distribution were the same proportion of the U.K. average as were earnings in manufacturing. On this basis, the May 1968 earnings were just over £1,000 per annum for an adult male and just under £500 per annum for an adult female. The only Scottish earnings figures available were those for miscellaneous services and these were roughly comparable with those calculated for distribution.

In the absence of regional data, the distribution estimates are taken as earnings in the service trades. The payroll taxes, national insurance and S.E.T. must be added. This raises the gross cost to the employer (excluding fringe benefits) of an additional employee to £1,142 per annum per adult male and £636 per annum per adult female. If it assumed that the Scottish ratio of female:male employees in these trades applied in the Highlands, then the average cost to the employer of an additional employee would be some £830 per annum.

(b) L.V.A. per Additional Job (ℓ)

1. Upper Estimate

For the upper estimate, £830 per annum is taken as the additional local income necessary to create, or prevent the loss of one (adult) job in the service trades. For this to be so, certain simplifying assumptions must be made:

(i) That the proportion of profits included in L.V.A., but remitted outside the Highlands is small enough to be ignored. This may well be justified since the source of most of these leakages, national retail chains, are not very prevalent in the Highlands.

(ii) That the higher rate of corporation tax paid by firms in the area can be ignored, since the majority of businesses will be sole traders with a tax position similar to an individual.

(iii) That retained profits will be included in the estimate of s*.

(iv) That there will be a constant equilibrium degree of under capacity in the area, i.e. on average firms will not reduce the level of their initial excess capacity and hence increased turnover will result in increased employment and not just an increase in productivity. This clearly represents the upper limiting case.

2. Lower Estimate

The relaxation of assumptions (i) to (iii) would probably only cause a small modification in (ℓ). Assumption (iv) is more important, and in the lower estimate, it is assumed that to some extent the increase in turnover will result in higher productivity rather than increased employment. The scope for this appears to be less in Fort William than in the rest of the Highlands. The increase in base load which the mill placed on retail facilities in Fort William appears to have stretched facilities beyond capacity limits in summer. New developments have taken place in the town and its environs and a major new shopping precinct is planned for the town. A similar pattern is probably reflected in other services in the Fort William area. In the rest of the

Highlands, where perhaps 25 to 30 per cent. of the increased spending occurs, the degree of undercapacity is such that a thin spread of increased expenditure may not result in much of a deviation from existing employment trends.

This discussion does not allow a precise estimate to be made. However, it does suggest that the necessary increase in L.V.A. could well be in excess of the average earnings estimate and for the purposes of the excercise, a 'best guess' estimate of ℓ is taken at £1,200 per annum.

Sources:

1. 'Selling Staff in Retail Distribution'. Employment and Productivity Gazette, December, 1968.

2. Statistics on Incomes, Prices, Employment and Productivity, March, 1969.

3. Digest of Scottish Statistics, April, 1969.

APPENDIX 4.5

Employment and Income in Education, Health and Local Authority Services (Public Services)

The Scottish ratio of employment in these services to total workforce (14.8 per cent.) is taken as the basis for the calculation. This ratio is then checked to see whether any marked differences might be expected to apply in the Highlands. The major adjustment made was to reduce the education ratio, to allow for the lower employment in higher education in the Highlands. The use of the Scottish average ratio implies some recognition that the marginal coefficient may be below the average, since the Scottish average ratio is below the Highland average.

In the first round upper estimate, the adjusted ratio of 13.5 per cent. was applied to the first round direct and indirect employment. This was grossed up by a factor of $\frac{(\quad 13.5 \quad)}{(100 - 13.5)}$ x 100 per cent. to allow for the fact that public service workers themselves require these services. For the first round lower estimate, the previous assumption as to migration or unemployment must be considered, for it is only immigrants and potential migrants who could cause employment in this sector to deviate from trend. Hence the ratio is adjusted to exclude the impact of those previously unemployed.

In the subsequent round multiplier, λ is estimated by inserting the previously estimated values in the formula, substituting average propensities produces a value of λ of 0.037 in the upper case and marginal propensities a value of 0.01 in the lower case.

Average Income of Public Service Employees

The assumptions made are:-

(i) That the Scottish male:female ratio in these services can be applied.

(ii) That a 50:50 split between wage:salaried workers is appropriate.

(iii) Scottish average earnings figures for each group of workers was used when available, otherwise it was assumed that earnings were 96 per cent of U.K. average.

Sources:

Statistics on Incomes, Prices, Employment and Production, March, 1969.

Employment and Productivity Gazette, March, 1967.

Digest of Scottish Statistics, April, 1969.

THE STATISTICAL APPENDICES TO CHAPTER 5.

APPENDIX 5.1

Coefficients of the Multiplicand

Table A 5.1(a)

Mean Multiplicand Coefficients for Fishing Boats : Sub-Regional Estimates

		Argyll	Orkney and Mainland	Outer Isles	Shetland
A	Personal earnings	£64,700	£66,500	£95,000	£51,500
α^a	L.V.A. in A	1.0	1.0	1.0	1.0
β^a	Proportion spent in the Highlands	0.98	1.0	0.97	1.0
$\beta^{a'}$	Proportion spent in sub-region	0.98	1.0	0.97	1.0
B	Expenditure of boats	£41,900	£63,800	£113,100	£56,400
α^b	L.V.A. in B	0.29	0.28	0.27	0.32
β^b	Proportion spent in the Highlands	0.91	0.7	0.93	1.0
$\beta^{b'}$	Proportion spent in sub-region	0.91	0.7	0.47	1.0
C	Total sales of boats	£110,100	£136,100	£222,700	£125,500
α^c	L.V.A. in C	0.06	0.06	0.05	0.36
β^c	Proportion spent in the Highlands	0.9[1]	0.7	0.97	1.0
$\beta^{c'}$	Proportion spent in sub-region	0.9[1]	0.7	0.49[2]	1.0
γ^c	Proportion processed in sub-region	0.09	0.23	0.16	0.96
$\alpha^{c'}$	L.V.A. in processing in sub-region	0.36	0.19	0.39	0.36

1. Subsequent information suggests that this may be a slight underestimate of local landings.

2. Including herring for 'klondiking'.

Table A 5.1(b)

Calculation of the Multiplicand for the Outer Isles Boats[1]

Expenditure of the 19 Outer Isles Boats (B)		L.V.A. (α^b) in each category of B	$\alpha^b B$	Proportion of expenditure in the sub-region ($\beta^{b'}$)	Proportion of expenditure in the Highlands (β^b)	Total impact on income in the sub-region ($\alpha^b \beta^{b'} B$)	Total impact on income in the Highlands ($\alpha^b \beta^b B$)
Sales Commission	10,763	1.00	10,763	0.20	0.97	2,152	10,440
Dues, Cartage & Labour	5,803	0.50	2,902	0.20	0.97	580	2,815
Boxes	281	0.50	141	1.00	1.00	141	141
Ice	1,446	0.35	506	0.37	0.97	187	491
Fuel	19,401	0.11	2,134	0.37	0.97	790	2,070
Food	11,285	0.30*	3,385	0.97	0.97	3,283	4,378
N.H.I.	3,462	-	-	-	-	-	-
Miscellaneous	1,886	0.10	189	0.37	0.97	70	183
Insurance	10,459	0.01	105	1.00	1.00	105	105
Repairs	15,451	0.52	8,034	0.63	0.69	5,061	5,543
Hire Charges	10,366	0.02	207	1.00	1.00	207	207
Gear	20,512	0.08	1,641	0.80	0.95	1,313	1,559
Other	1,986	0.10	199	1.00	1.00	199	119
TOTAL	£113,100		£30,206			£14,088	£28,131
MEAN		0.267		0.466	0,931		

1- This table is intended to indicate the method used, similar tables were calculated for each sub-region.

Table A 5.1(c)

Increase in L.V.A. necessary to generate a further job in the processing sector (ℓ^c)

Estimates of ℓ^c for each of the sub-regions were based on information on earnings patterns in each of the areas, generously provided by the Department of Employment. The estimates reflect average earnings in the area, plus a local profit margin. The marginal value of ℓ^c may vary from the average, for example, because the proportion of female employees employed or the type of processing varies[1], hence it was decided to present the estimates as a range. The lower end of this range was used to produce the upper estimate of employment generated:- the 'upper case' as used throughout the excercise. The estimates for each sub-region were as follows:

	Lower Case	Upper Case
Argyll	£1,300	£1,000
Orkney and Mainland	£1,200	£1,000
Outer Isles	£1,000	£ 800
Shetland	£1,500	£1,100

1. On average women are lower paid, and processes vary in their labour intensity.

APPENDIX 5.2

Coefficients of the regional multiplier model for 1970

1. Average tax rate (t)

The average tax rate and national insurance contributions for employees in the fisheries sector were calculated for 1970, based on average earnings in that year. With one exception, the same assumptions were made as in the first case study (see appendix 4.2). The exception being that all employment was taken to be male. The revised average income tax rate was rather higher in 1970 at 12.5 per cent., however, the average national insurance and graduated pension contribution was slightly lower at 5.5 per cent. Therefore the average tax rate (t) remained constant ie. $t = 0.18$

2. Ratio of unemployment benefit to income

On the assumptions made in 1969 (see appendix 4.2) the estimated value of u had fallen marginally in 1970. However, since the change was very small, it was decided to retain the previous (more conservative) estimate of $u = 0.1$

3. Average propensity to import

Very little additional information became available between the two years which would have allowed m to be completely re-estimated. Hence, on the grounds that average values (e.g. of retail margins) would be unlikely to vary much from year to year, it was decided to use the earlier estimate of $m = 0.71$.

The attempt to estimate the multiplier effect of the fishing boats on a sub-regional basis, necessitates an estimate to be made of the higher (average) propensity to import which would be expected for a smaller area (m'). Despite the fact that three of the sub-regions are very small[1], it is not thought that

1. They may be small, but, except for parts of Argyll, they are probably isolated and hence they have well-developed local facilities. The exception may be the unwieldy Orkney and Mainland region, this will be likely to have much the same m coefficient as the whole region. However, for consistency, m' will be used for this area.

the propensity to import will be very much higher for these areas. This is because the original estimate of m was very much a minimum figure; the local elements mainly being in retail margins and value added in (locally provided) personal services. These sources of L.V.A. will remain for the most part in the smaller areas. The main differences for the smaller areas are thought to lie, partly, in reduced production for local consumption (always very small) and, more significantly, in direct purchases made outside the area. If it is assumed, somewhat arbitrarily, that 20% of clothing, footware, durable household goods, transport and vehicles and 'other goods' are purchased outside the sub-region and that the smaller area produces only half as much of its own foods as does the Highlands region as a whole. Then the average propensity to import would rise from 0.71 to a m' value of 0.75. Obviously, this is a somewhat rough and ready preliminary estimate. Were resources available, it seems likely that survey methods could produce very reasonable estimates, at least for the Island communities.[1]

4. Calculation of additional L.V.A. necessary to create one extra job in the service trades

For the 1970 estimate, additional data was available from the 'New Earnings Survey' carried out by the Department of Employment. Average data for Scotland for manual/non-manual and male/female earnings, were used to calculate a weighted average of earnings in these trades. This sample data is obviously not completely reliable, but it represents some improvement over the use of incomplete national data and one standard regional conversion coefficient.

The earnings estimates for April 1970 were just over £1,200 per annum for an adult male and just under £600 per annum for an adult female. When employers'

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1. Aberdeen University's estimates for the Invergordon region are awaited eagerly.

national insurance and S.E.T. contributions (at December 1970 rates) are added, the gross cost rises to approximately £1,400 and £700 per annum respectively. Based on the same assumptions as the pulp-mill study (see appendix 4.4), this would raise the average cost to the employer of an additional employee to some £970 per annum.

On the previous (limiting) assumption made in the upper case (see appendix 4.4) then an additional £970 per annum of L.V.A. would generate one further job i.e. ℓ = £970. In the lower case estimate, a more generous 'margin' of some 50% has been allowed. This reflects the thinner spread of additional demand for such services generated by the impact of the fisheries projects. Thus the lower case estimate of ℓ is a relatively conservative £1,500.

5. Employment and Income in Education, Health and Local Authority Services (Public Services)

The Scottish ratio of employment in these services to total employment was only slightly higher in 1970 than in 1969. Hence, the earlier ratio was retained, i.e. the upper case value of $\theta = 0.156$. Since there was less direct immigration to work in the fisheries projects, the lower case value of θ was lower than that made for the pulp-mill, the 1970 estimate of θ being 0.8 against 0.11 for 1969.

In 1969, the average earnings in public services was estimated at £970 per annum, by 1970 this figure had risen to some £1,100 per annum. Both estimates were made on the same basis (see appendix 4.5).

The estimates of λ remained unchanged in 1970, i.e. in the upper case $\lambda = 0.037$ in the lower case $\lambda = 0.016$

APPENDIX 5.3

Forecast Increase in Income and Employment in the Highlands[1] Generated by the Boats in the Sample

Table A 5.3(a)

Income

Area		Boats	Direct Processing & Ancillary	Sub-Total	Indirect	Total
Argyll	U	£64,700	£16,400	£81,100	£39,000	£120,100
	L	£56,000	£13,800	£69,800	£25,100	£ 94,900
Orkney & Mainland	U	£66,500	£18,000	£84,500	£42,300	£126,800
	L	£55,000	£15,000	£70,000	£26,600	£ 96,600
Outer Isles	U	£95,000	£38,400	£133,500	£73,400	£206,900
	L	£73,300	£31,900	£105,200	£43,200	£148,400
Shetland	U	£51,500	£60,900	£112,400	£60,700	£173,200
	L	£40,000	£51,200	£ 91,200	£34,700	£125,900
Highland	U	£277,800	£133,800	£411,600	£218,200	£629,800
	L	£224,300	£112,000	£336,200	£129,600	£465,800

Table A 5.3(b)

Employment

Area		Boats	Direct Processing & Ancillary	Sub-Total	Indirect	Total
Argyll	U		14	49	38	87
	L	35	10	45	18	63
Orkney & Mainland	U		16	62	42	104
	L	46	12	58	20	78
Outer Isles	U		36	123	72	195
	L	87	26	113	30	143
Shetland	U		54	100	61	161
	L	46	39	85	26	111
Highland	U		120	334	213	547
	L	214	87	301	94	395

1. The sub-regional estimates indicate the impact of the boats from these regions on the Highlands as a whole. (Income figures are rounded to the nearest £100)

APPENDIX 5.3

Multiplicands for Tables (a) and (b): Impact on the Highlands[1]

Table A 5.3(c)

Income

Area	J_a	J_b	J_c	ΔY(upper)	ΔY(lower)[2]
Argyll	£64,700	£11,000	£5,400	£81,100	£69,800
Orkney & Mainland	£66,500	£12,500	£5,600	£84,500	£70,000
Outer Isles	£95,000	£28,100	£10,300	£133,500	£105,200
Shetland	£51,500	£17,900	£43,000	£112,600	£ 91,200
HIGHLAND	£277,700	£69,500	£64,300	£411,700	£336,200

Table A 5.3(d)

Employment

Area		Boats	ΔE_a	ΔE_b	ΔE_c	ΔE_d
Argyll	U			9	5	49
	L	10	35	6	4	45
Orkney &	U			10	6	62
Mainland	L	12	46	7	5	58
Outer Isles	U			23	13	123
	L	19	87	16	10	113
Shetland	U			15	39	100
	L	11	46	10	29	85
HIGHLAND		53	214	$U_{57/39_L}$	$U_{63/48_L}$	$U_{334/301_L}$

1. The sub-regional estimates indicate the impact of the boats from these regions on the Highlands as a whole. (Income figures are rounded to the nearest £100)
2. Assuming that 50% of persons employed would previously have been drawing unemployment benefit.

APPENDIX 5.3

Forecast Increase in Income and Employment in each Sub-region generated by the Boats in the Sample Located in these Regions[1]

Table A 5.3(e)

Income

Area		Boats	Direct Processing & Ancillary	Sub-Total	Indirect	Total
Argyll	U	£63,500	£16,400	£79,900	£33,500	£113,400
	L	54,700	13,900	68,600	21,300	89,900
Orkney & Mainland	U	66,500	18,000	84,500	37,200	121,700
	L	55,000	15,000	70,000	23,800	93,800
Outer Isles	U	92,200	21,000	113,200	56,600	169,800
	L	70,400	17,300	87,700	31,600	119,300
Shetland	U	51,500	61,000	112,500	53,900	166,400
	L	40,000	51,200	91,200	31,000	122,200

Table A 5.3(f)

Employment

Area		Boats	Direct Processing & Ancillary	Sub-Total	Indirect	Total
Argyll	U		14	49	33	81
	L	35	10	45	17	61
Orkney & Mainland	U		16	62	38	100
	L	46	12	58	18	76
Outer Isles	U		21	108	54	162
	L	87	15	102	24	126
Shetland	U		54	100	52	152
	L	46	39	85	23	108

1. These estimates do not reflect the total impact on the sub-region of the additional boats in the fishing fleet, only of the boats centred in the sub-regions. In fact, it is only in the mainland that a substantial additional effect will be felt, for example, through the landings of the Outer Isles boats on the N.W. coast. (Income figures are rounded to the nearest £100).

APPENDIX 5.3

Multiplicands for Tables (e) and (f): Impact by Sub-Region

Table A 5.3(g)

Income

Area	J_a	J_b	J_c	ΔY upper	ΔY lower
Argyll	£63,500	£11,000	£5,400	£79,900	£68,600
Orkney & Mainland	£66,500	£12,400	£5,600	£84,500	£69,000
Outer Isles	£92,200	£14,100	£7,000	£113,200	£87,700
Shetland	£51,500	£18,000	£43,000	£112,500	£91,200

Table A 5.3(h)

Employment

Area		ΔE_a	ΔE_b	ΔE_c	ΔE_d
Argyll	U		9	5	49
	L	35	6	4	45
Orkney & Mainland	U		10	6	62
	L	46	7	5	58
Outer Isles	U		12	9	108
	L	87	8	7	102
Shetland	U		15	39	100
	L	46	10	29	85

(Income figures rounded to the nearest £100)

APPENDIX 5.4

Government Development Assistance

This appendix estimates the direct cost to the exchequer of providing assistance to the fisheries schemes. The calculations are made on a conventional 'cost per job' basis (see e.g. Board of Trade, 1971). It is clear that the calculation of regional multipliers by providing estimates of indirect employment, allow some refinement of this very crude technique. But since the technique is still thought to be unsatisfactory, little reference is made to the work in the main text. However, the results are of some interest in as much as they point to a field for further analysis.

1. Development Assistance to Fishing Boats

As noted earlier, Government assistance to fishing boats takes two forms, grants and loans. Since a grant obviously involves a greater element of subsidy than a loan and also because the H.I.D.B. do not give grants to new boats in the Fisheries Development Scheme, then these two elements of assistance to the boats will be identified separately. Theoretically, it would be more satisfactory to place the two elements of assistance on the same basis in terms of cost to the exchequer: for it is clear that a pound of loan assistance, which bears interest and is subsequently repaid, does not involve the same resource cost to the exchequer as does a pound of outright grant. But the practical difficulties of reducing loan assistance to a grant equivalent are considerable. For example, it would be necessary to calculate the interest differential between the rate charged in each time period and the 'true' commercial rate applicable to each boat or at least each category of boat. This stream of subsidies would then need to be discounted at an appropriate 'social discount rate'. In short, an extensive hypothetical exercise would be necessary in order to equate the two forms of assistance.

The actual development assistance given is expressed as a 'cost per job' created. These figures provide an indication of the cost to the exchequer of providing additional employment in 1970. Table A 5.4(a), see below, provides an analysis of the cost per job in each type of boat aided by the H.I.D.B. For each category of boat several cost figures are calculated. The first relates to the straight-forward cost per job in the 53 boats in the sample. The second to cost per job for all of the Board sponsored boats operating in 1970. The third estimate reflects the indirect as well as the direct employment generation. This is the 'true' cost per job created overall and represents a more satisfactory measure of the short-term effectiveness of government expenditure than does category (b).[1] The fourth estimate takes account of the boats that have failed in the period, the money lost in reclaiming and reselling the boats is added to the assistance given to the boats operating in 1970, this gives an indication of the total cost to the exchequer of building up the fleet and hence of providing employment in 1970. In practice, the sum actually lost is not very large, for although a number of boats have failed, most of the money has been recovered from payments made and by reclaiming and reselling the boat.[2] Details of the cost per job are set out in table A 5.4(a) below.

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1. Unfortunately, comparable figures are not available for other industries.
2. No account has been taken of the loss in terms of staff time.

Table A 5.4(a)

Development Assistance: H.I.D.B. Boats Operating in 1970

1. Fisheries Development Scheme

		Jobs	Cost per Job	Grant %	Loan %
a)	Sample	82	£6,040	40	60
b)	All F.D.S. boats	91	£6,030	40	60
c)	Total direct and indirect employment i) upper	232	£2,360	40	60
	ii) lower	167	£3,290	40	60
b)*	All F.D.S. boats + sums written off[1]	91	£6,370	43	57

2. Dual Purpose Boats

		Jobs	Cost per job	Grant %	Loan %
a)	Sample	10	£2,720	50	50
b)	All D.P. boats	40	£2,330	45	55
c)	Total direct and indirect employment i) upper	92	£1,010	45	55
	ii) lower	72	£1,300	45	55
b)*	All D.P. boats + sums written off	Negligible			

3. Second Hand Boats

		Jobs	Cost per job	Grant %[2]	Loan %
a)	Sample	122	£1,620	-	100
b)	all second-hand boats	169	£1,610	-	100
c)	Total direct and indirect employment i) upper	434	630	-	100
	ii) lower	313	870	-	100
b)*	All S.H. boats + sums written off	169	£1,650	3	97

1. Treated as grant

2. Some very small grants were made

These calculations suggest that the Fisheries Development Scheme was the most expensive way of providing employment in 1970. This follows from the relatively high capital cost of these boats. The cost per job in the smaller dual purpose boats was somewhat under ½ of that in the F.D.S. boats; so that, even allowing for the rather higher grant element, they represent a less costly form of (short-term) employment provision. Not surprisingly, the provision of second-hand boats is the cheapest way of providing employment in the short-term. The cost per job in these boats is only a little more than ¼ of that in the F.D.S. boats. Moreover, the cost involved is almost exclusively in terms of loan assistance which involves a lower real cost to the exchequer.

It should immediately be pointed out that the obvious conclusion to be drawn from these calculations, i.e. that the Board should concentrate its attention on second-hand boats, is not necessarily the correct one. A number of qualifications are necessary. Firstly, the geographical distribution of additional boats may be different, e.g. if additional F.D.S. boats were provided in Shetland the multiplier effects would be likely to be higher and hence cost per job figure lower than for the existing boats. Secondly, cost per job figures take no account of income generated, such income generation is presumably one objective of the regional policy. Thirdly, the cost per job calculations are for one year only and hence provide limited guidance in the evaluation of alternative investment opportunities which provide jobs over a number of years. It may be worthwhile mentioning some of the factors that might change the balance over time.:

i) Second-hand boats are thoroughly checked before purchase and hence one might expect that the first year or so of operation to be relatively trouble-free. Thereafter, the probability of major trouble is likely to be higher for second-hand than for new boats. Since the H.I.D.B. fleet is young, this factor may not have shown through yet.

ii) On average, the effective life of second-hand boats will be shorter than that of new boats.

iii) Since most of the boats in the sample had not been fishing very long, their results may improve with experience.

iv) Small boats may lack flexibility, for example, they may not be able to move further afield should fishing in their area/inshore deteriorate, or they may lack the power to change the type of fishing they are engaged in.

v) Any particular year may be unrepresentative. For example, 1970 was an above trend year as far as landings of fish in the Highlands were concerned.[1]

This list is obviously not comprehensive, but does indicate that cost per job figures alone do not form a reliable basis for choosing between different types of boat. However, the large differences in the cost per job estimates between different types of boat does not suggest that further analysis could prove rewarding.

2. Development Assistance :- Boatyards and Processing Factories

It is necessary to calculate the 'cost per job' figures for these two types of project in order to compare these effects with the development assistance given to each category of boat.

The average cost of providing a job in a boatyard in 1970 was some £2,200 per annum, of which 32% was grant aid and 68% loan. When indirect employment is included in the calculations, this cost falls to about £1,550 per job.[2]

Comparable figures for the processing factories suggest that the capital cost involved in providing an additional job is lower than that in boatyards. The average cost of providing a full-time job in a processing factory was some

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1. For details see H.I.D.B. 5th Annual Report, 1970, Appendix VII

2. The mid-point of the range £1,400 to £1,700

£1,400 (15% grant and 85% loan); if part-time and seasonal workers are included, this cost is only £750 per annum. When secondary employment generation is taken into the calculation, the cost of a full-time job is some £1.100 and only £600 including part-time and seasonal workers.[1]

Caution must be excercised in interpreting these results, for in addition to the reservations indicated above, another problem of interpretation arises. Calculating the cost per job figures for 1970 takes no account of the fact that these factories may not have reached full capacity by that year. For example, the cost per job figure in boatbuilding is biased upwards by the inclusion of a major investment in a new boatyard, in 1970 this yard was only operating at about half its projected capacity.

It is now possible to rank each of the separate categories of project studied according to the amount of assistance given per job (see table A 5.4(b) below):

Table A 5.4(b)

Development Assistance: By Category of Project

Project	'Cost per Job' (mid-point estimate)	Grant %	Loan %
F.D.S. boats	£2,800	40	60
Boatyards	£1,550	32	68
Dual Purpose boats	£1,150	45	55
Fish processing	£1,100	15	85
Second-hand boats	£ 750	-	100

These intriguing results are, unfortunately, subject to so many qualifications, that they cannot in themselves be recommended as a basis for policy decisions. However, they do point to a potentially fruitful field for further analysis.

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1. The lower employment multiplier, the lower the differential between the cost of direct employment and that of direct plus indirect employment (Cf. the fishing projects).

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The bibliography contains references to the works cited in the text of the thesis. In addition to these references, data has been extracted from a number of Government publications. While the precise references are given in the statistical appendices, the main sources used were: Reports of the National Board for Prices and Incomes, Family Expenditure Surveys, the Department of Employment Gazette (formerly the Department of Employment and Productivity Gazette), Statistics on Incomes, Prices, Employment and Production and the Digest of Scottish Statistics. For the case studies, considerable use has been made of unpublished data supplied by the Department of Agriculture and Fisheries, the Forestry Commission, the Highlands and Islands Development Board and Scottish Pulp and Paper Mills Ltd.

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