THE AMALGAMATION OF AGRICULTURAL HOLDINGS IN SCOTLAND, 1968 - 1973

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This thesis has been composed by myself, and the work on which it is based is my own.

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ABSTRACT

The thesis reports on research into the processes and effects of the amalgamation of agricultural holdings in Scotland between 1968 and 1973. Through the use of information from the Agricultural Census, it was possible to measure with considerable accuracy the rate at which agricultural holdings were amalgamating, and also to describe the socio-economic characteristics of the participating holdings. This showed that the process of amalgamation was particularly rapid in certain parts of Scotland and also among large and owner-occupied holdings.

A programme of field investigation was carried out during 1974 to explain these patterns. A sample of over one hundred amalgamations in several constrasting regions of Scotland was selected using a method of cluster analysis. The analysis of the results from these investigations has provided explanations of these concentrations of amalgamating. Further investigation revealed the criteria by which amalgamation was favoured as a means of expanding a farm, and this demonstrated a weakness in the model of decision-making presently incorporated in the theory of innovation diffusion. A refinement to that model is presented. The extent of the planning preceding an amalgamation, and the changes in the way the land of the expanding holding is used after amalgamation, are also analysed. Since the amalgamation of holdings is actively supported by a system of official financial aid, there is a preliminary analysis of the use made of this aid. Consideration is given also to the broader background to structural change in British agriculture, with particular concern for the reasons which may be advanced for promoting structural change.

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CHAPTER 1

INTRODUCTION

Agricultural geography has been concerned predominantly with describing and explaining the distributions of crops and livestock. Its concern with the study of the economic systems within which these crops and livestock are produced has been much more limited. By contrast, agricultural economists have been aware for a long time that the farms of different sizes which constitute the agricultural industry rarely face the same problems and they have a longstanding interest in the difficulties of those who run very small farms, such as smallholdings and crofts. Geographers have shown an interest in these aspects of agriculture less frequently despite their clear spatial dimension and in particular they have conducted only limited research into the ways large and small farms expand in different areas. The present research will be concerned with evaluating and explaining the changes to Scottish farming which result from the amalgamation of farms.

There are four principal reasons why a study of the amalgamation of farms is valuable. The first is because so little is known about changes in the size structure of agriculture. Very little is known of why some farms expand but others do not, of how farms expand or of why some expand by amalgamation and others expand their economic importance within a stable acreage. The second reason is that many governments in the United Kingdom and elsewhere in Europe have shown considerable interest in the great range of sizes of farms and

particularly in the problem of the small farm. Small farms are a social and an economic problem since generally they combine poverty through low incomes and economic inefficiency for themselves and for the industry as a whole. Successive governments in the United Kingdom have adopted policies for the alleviation of these twin problems of poverty and inefficiency and some of these policies have concentrated on modifying or accelerating the normal trend towards larger farms. It is obviously advantageous to understand how the size structure of an industry changes so that policies to alter the size structure can be set against the background of normal economic and social change. Any policy which seeks to harness a natural trend is likely to be more successful in achieving its aims than one which tries to act against the normal tide of events. So, if policies to alter the size structure of agriculture can be modelled as closely as possible on the normal patterns of farm expansion, then they are more likely to be effective. There is, therefore, a practical benefit which may accrue from the research.

The third reason is more clearly academic in character and is based on one of the more important changes recently in human geography. Geographers have felt increasingly that it was important for them to pursue their studies at a more detailed level than previously. Often this has led them to focus their attention more on the actions of individuals rather than on broad areas of country. This scale of study is advocated on the grounds that the observable spatial distribution of, for example, a population's economic activity is in part at least the sum of the actions of the individual people who comprise that population. So to explain the distribution of economic activity, one

must explain the actions of individual businessmen. Yet there is a clear problem here since the only way one can understand why a person acts in a particular way is by seeing how he acts and by asking him, directly or indirectly, why he decided on that course. There is no certainty that his stated reasons for his actions will be his actual reasons since the latter may be suppressed or he may not have formulated them explicitly. The study of why farmers make particular decisions is beset therefore by complex problems of interpretation. This research will describe farmers' reasons for amalgamating and then will attempt to explain the relationship between their stated reasons and their probable motives and values. Their motives and values define what they hope to gain from their economic environment and this may modify one's judgment of their stated reasons for acting in the way they did. The explanation of a spatial process such as amalgamation requires that note is taken both of stated reasons and of motives. So, the third reason for this research is to examine why farmers decide to amalgamate since it is assumed that only by aggregating these studies of the decisions of individuals can one approach a satisfactory explanation of the national process of amalgamation.

The fourth reason for this research follows on from the last since there is an interest throughout this thesis in how geographers ought to proceed when trying to explain a phenomenon. One feels intuitively that there ought to be some general principles on how an explanation in geography should be formed if it is to be rigorous and in part this consists of being clear about what one means by a "cause" in the social sciences. It is likely that the word will have

different meanings when dealing with the actions of individuals and with aggregated patterns and this will be discussed at some length in Chapter 4. Also, the thesis will be concerned (notably in Chapter 8) with whether a spatial process such as amalgamation requires a distinctively spatial explanation or whether the explanation of a spatial process can be similar to the explanations of the non-spatial facets of that process.

Therefore, the amalgamation of farms is a process which has been studied little by geographers despite being the subject of government action in many countries and it offers the geographer the opportunity to pursue his interests in the structural changes of a sector of the economy both at an aggregated scale and at the scale of the individual farmer. It will allow a comparison of the nature of geographical enquiry at these two scales and also it will provide a comparison between the nature of explanation for spatial and non-spatial aspects of economic change.

The first step is obviously to set the scene for this study through the discussion in Chapter 2 of the background to structural changes in agriculture and the relationship between this and the evolution of the policy of successive British governments for encouraging structural change. There will be an examination of the social and economic justification for such a policy and then, in Chapter 12, the relationship between the policy and the process of amalgamation will be examined briefly. Measurements will be made of the proportion of amalgamations which were assisted by the policy both nationally and regionally. Before this can be done, however, it is necessary to establish the basic parameters of the amalgamation

process between 1968 and 1973 - its scale, its variations over time and spatially and the kinds of farms and farmers participating in it. This is the principal concern in Chapter 3 where the most distinctive aspects of the process of amalgamation will be highlighted by setting amalgamation in the context of Scottish agriculture in general and in the context in particular of both the normal turnover of occupiers and of other types of farm expansion. Considerable emphasis will be placed in this chapter on the methodology required to establish this basic description of the process of amalgamation and several different cartographic devices for presenting the results will be displayed.

The method of research used here is problem-oriented in the sense that the general description of amalgamation in Chapter 3 reveals several problems or dimensions of the process which are unexpected and the causes of which require clarification. In Chapter 4, a detailed discussion is pursued of explanation and causation in geography with a view to defining general principles for constructing an explanation of the unexpected aspects of amalgamation and describing their causes. One of these principles is that it would be very desirable to have more information about individual amalgamations than is available from the agricultural census and, in consequence, it was necessary to draw a sample of amalgamations. This sample would be studied in detail to obtain information which would be used to test competing hypotheses which could explain the unexpected features of the amalgamation process. The sampling procedure is described in Chapter 5 which also provides measures of the quality and representativeness of the sample.

Amalgamation occurs differentially as the size of farms varies. It affects farms of different tenure to different extents and it varies spatially in its incidence. These three anomalous and unexpected aspects of amalgamation are examined in turn in Chapter 6 to 8 so that the effects of farm size, the tenure of a farm and its location in Scotland can be clarified. The biases towards certain sizes of farm and to farms in certain areas amalgamating rapidly will be explained in these chapters by using the information collected from the sample of amalgamations in accordance with the general methodological principles set out in Chapter 4. Chapter 9 broadens the view of the process by attempting, firstly, to link the amalgamation process to the existing body of geographical theory and, secondly, to discover why farmers amalgamated at all. The attractions of this method of expanding the farm business will be noted and then the results will be used to amend the existing theories about how and why entrepreneurs make decisions on how to pursue their businesses when in a situation of uncertainty over the future course of events.

Chapters 10 and 11 consider two lesser aspects of amalgamation. In Chapter 10, the degree of planning which precedes an amalgamation is assessed, while in Chapter 11 the consequences of an amalgamation for the way the land is farmed are defined. Chapter 12 examines the relationship between the British Government's schemes to promote amalgamation and the actual process of structural change, while the final chapter summarises some of the findings of this research and draws certain conclusions regarding the nature of explanation in geography. It also points the way to further research in this field.

Probably the best introduction to the subject of farm amalgamation is through a study of the agricultural and political economy within which it is set and by which it is moulded and this forms the subject of the next chapter.

CHAPTER 2

THE BACKGROUND TO GOVERNMENT POLICY

A study of the amalgamation of farms is one aspect of the study of the size structure of agriculture. The concept of the size structure of farms is a particularly useful one but it can be misleading if the terms "size" and "farm" are not defined.

The size of any economic organisation can be measured in many ways but in practice only two measures are possible for all farms. The first is either the farm's total area or its area of crops and grass. A farm's area is not an accurate measure of its economic importance as can be demonstrated easily. An intensive poultry farm will cover few acres but will employ many people and much capital and will produce a large volume of food. Conversely, the area of the hill sheep farm will exaggerate its economic importance. The only measure of size which sheds some light on the economic importance of farms and which is available for all farms is their standard man-day (smd) size. This measure of size is constructed by weighting each acre of a crop and each head of livestock on a farm by the standard amount of labour needed to look after it for a year. The sum of these weighted acres of crops and head of livestock is the standard man-day size of the farm and this measure of size is now calculated annually for each farm using the return made by the farmer at the census in June. It really represents an approximation to the farm's labour requirements since a farm of 250 smd in Scotland is equated with a farm employing one person

full time and a farm of 600 smd with a farm employing two people full time. The amount of congruence between standard man-day size and volume of output or value of output cannot be assessed but it is usually assumed that standard man-day size is a more accurate indicator of a farm's economic importance than its acreage.

In order to speak unambiguously about the size structure of farms in Scotland, it is necessary also to specify what is meant by the term "farm" since the word is open to several definitions. For this research, the term "farm" will be replaced by the word "holding". A holding is defined officially as any unit of agricultural land which is required by statute to complete a census form. A holding may be the same as a farm, but in other cases a farmer may operate several holdings in which case the farm is a more extensive organisation than the holding. The holding will be used in this case since the official statistics are based on the holding and these statistics will be used extensively in this research.

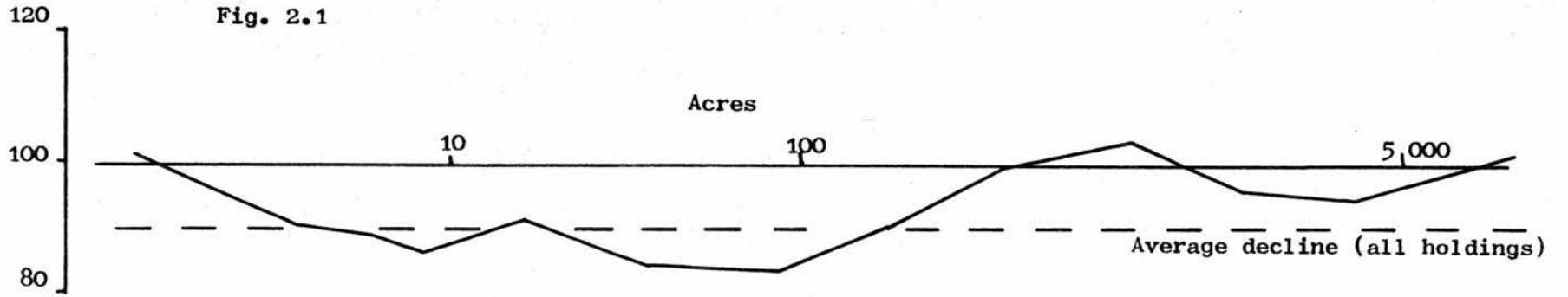
The size structure of Scottish agriculture at any one census can be described quite accurately using the information published annually in "Agricultural Statistics - Scotland". This information is derived from the census of agriculture in June and it shows how many holdings have a total area in each of 13 size classes ranging between one acre and over 5,000 acres. This is available for the whole of Scotland and for each of the counties (now, districts and regions) and comparable frequency distributions are available to show the size structure when size is measured by standard man-days (smd).

It is possible to show that the decline in the number of holdings has affected small and large holdings to different extents. In Figure 2.1, the overall decline in the number of holdings between 1968 and 1973 (a decline of 9.8 per cent) is compared with the decline in each of the 13 acreage

Fig. 2.1 Percentage change in total number of holdings by holding acreage - Scotland, 1968 - 1973

Fig. 2.2 Percentage change in total number of holdings by holding size in standard man-days - Scotland, 1968 - 1973

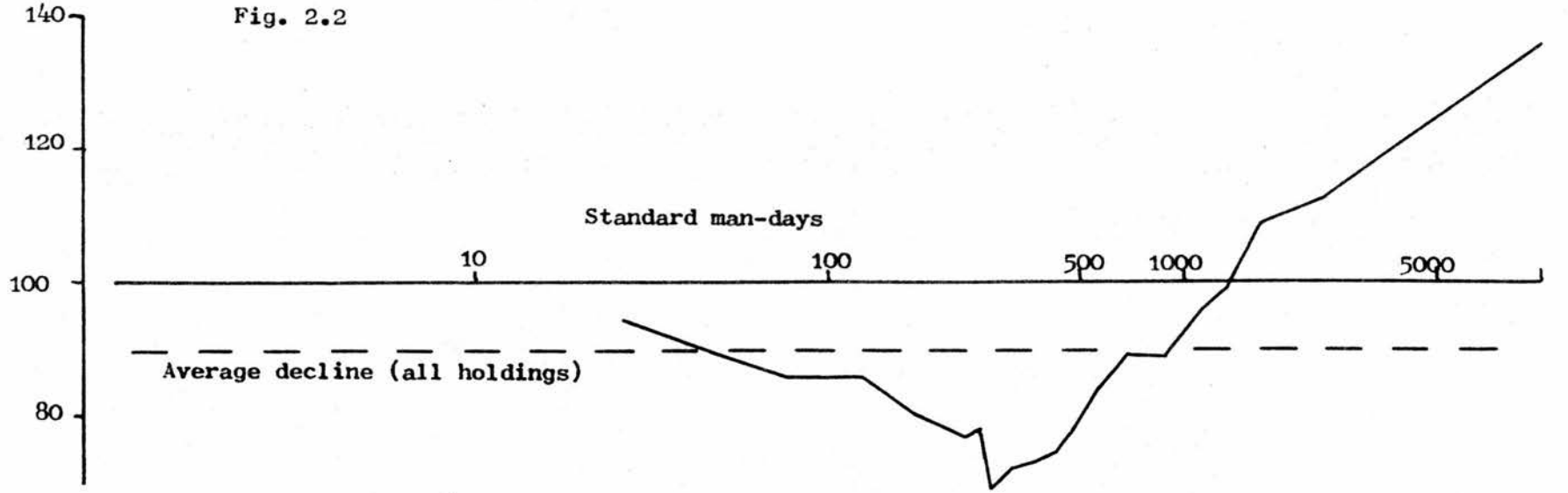
Fig. 2.1



Number of holdings in 1973 as a percentage of holdings in 1968

Source: Agricultural Statistics, Scotland 1968 and 1973

Fig. 2.2



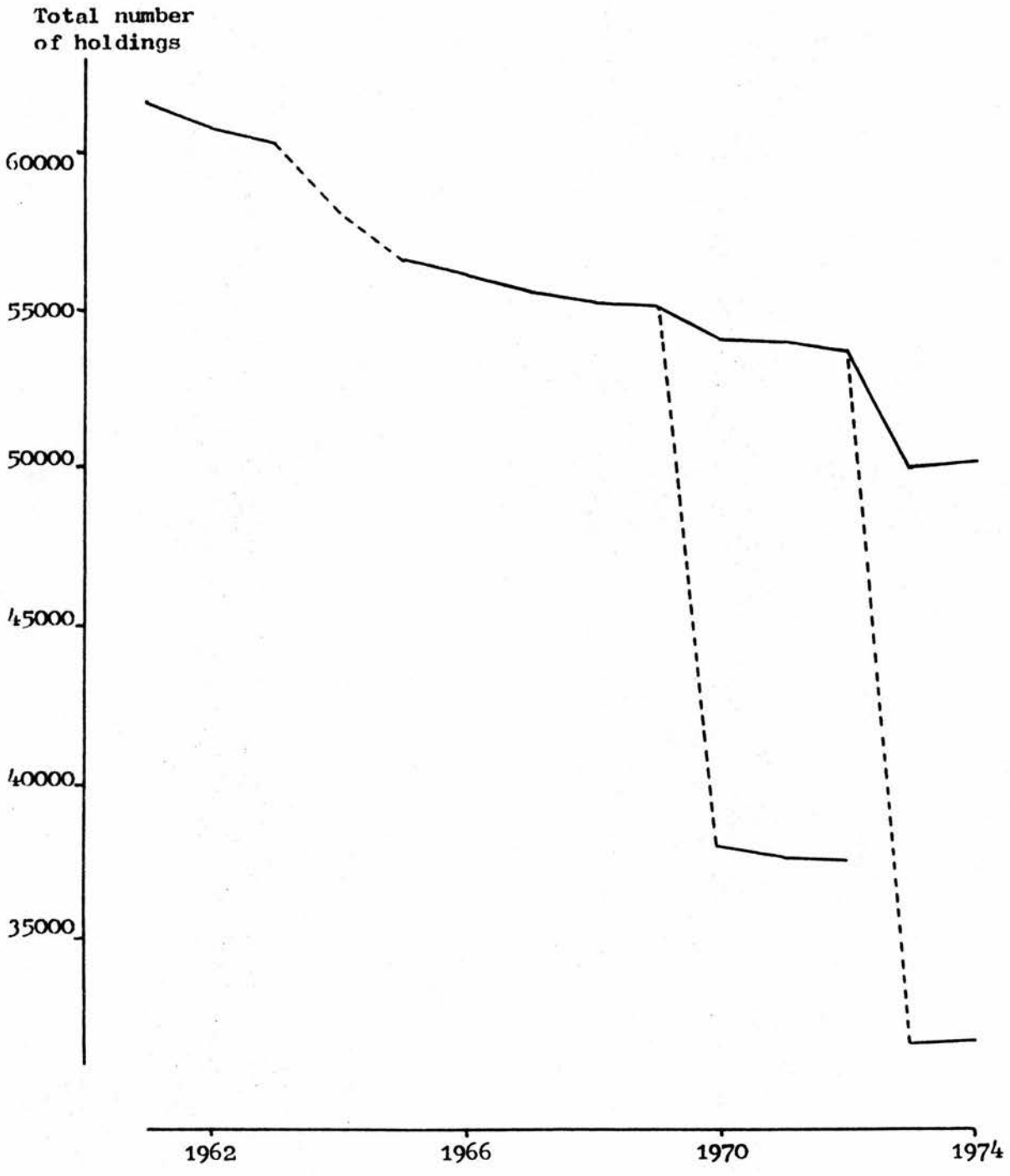
size classes and in Figure 2.2 it is compared with the decline in each of the 19 standard man-day (smd) size classes. Both diagrams show that small holdings have been declining in numbers faster than large holdings. Indeed, some of the very largest holdings, particularly those larger than 1500 smd, have been increasing in numbers. The decline in numbers has been greatest for holdings between 25 and 125 acres and between 275 smd and 400 smd (roughly a one to $1\frac{1}{2}$ man farm). The turning points between below-average and above-average rates of decline are about 250 acres and 1,000 smd (roughly a three-man farm). Comparable figures for England and Wales have been produced by Britton and Hill (1975 pp 31-33). In respect of the rate of decline by acreage, the general pattern of a faster decline for small holdings is similar on both sides of the Border but the rates of decline are much greater in England and Wales than in Scotland for the very small holdings and the rates of increase are much greater than in Scotland for the largest holdings. These features may be due to the great stability of the crofting sector at the lower end of the Scottish size distribution and the greater number of very large upland and hill farms in Scotland at the upper end of the distribution. When the decline is measured in relation to standard man-day size, the patterns of change in Scotland and England/Wales are much more alike, with the turning point between decline and increase in numbers being at about 1,000 smd. The only difference between the two areas is again at the lower end of the size distribution where slower rates of decline in Scotland may reflect the situation in the crofting counties.

It is, however, very difficult to use this abundance of information to obtain a dynamic picture of size structure rather than the purely static picture which the official published data are designed to show.

Consider the simplest case of how many holdings there are in Scotland (irrespective of their size or their location). The static picture - the number of holdings at a single census - is readily available and this has been graphed for the years 1961 to 1974 in Figure 2.3. When one attempts to interpret this so as to understand the dynamic picture - how much change is occurring and why the changes are occurring - then two principal problems arise which combine to obscure the dynamic picture and make its interpretation impossible.

The first and less serious problem concerns changes of definition and official policy. It is difficult to provide a longer series for the total number of holdings because of changes in the definition of a holding. In 1959, the rough grazing used as deer forests was brought into the census and this caused large changes in the acreage of a few holdings. In 1955, the requirement for a census return from every entry in the Valuation Roll was dropped (MAFF and DAFS 1968 p21) and between 1957 and 1959, between 1963 and 1965 and in 1973, the Department of Agriculture and Fisheries for Scotland (DAFS) took active steps to encourage farmers who occupied more than one holding to have these holdings amalgamated into a single holding with a single census form being returned in place of several. Since Figure 2.3 measures the number of holdings (agricultural units for which a census form is completed), there are sharp declines in the number of holdings between 1957 and 1959, 1963 and 1965 and in 1973 which are due to these "paper amalgamations". These periods are marked by the dashed line on Figure 2.3. These short periods produce greater declines in the total number of holdings than do the longer intervening periods when the numbers drift downwards more gently. In other words, the effect of changes in official policy is to tend to

Fig. 2.3 Total number of holdings in Scotland, 1961 - 1974



The pecked line indicates "paper amalgamations" (1963-65) and the removal of statistically insignificant holdings in 1970 (holdings under 26smd) and in 1973 (holdings under 40smd).

Source: Agricultural Statistics, Scotland 1961 - 1974

swamp the less marked "natural" trend in farm numbers. This is particularly obvious in 1970 and 1973. In 1970, some very small holdings were defined officially as statistically insignificant since they had less than 26 smd and they were removed from the census. These statistically insignificant holdings accounted for nearly 30 per cent of all holdings and after 1970 they were to be enumerated triennially rather than biannually, as for other holdings. The number of statistically insignificant holdings is known for 1970 and so the total number of holdings for that year can be calculated by simple addition but this is not possible for 1971 or 1972. In these years, the number of holdings larger than 26 smd is known but the number of insignificant holdings below 26 smd is not, although it is almost certainly not the same as in 1970. However, in the absence of other evidence, it must be assumed that the number is the same as in 1970. Since the rate of decline of holdings is slow, it would require an error of only a thousand in the assumed number of insignificant holdings for comparison between years to become meaningless. An exact figure for the number of insignificant holdings does become available again for 1973 when they were enumerated for the first time since 1970 but there are some complications here. Firstly, the "threshold of insignificance" was raised from 26 smd to 40 smd and secondly, 1973 was one of the principal years in which the DAFS encouraged the amalgamation of holdings. These two influences combine to make a comparison of the 1973 data with those for previous years very difficult.

These problems of definition and of changes in official policy make it very difficult to measure the amount of change which is occurring in the sizes of holdings in Scotland. However, even if such measurement were possible, there would still be formidable problems in interpreting

it since the change in the total number of holdings between any two years is the net loss of holdings. The absolute loss (the gross loss) is greater than the net loss in so far as new holdings are being created constantly. These new holdings, often the result of the division of an existing farm into separate units or of the inclusion in the census of a new farm, tend to offset in part the larger number of holdings which is lost each year to forestry, to urban uses or by amalgamation into another farm. It is, therefore, not possible to say whether an increasing rate of decline in the number of holdings is due to more holdings being lost for whatever reason (amalgamation being only one of the reasons) or to fewer new holdings being created. Either trend would produce the same effect of a greater net loss of holdings which would appear on Figure 2.3 as a steeper decline in the graph.

The published data on the size structure of Scottish agriculture are sometimes inadequate for measuring the amount of "normal" change because of the effect of changes of policy or of definition and it is almost impossible to provide any explanation of how much of the observed decline in the numbers of holdings is due to a single cause such as amalgamation. Clearly, some more direct measurement of amalgamation will be needed because progress in understanding amalgamation more fully will be hardly possible without more accurate measurement. The difficulties and limitations of an approach which relies wholly on aggregated data such as those in Figure 2.3 are well demonstrated by Helmfrid's paper on Sweden (1968) and by Boxley's (1971) research in the USA.

BRITISH GOVERNMENT POLICY TOWARD THE AMALGAMATION OF FARMS

It is against this rather hazy statistical background that the British government has evolved its policy toward amalgamation. The fact

that a need for such a policy has been felt provides one rationale for this research.

As in so many other aspects of agricultural policy, the Agriculture Act 1947 was an important landmark. Prior to 1947, policy on the size structure of agriculture concerned the creation of small holdings under the Land Settlement Schemes which were based on the Small Landholders (Scotland) Acts of 1886, 1911 and 1931. In the 1947 Act and also in the parallel Scottish measure, the Agriculture (Scotland) Act 1948, the Ministers' powers to create and equip such small holdings were renewed. In Scotland, these powers were very similar to those already given to the Secretary of State under the Small Holdings Colonies Acts of 1916 and 1918. The importance of the 1947 Act lay in its transitional character for it contained powers not only to set up small holdings but also to move in the opposite direction, firstly by affecting the layout of farms and secondly by preventing the sub-division of land. In respect of the layout of farms, the Minister of Agriculture was empowered to designate up to three areas where the structure of the holdings was contrary to the full and efficient agricultural use of the land. Within these areas, schemes could be prepared to adjust the boundaries between holdings where these were highly fragmented and also to amalgamate holdings or parts of holdings where this would improve farming efficiency. Powers of compulsory purchase could be used to implement the schemes. In respect of the prevention of the sub-division of land, the Minister was able to purchase any farm where its sub-division had not been agreed by his ministry. These two measures to prevent the fragmentation of holdings and to improve the layout of farms in an area, if necessary by amalgamation, mark the first evidence

of official concern over the number of small farms in the United Kingdom. However, they are little more than an indication of concern because they had no practical effect. They were omitted from the Agriculture (Scotland) Act of 1948 and so applied to England and Wales only and in practice no such schemes were ever used in England or Wales. An attempt to restructure the farms in the first experimental scheme failed because the approval for it from local opinion was lacking (OECD 1964 pp 478-9).

It was another ten years before the next step was taken towards a policy of assisting amalgamations. The Agriculture Act 1957 contained powers for the Minister of Agriculture (or the Secretary of State for Scotland) to make grants towards the cost of private amalgamations anywhere in the United Kingdom. The amalgamation was to result in all the land having the same owner(s) and the same occupier(s), and grant would only be paid where the amalgamation resulted in agricultural land which was not part of an economic unit being brought into such a unit. An economic unit was defined as one "capable of yielding a sufficient livelihood to an occupier reasonably skilled in husbandry." The grant would consist of one third of certain approved costs. These included surveyors' fees, legal costs, stamp duty and disturbance costs which had to be incurred under the Agricultural Holdings Act 1948 (or the Scottish equivalent of 1949). These constituted a very minor financial incentive to amalgamating so it is not surprising that no money was paid out under these Schemes in Scotland (DAFS pers.comm. 2/4/73) and that only 154 applications had been received in England and Wales by 1962 (OECD 1964 p 476). The importance of the 1957 Act lay in four points. Firstly, it concerned private amalgamations or adjustments to

the layout of farms and did not depend on Government initiative, as had the experimental schemes under the 1947 Act. Secondly, the principle was introduced that aid should be given only for those amalgamations which would result in the disappearance of an uneconomic (i.e., small) unit by its being absorbed by a holding which would be of an economic size after the amalgamation. Thirdly, the whole unit after amalgamation had to have a common owner and a common occupier. Fourthly, a link was established between the amount of grant paid and the actual costs incurred during each individual amalgamation.

A further development was the Small Farmer Scheme of 1958. The importance of this measure lay in the fact that aid was given only to small farms of over 20 acres and capable after improvement of employing one man full time. The very smallest farmers were not to receive aid to prolong their farming lives. This was a rather negative sort of structural policy but it has been continued in the Farm Improvement Scheme and in its successor, the Farm Capital Grant Scheme, under which investment subsidies are not given to uncommercial holdings.

The precursor to the first effective measure to assist amalgamations was the white paper The Development of Agriculture (1965). This document set the amalgamation of farms in the context of the "small farm problem", which was defined as occurring at the lower end of the size distribution of holdings in agriculture where the small farmer will "find it more and more difficult to maintain a standard of living in keeping with modern times" (ibid., p 1, para. 1). Four possible solutions were envisaged for the full time small farmer. Firstly, he could increase the size of his business through better management with help under the Small Farmer Scheme. Secondly, he could co-operate with

other farmers to gain some of the benefits of farming and marketing at a larger scale while retaining much of his independence. Thirdly, he could enlarge his farm and his income by obtaining more land. Finally, he could retire and "give up an unrewarding struggle" (ibid., p 1, para. 3).

To assist farmers with the last two alternatives, three schemes were proposed. The first scheme was to encourage the amalgamation of farms in order to create holdings which would employ at least one person full time and, preferably, at least two full time workers. Measures were proposed to ensure the financial soundness and the permanence of the amalgamation and the financial aid to be given was to be extended to 50 per cent of "everything required to carry out an approved private amalgamation scheme" (ibid., p 2, para. 9), although this was not to include the cost of buying land.

The second scheme proposed that the normal rate of structural change should be speeded up by the Agricultural Departments purchasing land which would be suitable for an eventual amalgamation. After the amalgamation, the land would be sold again. This scheme was never put into practice nationally, although the North Pennines Rural Development Board did attempt a similar intervention in the land market during its brief life (Whitby 1974 p 103).

The third scheme involved the payment of a lump sum or an annuity to small farmers who allowed their land to be amalgamated in order to create a commercial unit. The payments would be made only to <u>bona fide</u> farmers who left the industry completely and who earned only a minor part of their income from outside their farms. The amount paid would consist of a basic amount paid to all successful applicants, supplemented by an extra payment which varied in direct proportion to the acreage of the land to be given up. The tone of the White Paper suggested a

generally social rather than economic rationale for these proposed schemes.

Accordingly, the Agriculture Act 1967 provided the powers for one scheme to assist amalgamators and for another to assist those leaving their farms. The scheme to assist amalgamators was wider than that envisaged in the White Paper two years earlier since it allowed grant to be paid for the adjustment of farm boundaries where this fell short of amalgamating. The principle of common ownership and occupation after the amalgamation was maintained, as was the idea that the grant paid to the farmer should cover some substantial proportion of the costs of the amalgamation where these costs were necessary and expedient as a direct consequence of the amalgamation or boundary adjustment. In practice this meant that, where investment other than in land or for livestock was needed so as to make the amalgamation successful, grant would be paid to cover 20 per cent more of the costs of these works than would be paid for the works under the Farm Capital Grant Scheme (formerly the Farm Improvement Scheme) where the farmer was not an amalgamator. The grant would also cover 50 per cent of legal and other professional fees and the amounts to be paid were considerably higher than those suggested in the White Paper.

An important part of the 1967 Act was its Schedule 3 in which the conditions to be attached to each grant were set out. It was a condition of receiving a grant under the Farm Amalgamations and Boundary Adjustments Scheme that the amalgamation could not be dissolved nor the holding in any way reduced or split up for 40 years after the amalgamation (60 years had been proposed originally) and that the whole unit should be farmed throughout this period. The conditions

about the recipient being a farmer of long-standing and not having much income from non-farm sources were also set out, as were the conditions that the holding being amalgamated should be between 80 or 100 smd and 600 smd (i.e. uncommercial) and that the resulting holding should be of at least 275 smd and preferably should employ at least two people full time (over 600 smd) after the amalgamation. A scheme to encourage the occupiers of uncommercial holdings to leave agriculture completely or retire by paying them a lump sum or an annuity was also introduced along the lines envisaged in the White Paper. Under the Farm Structure (Payments to Outgoers) Scheme, an outgoer's grant could be paid only if the amalgamation also qualified for a grant under the first scheme to encourage amalgamators. The amount of grant paid was linked to the acreage being vacated up to a maximum of 110 acres and subject to a basic minimum entitlement.

Following the passage of the Agriculture Act 1970, some minor amendments were made to the schemes. These consisted largely of giving the Agricultural Departments (MAFF, DAFS and MANI) greater flexibility in structuring the schemes. The restriction that a complete holding had to be taken over before grant could be paid was removed and the period for which the holding had to remain intact and in agricultural use was reduced from 40 years after the amalgamation to 15 years. The range of work which could qualify for the extra 20 per cent of grant following an amalgamation was widened, while the condition that the works had to be consequential upon the amalgamation was tightened.

The 1967 and 1970 Acts were further amended by the Agriculture (Miscellaneous Provisions) Act 1972. This Act reduced the period during

which the holding was to remain intact from 15 years to five and allowed more flexibility in the structure of grants which could be paid (Hine 1973 p328). The effect of this greater flexibility can be seen in the latest farm structure schemes which were introduced in 1973 (the Farm Amalgamations Scheme, S.I. 1973 No. 1404, and the Farm Structure (Payments to Outgoers) Scheme, S.I. 1973 No. 1403). These schemes were designed to harmonise with Directives 159 and 160 of the European Economic Community (1972) which control the nature of structural schemes in the Community. They concern any amalgamation or part amalgamation where a commercial holding is expanded or a previously uncommercial holding is made commercial by its expansion. The holding being amalgamated need not all be taken over, provided that the rest goes to an approved purpose such as forestry or public uses. Also, the condition that the entire holding must be in common ownership after the amalgamation was removed, so that part owner-occupation and part long-term tenancy became acceptable. The combined unit had to remain intact in agriculture for five years. The grants to be paid were also changed. Grant was paid on a simple acreage basis and so the administrative delays and complexities in judging what were "necessary and consequential" works were removed. The outgoers grants were changed only in detail, although the amounts paid were increased. In the 1973 Schemes, neither grant could be paid without the other being paid. As before, outgoers' grant could be paid only where an amalgamator also received a grant and, for the first time, the reverse condition applied to amalgamators.

These are the principal aspects of Government policy on the amalgamation of farms and they raise two questions immediately.

Firstly, why should the government consider amalgamation so highly that they try to encourage it? There seem to be both social and theoretical aspects to the answer to this question and these will be discussed in the next section. Secondly, what has been the effect of these schemes on amalgamating? This point will be discussed in Chapter 12.

THE RATIONALE FOR BRITISH GOVERNMENTS PROMOTING AMALGAMATIONS

By definition an amalgamation is an increase in the acreage of some holdings. While this may bring benefits to individual farmers, is there any reason to suppose that the concentration of land into fewer larger holdings is of general benefit to the country or the agricultural industry as a whole? Specifically, does this concentration result in a more efficient industry?

This is the central question in this section and it can be rephrased usefully as "Does efficiency improve as farm size increases?" Before this can be answered the concept of the size of a farm has to be defined and then the idea of efficiency has to be made clearer.

The simplest measure of the size of a farm is its area. However, in a study of efficiency area is not the ideal measure of size since farms of similar area can be cultivated at very different intensities in the production of different crops or stock. Standard man-days provide a better criterion of size since they allow the grouping together of farms where the theoretical amount of labour needed is similar. The theoretical amount of labour needed is not a real measure of agricultural intensity nor is it a measure of the economic or business size of a farm. It is, however, the best of the

available measures of size because it is quite closely related to area as Figure 2.4 shows (Britton and Hill 1975 p21) and because as Table 2.1 shows, it is also closely and positively related to gross output and to net farm income (Britton and Hill 1975 p93). Moreover, unlike gross output and net farm income, size in standard man-days is known for every farm in Scotland.

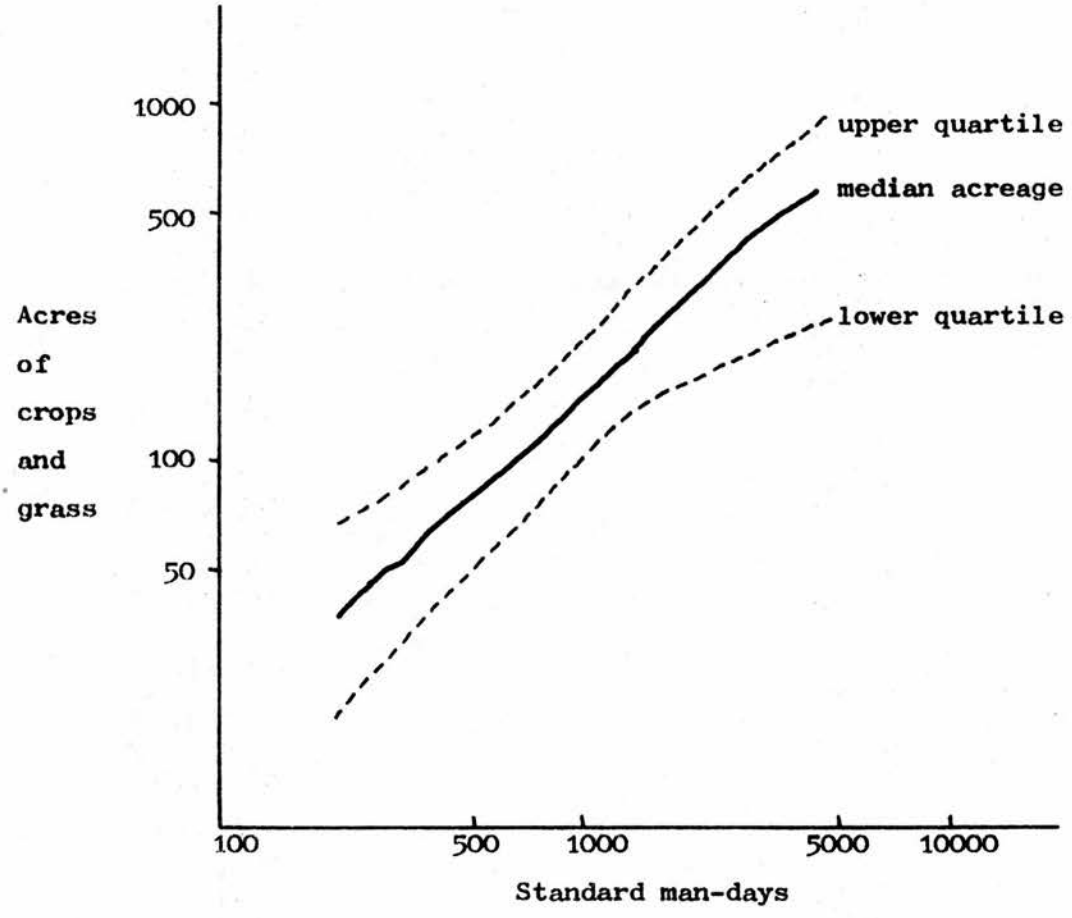
Table 2.1 Measures of size of business - Farm Management Survey, England and Wales 1970-71, average values (£'000s)

Smd size of business	Gross Output	Net farm income
300- 399	4.23	1.05
400- 499	4.93	1.25
500- 599	6.29	1.46
600- 699	7.71	1.87
700- 799	9.13	2.20
800- 899	10.35	2.55
900- 999	11.81	2.74
1000-1099	13.01	2.94
1100-1199	13.92	2.99
1200-1499	17.19	3.82
1500-1799	20.68	4.47
1800-2399	26.26	4.89
2400-2999	35.03	6.75
3000-3599	43.00	7.96
3600-4199	54.16	9.34
4200 and over	69.42	10.67

In a study of 216 farms in the North of Scotland, Robson (1973 p39) noted that the co-efficient of correlation between size by standard man-days and net farm income was 0.64 (significant at the .10 level), with the relationship being particularly strong on cropping, dairy and rearing with intensive livestock farms. Only on upland farms was the relationship negative during the mid 1960s.

In short, standard man-days provide the only widely available measure of a farm's size which is positively correlated for most types

Fig. 2.4 Ranges of crops and grass acreages by size of holding in standard man-days - England and Wales, 1972.



Source; Britton and Hill (1975) p21

of farm to most other measures of size in Scotland and in England and Wales.

The second point to be clarified is the concept of efficiency, which is difficult to measure but for this study the most common definition used by agricultural economists will be employed. By this, efficiency is the ratio of output to input, that is the value of the agricultural products produced in relation to the costs incurred in their production. In general, the costs of production will include only those actually incurred by the farmer. The cost of the upkeep of the roads to his farm would not be included as a cost, since this is met by the local authority. However, certain costs not actually incurred would be included. A hypothetical sum to represent the farmer's own labour on the farm and that of his wife would be included in the calculation of efficiency. Also, an estimated rent is charged to owner-occupiers so that income and efficiency can be measured irrespective of tenure. The use of monetary values in this study of efficiency can be justified because it provides a common metric for all the diverse products of the agricultural industry. However, it has the disadvantage that changes in prices from year to year because of the weather or Government action can alter the apparent efficiency of the industry. Such distortions can be mitigated by restricting comparisons of efficiency to farms of the same type so that changes in price ought to be felt equally by all the farms of that type.

The efficiency which will be measured in this way will be average efficiency. However, if could be argued that a more appropriate criterion would be marginal efficiency, that is the value added by the addition of an extra unit of inputs. Unfortunately, it has rarely

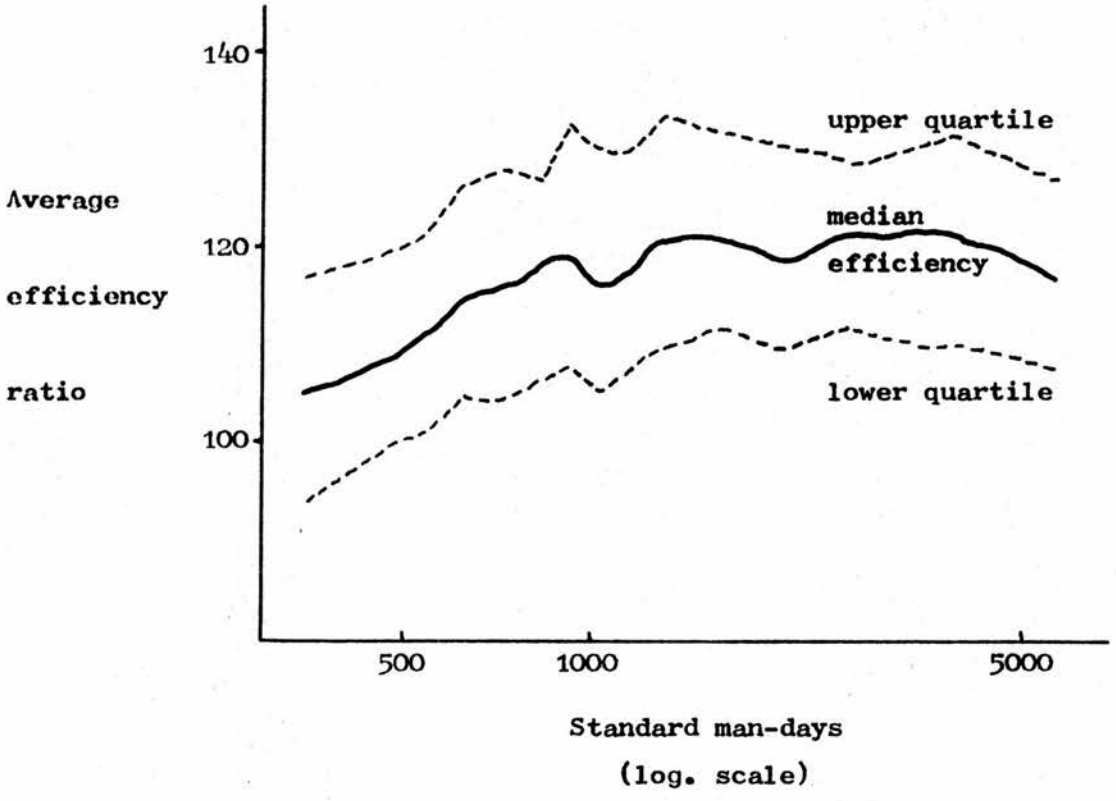
been possible to measure marginal factor performances on farms and the widely available data on average performance must, therefore, be used instead, with the marginal efficiencies being inferred from the average performances. At best, this should provide an indication of the directions in which resources should be transferred to raise the average efficiency of the industry (Britton and Hill 1975 pp 58-9).

Now that decisions have been made as to the appropriate criterion of farm size (standard man-days) and on the definition of efficiency (the average value of output per £100 input by farm type), the relationship between farm size and efficiency can now be examined.

Britton and Hill (1975) have provided the most comprehensive review of the relationship between size and efficiency. They studied the original data collected for the Farm Management Survey in England and Wales in 1970-71 and concluded that it was reasonably representative of farming generally (pp 36-37) - a point made by Robson (1973 p 14) after a study of data from the Farm Accounts Scheme in Scotland. They were able to show (Figure 2.5) that average efficiency for all farms in the survey increases quite rapidly from the low levels common on one-man farms up to the efficiency characteristic of, roughly, three-man farms (about 900 smd). Thereafter, increasing farm size affects average efficiency only very slightly, there being some slight indication of less than peak efficiency on the very largest farms (over 4,200 smd) although the number of farms on which this observation is based is very small. This pattern of economies of size accruing to farms up to the three-man size and of little gain in average efficiency thereafter is shown in Figure 2.5.

Of course there is a range of efficiencies for the farms of any

Fig. 2.5 Ranges of average efficiency ratios by standard man-day size of holding - England and Wales, 1970-71

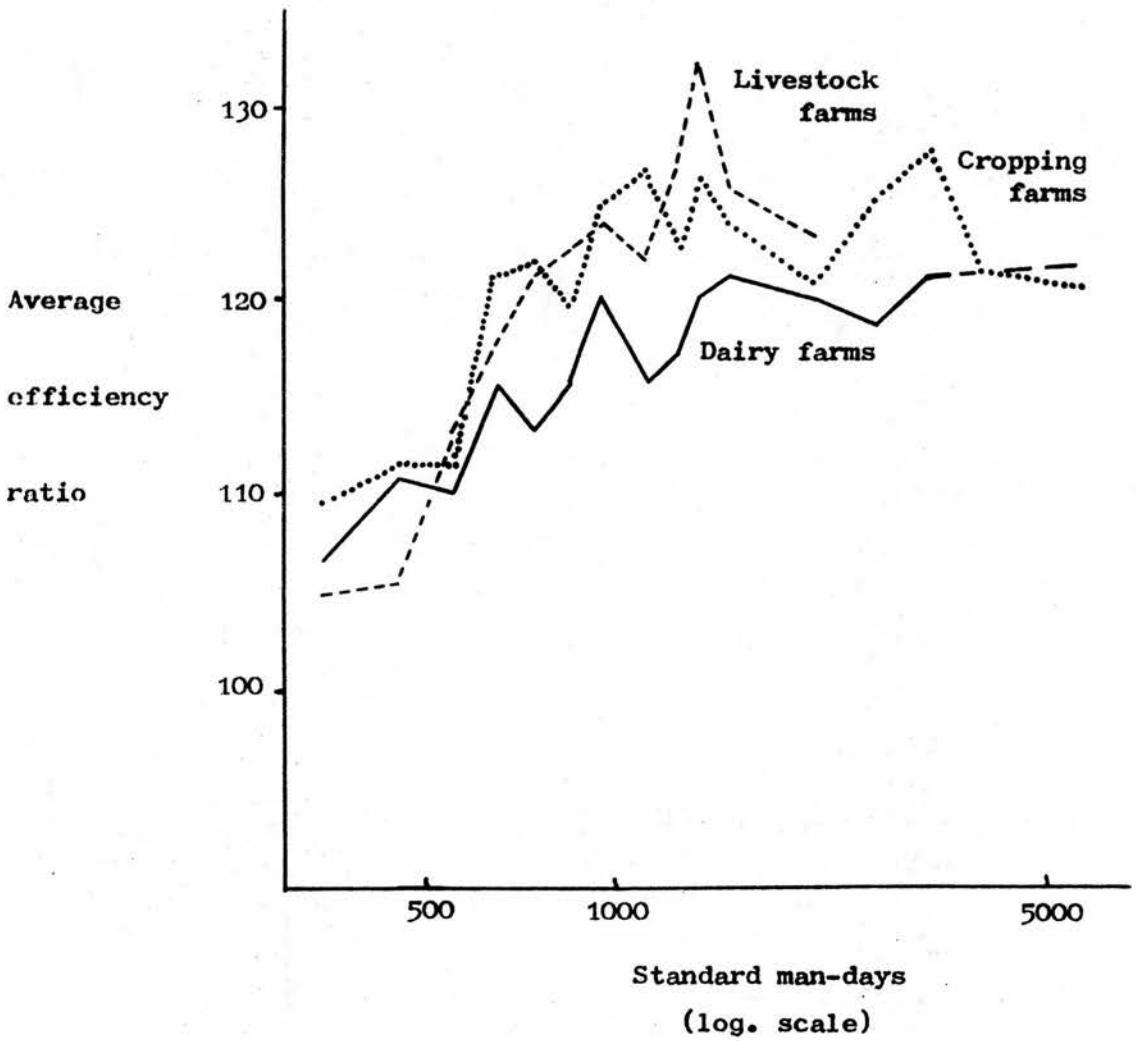


Source: Britton and Hill (1975) p89

particular size. Figure 2.5 shows the median efficiency and the upper and lower quartiles of each range of efficiency and it suggests that the range of variation in efficiency is constant with farm size since the inter-quartile range is always about 20 per cent of the median efficiency, irrespective of size. If the data are disaggregated into the main types of farms it can be seen that the relationship between size and efficiency for dairy, livestock and cropping farms is identical to the overall relationship for all farms (Figure 2.6). Although this finding refers to England and Wales, there is no reason to suppose that the size/efficiency relationship will be any different in Scotland, although in a study of 80 farms in the North of Scotland, Robson (1973 p 20) noted a slight decrease with farm size in the co-efficient of variation of an index of aggregated farm profits over the period 1956/7 to 1967/8. Profits varied a little more on holdings with less than 100 acres of crops and grass than they did on larger holdings.

Britton and Hill (1975 pp 109-174) also explored the sources of the rise in efficiency between the one-man size of farm and the three-man size. They examined first the marketing economies of size. The large farmer seemed to have little price advantage over the smaller farmer when buying products such as fertilisers, only the very smallest purchases being at a substantially higher cost per ton. Neither did the larger farmer succeed in borrowing capital at preferential rates although he might find it easier to borrow from the commercial banks than would the smaller farmer since his net worth (the security for the loan) would be greater. The smaller farmer might have to resort to obtaining credit from merchants which is a more expensive way of

Fig. 2.6 Average efficiency ratio by type of farm and standard man-day size of holding - England and Wales, 1970-1971

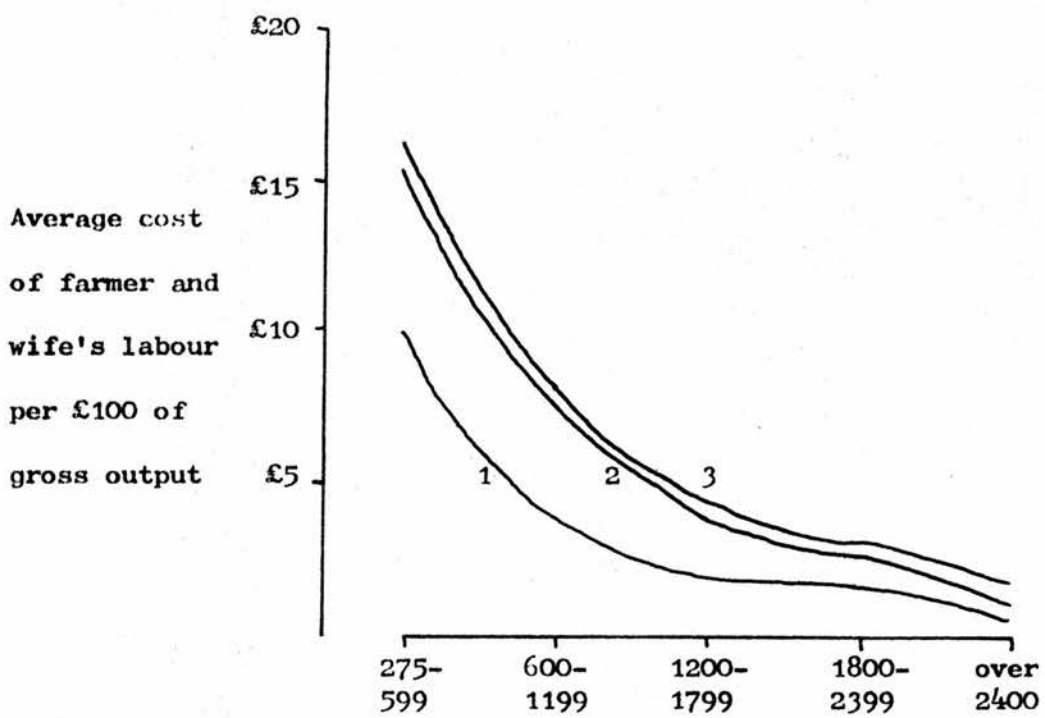


Source: Britton and Hill (1975) p86

borrowing. The large farmer did not seem able to obtain higher prices for his products simply on the basis of the volume he sold, although the larger farmer might be able to store his grain longer on the farm so that he could sell it when prices were higher. Larger farmers more often have written contracts for selling their products, and while these do not usually result in higher prices, they do benefit the farmer financially by reducing the risk of selling at a low price. Britton and Hill (1975 pp 117-118) concluded that, on balance, the marketing economies accruing from a farm's size were small.

They then examined the "technical" economies of size. The most obvious technical economy concerns machinery. Theoretically, the falling cost of machinery per unit output as the size of the farm increases ought to lead to economies of size when machinery is being used to capacity. After studying the Farm Management Survey data, they concluded that the theoretical economies of size were being achieved only between small and medium sized cereal cropping farms. On other types of farm, the value of the machinery increased at least in proportion to the farm's size. Large farms also appeared not to use any more or less feedingstuffs, seed or fertiliser than their size would suggest. The only substantial input which was found to decline per unit output as farms got bigger was the cost of the farmer's own labour and management and the value of his wife's labour (Figure 2.7). The total cost of labour per £100 gross output fell sharply between the 275 to 599 smd group and the 600 to 1199 smd group and this happened on all six types of farm (although, for clarity, only three are shown on Figure 2.7). Above 1200 smd, the total cost of labour varied little. The main cause of this decline in labour costs is the

Fig. 2.7 Average cost of farmer and wife's labour per £100 of gross output by type of farm and size of holding in England and Wales, 1971 - 1972



Types of farms: 1 Cropping (mainly cereals)
2 Specialist dairy
3 Livestock, cattle and sheep

Source: Britton and Hill (1975) pp122-123

decline in the cost of the farmer and wife's labour per £100 gross output, most of this decline being between 275 to 599 smd and 600 to 1199 smd. It continues to decline above 1200 smd but is offset by the rising cost of hired labour. The fact that the labour of the farmer and his wife costs so much per unit of output on small farms results in their being severely underemployed from the economist's point of view. Consequently, the principal gain in efficiency with farm size is the spreading of the cost of the farmer's own labour over a greater output. The gain is substantial as between small and medium farms but is minor among large farms which encounter neither economies of size nor diseconomies.

There have been several other studies of the relationship between size and efficiency in the United Kingdom and elsewhere, notably those by Madden (1967), Vollmar, Helmers and Retzlaff (1968), Longworth and McLeland (1972), Natural Resources (Technical) Committee (1961), Raeburn (1958), Uri (1970), Hendry and Beilby (1957) and Robson (1973). These all agree with Britton and Hill that there are diseconomies of size in being a small farmer and that the economies of size are very minor above the threshold of the two to three-man farm. Another study by Maunder (1966) also approached the same topic but in a different way. He looked at the effect of the actual increases in acreage on a sample of 39 farms in S.W. England between 1953 and 1963. He found that in most cases output per acre declined after amalgamation but that total net farm income tended to rise. Maunder was not able to measure efficiency before and after amalgamation, but he was able to measure the net marginal product of amalgamating, that is, the increase in output from the extra land added. Because most inputs rose little after amalgamation,

the extra land incurred few extra costs and so its marginal product was much higher than the average product per acre of the rest of the farm. Few of Maunder's sample of farms were larger than the threshold identified by Britton and Hill above which there are few economies of size. This means that the amount per acre the expanding farmer can bid for land on the market will be higher in general than the amount the new entrant can bid. This finding suggests that a majority of land for sale will go to expanding farmers rather than to new farmers and particularly to over-capitalised farmers for whom the marginal products will be higher and for farms with spare labour (Clark 1969 pp 11 and 23). These points will be taken up in greater detail in Chapter 3.

In a study of 22 farms in the North of Scotland which had all expanded their acreage by over 20 per cent, Robson (1973 pp 98-100) found that net farm income, profits, fixed and variable costs and gross output increased by less than the increase in the farm's acreage on at least 75 per cent of the farms. Gross output increased by less than the increase in the acreage (38 per cent on average compared with 53 per cent) and net farm income increased by only 32 per cent on average and declined by 13 per cent per acre even before allowing for interest charges on that half of the 40 per cent increase in tenant's capital which was borrowed. Direct measures of efficiency comparable with those used by Britton and Hill are not given, but these figures, which show clearly diminishing returns to increasing acreage and static returns to increasing costs and capital, suggest that these expansions conform to Britton and Hill's view of the size/income/efficiency relationship despite the very small sample Robson used.

This study of the effects of amalgamation on actual farms leads to a further point. If large and medium farms are more efficient than small farms, then it would make economic sense to encourage the transfer of resources from small to medium or large farms. Apart from the proviso that there would be a delay between a farm expanding and reaching the efficiency commensurate with its new size, there is the assumption that all farms lie on the same production curve and that any expansion of small farms will take those farms along the production curve to higher efficiency as they expand. Britton and Hill suggested that the highest levels of efficiency might not be available to the small farmer because of his own technical limitations or because his goals in farming were different from those sought by large farmers. However, if this is true, it will modify rather than nullify the general picture. Some increase in efficiency will be available to most expanding farmers, the increases being appreciable for most small farmers and minimal on average for large farmers. This is the central theoretical reason for promoting amalgamations. Increasing output spreads the farmer's own labour over a greater income which improves the general efficiency of agriculture. Some of the reasons for the limits on the size of holdings in amalgamations which the British Government are willing to assist now become clear. The amalgamator holding ought to be over 600 smd in size after amalgamation because beyond that size it will be approaching the peak of its efficiency. The amalgamated holding must be over 100 smd in size so as to make a noticeable increase in the amalgamator's size and must be under 600 smd in size since larger holdings would probably be expansions within the "large" size class of farms where gains in efficiency will be

limited. Holdings under 100 smd are probably too small to have provided a substantial proportion of any outgoer's income and the intention was not to assist the retiral of hobby or part-time farmers. If the holding was over 600 smd in size, its occupier probably would not need financial encouragement to retire.

So far, only theoretical benefits to income and efficiency have been attributed to amalgamation. Apart from Maunder's work, it is not known what the actual effects of amalgamation were. To fill this gap and to complement the theoretical studies already presented, a stratified random sample of 107 amalgamators was chosen by the author from three regions of Scotland - Aberdeenshire, the South West and the east coast counties from Berwick to Moray. The method of sampling the amalgamators will be described in detail in Chapter 5. In Table 2.2 the benefits or lack of benefits found from a specific amalgamation are listed. It was not possible to obtain a financial balance sheet for each farm before and after its expansion so that efficiency cannot be measured. All that could be done was to ask each occupier what were the benefits he had found from having a specific, named piece of extra land. Such an approach depends on the occupier remembering the effects of the specific expansion and it be must assumed that those he has forgotten or did not notice were probably quite minor. The question was put about half way through an extended questionnaire about his amalgamation, so the respondents had been thinking and talking about the amalgamation for some time before they answered this question about its benefits which should have improved the quality of the replies.

Table 2.2 Principal benefits from amalgamation noted by amalgamators

Benefit	Frequency
Increase income	84
(of which owing to "spreading overheads")	(35)
More self-sufficient farming	20
(of which "self-sufficiency in stock")	(14)
(of which "self-sufficiency in feed")	(14)
Keep workers with overtime or housing	10
Less disease, less overgrazing, spread rotation better	9
Less land rented	8
Justify amount, size or turnover of machinery	8
Let son join farm business	7
Less work after amalgamation	5
Better buying or selling prices	4
Greater status	2

Benefits mentioned once - more flexible selling time
- bigger fields
- lesser liability to capital gains tax and death duties
- owner has more control over his land when he occupies it

No benefits from the amalgamation	10
(of which owing to increase in acreage being so small)	(6)
Disadvantages due to amalgamation	6

Collected from 107 respondents, many of whom mentioned several benefits from amalgamating

Eighty per cent of the amalgamators felt that the amalgamation had increased their income and about half of them believed that some spreading of overheads over an increased output had helped in this. Few farmers took on more labour or bought more machines owing to the amalgamation, although none identified their own labour as the principal determinant of efficiency. Indeed, the idea of efficiency was never

mentioned in their answers. The level of profit (income left after costs were met) was the criterion by which the benefits of the amalgamation were judged. Most of those who noted no benefit from amalgamation had taken over so little land that any influence on income was too small to be noticed. All the other benefits from amalgamation were largely technical or agronomic or were concerned with farmers' sons or their workers. They were all minor advantages. As Britton and Hill suspected, few farmers found that the marketing of their products was made more advantageous for them after amalgamation.

Although the principal theoretical reason for advocating the elimination of smaller farmers concerns their inefficiency, this seems not to be the major consideration in the Government's encouragement of amalgamation as set out in the 1965 White Paper. It is clear from the tone of this document that it is the low incomes in absolute terms of small farm businesses which are the principal concern. The amalgamation of small farms is advocated as a way of raising these incomes and, although the schemes as enacted were no longer concerned solely with the amalgamation of small farms, it is plain on the evidence of the farmers' replies that the Government's aim of raising incomes is being achieved by amalgamation. Given this accordance between their goals and the effect of amalgamations, the Government's encouragement of amalgamations is apposite and well-directed.

In their study of amalgamating in the East Midlands and Devon, Hine and Houston (1973 pp 76-80 and A50) found that the improvement of income was relatively less important as a reason for expansion than in Scotland while the extra land was more important as an appreciating

asset, as a means of improving the farm's layout and as a way of getting a son into the farm business. It is not clear whether these differences are inherent in the farming structure of the areas studied or whether they are a reflection of different priorities and expectations among the farmers interviewed. However, there is little doubt that, for the individual farmer, the principal reason for, and benefit from, amalgamating is a greater farm income derived from expanded output. Hine and Houston (p 80) seem to regard the economies of size concerning machinery and buildings as being rather larger than Britton and Hill see them.

There are also some minor advantages from amalgamation. For the Government, amalgamation tends to reduce the cost of agricultural support. All the available evidence suggests that after an amalgamation, the amount produced per acre tends to fall on the amalgamator holding and, since the amalgamated holding was probably the smaller and more intensive unit, the total output from the amalgamated land ought to go down sharply after amalgamation (Maunder 1966 p 60; Robson 1973 p 99 Table 27). This could go some way to reducing the amount of produce needing to be subsidised either under a system of deficiency payments or under intervention buying, although the scale of amalgamation would have to be considerable for this effect to be other than minor.

The other and related rationale which can be advanced for a policy of encouraging amalgamation is based on differential increases in incomes. The demand for food is fairly inelastic for two reasons. Firstly, the population of the United Kingdom is rising only slowly so the total demand for food is only increasing slowly, despite some imported goods being replaced by home produced goods. Secondly, although the population

as a whole is getting richer quite rapidly in the United Kingdom, the income elasticity of demand for food is low - Rogers has suggested that a figure of 0.25 for foods generally would be typical (Rogers 1968 p 5) while Robson suggested 0.2 (Robson 1973 p 4). Thus, if incomes increased by 10 per cent, the resulting increase in the demand for foods would be only 2.5 per cent (Rogers) or 2 per cent (Robson). Moreover, this increased demand resulting from higher incomes will tend to express itself, not in a greater volume of foods being consumed (except in so far as wealth encourages a greater wastage of foods in their preparation), but in more exotic (i.e., imported) foods being bought or in more expensive and better quality foods being substituted for lower quality foods. Also, as incomes increase, foods are more often bought in a processed form rather than fresh so that more of the final cost will go to the processors and packers and less to the farmers, although it has been noted that the increasing non-farm content in retailed foods is partly offset by the rapid technical economies of recent years in food processing and its retailing, e.g., the growth of supermarkets and other self-service shops (OECD 1974 p 23). Consequently, the prices received by farmers for their produce have risen less fast than either retail prices in general or food retail prices in particular. Over the period 1954-57 to 1972-73, prices of agricultural products rose by only 37 per cent, while retail prices rose by 93 per cent and food retail prices rose by 87.5 per cent (OECD 1974 p 24). If the size of the total income available for farmers is increasing less fast than the incomes of other people, as measured by their retail expenditure, then a reduction in the number of farmers is one way of maintaining agricultural incomes;

if the economic cake is not expanding fast enough, it can be cut into fewer slices. Other ways of trying to preserve relative agricultural incomes would be to improve farmers' efficiency of production and particularly their labour efficiency (which has happened) and to resort to some form of subsidy or market support (which has also happened). The amalgamation of farms will reduce the number of farmers and help maintain relative incomes for the remainder, given the constraints imposed on demand by slow population growth, low income elasticity of demand for foods and, possibly, a greater "processing" or exotic element in demand. Robson has calculated that to maintain relative real income over the period 1951/52 to 1969/70, farmers would need to have expanded their acreage by 37.5 per cent if they were less than 50 acres and by 73 per cent if they were over 500 acres (Robson 1973 p 105). This assumes a constant level of efficiency and intensity of production over the period, so these are rather unrealistic and extreme figures which will be discussed further in Chapter 6, but they serve to set an upper limit to the structural consequences of the cost/price squeeze on farmers' incomes.

The theoretical and social background to amalgamating can now be summarized briefly. Although they have had only a general picture of the approximate scale of amalgamation, British governments of the past 20 years have moved slowly toward accepting the need for the active encouragement by subsidies of the amalgamation of farms. Such a policy can be supported on theoretical grounds as acting to shift agricultural resources (particularly land) from small and generally less efficient farms to larger and generally more efficient farms, so that the efficiency of the industry in general is raised. The small farms are

generally believed to be inefficient owing to the farmer's own labour being spread over only a small output of produce. The government's policy can also be supported on social grounds as serving to reduce the number of farmers on low incomes, although those who retire are hardly gaining high incomes. This is in accord with the view of most farmers who have amalgamated in the past that the principal effect of the amalgamation was to increase their residual incomes. Amalgamation also has a useful role to play in maintaining the relative incomes of farmers, given that the total amount paid to them for their produce is increasing less fast than retail prices and other people's incomes owing principally to a slow increase in population and a low elasticity of demand for foods. These, briefly, are the reasons which can be advanced by government or farmer in support of a policy to increase the number of amalgamations. The next step is to discover the nature of the actual process of amalgamating in Scotland and this will be discussed in Chapter 3.

CHAPTER 3

THE STRUCTURE OF AMALGAMATION IN SCOTLAND

A CENSUS OF AMALGAMATIONS

A study of the amalgamation of farms in order to discover how many amalgamations there have been and what characteristics they have is hindered by a paucity of published information. The number of amalgamations in Scotland in 1971 and 1972 is known (DAFS, 1972 p 9 and DAFS, 1974 p 9) but almost nothing else is known about amalgamations from this source. The primary objective, therefore, was to obtain access to the official records of the Department of Agriculture and Fisheries for Scotland (DAFS) so as to compile a census of all amalgamations throughout Scotland over a designated period for study. The information about individual amalgamations could then be aggregated so as to describe the distribution of amalgamations and the sizes and the types of holdings participating in them. Fortunately, the DAFS allowed access to their census and clerical records so that compiling this census of amalgamations became practicable. Access was given subject to the strict maintenance of confidentiality, particularly about individual amalgamations and in accordance with this, no mention will be made in this thesis, nor in any publications based upon it, of individual amalgamations which can be identified.

The methods used to compile this census of amalgamations were determined largely by the systems used by the DAFS to store their information and, consequently, the work proceeded in three stages.

The first was to identify the "amalgamator holdings" - that is, those holdings which took over the extra land - and to obtain some information about these holdings. The second stage was to identify which holding or holdings they had taken over - that is, to identify the "amalgamated holdings." The third stage was to obtain data on the characteristics of these amalgamated holdings.

The first stage, the identification of the amalgamator holdings proved to be the quickest. The DAFS stores the results of each June and December census on a computer tape and the tape includes also miscellaneous information called indicators. One of these indicates whether the holding has gained land from another holding in the same parish and another indicates whether the gain was from a holding in another parish. The census tapes for the censuses between June 1968 and December 1972 (when the research began) were scanned and the holdings which had gained acreage were printed out along with some information about each holding. This additional information differed depending on whether the amalgamation was recorded at a June census (henceforth called a June amalgamation) or at a December census (a December amalgamation).

The June censuses yielded the following information:

a) the parish and code number of the amalgamator holding,

b) the total area (to the nearest $\frac{1}{4}$ acre) of the amalgamator holding, the land it had just gained being included in this,

c) the area of (b) which was owned by the occupier of the amalgamator holding,

d) the area which the amalgamator had gained at the census. This might be the acreage of a single holding or of several. It was also indicated whether this acreage lay in the same parish as the amalgamator holding or in another unspecified parish.

e) the size in standard man-days (smd) of the amalgamator holding after the amalgamation.

f) the farm type of the amalgamator holding after amalgamation.

The points of particular interest at this stage are that the amalgamated holdings have not been identified so far and that the data on size, type and tenure refer to the amalgamator holding after the amalgamated holding or holdings have been added to it.

The December censuses yielded the following more restricted set of data:

a) the parish and code number of the amalgamator holding,

b) the total area (to the nearest $\frac{1}{4}$ acre) of the amalgamator holding <u>excluding</u> the amalgamated holding,

c) the area which the amalgamator had gained at that census. This might be the area of a single holding or of several. Again, it was indicated whether this acreage lay in the same parish as the amalgamator holding or in another unspecified parish.

d) the farm type of the amalgamator holding before the amalgamation.

Again, the amalgamated holding has not been identified while, in contrast, the information about the size and type of amalgamator holdings refers to those holdings before they expanded. The farm type is

the type at the preceding June census since type cannot be calculated from the returns to the partial censuses held in December. Similarly, size in standard man-days and tenure are not recorded at the December census.

The second stage of the census was to identify the specific holding or holdings taken over by each amalgamator holding. This was not recorded on the census tapes so the information had to be collected manually from the record envelopes of each of the amalgamator holdings. These envelopes recorded the sources of all land gained by the amalgamator as well as changes of occupier. The identification of the amalgamated holding was cross-checked from the amalgamated holding's own record envelope. At this stage too, the names and addresses of the occupiers of both holdings were noted and also two dates were recorded. The first was the date on which the amalgamation was processed and recorded by the DAFS and this was nearly always within three months of the census under which the amalgamation was listed. The second date was the date on which the expanding occupier took over the amalgamated holding which is the truer indicator of when the amalgamation took place. Unfortunately, the date of the change of occupier is not always available.

It was at this stage that a series of amendments was made to the data collected up till then. These includes the removal of "false amalgamations", the reversal of amalgamations, the addition of new amalgamations and miscellaneous minor changes.

The term "false amalgamation" is a rather broad and loose one since it covers a number of circumstances during the second stage of

the data collection in which a supposed amalgamation was discovered not to be a true amalgamation. In 26 cases, for example, when an existing holding was divided in order to create a new one, the new holding was placed on the census tape by amalgamating it with a fictitious holding of zero acreage. Thus, what seemed at first to be an amalgamation was in fact the opposite. There were also cases where the loss of some land, perhaps the dissolution of a previous amalgamation, was wrongly called an amalgamation. This probably arises because of a punching error during the creation of the census tape. Similarly, 143 cases were found where a holding was listed as an amalgamator but had not been involved in any verifiable amalgamations or any other apparent transfers of land. In 57 cases the land taken over by the amalgamator holding formed only a part of the other holding. If the other part was added to a second amalgamator holding at the same time or if the other part left agriculture completely, this was considered a proper amalgamation. The acid test is whether the holding losing the land ceases to exist as a holding in which case its loss of land is an amalgamation. If it is still farmed afterwards, it is a false amalgamation. There were also a few cases where a holding which in fact lost its land in an amalgamation was credited with receiving the acreage it had just lost. In all these cases, no amalgamation had taken place and these "false amalgamations" were removed from the census of amalgamations during the second stage of the data collection. This involved the removal of 231 cases (10.3 per cent) of the 2,234 original entries on the print out of amalgamators. About a third of these false amalgamations occur at the census of December 1969 which had the largest number of amalgamations of any of the censuses surveyed. The spatial

distribution of these false amalgamations is close to that for the genuine amalgamations except for unusually large numbers in Lanarkshire and Fife.

The second and less dramatic change was the reversal of the direction of some amalgamations. The term "reversal" refers to which of the participating holdings is designated the amalgamator holding and which the amalgamated holding. It is not relevant for the purposes of the Agricultural Census whether holding A is recorded as taking over holding B or vice versa. The concern of the census is to record the size of the combined unit and to record the disappearance of another unit and of less importance is the direction of the amalgamation. However, this creates certain problems for this research because if the records show that holding A acquired the entire acreage of holding B and that the combined holding is called A, this does not mean that it was the farmer of A who bought out the farmer of B and is now farming (A+B). The name given to the combined holding depends, not on which farmer is the purchaser, but either on which of the original holdings contains the principal farm buildings for the future operation of the combined holding or it depends on which name the farmer insists on using for the enlarged holding. In order to study the characteristics of amalgamator and amalgamated holdings, a more consistent differentiation than this is necessary.

To achieve this consistency, a comparison was made of the occupiers' names before and after every amalgamation. If the occupier of holding B was the occupier of the combined holding after the amalgamation, then holding B was designated the amalgamator holding for this study irrespective of whether the DAFS called the combined holding A or B.

This procedure beings the data more into line with the reality of decision making in this situation. In fact, it was necessary to reverse only 82 amalgamations or 4.1 per cent of the final number of amalgamator holdings so that this amendment is quite a minor one but it could have been a major source of error and even of absurdity. During fieldwork some time after this reversal of amalgamations, it was possible to confirm that all the farmers who were eventually designated as amalgamators were, in fact, the operators of the combined holding after amalgamation so that this amendment has succeeded in providing a more consistent designation of the relevant decision maker. With 11 per cent of these reversals being in Shetland, there appears to be an unusual concentration of them there. They are fairly evenly spread across the censuses studied. The reversal of amalgamations changed the county in which the amalgamator was located in two cases.

A third minor amendment was the addition of 30 new amalgamations, that is, amalgamations not previously recorded on the census tapes but which definitely occurred within the study period (June 1968 to December 1972). They form about 1.5 per cent of the final total number of amalgamator holdings and are distributed as one would expect given the distribution of the other 98.5 per cent of amalgamator holdings. These new amalgamations were identified from the record envelopes which were being examined for another amalgamation which had been recorded normally. No information is available about any unrecorded amalgamations between holdings not involved in any other properly recorded amalgamations. Given the very small number of new amalgamations which were discovered, there is not likely to be much under-recording.

There were also several other minor changes. There were 17 cases of one amalgamation being recorded at successive censuses. These cases of double counting were removed. They were not concentrated particularly by one county or census. There were a dozen cases of changes to the acreages of the participating holdings. Where the acreages were found to be different on the print-out from the census tapes and on the record envelopes, it was normally the clerical records which proved to be the more accurate and the appropriate changes were made. Another minor problem was in the non-availability of some record cards. The number of such missing envelopes was reduced eventually to 17, that is, to 0.85 per cent of the final number of amalgamator holdings. In these cases, the amalgamated holding could not be identified so that the information about these unidentified amalgamated holdings is less complete.

The final amendment concerned the census of June 1968. This census recorded only 14 amalgamations (allowing for double counting) compared with 124 amalgamations in the next smallest census total. This is clearly a gross underestimate of the rate of amalgamating and also is a biased estimate since none of the amalgamations are in Aberdeenshire which invariably accounts for 20 to 25 per cent of amalgamations at each census. The census of June 1968 marked a change in the computer used to process the census and this could account for the under-counting. It was felt to be prudent to omit this census from the study. The study period is, therefore, defined as the nine censuses spanning four and a half years between December 1968 and December 1972 inclusive. The coverage is four and a half years rather than four years since each census covers amalgamations in a six-month period so that the effective

coverage extends from September 1968 to March 1973. This period mostly avoids the periods during which the DAFS carried out "paper amalgamations" and so is a fair period of normally recorded amalgamations.

The first stage of the data collection was to identify the amalgamator holdings and to record some of their characteristics. The second stage was to identify the amalgamated holdings and to carry out some amendements to the data. This stage lasted just over nine weeks and was followed by the third stage which was the recording of the characteristics of the amalgamated holdings. The third stage involved getting the list of amalgamated holdings back into the computer so that the characteristics of each could be printed out. Out of 2,259 such holdings, 99 were not on the tape of the preceding June census and a further 17 holdings could not be identified because of missing amalgamator record envelopes as already described. In all, 116 amalgamated holdings (5.1 per cent) are unknown for this study. For the other 2,143 (94.9 per cent) of the amalgamated holdings the following is known:

a) parish, code number and address

b) the total acreage (to the nearest $\frac{1}{4}$ acre)

c) the area of (b) which was owned by the occupier before the amalgamation

d) the size in standard man-days

e) the farm type of the amalgamated holding

The collection of data from official records has produced a census of amalgamations during the $4\frac{1}{2}$ years of the study period which is as complete as possible. Within this census, information is available on the socio-economic nature of the participating holdings. This

information is not uniform as between June and December amalgamator holdings and the amalgamated holdings and in most cases coverage is between 95 per cent and 99.5 per cent complete. Most of this information relates to the holdings and not to the occupiers or owners. The next section will analyse this information so as to describe the spatial and socio-economic structure of the process of amalgamation.

THE STRUCTURE OF AMALGAMATIONS

The process of amalgamation has many facets and the data obtained from the DAFS allow several of these to be described. Firstly, there is the spatial distribution of amalgamations which is described in the next section. Then the socio-economic structure of amalgamators and their holdings will be discussed in the following section and then amalgamators will be compared with farmers in general to highlight their distinctiveness. Finally, amalgamation will be compared with some other types of farm expansion

The simplest facet of amalgamation is its scale. Between the censuses of December 1968 and December 1972, exactly 2,000 amalgamator holdings took over 2,259 holdings. Of the 2,000 amalgamators, 132 were repeating amalgamator holdings which took over holdings at more than one census and 206 amalgamators took over more than one holding at a single census. Allowing for a slight overlap between repeating and multiple amalgamators, there were 1,689 holdings which amalgamated once during the study period and 311 which amalgamated more than once. By the end of the study period, the equivalent of 3.60 per cent of all Scottish holdings at June 1968 had recorded an amalgamation - an annual rate of 0.801 per cent. The percentage probability of a holding ceasing to exist during the study period of $4\frac{1}{2}$ years due to its being

amalgamated is therefore the equivalent of 4.07 per cent of all the holdings extant at June 1968, an annual rate of 0.905 per cent. During the study period there was a net loss of 1,523 holdings in Scotland if one ignores the category of statistically insignificant holdings which was identified in 1970. The 2,259 amalgamated holdings represent 148.3 per cent of this net loss. Considering only full time holdings (the 22,633 holdings with over 250 smd) the annual rate of amalgamating was approximately 1.68 per cent for amalgamators over 250 smd.

An enquiry was also made to see what proportion of holdings change their occupier each year in Scotland and from this to calculate the proportion of changes in occupier which result in an amalgamation. There seem to be no published data on the incidence of changes in occupier and no comprehensive national figures are known even in unpublished form. The only source of information on changes in occupier is the clerical records held on each holding by the DAFS. These records are not machine-readable and so the enquiry proceeded manually. Since the DAFS hold at least 70,000 records of holdings, a sampling procedure was needed. The only practical way of sampling the records which are not numbered continuously was a systematic sample of every one hundredth holding. For each holding so sampled, a note was made of whether or not it changed its occupier between 1969 and 1971 and then of whether this was followed by an amalgamation during the 1969 to 1971 period. Some changes in occupier resulted in an amalgamation after 1971 (particularly during the amalgamation exercise conducted during 1973 by the DAFS) but these are partly offset by the inclusion in the period 1969-71 of amalgamations which resulted from changes of occupier occurring before 1969 but not recorded by the DAFS until after 1969. A note was also

made of the acreage in 1970 of each holding in the sample, of its location and of whether it was a croft.

The target population for the sampling was the total number of holdings existing in 1969 (55,148), which would give a sample of 551 holdings on the basis of a sampling fraction of one in 100. Unfortunately, it is difficult to separate fully the holdings "alive" in 1969 from those which "died" before then, since their records are mixed together. It is not difficult to sample the holdings which were alive in 1969 and which are still alive since these are held separately. The principal problem lies with the "dead" holdings which are held together irrespective of whether they died before 1969 (which should not be sampled) or died after 1969 (which should be sampled). It was possible to separate the holdings which died before about 1960 from those which died later because the former have a different style of record card, but the division of those which died between about 1960 and 1968 from those which died in 1969 or later could not be done during the sampling. This problem was overcome by sampling all the holdings which died after 1960 with a one in 100 sampling fraction, ensuring that each sampled holding was one which was alive in 1969 and then applying a general correction factor to the sub-sample of dead holdings before adding it to the sub-sample from the live holdings to arrive at the total sample.

The critical aspect of this procedure is the calculation of the correction factor. The uncorrected sub-sample consisted of 204 cases implying that the population of holdings dying after 1960 was approximately 20,400 holdings. Between 1969, when there were 55,148 holdings in Scotland, and 1974 when there were about 50,200 (an estimate

including statistically insignificant holdings), there was a net loss from all causes of about 4,950 holdings. This net loss is not the total number of holdings lost during this period of five census years (June to June), since the gross loss is reduced by the total number of new holdings created during the five years (1969-74) to give the net loss of 4,950 holdings. Between 1970 and 1974, 1,760 new holdings, approximately, were created. The number created between 1969 and 1970 is not known but a proportionate increase on the figure of 1,760 for four years gives a figure of 2,200 for the five years between 1969 and 1974. When this is added to the net loss of holdings (4,950), the gross loss can be estimated at 7,150 holdings for the five years. This is thus the estimated size of the population of holdings which died in or after 1969 and which should have been sampled. The ratio of the estimated population dying after 1969 to the actual population dying after about 1960 is 7,150 $\div$ 20,400 which equals 0.35 which is the correction factor. The sample of dead holdings and all measurements made from it was reduced by this factor of 0.35 so that the sampling fraction of one in 100 of holdings alive in 1969 was preserved and then the sub-sample of dead holdings was added to the rest of the sample drawn from the holdings alive today. The latter was not corrected for the number of holdings alive in 1975 but not alive in 1971 since the correction factor of about 0.027 was very small particularly when compared with the amount of estimation involved in calculating the first correction factor.

Thus, the final sample consists of 577 holdings, which is 4.7 per cent larger than a strict one in 100 sample of the 55,148 holdings alive in 1969 would require (551 holdings). However, this is considered acceptable given the difficulties of conducting the sample, isolating

the relevant population and calculating the proper correction factor. The results can be presented quite simply. The proportion of holdings changing occupier annually is 5.9 per cent ± ca. 1.0 per cent when averaged over the three years 1969 to 1971. About 3.9 per cent ± ca. 0.8 per cent annually changed occupier without a subsequent amalgamation, and 1.5 per cent ± ca. 0.5 per cent annually changed occupier and amalgamated between 1969 and 1971. A further 0.5 per cent ± ca. 0.3 per cent annually changed occupier between 1969 and 1971 and amalgamated after 1971. Approximately 25.5 per cent of changes in occupier resulted in an amalgamation during the study period and the proportion raises to exactly one third when amalgamations delayed until after 1971 are included. The only independent, albeit partial, check on these figures concerns the 1.5 per cent ± ca. 0.5 per cent of holdings amalgamating each year between 1969 and 1971. Using the complete census of amalgamations, almost exactly 1.0 per cent of holdings were amalgamated annually between 1969 and 1971. Since the sample estimate lies within one estimated standard error of the true figure, the sample can be judged likely to be unbiased particularly since its size (577 cases) reduces standard errors satisfactorily (Footnote 3.1).

Footnote 3.1 Throughout this section the standard errors are all described as approximate. This is because there is no generally valid procedure for estimating the standard errors from a systematic sample. Moser and Kalton (1971 p 83) and Yates (1960 pp 29-30) note, however, that a systematic sample will be somewhat more precise than a fully random sample provided there is no periodic arrangement of the population (which there is not). Its standard errors can be estimated (actually, over-estimated) by calculating the standard errors which would have occurred had it been a simple random sample. The standard errors presented in this section are, therefore, approximate in the sense of being rather larger than the true standard errors which cannot be calculated.

Comparable figures from other parts of the United Kingdom are rare. The Agricultural Adjustment Unit suggested that the rate of turnover of occupiers was 4 per cent per annum with the amalgamation percentage being about 60 per cent (AAU 1968 p 7). The source and reliability of these figures is not given but they can be compared with the Scottish figures given above of 5.9 per cent $\pm$ ca. 1 per cent and 25.5 per cent. From his study of farming in Yorkshire, Simpson (1968 p 9) noted that the proportion of holdings with over 20 acres of crops and grass which changed occupier annually was 7.8 per cent in the West Riding, 2.5 per cent in the East Riding and 4.1 per cent in the North Riding. No standard errors were given as the figures were based on a census of all holdings for the year 1965-66. Hine and Houston (1973 p8) found that the rate of turnover was 5.0 per cent in Leicestershire, 5.2 per cent in Nottinghamshire and 4.9 per cent in Devon. These figures refer only to complete changes of occupier in random samples of 24 per cent of the Devon parishes and 33 per cent of the parishes in the East Midlands. Partial changes of occupier raised the rates of turnover to 6.4 per cent in Leicestershire and 7.8 per cent in Nottinghamshire. No standard errors were given, since the results were based on a complete enumeration of holdings in the samples of parishes, and their results are annual averages for the period 1963/4 to 1968/9. The proportion of the changes of occupier which resulted in an amalgamation was 57 per cent in the East Midland counties and 40 per cent in Devon. These figures from different parts of England are not always strictly comparable with the Scottish figures but, allowing for differences of definition and for sampling errors, the rate of turnover of occupiers appears to be within a percentage

point of five per cent. The proportion of changes of occupier which result in an amalgamation is not nearly as high in Scotland as in the English areas even when statistical amalgamations are included. This is puzzling and may be due to differences of definition in different studies.

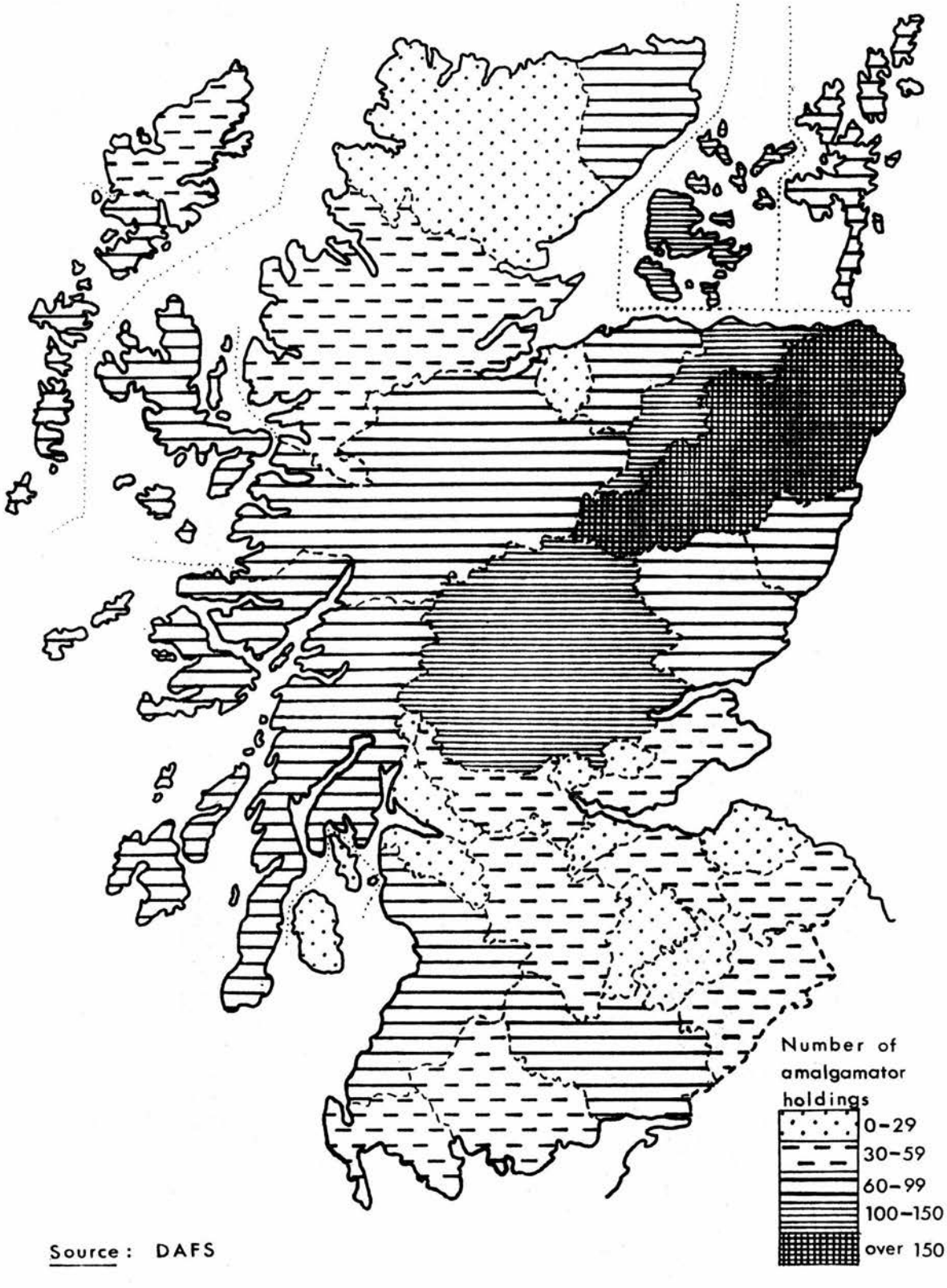
The next stage is to proceed from this description of the amount of amalgamating, both in relation to the total number of holdings and to the number of changes of occupier, to the locating of these amalgamations in order to calculate the rate of amalgamating in different parts of Scotland.

THE SPATIAL STRUCTURE OF AMALGAMATIONS

The spatial distribution of amalgamator holdings can be mapped quite easily by county (Figure 3.1) and by parish (Figure 3.2). Since these maps show the number of amalgamator holdings rather than the rate of amalgamating, they could be a reflection of the distribution of holdings as much as of the distribution of amalgamations. To overcome this, Figure 3.3 shows the probability of amalgamation in each county based on the period 1968 to 1972. The counties of the North East from Kincardine to Nairn and also Orkney are shown to have high probabilities of amalgamation while the probabilities of amalgamation are very low in Lanarkshire and in most of the crofting counties except Orkney (Footnote 3.2). These probabilities have to be treated with caution in some of the small counties where even a single amalgamation can change the probability greatly. The difference in the probability of amalgamation between Kinross and Clackmannan is as much a function of the small number of holdings in these counties as it is of an actual difference in the amalgamating.

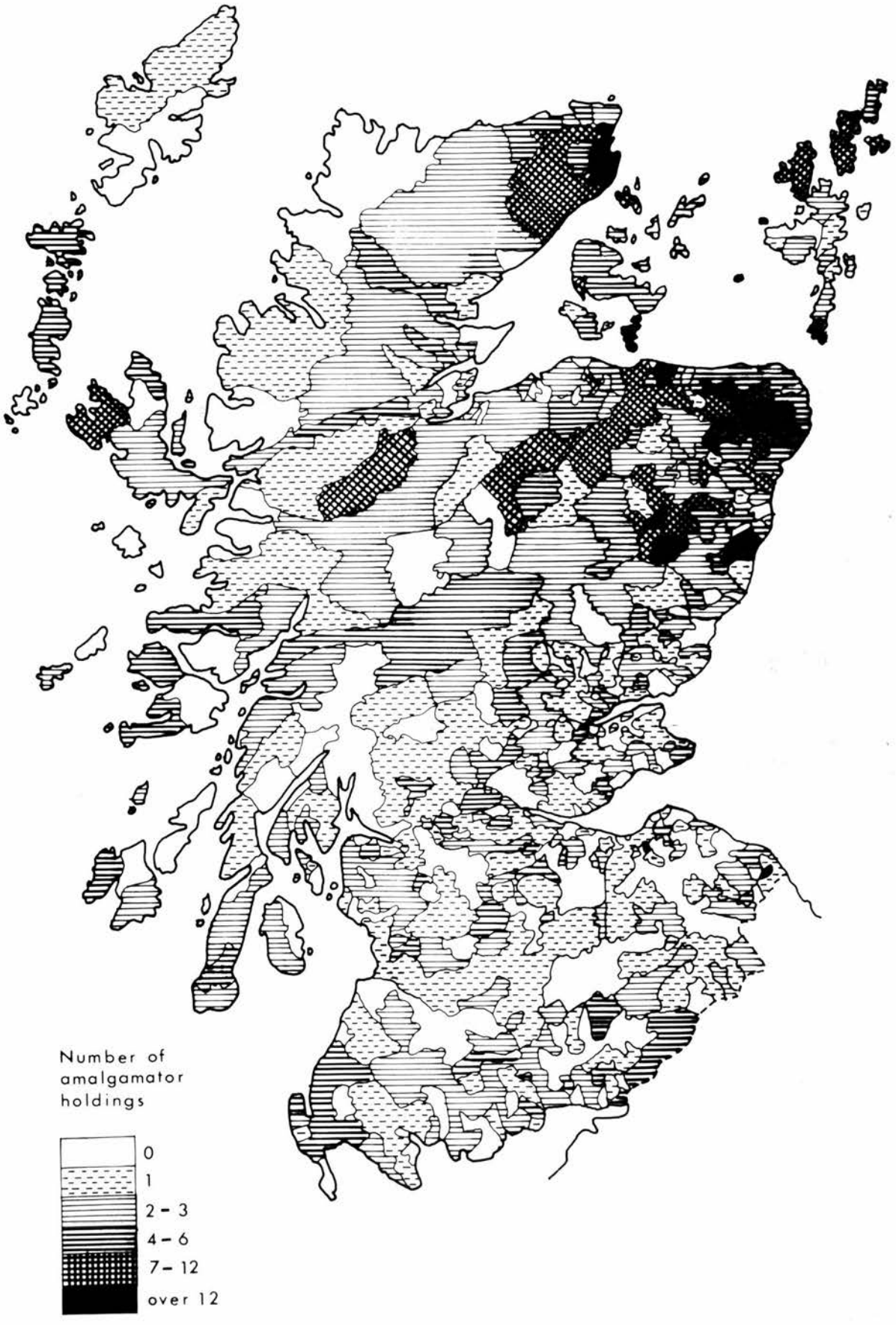
Footnote 3.2 Zetland, Ross and Cromarty, Inverness-shire and Sutherland have low rates of amalgamating.

Fig. 3.1 Frequency of amalgamator holdings by county 1968 – 1972



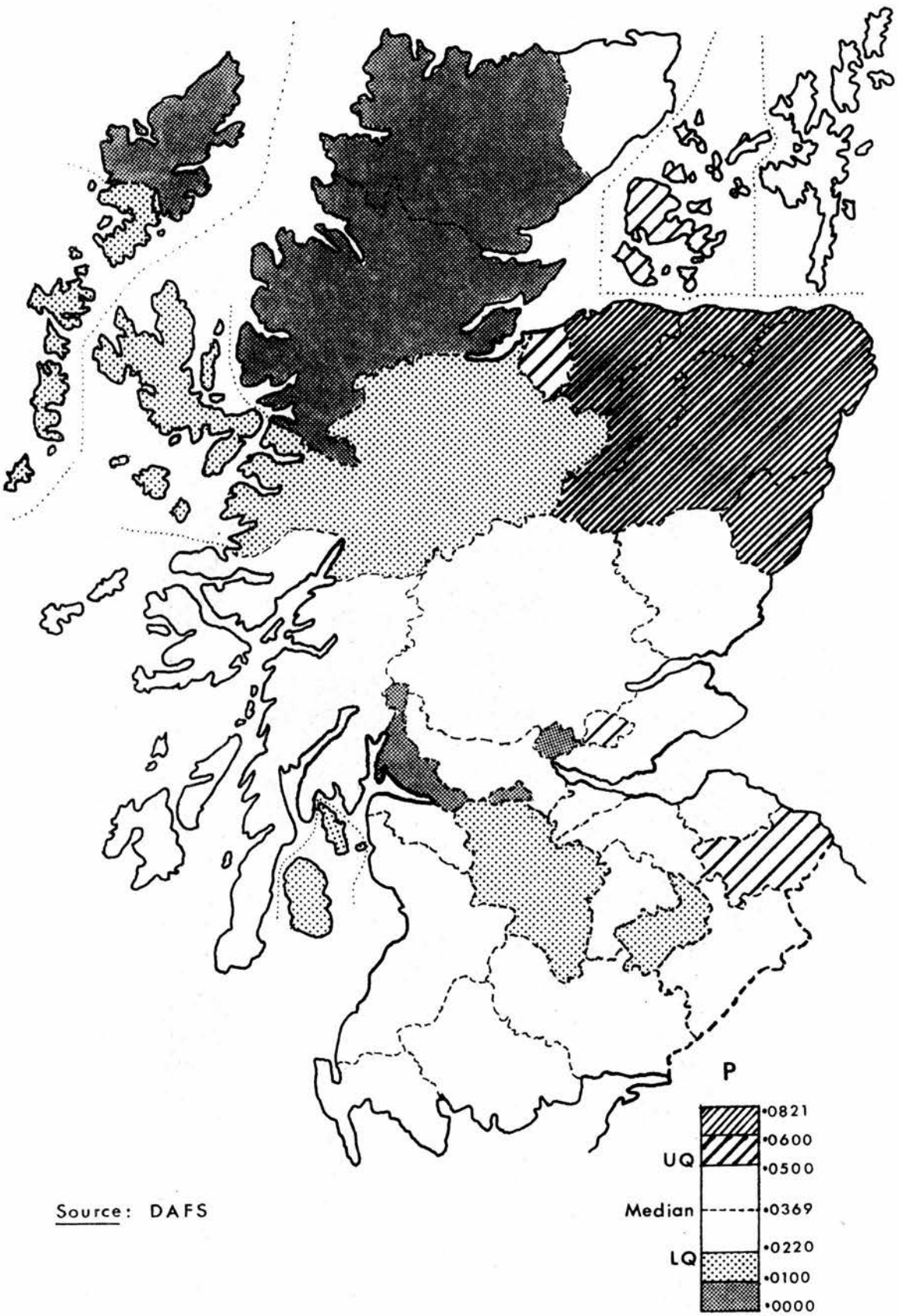
Source: DAFS

Fig. 3.2 Frequency of amalgamator holdings by parish 1968 - 1972



Source: DAFS

Fig.3.3 Probability of being an amalgamator holding by county, 1968-72

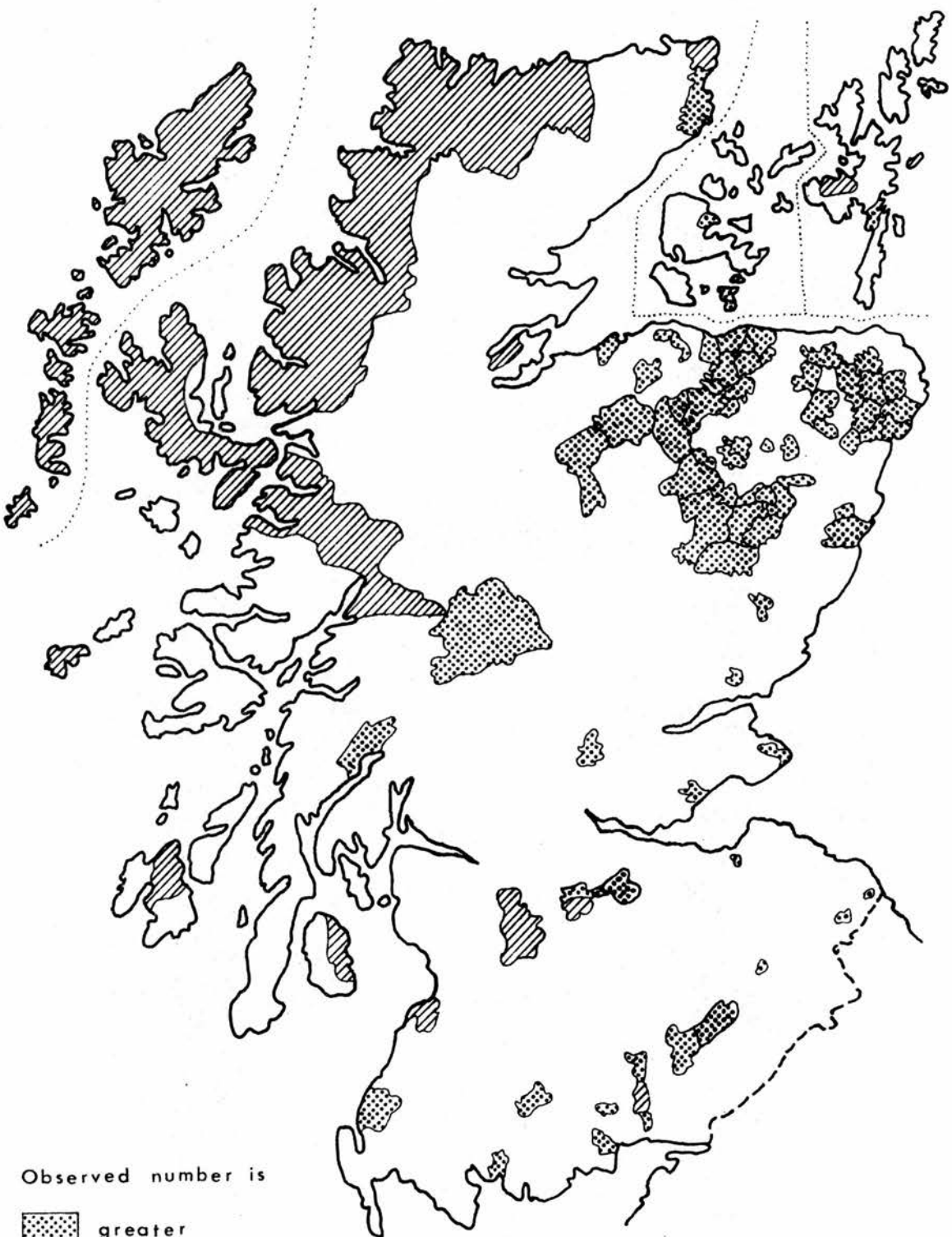


Source: DAFS

Partly to overcome this problem of small numbers, and partly to show up the areas of rapid amalgamating in greater detail, a Poisson probability map was drawn to show those parishes where the number of amalgamations differed significantly from the national average, given the size of the parish. The method used to construct this map (Figure 3.4) is described in Appendix 3.1. The principal conclusion is that the areas where the rate of amalgamating is unusual can be narrowed down to Buchan, West Aberdeenshire, Banff and parts of Moray and Orkney where the rate is high, and to the Hebrides and the North West coastal fringe where the rate is low. Outside these areas there are no concentrations of unusually high or low rates of amalgamating although there may be some tendency to more rapid amalgamating on the southern edges of the Southern Uplands. The fringes of the major cities show no tendency toward more rapid amalgamating, although this has been found in Sweden (Helmfrid 1968 p 43).

The distribution of rapid amalgamating can be approached also in a different way from that of statistical significance. In Figure 3.5, there is a Lorenz curve of the concentration of amalgamator holdings by parish. In a Lorenz curve, the diagonal represents a completely even spread of amalgamators across all the parishes, while the greater the concavity of the curve under the diagonal, the more spatially concentrated are the amalgamator holdings. Of course, the Lorenz curve gives no information on the location of the concentration shown in Figure 3.5 but if the method of constructing the Lorenz curve is reversed, then the results can be mapped as in Figure 3.6. On this map, the five parishes with the largest number of amalgamator holdings and which account for 5 per cent of all the amalgamator holdings between

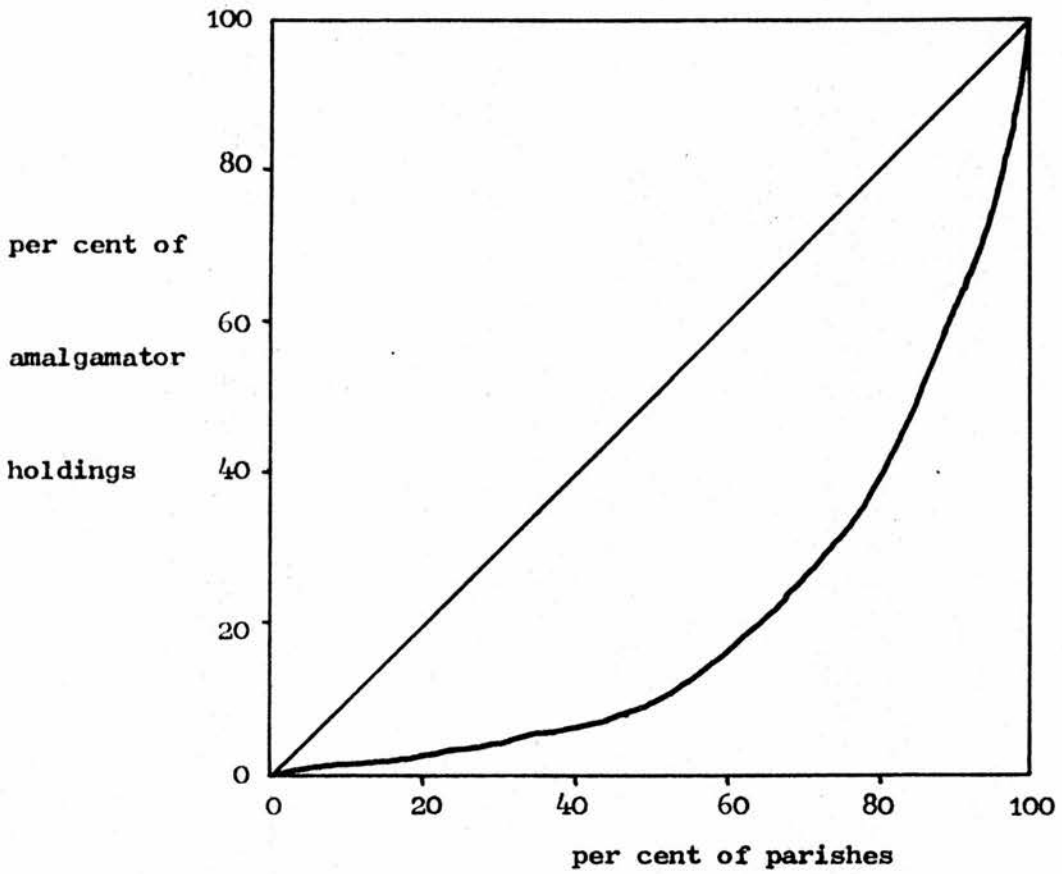
Fig. 3.4 Parishes with abnormal numbers of amalgamator holdings



Significance level = 0·05 (Poisson)

Fig. 3.5 The spatial concentration of amalgamator holdings

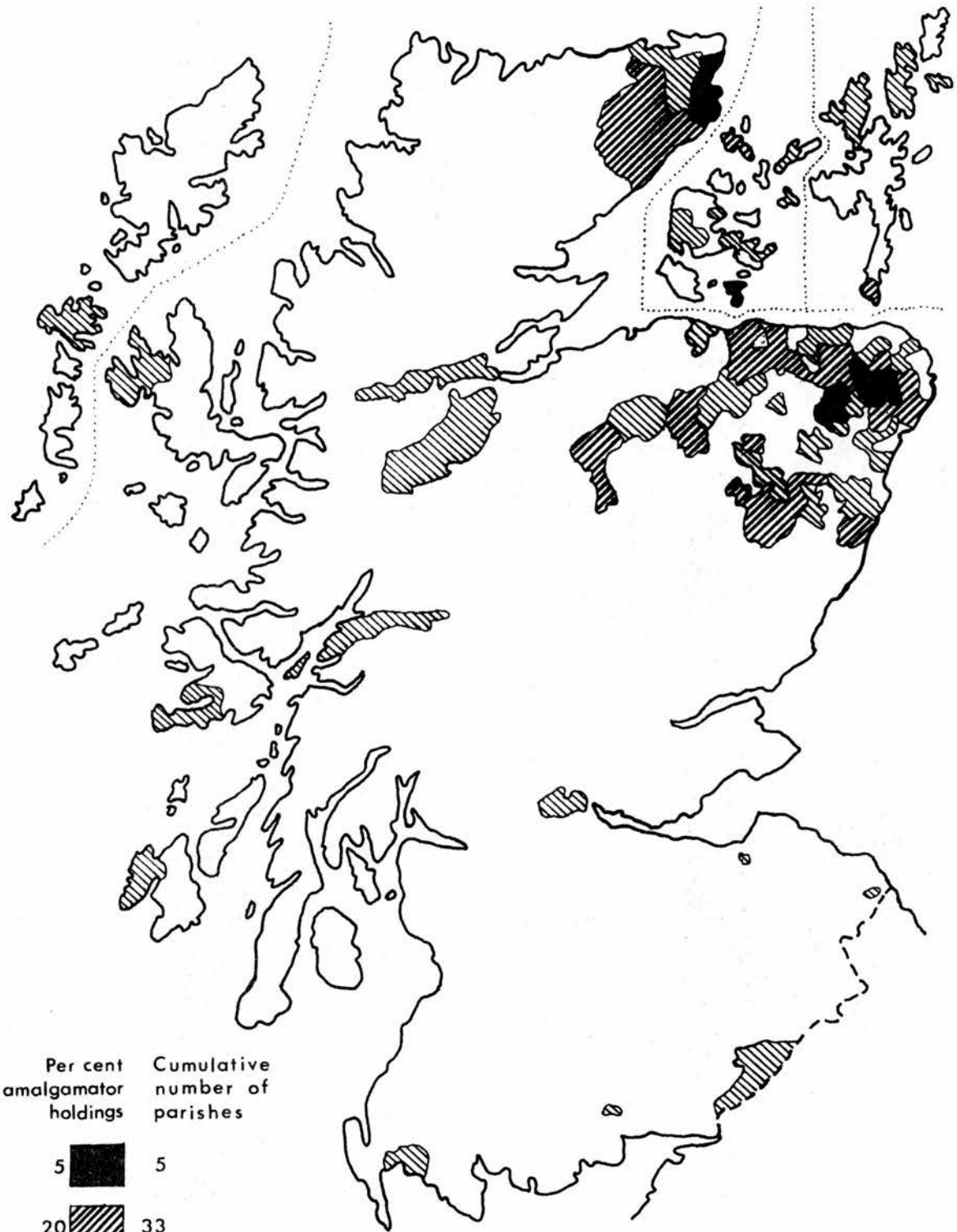
(Lorenz curve)



The Gini coefficient, g = 2.784

Source: Amended census records.

Fig. 3.6 The spatial concentration of amalgamator holdings – 1968-72



Source: DAFS

1968 and 1972 are differentiated from the 33 parishes (out of 891) which account for 20 per cent of all amalgamators and from the 92 parishes which account for 40 per cent of the amalgamators. The pattern centres on the North East as in Figure 3.4 but areas such as Caithness, parts of Shetland and a few Hebridean parishes are brought out as well. In these areas there were many amalgamations in absolute terms although the rate of amalgamating was low due to the plethora of crofts.

In general terms the areas with many amalgamations tend to have high rates of amalgamating with the exception of the crofting counties (apart from Orkney) which have low rates of amalgamating. Conversely, most counties with few amalgamations have low rates of amalgamating.

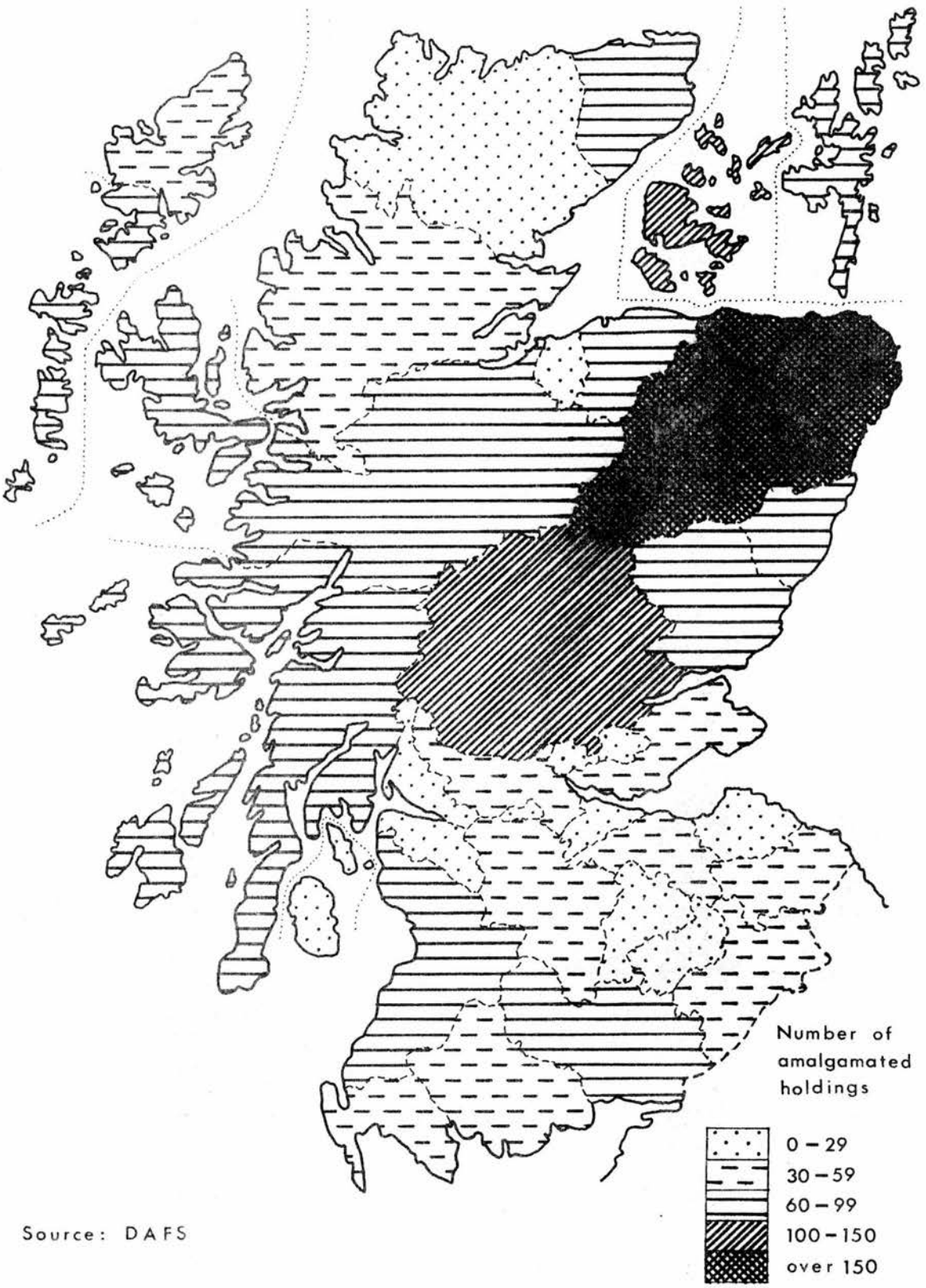
The maps and diagrams presented so far all concern the amalgamator holdings involved in amalgamations. Some idea of the range of amalgamating can be gained from Table 3.1 which shows the number of amalgamations occurring between holdings in the same parish, between holdings in different parishes but in the same county and, thirdly between holdings in different parishes and counties.

Table 3.1 Amalgamations across parish boundaries - 1968-1972

	Number	Per cent
Amalgamations within one parish	1944	86.06
Amalgamations between parishes in the same county	284	12.57
Amalgamations between parishes in different counties	31	1.37
TOTAL	2259	100.00

The amalgamations between holdings in different parishes are nearly always between holdings in contiguous parishes, so that the

Fig. 3.7 Frequency of amalgamated holdings by county 1968 – 1972



Source: DAFS

distributions of amalgamations and the rate of amalgamating shown above are good indicators of the distribution of the holdings taken over - the amalgamated holdings. This is confirmed by an examination of Figure 3.7 which shows a distribution of amalgamated holdings very similar to the distribution of amalgamator holdings (Figure 3.1).

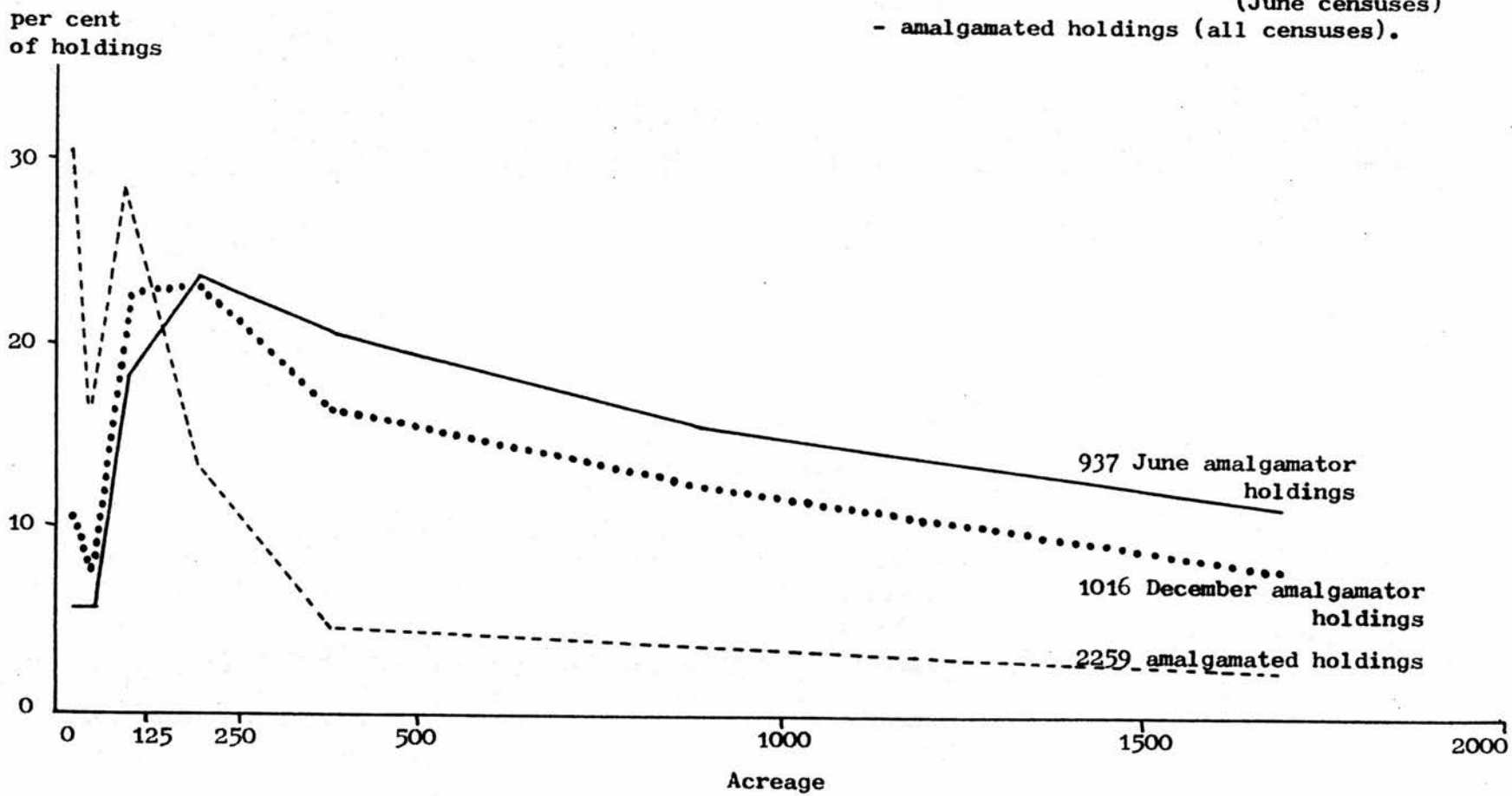
We can now turn from the spatial occurrence of amalgamating to the socio-economic features of the holdings and their occupier in so far as the agricultural census records these.

THE SOCIO-ECONOMIC STRUCTURE OF AMALGAMATIONS

The information from the DAFS not only demonstrates the spatial incidence of amalgamating but also its socio-economic incidence. The acreages of the amalgamator holdings before the amalgamations at the December censuses can be compared in Figure 3.8 with acreages of the holdings taken over and also with the acreages of the amalgamator holdings after amalgamation as recorded at the June censuses. These graphs show the usual positive skewness of economic size distributions and this is repeated in both the estimated standard man-day distributions of June amalgamators before their amalgamation and of the June amalgamated holdings (Figure 3.9). There is a clear tendency for the holding taken over to be smaller than the amalgamator holding both in acreage and by standard man-day size and also for the larger amalgamator holdings to take over bigger holdings than the smaller amalgamators. This comes out well in Figure 3.10 where the median standard man-day sizes are given for each size class of amalgamator holding.

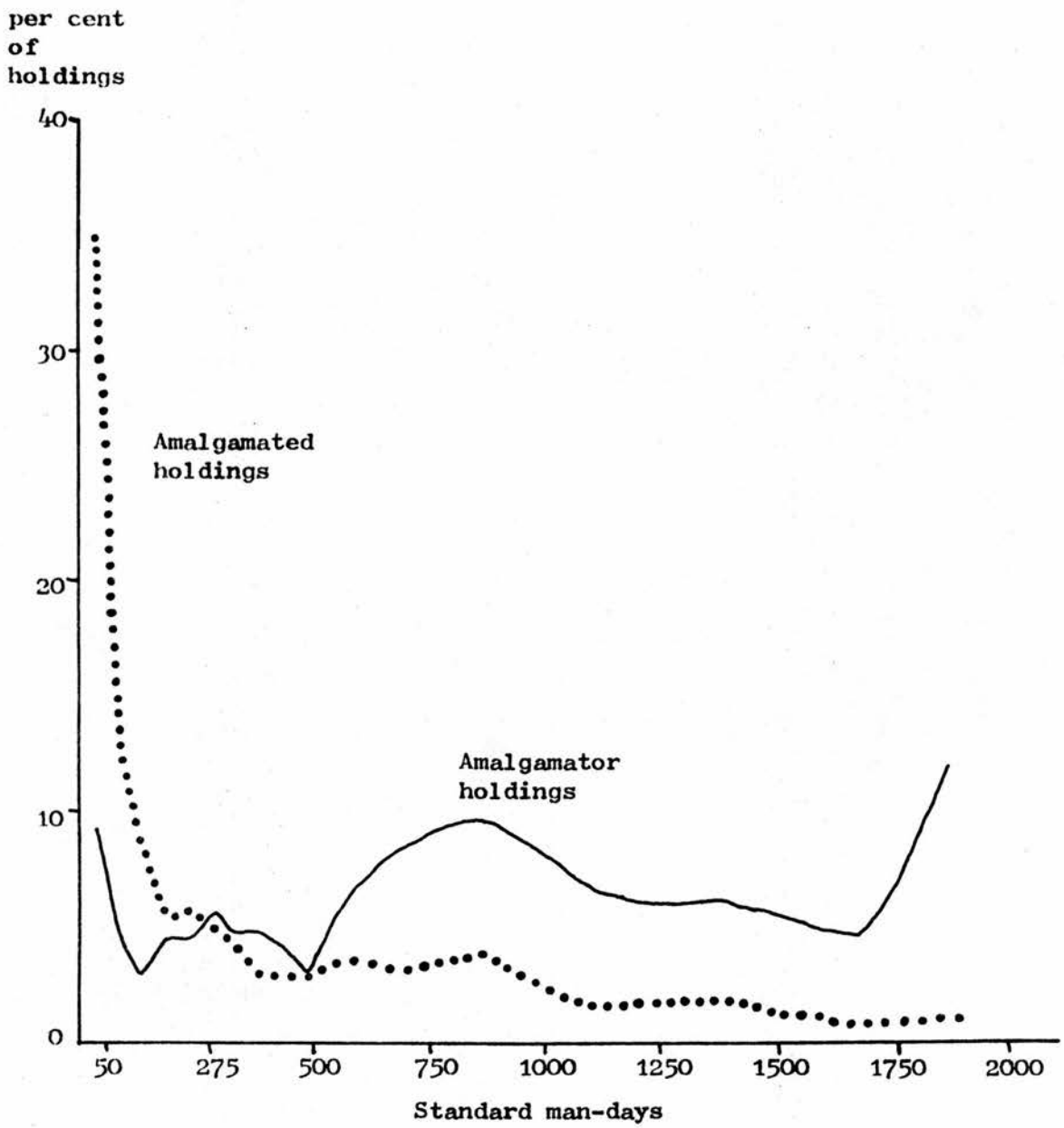
The farm types of the amalgamating holdings is shown in Table 3.2 for the December amalgamations. These data are not strictly comparable with those for the June censuses (given in Appendix 3.2) although, in

Fig. 3.8 Acreage distributions of - amalgamator holdings before amalgamation (December censuses)
- amalgamator holdings after amalgamation (June censuses)
- amalgamated holdings (all censuses).



Source: Amended census records.

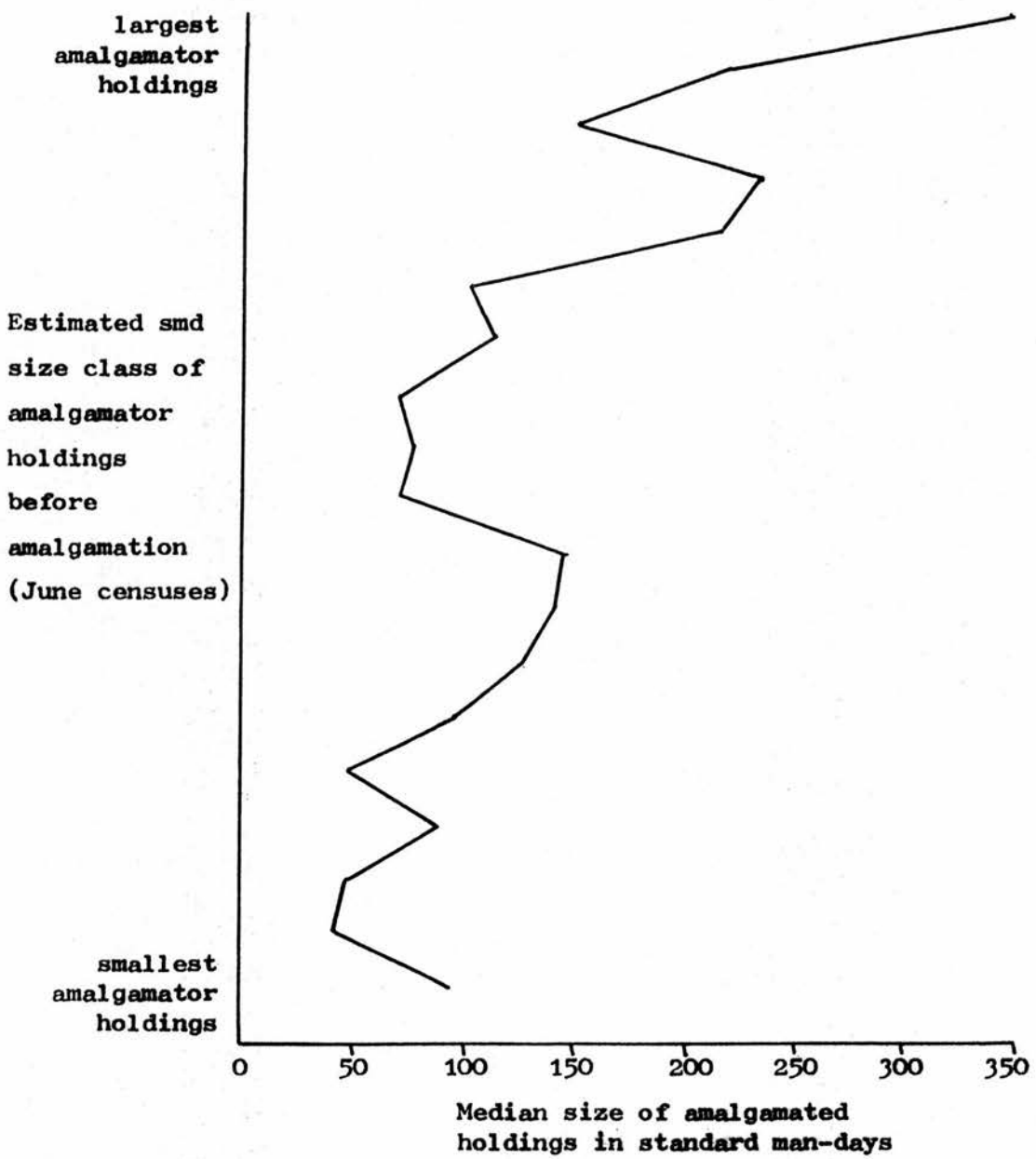
Fig. 3.9 Standard man-day size distribution of amalgamator holdings before amalgamation (estimated size) and amalgamated holdings at June censuses.



Based on 1016 amalgamations.

Source: Amended census records.

Fig. 3.10 Median size of amalgamated holdings by the estimated size of their amalgamator holding.



Based on 1016 amalgamations.

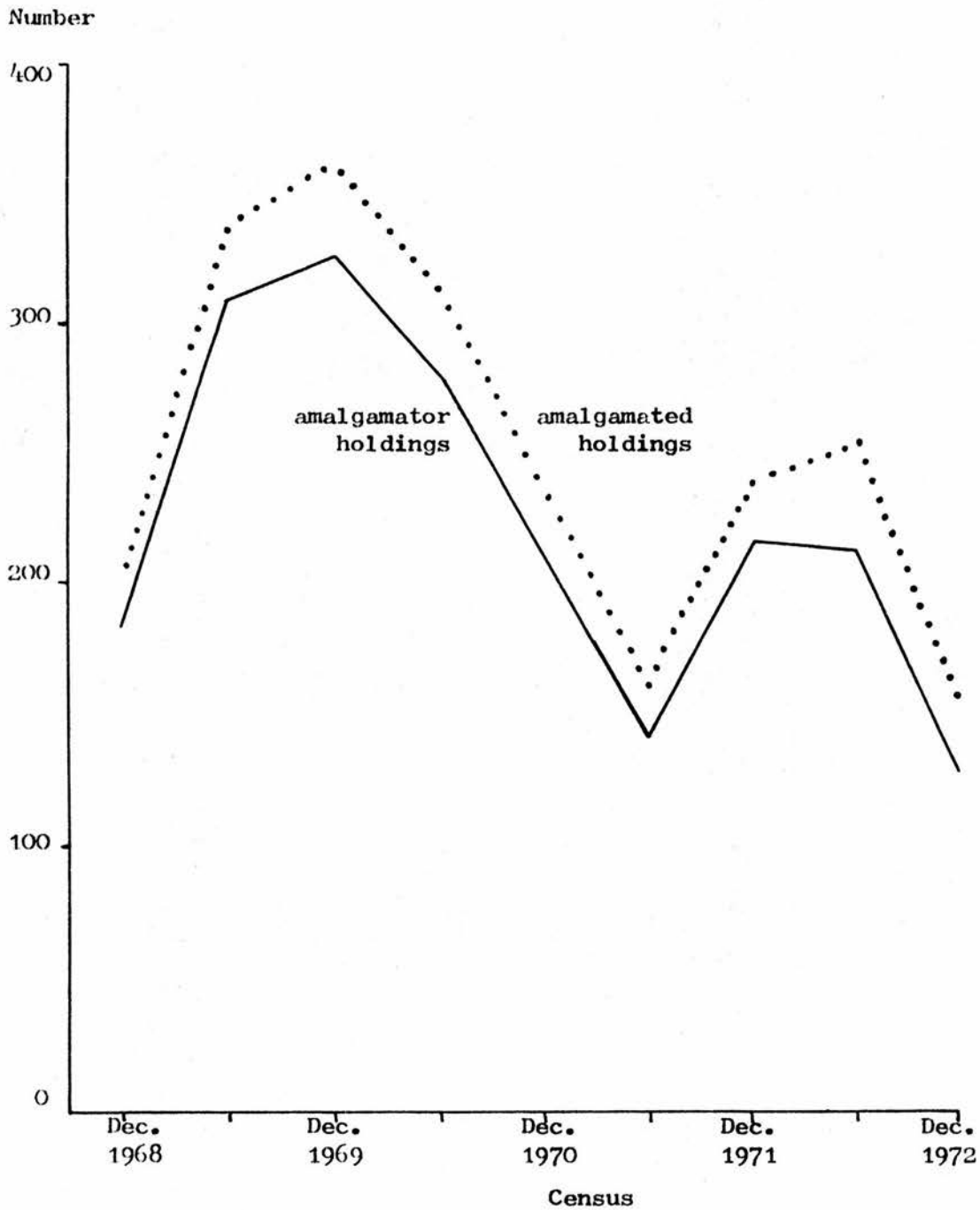
Source: Amended census records.

fact, a similar pattern emerges. Upland farms, rearing with arable farms, cropping and dairying farms account for 64.5 per cent of the amalgamator holdings and the amalgamated holdings are either in these four types (31.2 per cent) or are less than full time holdings (58.7 per cent). Both Table 3.2 and Appendix 3.2 show that holdings of one type tend to take over either holdings of the same type or holdings which are too small to be classified - that is, they have less than 250 smd. The number of amalgamations recorded at each census varies somewhat as Figure 3.11 shows and the ratio of amalgamator to amalgamated holdings also varies a little between censuses as the widening and narrowing gap between the two lines on Figure 3.11 demonstrates. The amount of variation is slight, however, as Table 3.3 shows.

Table 3.2 The types of farms participating in December amalgamations

TYPE OF AMALGAMATORS	FARM TYPE OF AMALGAMATED HOLDINGS												
	1	2	3	4	5	6	7	81	82	83	91	92	Total
1	6	8	1			3	1				6	18	43
2	6	39	19	3	6	1	14				50	69	207
3	1	10	28	3	17	11	4		1		55	52	182
4		2	8	1	4	4			1	1	13	11	45
5		2	2	2	11	2					17	21	57
6	1	3	9	2	7	53	7	3			30	38	153
7	2	12	13		9	13	30			3	24	36	142
81					1		1	4			2	6	14
82				1			1		1				3
83			1			1				3	4	3	12
91	1	8	5	1		6	4	1		1	24	62	113
92	1	4					1	2			7	75	90
Total	18	88	86	13	55	94	63	10	3	8	232	391	1061

Fig. 3.11 Number of amalgamator and amalgamated holdings per census (Dec. 1968 - Dec. 1972).



Source: Amended census records.

Table 3.2 (continued)

All values are frequencies
The type for the December amalgamator holdings refer to their type at the preceding June census
Coverage = 88.71 per cent. Data are not available for new amalgamations nor for reversed amalgamations (defined earlier in this chapter)

Farm type key

1	Hill sheep	7	Dairying
2	Upland	81	Horticulture
3	Rearing with arable	82	Poultry
4	Rearing with intensive livestock	83	Pigs
5	Arable, rearing and feeding	91	Part-time (100-250 smd)
6	Cropping	92	Spare time (< 100 smd)

The data on farm types in June amalgamations (Appendix 3.2) are not strictly comparable with this table.

The farm type classification used is that employed by the DAFS.

Table 3.3 The ratio of amalgamator holdings to amalgamated holdings by census period

Census	Ratio - amalgamators to amalgamateds
December 1968	1 to 1.120
June 1969	1 to 1.101
December 1969	1 to 1.110
June 1970	1 to 1.121
December 1970	1 to 1.112
June 1971	1 to 1.143
December 1971	1 to 1.112
June 1972	1 to 1.194
December 1972	1 to 1.226
Overall ratio	1 to 1.130
Median ratio	1 to 1.120

Figure 3.11 shows the number of amalgamations at each census and also how this figure varies over the nine censuses. However, this establishes a chronology for the recording of amalgamations by the DAFS rather than a chronology for the occurrence of these amalgamations

on the ground. It takes some time for the DAFS to hear about each amalgamation. Sometimes the next census will reveal the farm's expansion but sometimes it will take some years before the farmer decides to amalgamate formally his holdings. In Table 3.4 there is shown the year in which the amalgamation took place for the 339 amalgamations which were recorded officially at the census in June 1969. Here, amalgamation means the year in which the amalgamator took occupation of the extra holding which would become officially the amalgamated holding in June 1969.

Table 3.4 Year of change of occupier for amalgamations recorded officially at the June 1969 census

Year of change of occupier	Number of amalgamations	Percentage	
Before 1964	8	2.4%)	
1964	12	3.5%)	
1965	10	2.9%)	18.8%
1966	11	3.2%)	
1967	23	6.8%)	
1968	127	37.5%	
1969	146	43.1%	
Total known dates	337	99.4%	
No date known	2	0.6%	
Total	339	100.0%	

In some other studies of amalgamation, reference is made to "paper amalgamations" and "statistical amalgamations", terms which refer to cases where the amalgamation took place several years prior to its being recorded officially. In these cases the date of recording the amalgamation is not a fair indicator of the actual chronology of amalgamating. As Table 3.4 shows, there is no point in the distribution

at which one could unequivocally draw the line between "statistical amalgamations" and "present day amalgamations". If, however, a rather arbitrary line is drawn so that amalgamations taking place within two years of the June census in 1969 are called "present day amalgamations", then 80.6 per cent of the amalgamations are "present day" ones and 18.8 per cent are "statistical". The remaining 0.6 per cent could not be dated. It could be argued that a discussion of the nature of amalgamating should confine itself to the nature of present day amalgamations and should not consider the possibly different characteristics of the earlier statistical amalgamations. This point loses much force, however, when three further matters are considered.

Firstly, many of the statistical amalgamations recorded in the later censuses of 1971 and 1972 still occurred during the study period being used here and so are relevant to this study. Secondly, if one were to omit the amalgamations which really occurred before the start of the study period, then, far from avoiding bias, one would be introducing it since it is fair to assume that the latter part of the study period also under-records the true number of amalgamations. The amalgamations not recorded in 1971 and 1972 would appear as statistical amalgamations in the years after the study period. It is felt to be better to have a census of amalgamating which counterbalances under-recording toward the end of the study period by over-recording of amalgamating by including statistical amalgamations at the start of the study period. In so far as all amalgamations during a period can ever be known, this method of roughly compensating errors seems the most likely to approximate to such a census of amalgamation.

Thirdly, it can be demonstrated that the process of amalgamation

is a fairly stable one over the $4\frac{1}{2}$ years of the study period. Each census was compared with the sum of the other eight censuses using either a Kolmogorov-Smirnov one sample test (two-tailed) or a Spearman rank correlation test as appropriate. The characteristics of the censuses which were compared were

a) the distribution by county of the amalgamator holdings,

b) the acreage distribution of the amalgamator holdings,

c) the acreage distribution of the amalgamated holdings,

d) the size distribution in standard man-days of the amalgamator holdings at June censuses,

e) the farm type distribution of the amalgamator holdings and

f) the distribution of the number of amalgamated holdings per amalgamator holding.

In all cases the source of the data was the amended census records divided into the 33 counties, the 12 farm types, the 13 acreage classes and the 19 smd size classes used by the DAFS. In each case the significance level for the correlation or difference was set at .05 and censuses which failed to show up as significantly different from the others or are significantly correlated with the others can be called normal censuses. By the six criteria listed above (a to f), nine out of nine censuses are normal for (a), eight out of nine for (b), six out of nine for (c), three out of four for (d), eight out of nine for (e) and nine out of nine for (f). Out of 49 comparisons only six showed a census to be different from the general run of amalgamating. These six cases are usually different censuses and are spread across the study period.

Therefore, there is no evidence that the character of amalgamating

has been changing during the study period which suggests again that including early statistical amalgamations and omitting later amalgamations which will be recorded after the study period should have no distorting or biasing effect on the picture of amalgamating which this research presents. Consequently, a distinction between statistical and present day amalgamations will no longer be made.

Clearly, some proportion of the amalgamator holdings are "multiple amalgamators" - that is, they take over more than one holding during a single census period. Also, there will be some "repeated amalgamators" which take over more than one holding during the study period although at different censuses. The prevalence of multiple amalgamators is shown in Table 3.5 which gives the proportion of the amalgamators who took over one or more holdings at a single census.

Table 3.5 Number of amalgamated holdings per amalgamator holding, 1968-1972

Number of amalgamated holdings	1	2	3	4	5	6	7	Total
Frequency of amalgamator holdings	1794	167	30	7	-	1	1	2000
Percentage of amalgamator holdings	89.7	8.4	1.5	0.3	-	0.05	0.05	100%

Only about ten per cent of the amalgamators took over more than one farm at a single census. This is not a particularly revealing figure since the recording of two amalgamations at one census (a multiple amalgamation) or at separate censuses (a repeated amalgamator) is as much a product of official clerical procedures as it is of the real incidence of amalgamation. Of greater interest is the combined category of all those amalgamator holdings which were recorded as taking over more than one holding during the study period,

irrespective of whether they were recorded at the same or different censuses. After allowance is made for the removal of holdings which are in both the "multiple" and "repeated" categories (27 cases), some 311 out of 2000 amalgamator holdings (15.55 per cent) were recorded as taking over more than one holding and they accounted for 715 of the 2259 amalgamated holding (31.65 per cent). These repeated and multiple amalgamators do not appear to be distributed in any clear spatial pattern. If, for each county, the probability is calculated of a holding being an amalgamator (essentially using the data contained in Figure 3.1), and if these probabilities are compared with the probability of an amalgamator taking over only one holding, one finds almost no difference in the spatial pattern of the two sets of probabilities. Alternatively, using the Spearman rank correlation test, a very high correlation co-efficient of 0.8461 was found between the probabilities of taking over one holding during the study period and the probabilities of taking over more than one holding. The spatial incidence of prolific amalgamators does not differ from the pattern of amalgamating presented in Figures 3.1 to 3.7.

It has already been stated that there were 2259 amalgamated holdings during the study period. This is not quite accurate, however, since there were 2259 amalgamations but not all the holdings taken over were separate. The definition of an amalgamation which was used included cases where the holding taken over was split between, for example, two amalgamators. Both amalgamators got a part of the holding and that was counted as two amalgamations, provided that they had divided the holding completely between them so that the amalgamated holding disappeared entirely as an agricultural unit. There were 58 cases

(2.6 per cent of all amalgamated holdings) where an amalgamated holding was split in this way between two amalgamators (51 cases) or three amalgamators (7 cases). There is no unusual spatial concentration of these cases and no one census has a large number of them. They do not appear to be larger range amalgamations since the proportion occurring within a parish is only a little higher than the overall proportion (90.2 per cent compared with 86.1 per cent). However, they do seem to be rather larger holdings than those taken over by a single amalgamator. The acreage distribution before the amalgamation of the split holdings is compared in Table 3.6 with the acreage distribution of all other amalgamated holdings and, by the Kolmogorov-Smirnov one sample test (two-tailed), the split amalgamated holdings are significantly different from the other holdings at the .01 level. Even by visual inspection, the higher modal acreage of the split holdings is evident.

Table 3.6 Acreage distributions of split amalgamated holdings and all other amalgamated holdings

Acreage category	$1\frac{1}{4}$-$24\frac{3}{4}$	25-$49\frac{3}{4}$	50-$124\frac{3}{4}$	125-$249\frac{3}{4}$	≥250	Total
Other amalgamated holdings	29.8	16.4	29.1	14.1	10.6	100%
Split amalgamated holdings	6.9	29.3	37.9	17.2	8.7	100%

All values are percentages and the absolute totals are 2136 and 58 respectively

As one would expect given the greater size of these split amalgamated holdings, their division is usually fairly even between the amalgamators. Considering only the 76 per cent of cases where the entire holding

continued in agricultural use and where the holding was divided between only two amalgamators, about three quarters of the amalgamators (77 per cent) received between 30 per cent and 70 per cent of the original holding (that is, in 34 out of 44 cases).

Their greater size is also reflected in their size in standard man-days. This is shown in Table 3.7 together with the size distribution in standard man-days of the 2136 other amalgamated holdings. The Kolmogorov-Smirnov one sample test (two tailed) shows that the split amalgamated holdings differ significantly from all the other amalgamated holdings with respect to their standard man-day size at the .05 level. The greater proportion of split holdings between 200 smd and 400 smd comes out clearly in Table 3.7.

Table 3.7 Smd size distributions of split amalgamated holdings and all other amalgamated holdings

Smd size category	0-199⅞	200-399⅞	400-599⅞	600-1199⅞	1200	Total
Other amalgamated holdings	56.5	20.9	10.0	9.1	3.5	100.0%
Split amalgamated holdings	37.9	36.2	5.2	15.5	5.2	100.0%

All values are percentages. The absolute totals are 2136 and 58.

The splitting of holdings on amalgamation is not unusually prevalent among any particular types of farm.

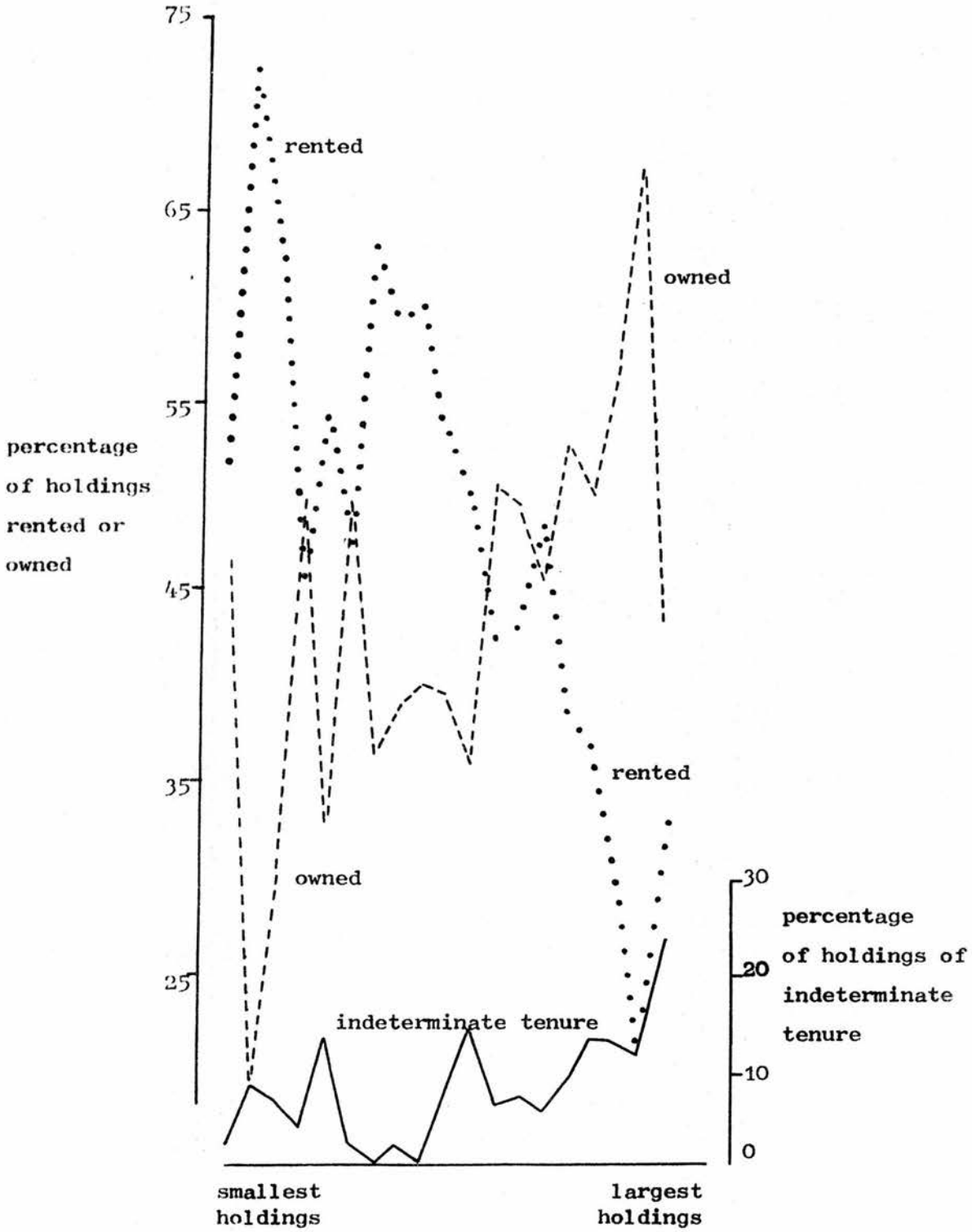
The splitting of holdings is not a very important aspect of amalgamating as it appears to be a fairly rare occurrence associated with larger than normal holdings.

The last aspect of the structure of amalgamating which is illuminated by the national data concerns the tenure of the holdings. Information about tenure was available for 96.8 per cent of the June amalgamator holdings and each was classified according to whether it was rented, owned or of indeterminate tenure before the amalgamation. Since the total area and area owned are known only for the amalgamator holdings after expansion, their classification by tenure before amalgamation requires some calculation. The area of the amalgamator holding which is owned after amalgamation may be less than half the area of the amalgamated holding in which case the amalgamator holding is classified as rented. If the area not owned after amalgamation by the amalgamator is less than half the area of the amalgamated holding, then the amalgamator is classified as owned. The holdings which meet neither condition, that is, are of substantially mixed tenure are classified as being of indeterminate tenure, except where the area of the amalgamated holding exactly equals the area owned or rented, in which case a precise classification into owned or rented is possible. Overall, 46.4 per cent of the amalgamator holdings were rented farms before amalgamation, 45.8 per cent were owned and 7.8 per cent were of indeterminate tenure. The approximate equality of the tenures overall conceals an interesting relationship with the holding's size. Each holding was classified firstly by its estimated size in standard man-days before the amalgamation. The estimation procedure involves simply the subtraction of the smd size of the amalgamated holding from the smd size of the combined holdings and it appears to over-compensate for the extra land and so under-estimate the amalgamators' prior smd size. In a few cases this led to an estimate of a negative

smd size since the amalgamated holding had a greater smd size than the amalgamator. This is not a common occurrence but it means that the smallest smd category is of limited value and so it is omitted. For the other categories, the relationship between estimated size in standard man-days before amalgamation and the amalgamator's tenure is shown in Figure 3.12. The smaller amalgamator holdings are predominantly rented while, the larger the holding, the more likely it is to be owned. There is also some increase in the number of holdings of mixed or indeterminate tenure with size. The Kolmogorov-Smirnov one sample test indicates that the actual frequencies of rented holdings differ at the .01 level from a theoretical even distribution of tenancy with smd size on a two tailed test. The smaller amalgamator holdings were disproportionately often rented holdings before the amalgamation.

This is only one of many cross-tabulations which could be carried out to show that location, acreage, smd size, farm type and tenure are all inter-related among amalgamators. So far, however, this section has concentrated on describing the socio-economic concentrations in the process of amalgamation without reference to the underlying distribution of holdings in Scotland. Just as the spatial distribution of amalgamating shown in Figures 3.1 and 3.2 had to be related to the underlying spatial distribution of all holdings in Scotland so as to show that there were real differences spatially in the rate of amalgamating, so the socio-economic patterns described in this section will have to be related to the overall structure of Scottish farming so as to test the stability of the picture presented here.

Fig. 3.12 Tenure of amalgamator holdings before amalgamation (June censuses) by their estimated size in standard man-days before amalgamation.



Based on 1029 amalgamator holdings - 96.8 per cent coverage.

THE SOCIO-ECONOMIC DISTINCTIVENESS OF AMALGAMATORS AND THEIR HOLDINGS

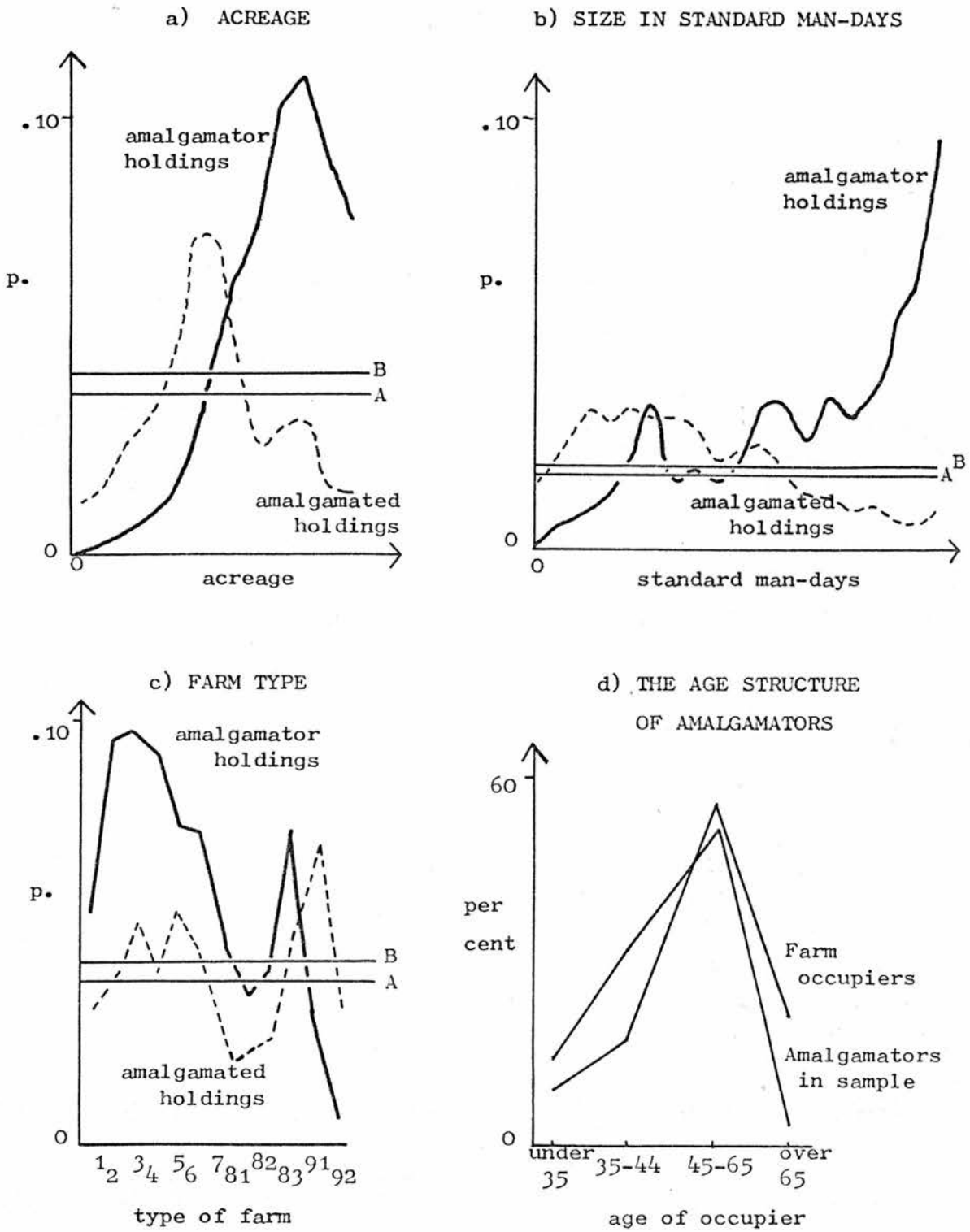
Using information principally from the censuses about amalgamations, it was possible to specify the distinctive characteristics of the farm occupiers who were expanding their acreages. A series of comparisons was made between all amalgamations (or between all June or December amalgamations) and the universe of Scottish holdings. In a few cases the comparison was between a sample of all Scottish holdings and the sample of amalgamations selected for this research. The results of these comparisons are set out in Appendix 3.3.

Amalgamations occur disproportionately often on holdings which are large both by acreage, which agrees with Helmfrid's findings in Sweden (Helmfrid 1968 pp 41-2), and by size in standard man-days and the holdings they take over are also larger than normal by both criteria. Amalgamators are concentrated on upland farms, rearing with arable farms and cropping farms. The amalgamated holdings are less concentrated but still rearing with arable farms are taken over more often than normal and dairy farms were less commonly taken over than their numbers would lead one to suppose. The spatial concentration of amalgamations in the North East and the Orkney Islands has been described already elsewhere. Amalgamators are younger than other Scottish farm occupiers and their holdings are more often owner-occupied and run by a manager than is usual.

Most of the real traits of amalgamators are shown diagramatically in Figure 3.13 and are similar to those noted by Fuller for expanding farmers in Ontario (Fuller 1976).

Fig. 3.13 The distinctiveness of amalgamating holdings and their occupiers.
(see also Appendix 3.3)

THE PROBABILITY OF AMALGAMATING BY :



A = the overall probability for all amalgamator holdings.
B = the overall probability for all amalgamated holdings.

The code numbers for the types of farm are listed in Appendix 3.2.

AREAL EXPANSION OF FARMS OTHER THAN BY AMALGAMATION

During the early collection of data about amalgamations, some care was taken to describe the steps used to remove from the list of amalgamations cases which did not meet the definition of an amalgamation used here. This involved the removal of cases of double-counting and several other kinds of non-amalgamating. One of these was where a holding expanded by gaining land from within the agricultural sector but where the holding which lost the land continued to be farmed as a separate holding after the loss of the land. Holdings can also gain acreage by transfers of land into farming from, principally, forestry or the service departments. These transfers of land into agriculture are known to have resulted in the creation of 80 new holdings in 1971 and another 30 in 1972 (DAFS 1972 p 9, 1974 p 9). It is not known in how many cases the gain of non-agricultural land resulted, not in a new holding, but in the expansion of an existing one, although this information should be available from the census records. Similarly, the fragmentation of a farm may have two effects - either the creation of a new holding or the expansion of an existing one. In 1971 and 1972, 170 and 380 new holdings respectively were created as a result of fragmentation (DAFS 1972 p 9, 1974 p 9). The number of cases where fragmentation led to the expansion of an existing holding was previously unknown but the present study has allowed this to be measured. During the study period (September 1968 to March 1973), there were 57 cases of a holding expanding by the acquisition of agricultural land from another holding which continued to be farmed after this loss of land. Compared with 2259 amalgamations during the

same period or even compared with 550 new holdings created by fragmentation in 1971 and 1972 alone, this is a very minor structural change. Thus, 97.5 per cent of holdings expand their acreage by amalgamation rather than by taking over only a part of another continuing holding. Transfers of non-agricultural land into farm use have been ignored in this calculation but are probably minor. Also, a very high proportion of the farms losing some of their acreage (other than losses out of the agricultural sector) but staying in the agricultural sector themselves transfer the land to a new farm rather than to an existing one.

In so far as comparable information is available for the 2259 amalgamations and the 57 non-amalgamating expansions, these two groups appear very similar in most respects. Both kinds of expansion seem to occur at the same periods since both were most common during the period between the censuses of June 1969 and December 1970. The acreages taken over and the acreages and standard man-day sizes of the expanding farms do not differ significantly at the .05 level by the Kolmogorov-Smirnov test. The proportion of expansions within a single parish is very similar for both kinds of expansion by the binomial z test. The types of farms involved do differ, however. There are fewer rearing with livestock and cropping farms among the non-amalgamating expanders and many more dairy farms. The binomial z test shows only the latter difference to be statistically significant at the .05 level, however. This prevalance of dairy farms among the non-amalgamating expanding farms is probably connected with their unusual concentration in Dumfriesshire, Lanarkshire and Renfrewshire. They are also relatively more common than amalgamations in Orkney and

and Nairn. Only in Aberdeenshire is the proportion of the non-amalgamating expanders much lower than the county's proportion of the amalgamations.

In summary, the expansion of a holding by gaining less than a complete holding is rare compared with expansion by amalgamation with a complete holding. Apart from a prevalence in certain counties with many dairy farms and relatively fewer amalgamations, the holdings participating in non-amalgamating expansions within the agricultural sector appear very similar to amalgamating holdings in so far as the data allow comparisons to be made.

MULTIPLE UNIT BUSINESSES AND AMALGAMATION

Holdings can also expand their acreage by occupying another complete holding but without this being recorded as an amalgamation. This may be because the farmer objects to their amalgamation, or because they are genuinely run as separate holdings, or because they are too far apart to qualify as an amalgamation. Yet these holdings have one occupier - in this context, their ownership is not important.

In 1952, the Department of Agriculture for Scotland published the results of a study which had been made into "multiple-unit farm businesses" (DAS 1952 pp 73-74). A multiple unit business was defined as a farm run with other farms by a single occupier but where the recognisable agricultural patterns diagnostic of an amalgamation had not been built up. The study found that in the early 1950s there were 1,412 such businesses comprising 3,453 farms (10.7 per cent of all full time farms and 4.6 per cent of all holdings in 1950). There were, therefore, 1,412 such businesses out of 74,792 holdings in 1950, that is 1.9 per cent. The survey showed that they were nearly twice

as common in the East and South East regions as in the rest of Scotland. They were also very prevalent among hill sheep farms and cropping with livestock farms forming 33 per cent and 24 per cent respectively of all full time farms of these types. Because these data are now 20 to 25 years old and particularly because they refer to the time before the periods of paper amalgamations between 1957 and 1959 and between 1963 and 1965 (Russell 1970 p 299), it is difficult to provide comparable information for the 1970s, although a survey of multiple unit businesses was carried out by the DAFS in 1968 (Russell 1970 pp 324-325 and Whitby 1970 p 2). In that year, at least 6,000 holdings (11 per cent of the total of over 55,000 holdings) were associated in about 2,500 multiple unit businesses (4.50 per cent of all holdings). This proportion is nearly two and a half times as great as the proportion of 1.9 per cent in the early 1950s. A similar concentration in the South East was noted in 1968 to that found in 1950-52 and again multiple unit businesses were most common among hill sheep, upland and cropping farms. Some work on multiple unit businesses in England and Wales had been published but is rather elderly now for comparing with Scotland (Ashton and Cracknell 1960-61). In 1972-73 there were estimated (Dunn 1975 p 373) to be 2,500 holdings run by another holding but not amalgamated with it, although this survey is not fully comparable with earlier ones because it was confined to significant holdings (over 40 smd).

In order to try and relate multiple unit businesses to amalgamations, an estimate was made of the number of amalgamators in a sample of 107 who occupied farms which were still separate holdings in the census and which were not included in the amalgamation. The nature of this

sample of amalgamators will be described in detail in Chapter 5. The degree of integration between these holdings is not known but their occupier is one whose scale of farming is being under-estimated by the concept of the holding. Just as with the DAFS surveys of 1952 and 1968, the results which refer to the sample are estimates. About fourteen per cent of amalgamators in the sample of 107 seem to have multiple unit businesses compared with the estimate of 4.5 per cent given by Russell as the national incidence of multiple unit businesses in 1968. The proportion in Aberdeenshire, the eastern counties and the south west varies little (14.5 per cent, 11.8 per cent and 16.7 per cent respectively). The holdings which are part of multiple unit businesses seem to have larger acreages than the other holdings (661 acres compared with 277 acres on average) and the holdings they took over at the amalgamation were also more extensive (313 acres compared with 86 acres on average). However, the mean sizes in standard man-days for the two types of amalgamators are very similar (1,480 smd compared with 1,340 smd for the amalgamators and 233 smd compared with 306 smd for their amalgamated holdings). The types of farms which amalgamate and thereafter still form part of a multiple unit business are very similar to those which amalgamate and are not part of multiple unit businesses with the upland, rearing with arable and cropping types most common. The restricted geographical extent of the sample - it covered only 11 of the 33 counties in Scotland - precluded finding the well confirmed tendency for hill sheep farms to form part of multiple unit businesses disproportionately frequently. The holdings involved in multiple unit businesses took over by amalgamation an average of 1.87 holdings each during the study period

which is so similar to the figure of 1.73 holdings taken over by other amalgamators that neither group seems to be the more prolific amalgamators.

The ranges over which the sampled amalgamations took place are less similar as Table 3.8 shows.

Table 3.8 Ranges of amalgamations - distances between amalgamator and amalgamated holdings (percentages in brackets)

Distance (miles)	M.U.B.s	Other amalgamations
0.5	7 (46.7%)	52 (56.5%)
1.0	5 (33.3%)	20 (21.7%)
1.5	1 (6.7%)	8 (8.7%)
2.0	1 (6.7%)	4 (4.3%)
⩾2.5	1 (6.7%)	8 (8.7%)
TOTAL	15 (100.1%)	92 (99.9%)

However, the difference is not statistically significant by the χ^2 test at the .05 level (see Footnote 3.3). The structure by tenure of amalgamators also varies according to whether or nor the holding is part of a multiple unit business as Table 3.9 shows.

Table 3.9 The tenure of amalgamator holdings in sample (percentages in brackets)

Tenure	M.U.B.s	Other amalgamators
Rented	3 (20.0%)	39 (42.4%)
Owner-occupied	6 (40.0%)	41 (44.6%)
Land being taken in hand	6 (40.0%)	12 (13.0%)
TOTALS	15 (100.0%)	92 (100.0%)

Footnote 3.3 The symbol χ^2 is used to indicate the chi-squared distributional form and the symbol X^2 is used to indicate the statistic calculated from a χ^2 test (Kendall and Stuart 1967 p 421)

Amalgamators which are part of a multiple unit business are much more likely to be taking land in hand when they amalgamate than to be renting the extra land. The proportions of amalgamators who are taking land in hand appears to be greater for the multiple unit businesses which amalgamated than for the other amalgamators although the small frequencies preclude a formal testing of this difference.

This section about the relationship between amalgamators and multiple unit businesses is rather unsatisfactory since comparable information is not available nationally from the DAFS and from the present sample of amalgamators. Much formal statistical inference is, therefore, impossible as areal coverage varies, definitions of multiple unit businesses may differ and some of the data are only estimates. From what information is available, multiple unit businesses appear to be disproportionately common among amalgamators although they are not unusually prolific amalgamators. They are extensive farms, even for amalgamators, although they are not particularly large as businesses (smd size) and they are usually owner-occupied. In particular, they are often owner-occupiers taking land in hand over rather greater distances than usual. In other respects amalgamators which are part of multiple unit businesses are similar to other amalgamators.

CHAPTER 4

THE STRUCTURE OF EXPLANATION IN GEOGRAPHY

The purpose of this thesis is to select some aspects of the patterns of amalgamating which have been described already in Chapter 3 and to explain why the process of amalgamating has these characteristics. Why are amalgamations more common among large farms than small ones and why are there more amalgamations in the North East than elsewhere? The placing of explanation at the centre of the thesis seems justifiable on three grounds. Firstly, it provides a sense of purpose and a goal for the research so that it will eventually become an integrated piece of work built around the focal point of explanation. Secondly, the explanation of a phenomenon may open the way to its prediction, although the reverse does not hold (Olsson 1970 p 224). The gravity model can predict interaction, for example, but it makes no claim to have explained anything. When the process underlying the development of a pattern has been understood, then it may be possible to forecast the process's likely effects. Thirdly, any description which is not wholly random will have a structure to it which will determine the relative importance of information and will order that information into a pattern determined by general concepts and rules. No description can be "simple" or "neutral" in the sense that it is dictated by the reality being described and by nothing else (Kuhn 1970 p 127). All

descriptions are in part structured by general concepts and theories and it is desirable that these should be expressed explicitly rather than just implied (Hanson 1969 p 74). Since explanation is normally expressed in terms of theories or hypotheses, no description can be free from implied theories and hence from implied explanations and consequently it is desirable to place these explanations at the heart of the work.

Since explanation is to be so important, it needs to be defined and explanation appears to take two forms depending on its scale, that is, on whether it concerns aggregated data relating, for example, to parishes or size classes or whether it concerns individuals or single events. There seems to be no alternative to regarding explanations of aggregated data (such as the number of amalgamations in each county) as consisting of correlations between variables at the aggregated scale. If it is accepted that correlation does not imply causation, then the explanation of aggregated data which are affected in some way by human choice cannot extend beyond correlation. Whether correlations are really sufficient to constitute explanations seems very debatable (Lyon 1967 pp 4-5). Obviously, the absurdities of some possible correlations have to be avoided by justifying the significance of the correlation both statistically and also in relation to logical argument or to the normal behaviour of the individual. A correlation between, for example, the rate of farm amalgamations in counties and the density of hospitals might be statistically significant but could hardly be logically significant. If the statistically significant correlation were between the rate of farm amalgamations and the proportion of large farms, then this could be

logically significant as well, since large farms might have larger financial resources and so might be disproportionately successful in bidding for farms which were for sale. Conversely, circumstances could be envisaged where the lack of a statistical correlation would not invalidate the argument that the uncorrelated variables were linked causally. Whether or not significant correlations can constitute an explanation is less important than recognising that they are very insubstantial, tending to raise more questions and suggest more hypotheses than they answer. The hypotheses they raise can only be tested at the level of the individual event, the single amalgamation, for example, so that if information on an individual basis is not available, the research will hardly advance beyond suggesting plausible "factors" or "influences" on farmers' behaviour without ever showing why they decided to act in the way they did. The limited development of explanation in agricultural geography is in fair measure due to the almost exclusively aggregated nature of the data available from the agricultural censuses and also to the difficulties in using field work to fill the gaps. The conclusion of this seems inescapable. If an explanation of an aspect of the amalgamation of farms is to be attempted, then its chances of success will be much improved if details can be obtained about individual amalgamations, that is, if one can in Bunge's terms replace a black box approach by a translucid box approach (Bunge 1964).

When information about individual amalgamations is available then it is possible that one can approach discovering either the causes or the stated causes of individual actions. One would express possible causation by means of hypotheses whose function would be to

assign variables to a category of causation. The concept of categories of causes was described by Lyon (1967) who visualised at least three groups of causes

a) "specific causes" - occurrences which precede the event to be explained when that event occurs and whose absence will necessarily preclude the event. The specific cause is not sufficient by itself to cause the event but will cause the event when the predisposition is present.

b) "predispositions" - those necessary conditions which are broadly favourable to the event under study but which are not sufficient per se to bring it about.

c) "contributory causes" - neither necessary nor sufficient conditions but occurrences which may be present and may either reinforce the effectiveness of the specific cause or influence the exact timing of the event.

Not all these categories of causation will be filled in any single explanation and it is interesting to note that none of the categories of causation constitutes by itself a sufficient cause - that is, an event whose occurrence will invariably be followed by the effect to be explained, whose presence alone is enough to produce the effect and whose absence is enough to preclude the effect. The view

being expressed here is that there are no single dominant causes of geographical phenomena. There are always multiple causes because there are the three types of causes mentioned above and because within any type there are no sufficient causes to account for human behaviour. There are no occurrences which always entail a certain reaction in people's way of life and no other reaction. The young, for example, migrate more than the elderly but youthfulness is neither a necessary nor a sufficient condition (in Lyon's terms neither a predisposition nor a specific cause) of migration since some young people will not migrate and some migrants will be elderly. Youthfulness is rather one of several contributory causes since its effect is probabilistic. It makes migration more likely among certain sections of the community but not certain. We are, therefore, seeking to construct our explanation of amalgamation out of one or several contributory causes. The consequences of these points for the nature of the multiple causes will be taken up later.

However, it is appropriate at this point to consider the sequence of events which should lead up to the formation of theories or explanations. The inductive process would form hypotheses from an impartial observation of the real world, these hypotheses would then be tested against reality and if their postulates were confirmed then the hypotheses would be validated. The weaknesses of this inductive approach have been instanced several times but they can be listed briefly. Firstly, induction assumes an impartial observation of reality as the starting point for explanation and yet we never observe impartially, free from preconceptions. All descriptions are basically classifications of objects' characteristics and every

classification has a theory behind it setting out which characteristics are important and which values for those characteristics are important. We research with what Louis Pasteur called "a prepared mind" so that the inductivist assumption that explanation starts with hard agreed facts is not acceptable. Our perception of the world is less clear cut than that. Secondly, the inductive approach assumes that there is only one interpretation possible of a given situation. This too is unacceptable as Lyon (1967 p 9) notes that evidence statements never entail causation statements and, more simply, Kuhn (1970 p 76) notes that no fact ever entails any single explanations of itself and that it has been "repeatedly demonstrated that more than one theoretical construction can always be placed upon a given collection of data." Similarly, Kerlinger (1964/1970 p 24) cites Braithwaite as supporting this since "no hypothesis is ever a logical consequence of its supporting evidence." The assumption of the inductive method that the explanation of any event is self-evident from its description is unacceptable even if only because this assumption cannot accommodate the cases of good fortune and of false hypotheses which are all too numerous in real research. Thirdly, the inductive approach requires that one attempts to verify one's hypothesis so as to help decide whether to accept or reject it. The principle of verification has been criticised since the time of David Hume for ignoring that a single counter-instance - that is, a single piece of evidence unfavourable to the hypothesis - would demonstrate that the hypothesis did not describe adequately the causation at work.

Given these three areas where the inductive method seems unacceptable, an opposing method of forming and testing hypotheses

and hence explanations has been proposed particularly by Popper (1963). This method, called hypothetico-deductive, starts from a hypothesis, a product of one's imagination in large part, which is subjected to severe tests to attempt to show that it is a false explanation of the initial problem. If none of the tests succeeds, the hypothesis is accepted pro tem. as the explanation of the given phenomenon. While the hypothetico-deductive method meets several of the points raised against the inductive method, it is still open to question on several counts. Firstly, one can think of not one hypothesis to explain an event but of several. Instead of having one hypothesis which is tested and, if rejected, is replaced by another which explains all that the first hypothesis did and which also explains what the first hypothesis failed to explain, it is more normal to have several simultaneous hypotheses each of which has the same potential range of validity. The hypothetico-deductive method is not structured to meet such a situation which is quite normal in research in the social sciences. Secondly, the method assumes that the hypothesis to be tested is an independent creation, largely autonomous of the reality against which it is to be tested. While such a view can be understood in relation to the criticisms made of induction, it is too extreme a reaction and, like induction, too simple a view of human thought processes. Conjectures or such hypotheses are developed against the researcher's ineradicable background of past theories and of his knowledge of the world. Such a background is not the sole basis of any hypothesis since pure imagination has a part to play nor does such a background entail any single hypothesis but to speak of hypothesis formation as a process without any theoretical or empirical antecedents in the

researcher's mind is not acceptable. There is probably an inductive element at work in how we form our many hypotheses.

Thirdly, there is the problem of testing the hypothesis, however this was formed. The Popperian hypothetico-deductive method introduced the concept of falsification whereby the aim of the tests was to disprove the hypothesis - that is, to show that it did not describe fully the world within its stated domain. Any instance of unfavourable evidence was held to be sufficient to reject the hypothesis and to start the process of creating a new, broader hypothesis.

Both the verification and falsification principles are inadequate. The method of verifying hypotheses has been criticised for assuming that sufficient favourable evidence can constitute a proof of the hypothesis. It ignores the fact that no hypothesis can be subjected to all possible tests (Kuhn 1970 p 145) and that a single piece of evidence unfavourable to the hypothesis could be sufficiently critical to disprove it. Equally, the method of falsifying hypotheses can be criticised. In the same way that a single favourable observation can verify a hypothesis to an extent, so a single unfavourable piece of evidence will falsify a hypothesis, even although falsification itself is subject to error. Both principles are weakened by accepting only proof or disproof and both are liable to sway the researcher into accepting the proof or disproof of a hypothesis through a single observation. Accordingly, it would be possible to verify, for a while, every explanation of the amalgamation of farms by the one principle and it would be equally easy to reject rapidly every explanation by the falsification principle (Kuhn 1970 p 146) since no theory will ever explain all the data completely. The result of

applying these scientific methodologies to the social sciences would be an almost perpetual vacuum between two types of hypotheses, the untested and the rejected. Such an unstable situation has been criticised by Kneale (1967 p 32 particularly). The instability arises from the absolute definitions given to verification (or acceptance) and falsification (or rejection) by which a single observation can be critical, in the sense of instantly causing a reversal in our opinion of a hypothesis. Any explanation in the social sciences is likely to have a balance of some evidence for it and some against it, the latter representing (a) some of the errors inherent in all hypothesis testing and (b) the fact that no hypothesis, irrespective of its generality or explanatory power will ever explain all the data exactly in the social sciences. One's judgement of a hypothesis must then become probabilistic rather than absolute. Instead of acceptance or rejection in absolute terms there ought to be a continuum of acceptability as the balance of evidence alters. This continuum of acceptability may not have a numerical scale attached to it but it should be possible at least to rank competing hypotheses, that is, potential explanations, along the scale so that one will be more likely, that is, have more favourable evidence and less contradictory evidence than the others. This hypothesis would then become the provisionally preferred explanation of the phenomenon (Kuhn 1970 p 147 and Hesse 1969 pp 91-97). The conclusion from this would seem to be that there is no way independent of theory to explain the amalgamation of farms but that there is no theory to show us which competing explanation should be chosen. Even the relative objectivity of the guidelines called significance levels provided by the

Neyman-Pearson method of testing purely statistical hypotheses may not be available always. Failing an agreed standard for the disproof of hypotheses (Robinson 1964 p 26), one is thrown back on the detailed justification in public of one's personal judgement about which explanation to choose. There seems to be no other standard to work to.

In the context of the present research, the basic data has been presented already in Chapter 3 which represents the extent of our knowledge of amalgamations based on official census data. From this and from the existing theories concerning economic change and decision making, certain possible explanations will be presented in Chapters 6 to 9 of the surprising or anomalous features of the process of amalgamating which have become apparent now. For example, the regional distribution of amalgamations is surprising - its unevenness presents a problem to be solved - and possible solutions, that is, several hypotheses, will be presented which would remove the surprise by explaining the distribution of amalgamating. The hypotheses will be tested sequentially, the testing will be largely attempting to build up falsifying evidence against each hypothesis and then the hypothesis or hypotheses with the least against it/them will be accepted as the provisional explanation(s) of the distribution of amalgamations in terms of predispositions and contributory causes. It will be accepted and the other explanations rejected, not because the former is proved and the latter are disproved, but rather because it is the most likely of those possible explanations derived at the start from the existing theories, the official data and the researcher's own imagination. It has the least evidence against it given the weakness

of the data and the extent to which hypothesis testing is possible. It may be that a hypothesis will have to be accepted subject to the proviso that all the testing of hypotheses one would wish to do is not possible.

It is felt that this scheme of forming explanations combines the desirable properties of both the inductive and deductive methods without also accepting their less realistic and more extreme elements. Probably neither purely inductive nor wholly deductive research could exist. The methodology in this work will lean more heavily to the deductive end of the spectrum in the testing of hypotheses but it will rely in part on induction for forming the hypotheses. By using individual data, the research will try to avoid the sterile data fitting of the positivist black box approach (a concomitant of aggregated data) since true explanation in terms of individuals' motives, values and attitudes and in terms of the constraints which limit individuals' actions should be possible. This means that there will be an element of <u>verstehen</u> in the methodology of explanation used here as advocated by Guelke (1975). While these pure methods may set down prescriptive idealisations of research, they are rarely descriptive of real-world research and the compromise methodology presented here is likely to be practicable as well as being logically satisfying. It seems to be suitable for the kind of data to be used and the kind of questions to be answered and Gale has noted the importance of allowing the context of research to determine the methodology (Gale 1973 p 260).

A final point needs to be made about explanation. There is a problem of infinite regression in all research. Thus, if Z was

caused by X and Y being present and by W being absent, then what caused the presence of X and Y and the absence of W? And when the causes of these three have been found, what caused their causes? The phenomena described in Chapter 3 are likely to be the end of a long causal chain and the danger is that the research will become enmeshed in the unending return to "ultimate causes". To prevent this, the explanations will only go so far and will stop, accepting certain things as given. Thus, in a study of cereal crops, if the distribution of wheat was found to be caused by soil type and farm size, it is unlikely that one would attempt to explain the distributions of soil types and farm sizes. Rather these would be taken as "given" features of the landscape for the purposes of that study of cereals although still recognising that workers with different aims and skills could use the distribution of soil as just the starting point for their own explanations. An alternative way of avoiding infinite regression is discussed by Bird (1975).

After this discussion of how, in general terms, explanations should be formed, the next step is to specify the problems needing to be explained and this will be done in the next chapter.

CHAPTER 5

SAMPLING AMALGAMATIONS

THE PURPOSE OF THE SAMPLE

After a study of the material from the census records, certain important aspects of the process of amalgamation remain unclear. These include the following points:

a) whether amalgamation is an immediate reaction to the vacancy on the amalgamated holding or whether it is the result of a period of searching for land;

b) whether the specific holding taken over is conditioned by prior business links or family ties;

c) what proportion of amalgamations are carried out within estates;

d) what effect amalgamation has on cropping and livestock activities;

e) whether amalgamation is regarded as similar to intensification or as a means of expansion with distinctive characteristics;

f) whether amalgamators are representative of the population of farm occupiers regarding their age, frequency of possessing non-farm incomes and the proportion of them with heirs at the time of the amalgamation.

The purpose of the sampling was to obtain information from individual amalgamators so as to test hypotheses regarding the nature and rate of amalgamating and to help explain the process of decision

making which precedes amalgamation (Chapter 9). The information collected will be used also to explain why holdings in particular areas amalgamate more than those in other areas and why large holdings take over more holdings than smaller holdings do (Chapters 8 and 6).

THE TARGET POPULATION

Within the total population of all the amalgamations in Scotland recorded between December 1968 and December 1972, a target population was defined as the first stage of the sampling. The sampling technique, which will be described later in detail, involved the stratification of the population before sampling by the standard man-day size of the amalgamator holdings before the amalgamation, and this information is available only for amalgamations recorded at a June census. For reasons to be discussed later in this chapter, it was decided also to restrict the sampling to eleven counties in three regions of Scotland. The target population of amalgamations was thus defined as amalgamations which were recorded at a June census during the study period, which can be classified by the smd size of the amalgamator holding before the amalgamation and which occur in one of the eleven sampled counties. The way this reduces the total population of amalgamations to the target population is set out in Table 5.1.

Table 5.1 The definition of the target population

	Number	Per cent
All amalgamations, December 1968 to December 1972 inclusive	2259	100.0
All such amalgamations recorded at a June census	1063	47.1

Table 5.1 (continued)

	Number	Per cent
All such amalgamations which are classifiable by smd size	1016	45.0
All such amalgamations occurring in county groups 1, 2 or 4	547	24.2

Three questions can be asked about this target population:

a) Are June amalgamations representative of all amalgamations?

b) Is is justifiable to include the amalgamations in only eleven of the 33 Scottish counties?

c) Does this definition leave all amalgamators with an equal probability of selection?

a) The representativeness of June amalgamations

Details of the twelve tests carried out to assess the representativeness of June amalgamations are set out in Appendix 5.1. The inference from these tests is that the amalgamations recorded at June censuses are not significantly distinctive in comparison with the December censuses in so far as comparable data exist for June and December censuses. There is the possibility that one group is different from the other by criteria on which no information exists just as there is a measureable tendency for the holdings taken over at the four June censuses to be more often part-time or spare time holdings. Apart from this one case, however, there is no evidence that the June amalgamations differ from the December amalgamations in any other respect. The conclusion from this is that restricting the sampling to June amalgamations (so as to allow the sample to be stratified by the holdings' standard man-day size) does not

introduce any systematic bias into the sample. This restriction should leave the results of the sample representative of the amalgamation process throughout the study period.

b) The restriction of the target population to eleven counties

The amalgamations in the 22 minor counties were omitted so that larger samples - and so more precise sample estimates - could be achieved in the three strata (regions) of eleven counties which were sampled. These three strata had either the greatest number of amalgamations or the greatest rates of amalgamating or they were particularly homogeneous in the types of farms participating in amalgamations. The excluded counties were, therefore, of minor importance for amalgamating in most cases. They also contain a great many crofting amalgamations in many cases and these are of very little agricultural importance although they are a factor of importance in the social development of the crofting areas. The only distinctive feature of these counties is the limited rate of amalgamating which is a rather unhelpful characteristic given the kind of information the questionnaire was designed to elicit. Although the restriction of the sample to three regions will raise the precision of estimates made for these regions - this is obviously advantageous where the aim is to explain regional variations in amalgamating - there is the compensating disadvantage that this prevents inferences being made about the whole of Scottish farming. This is a price worth paying, however, in order to try and explain the marked regional variation in the rate of amalgamating, particularly when the regions which were sampled were the ones with the most amalgamations.

c) Equal probability of selection

It is amalgamations - a single amalgamator and a single amalgamated holding - which are being sampled. This gives an equal probability of selection to each amalgamation and each amalgamated holding, but it means that prolific amalgamators have a greater probability of selection since two different amalgamations, involving the same amalgamator holding, may be sampled. It is impossible to achieve an equal probability of selection for both amalgamator and amalgamated holdings in one sample and it was felt to be preferable to over-sample the frequent amalgamators rather than under-sample the holdings taken over by them. It was possible that the prolific amalgamators might be an important distinguishing feature of amalgamating in the areas of rapid amalgamating and so their amalgamated holdings ought to be fairly represented in the sample.

POSTAL SURVEY OR PERSONAL INTERVIEW

There were two principal methods of obtaining the required information from the sample, by postal survey or personal interviews. The former method tends to have a higher rate of non-response which is selective and tends to introduce bias into the results. Such bias is difficult to detect other than by surmise and is almost impossible to measure or rectify. Although a personal interview of amalgamators would be more strenuous and time consuming, the higher response rate and the consequent confidence in the results made the case for personal interviewing overwhelming. The very high response rate which was achieved from the interviewing (98 per cent) vindicated this decision.

THE METHOD OF SAMPLING

The method of sampling evolved as the result of a sequence of decisions of which the first was whether to sample with or without replacement. The latter is more complex computationally since a finite population correction has to be made while the former produces major simplifications in sampling theory most of which relates to sampling with replacement (Moser and Kalton 1971 p 80; Stuart 1962 pp 37 and 39). These simplifications are particularly valuable where the population is to be cross-stratified as is the case here. Stuart has noted that with a stratified population and uniform sampling fraction, sampling with replacement reduces the sampling fraction to zero, strictly speaking, since it creates an infinite population from which to sample and this will ensure an increase in the precision of estimates over those produced by any unstratified sample (Stuart 1962 p 51). Since the sample will provide estimates of many parameters which may well be quite independent of the criteria used to stratify the population, this ensured gain in precision is felt to be more valuable than the small gain in precision which could result from sampling without replacement with its attendant increase in the complexity of standard error calculations.

The specific sampling design chosen for this study was proportionate stratified sampling, that is, stratification with a uniform sampling fraction. The sample was stratified for two reasons. Since stratification eliminates variation within strata, it nearly always produces lower standard errors for its estimates than does simple random sampling. So for a given sample size, stratification nearly always produces more precise results. The second reason for

stratification concerns the need to produce not only global estimates of parameters for the whole of the target population but also to produce regional estimates so as to assist in explaining the spatial variation in the rate of amalgamation. Stratification would allow these estimates to be made provided that the strata corresponded to regions, as in fact they did. This will be discussed later in more detail.

The next decision was whether the, as yet, unformed strata should be sampled with a uniform sampling fraction (proportionate sampling) or with a variable sampling fraction (disproportionate sampling). The former (a uniform fraction) was used for several reasons, one of which was that a variable fraction could have been applied incorrectly with the result that less precise estimates would be made. A variable fraction should only be used where the stratum is particularly diverse or where the stratum is of such interest in its own right that more precise results are desirable. A fraction of 1 in 5 was used in all the strata, one of which had a wide range of sizes and types of amalgamating holdings which fully required such intensive sampling. The other two strata were more homogeneous in character, so less intensive sampling, say a 1 in 10 fraction, would have sufficed except for two points. Firstly, a 1 in 5 fraction throughout ensures a comparable level of efficiency and secondly, the smallest stratum had so few amalgamations that a 1 in 10 fraction would have produced such a small sample that estimates from it would have been worthless. Moser and Kalton (1971 p 94) quote Kish as having advocated a variable sampling fraction only where the fraction will vary by a factor of more than two. Such a variation could not have been

achieved in this sample given the practical constraints on total sample size on the one hand and, on the other, the need to keep the sizes of the strata large enough to make estimates from the strata worthwhile. Ideally, the fractions used in each stratum should be proportional to the standard deviation of the parameter to be estimated and inversely proportional to the square root of the cost of sampling each unit in that stratum. Such an optimum design was not possible here, indeed it rarely is, since the locations of high standard deviations could not be gauged for variables which were very different from those by which the sample was to be stratified and this seems sufficient to favour a uniform fraction, particularly since the departures from the optimal range of sampling fractions have to be large before they affect precision detrimentally.

A further complication arose since it was desired not only to make population estimates where the sampling fractions should be proportional to the stratum standard deviations, but also to make estimates for domains which cut across the strata, in which case the sample sizes per stratum should be proportional to the stratum standard deviations (Moser and Kalton 1971 p 98). Although the variable strata tend to be the large ones, the probable need to estimate for both strata and domains favours a uniform fraction in the face of the contradictory range of fractions for domains and strata. Further, the allocation of a variable fraction for estimating one variable may be detrimental to the precision of estimates for other variables. The use of a uniform sampling fraction is an acceptable compromise between different optimal allocations.

Having decided to sample with stratification and with a uniform sampling fraction, the researcher is faced with three further problems.

a) By which criterion/criteria should the population be stratified?

b) How should the strata be formed using these criteria?

c) How many strata should be formed?

a) Criteria for stratification

Ideally, the stratification should have been done in terms of the variables under study but since information on these was not available, the criteria chosen had to be those already to hand. Work already presented in Chapter 3 on the socio-economic distinctiveness of amalgamating holdings suggests that there are likely to be three principal dimensions of variation in the population. These are:

i) the business (smd) size of the amalgamator holdings

ii) the types of holdings involved in the amalgamation and

iii) the location of the holdings

The use of these three dimensions as the criteria for the stratification is enhanced by their also representing some of the more important domains of the study (that is, areas of interest) and when there is some correspondence between domains and strata, one avoids the considerable loss of precision which occurs during estimation when domains cut across the strata (Yates 1960 p 24 and p 305; Moser and Kalton 1971 p 92).

In order to ensure the comparability of the results from the sample with the data on farm incomes (which is discussed in Chapter 6), the four size classes chosen were the same as those used in the Farm Accounts Scheme by the DAFS, i.e., under 275 smd, 275 smd to 599 smd,

600 smd to 1199 smd and over 1200 smd.

Strata should be constructed so that they are of minimum internal variance and so that there is the maximum difference between the means of the strata. This combination of internal compactness and the maximum distinctiveness between strata ensures the greatest precision in the estimates. However, there is no way of knowing whether the proposed division by size in standard man-days is ideal by the criteria just defined. It is fair to assume that differences in the characteristics of amalgamations will vary in a largely monotonic fashion across the size range so that this set of class intervals, which has the advantage of having been used already by the DAFS, should be satisfactory, particularly since minor departures from the optimal stratification are not serious.

After being stratified by size, the population was cross-stratified by the types of holdings involved in the amalgamations and by their location. Yates (1960 p 305) notes that such multiple stratification is generally more precise in its estimates than a single stratification. The way location and type of holding were combined will be discussed in the following section.

b) The formation of the strata

The second problem to be faced concerns how to form the strata by the criteria of farm type and location. It was tackled initially by drawing up a matrix for each of the 33 counties in Scotland to show the farm type of both the amalgamator and amalgamated holdings. Since there are twelve farm types, this created 33 matrices each 12 by 12 into which the 1061 classifiable December amalgamations were fitted. Because the June data indicates the type of the amalgamator

holding after amalgamation, the December data had to be used. This is only 88.7 per cent complete (compared with 92.5 per cent for the June data) but it records the amalgamator's farm type before the amalgamation which is the better basis for stratification. In fact, the national cross-tabulations of farms types involved in amalgamations at June and December censuses are very similar (see Chapter 3 (Table 3.2), Appendix 3.2 and Appendix 5.1). The principal purpose in classifying this county data is to simplify it into fewer than 33 groups (the strata) with the minimum of loss of information. This will have the effect of reducing the size of the sample needed to describe adequately the process of amalgamating. With 33 counties it would require a very large sample to ensure a large enough number of amalgamations in each cell (each county) in order to keep the sampling errors low enough to allow workable inferences to be drawn about strata. The sample size can be reduced to a practicable size either by reducing the sampling fraction, which would raise the sampling errors, or by reducing the number of groups (that is, combining counties into groups). The aim then is to stratify the population into a small number of county groups (regions) which will have the highest feasible internal similarity between counties in any one group and the greatest distinctiveness between the groups. The process of classifying counties into county groups/regions is analogous to stratification and this appears to provide a valid means of reducing the total sample to a manageable size without raising the sampling errors.

The guiding principle adhered to during the classification was that the quality of the classification should be judged on utilitarian

grounds following Cormack (1971 p 322) who quotes Williams and Lance (1965) as insisting that a classification "cannot be true or false, probable or improbable, only profitable or unprofitable." Everett (1974 p 87) agrees with this view in his review of cluster analysis (a group of classification techniques). There is rarely any uniquely correct classification of a set of data. Most data can be classified in several ways and which classification is chosen finally depends partly on the nature of the data and partly on the purpose of making the classification. This utilitarian principle in assessing classifications will be referred to again.

The specific classification technique used came from the group of techniques called cluster analysis. The classificatory algorithm used was Ward's method since this has the property (not shared by the other techniques of cluster analysis which were tried and rejected) of producing tight groups of objects (counties) which have a high internal homogeneity. More precisely, Ward's method produces spherical clusters of minimum variance using squared Euclidean distance (known as the error sum of squares) as the measure of statistical similarity. There is a greater theoretical justification for the single linkage method (see Cormack (quoting Jardine et al 1967) 1971 p 337) where cluster analysis is being used as a general purpose technique. However, it is markedly inferior a priori where the aim of the classification is to stratify a population and in actual practice it produced county groups which were less compact and so less useful due to the well-known effect of "chaining" which is a characteristic of the single linkage method.

After the counties had been grouped by Ward's algorithm, an

optimisation procedure called iterative relocation was used to check the classification of marginal counties which fell between groups. After testing, iterative relocation was not incorporated in the final classification as it clustered 23 counties into one group and left most of the other groups with only one member. This is a much less useful distribution of counties for stratification than the original one produced by Ward's algorithm. It could be argued that the data used in classification, that is, the 33 matrices each 12 by 12, should have been standardised from the raw frequencies to unit variance since the error sum of squares is a function of the cluster's variance and is biased to high variance variables. However, Cormack (1971 p 325) points out that differences of scale are an intrinsic feature of the data and should not be removed by standardisation or scaling. Standardisation was rejected finally after being used with Ward's algorithm and with the single linkage method since it produced markedly inferior clusters for the purposes of stratification. Three quarters of the counties were allocated to a single group and the remaining counties were in groups of only one county each. The inferiority of the classifications produced from standardised data is an inferiority in the sense of unprofitability of such classifications on the utilitarian criterion advanced earlier and not in the sense of intra-cluster variance being greater than the possible minimum. The use of discriminant analysis has been suggested by Anderson (1974 p 14) as the most powerful way to allocate marginal cases to a cluster and also as a measure of the goodness of the classification. The χ^2 test in conjunction with discriminant analysis is seen as indicating, at a given level of statistical

significance, which counties constitute "core members" of their cluster at, say, the .95 level. These levels would be the probability that that county should not be in the category of core or marginal member of its cluster. However, since there are only 33 cases (that is, counties) and since the selection of probability levels is arbitrary, this method could not be used and other measures of the statistical coherence of the classification will be presented later.

Ward's method of classifying unstandardised data by Euclidean distance into a hierarchical classification produced the best results of several methods tried but two important points have to be made before the results are presented. Firstly, cluster analysis has been used for many purposes which have been reviewed by Everitt (1974 pp 1-5). Curiously, the use of cluster analysis as a means of stratifying a population is not one of the purposes given and there appears to be only one reference to such a use in Everitt's broad review of the literature pertaining to cluster analysis (Morrison 1967). There are many difficult problems to be solved in using cluster analysis such as which algorithm to use or how to treat the data before classification. The frequent and pertinent criticism that cluster analyses have previously taken such decisions on quite arbitrary grounds, is not a criticism which can be made of this work since such problems are solved by the purpose of the classification, that is, the stratification of a population. Stratification provides a unique usefulness for Ward's method. Cluster analysis has been criticised frequently for tending to force data into an artificial structure rather than allowing the "real" structure of the data to emerge. This point, valid though it is frequently, loses its force in this research since

the creation of a specific type of structure - tight spherical clusters of minimum internal variance - is the specific requirement for stratification and the well-known ability of Ward's algorithm to create such a structure is highly desirable. The present research is the first case known to the author of cluster analysis being used in geography to stratify a sample which would seem to be the technique's natural use.

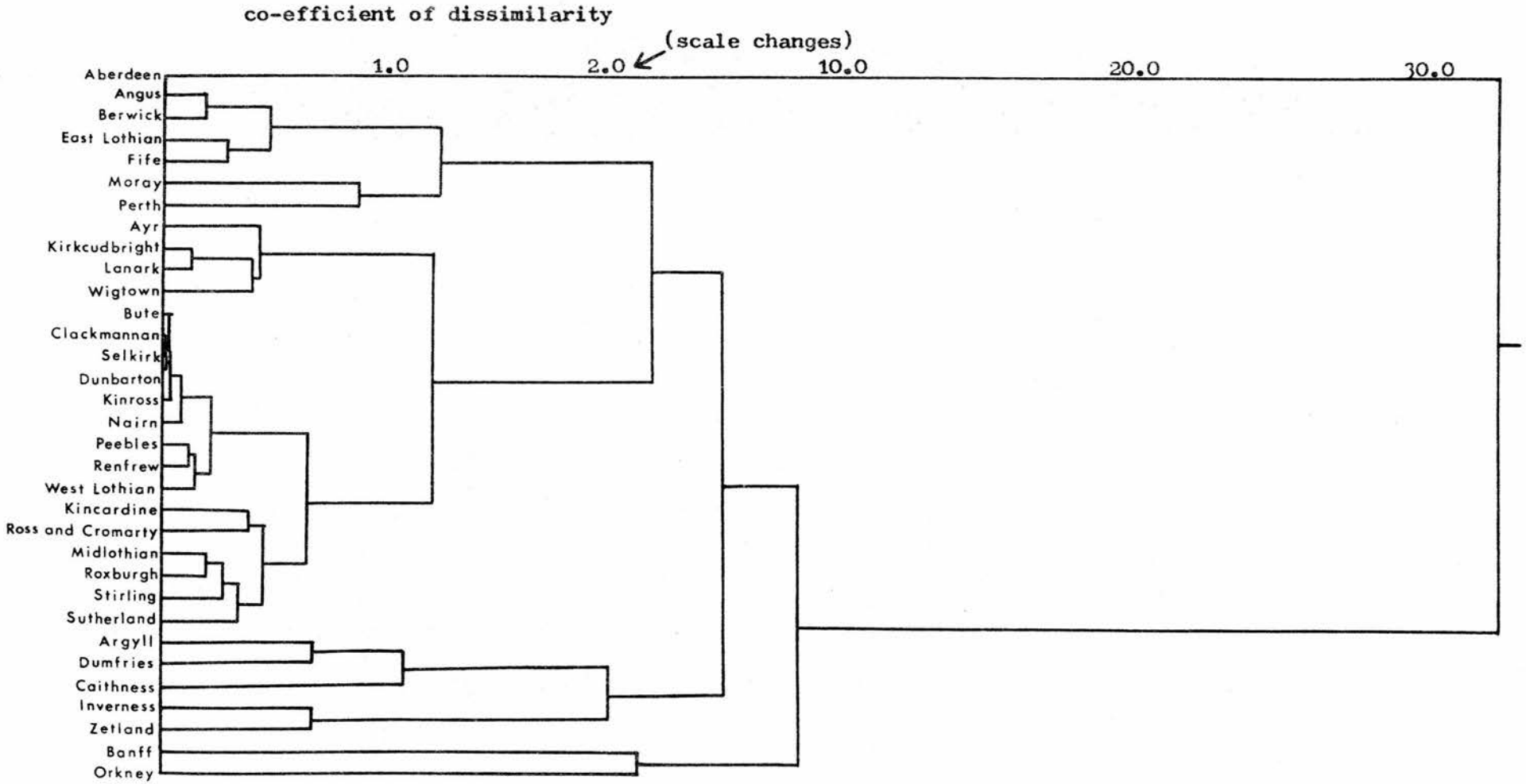
The second point which must be made is that the data appear to be unusual for a cluster analysis for two reasons. Firstly, the number of cases is rather low (33) while the number of variables is high (144), although it is less than this in practice. Normally, cluster analysis deals with more cases than variables. Secondly, a large number of the variables are of zero value and the county totals are low. More simply, there are many combinations of farm types which do not appear in any amalgamation particularly in minor counties where the total number of amalgamations is low. This results in the classification being partly a product of the total number of amalgamations in the county. This is particularly noticeable among the counties with very few amalgamations where the characteristic which unites them into a stratum is as much the paucity of amalgamations as it is the types of farm involved in such amalgamations as there are. Orloci (1967 p 204) supports this observation although, contrary to his views, it also appears with Ward's method using standardised data and with the single linkage method. The exclusion of zero variables was considered but later rejected since it could lead to the classification of counties on the basis of the almost random occurrence of a few amalgamations.

The preferred classification of counties using Ward's method on

unstandardised data is given in the dendrogram (Figure 5.1). This summarises the step-by-step reduction in the number of cases from 33 (each a separate county) to 1 (all Scotland). The further to the right the fusion of counties or clusters occurs, the more dissimilar are the constituent groups. The classification was produced by a program available at the Edinburgh Regional Computing Centre (Wishart 1972).

There remains one further problem which is how to extract the regions/strata/clusters from the hierarchy of clusters shown on the dendrogram. It must be stressed that the techniques of cluster analysis are neutral with respect to how many clusters are extracted from the classification and with respect to how they are extracted. The question of how many clusters were extracted will be dealt with later when the classification has been presented. The question of how to extract the clusters can be discussed now, however. Sokal and Sneath (1963 p 205) and Taylor (1969 p 186) advocate that clusters should be defined by drawing a straight line vertically down the dendrogram. The author considers that such an approach is unnecessarily rigid since clusters may be newly formed or may be about to be fused depending on where the line is drawn. Also, since the choice of the number of clusters is statistically arbitrary (that is, it is defined by the problem studied and not by the classification technique itself), then there seems no reason to follow one arbitrary choice by a wholly rigid and inflexible one (the use of a straight line). The latter is wasteful of the information in the dendrogram since it implies to the observer that each cluster is of equal internal similarity which may not be the case. The result of using a flexible approach to cluster selection is given in the next section.

Fig. 5.1 Dendrogram of cluster analysis of counties.

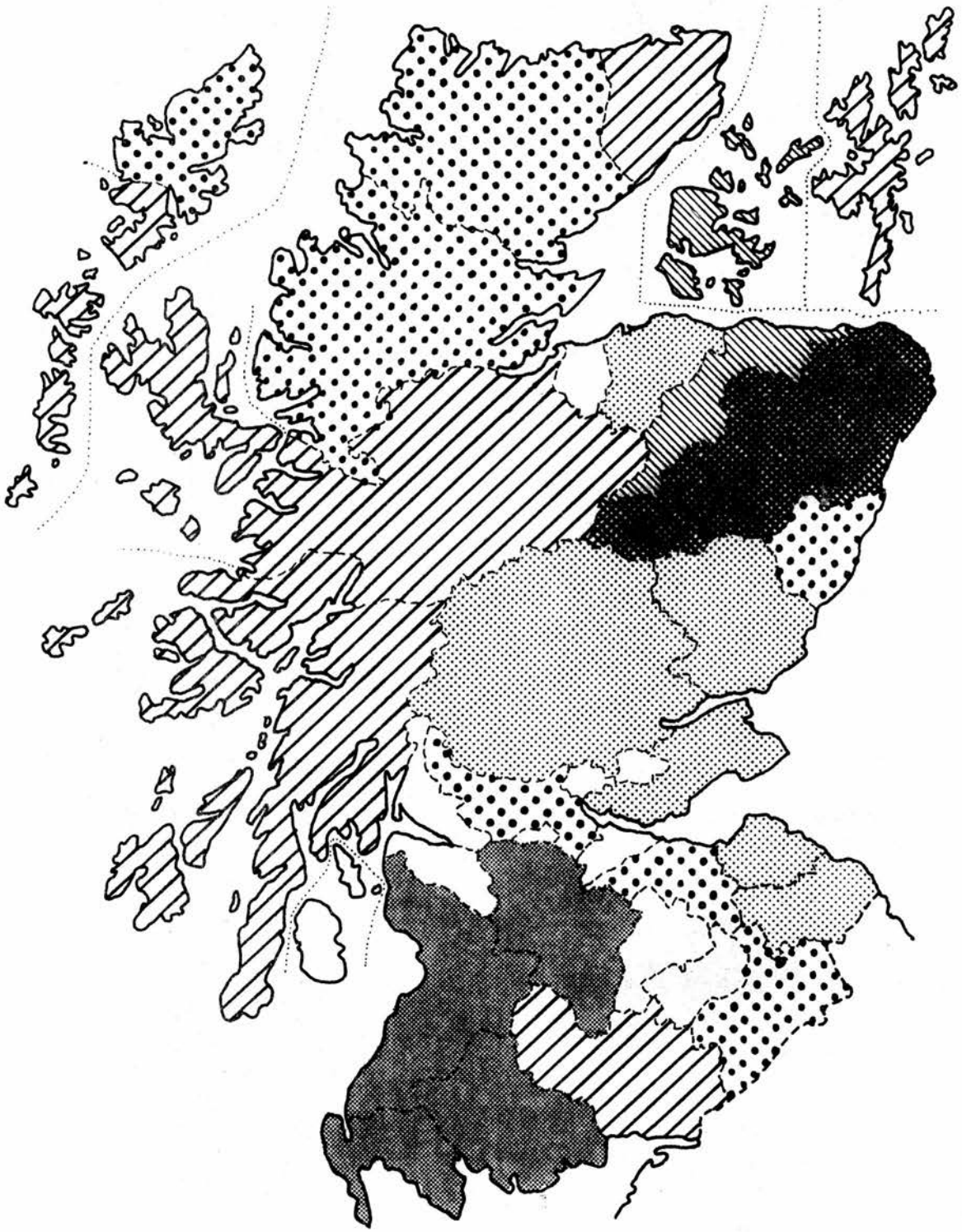


The classification of the counties

The 33 counties were grouped finally into seven clusters which are listed in Appendix 5.2. This table lists the counties in each cluster and the average co-efficient of the cluster. This co-efficient is a measure of the cluster's compactness - the lower the co-efficient, the more compact the cluster and the more suitable it is as a sampling stratum. The clusters were also mapped (Figure 5.2) to show the considerable degree of spatial contiguity possessed by the clusters. The technique of classification did not contain a contiguity constraint so the fact that in large part contiguity has been preserved without this constraint supports the notion that this classification is geographically sensible as well as statistically optimal in the sense of minimising internal cluster variance.

It was also decided to attempt to display the classification graphically using non-metric multi-dimensional scaling (hereafter MDS). This technique takes a matrix of the similarity of each county to all the others and attempts to reduce the 144 dimensions of variation to a much smaller number (in this case two dimensions) and also to measure the stress, that is, the loss of information or distortion which this procedure creates. MDS aims to produce an algorithm for solving this problem with minimum stress. Following Kruskal (1964) stress is the normalised residual sum of squares of the departure of the two dimensional arrangement of the counties from their true arrangement in the 144 dimensions which constitute the ranked dissimilarity matrix. For three dimensions, the stress in the present case is 26.54 per cent by Kruskal's statistic and 31.02 per cent by Guttman's co-efficient of alienation and, for two dimensions, it is 34.26 per

Fig. 5.2 Counties grouped by types of holdings in amalgamations



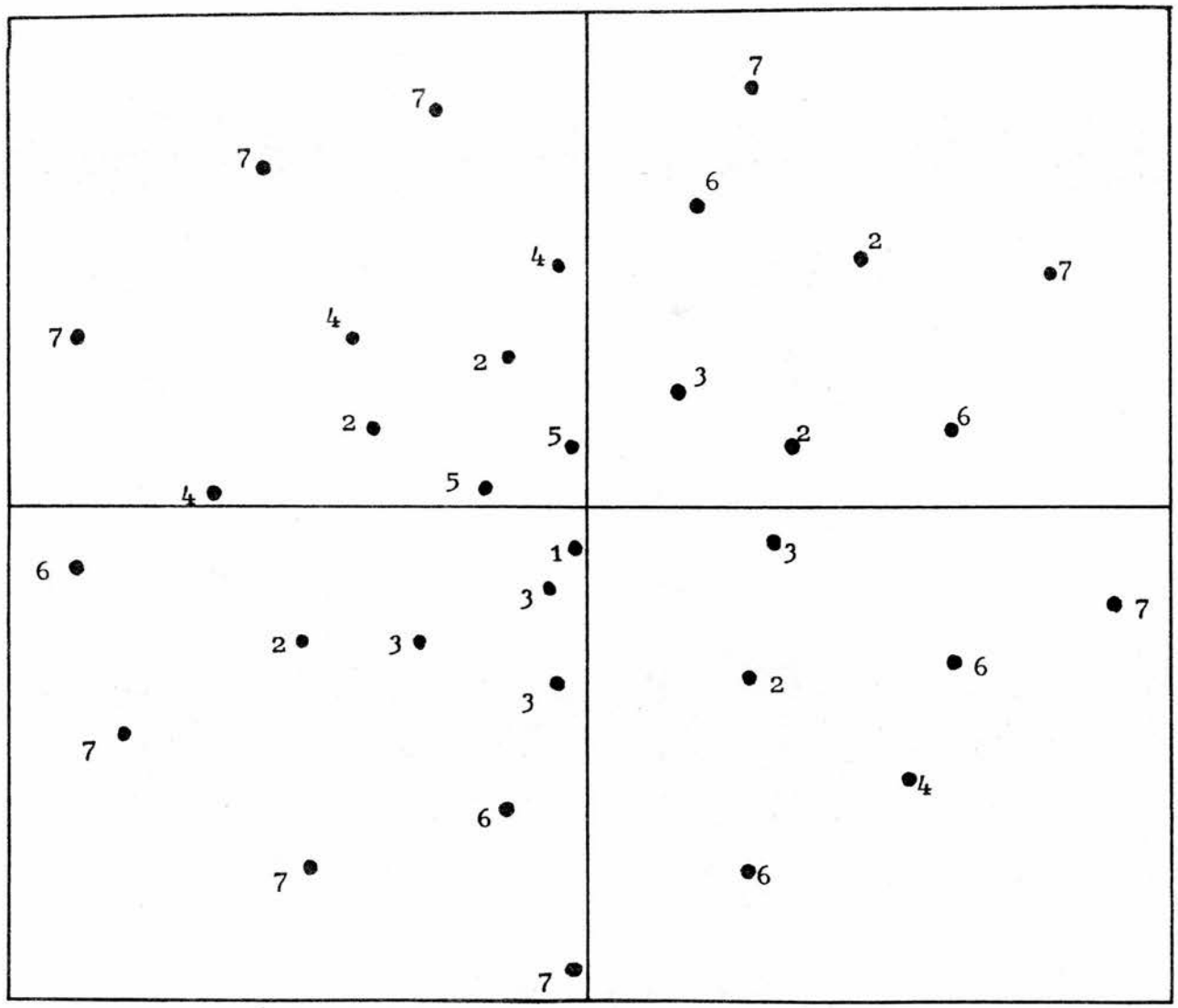
cent and 40.59 per cent respectively. These are quite acceptable figures given the magnitude of the reduction in dimensions from 144 to 2 or 3. MDS aims to preserve the ranked order of the counties, that is, to preserve the monotonicity of their true order as much as possible and the stress is a measure of the technique's failure to preserve monotonicity. Thus 60 per cent to 65 per cent of the counties' proper ranked relationships are preserved.

There are several advantages to using non-metric MDS algorithms. Firstly, they use non-metric (actually, ordinal) data on dissimilarities and the final number of dimensions is not specified in advance by the researcher. Factor analysis, which also reduced dimensions, is less satisfactory as it requires metric data, even if some of the variables cannot be measured so precisely and the final number of dimensions is specified in advance by the researcher. MDS shares with factor analysis the problem of how to interpret the final number of dimensions in terms of the real world context of the research but, in this case, this is not a problem since the results are presented only for their graphical effect. The calculations were made by a program available at the Edinburgh Regional Computing Centre (Roskam and Lingoes 1971).

The results of the MDS program are given in Figure 5.3. They are rather unusual in that the clusters produced by the cluster analysis do not appear on the diagram as clusters. With both two and three dimensions, Aberdeenshire appears near the node of the axes and the clusters are arranged in roughly concentric circles around it. Each group is a characteristic distance from Aberdeenshire, which is the most diverse county by the types of farms involved, but the groups

Fig. 5.3 Multi-dimensional scaling of seven clusters in two dimensions.

Each point shows a county assigned to one of the seven clusters.



The location of the seven clusters is shown in Figure 5.2

do not lie in any particular direction from Aberdeenshire. The distance of the county from the node and the number of amalgamations in that county are very highly negatively correlated by the Spearman rank correlation test (R_s = - 0.87). This correlation is particularly clear for the counties with few amalgamations which, as Figure 1 showed, are classified largely on the basis of the total number of amalgamations. Once the number of amalgamations becomes sufficiently large, the actual distribution of farms types becomes important and the classification produces an eastern arable group, a south-western dairying group, an upland livestock group (Banff and Orkney) and a mostly Highland group dominated by spare time and part-time amalgamating farms.

c) Number of strata

The question of the number of strata, that is, the choice of the point at which to stop the classification, has been referred to already as the third major problem to be faced once the method of sampling has been selected. So far the population has been stratified into four size classes and then cross-stratified into seven regions on the basis of the types of farms involved in the amalgamations. There were thus twenty-eight sub-strata. It was decided to omit from the sample four of the regions because they fell into one of the following categories.

i) They possessed few amalgamations (Cluster 7, see Appendix 5.2)

ii) They contained mostly crofting amalgamations (Cluster 3) which are of very limited agricultural significance in Scotland as a whole.

iii) They formed a highly scattered group, including the Western

Isles, which possessed no distinctive type of farm in the amalgamations and was classified largely on the basis of the total number of amalgamations (Cluster 6). There was no *a priori* unity to the cluster, other than a purely statistical one.

iv) They formed a very weak group (Cluster 5 of Banff and Orkney) as shown by the group's very high average co-efficient (Appendix 5.2). There was a strong resemblance in the farm types involved to the farms in Aberdeenshire as is shown by the closeness of Banff, Orkney and Aberdeen in Figure 5.3.

The sample was then drawn from the eleven counties which formed three strata or regions where there were many amalgamations and where the types of farm involved in these amalgamations in each of these relatively compact regions was distinctive to that region.

The sample was then drawn from the target population of 547 amalgamations using a table of random numbers (Lindley and Miller 1970 pp 12-13) and a sampling fraction of 1 in 5 in each stratum. The size of the population in each stratum is set out in Table 5.2 and the size of the sample taken from each stratum is given in Table 5.3.

Table 5.2 Distribution by region and size of the target population to be sampled

Region (see Fig. 2)	Size Class				
	1	2	3	4	Total
1	51	88	84	54	277
2	27	40	42	68	177
4	24	11	25	33	93
Total	102	139	151	155	547

N.B. a) 21 holdings already exlcuded from this cross-tabulation since their smd size was not known (See Table 5.1).

b) Size class 1 = not full time holdings. Size classes 2 to 4 = small, medium and large full time holdings respectively.

Table 5.3 Distribution by region and size class of the sample

Region	Size Class				
	1	2	3	4	Total
1	10	17	16	12	55
2	5	8	8	13	34
4	5	2	5	6	18
Total	20	27	29	31	107

The total sample of 107 is felt to be large enough for the purposes envisaged for the results. It is a practicable size for field work and the size of the standard errors is acceptable. For the full sample, an estimate of the percentage of the population having some attribute will have a standard error of between three and five per cent. This means that the true population parameter would be within an 11 to 19 per cent range of the sample statistic at the 95 per cent level, which is an acceptable level of accuracy. Again, with a sample of 107, a difference of about 20 per cent in the proportion of units in two strata which possess some attribute would be significantly different at the .05 level. Lesser differences could be created by non-sampling errors or could be unstable over time and so might not be real differences in the regional character of amalgamating. Such lesser differences are not thought to be of sufficient importance to warrant the sample size being raised so as to

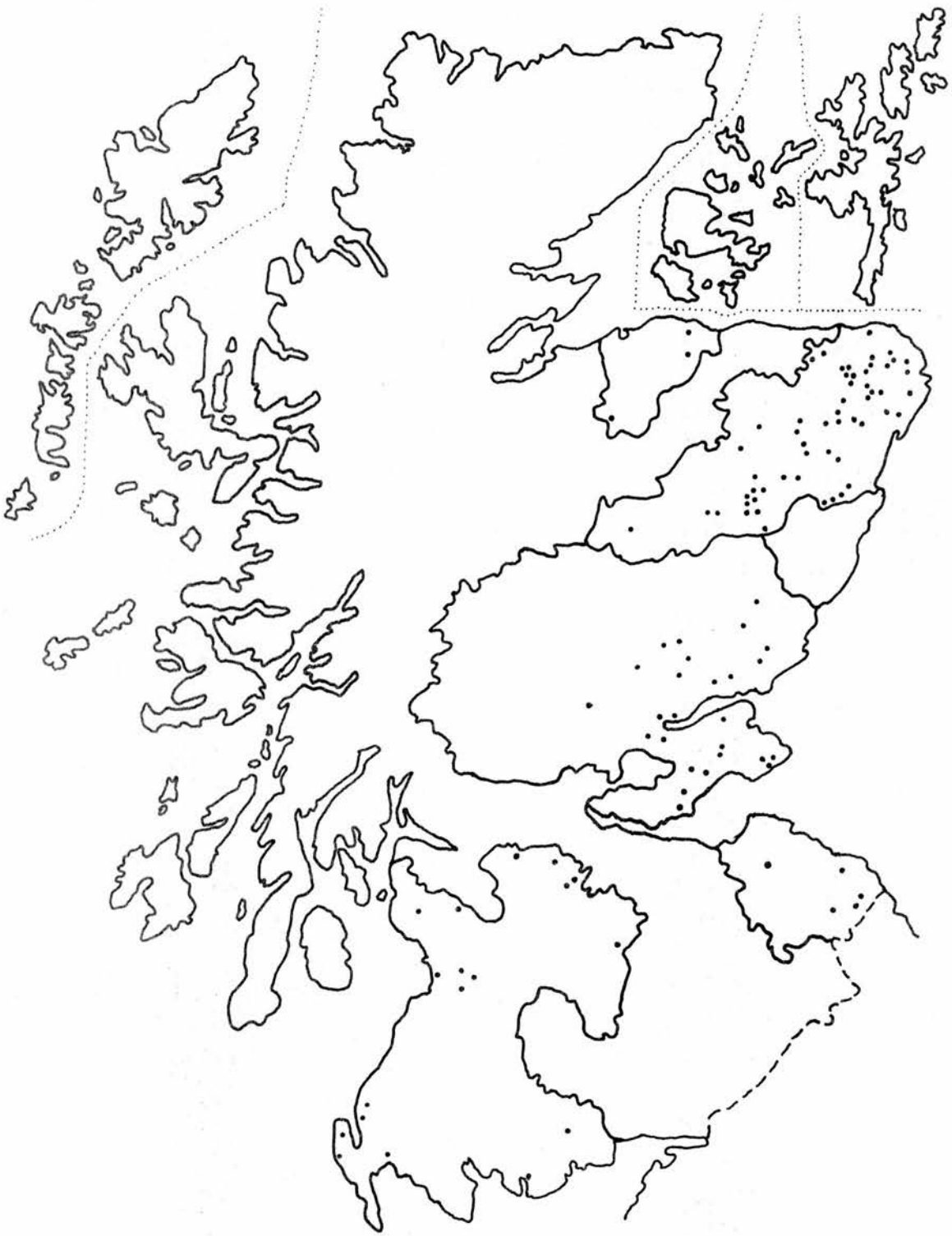
detect them. The location of the amalgamator holdings of the 107 sampled amalgamations is given in Figure 5.4.

THE FIELD INTERVIEWING AND THE QUESTIONNAIRE

The sample consisted of 107 occupiers and farmers of amalgamator holdings who might live on their farms or live elsewhere. To forestall the latter contingency, their home addresses were noted from records held by the DAFS so that they could be contacted efficiently for interview. This was not a survey of the owners of the holdings unless they were also the de facto occupiers of their holdings. Where the occupier and operator of the holding was a farm manager and where the de jure occupier took little part in the day-to-day management of the holding, then the interviewee was the manager. The questionnaire was modified so that the biographical details of the non-farming occupier, and not those of his manager, were obtained. Interviewing these non-farming occupiers might have been difficult since they included property companies, trusts, and industrialists scattered across the United Kingdom. Since some information was now being obtained at second hand, this could have introduced some inaccuracy into some of the results, but this would be compensated for by the greater accuracy of the information obtained about the husbandry.

The interviewing was carried out entirely by the author during twelve weeks between August and October 1974. Appointments were not made before the interviews because any failure to keep an appointment due to unforeseen or accidental circumstances could have seriously reduced the response rate for the following few days. If necessary, return visits to farmers were made at a more suitable time to secure the interview. The response rate after call-back visits was

Fig. 5.4 Distribution of sample of amalgamations 1974



very high. The importance of minimising non-response, and hence minimising the biases introduced by the selective nature of most non-response, is stressed heavily by Oppenheim (1966). One farmer refused to be interviewed point-blank and another said the interview could not apply to him since he had forgotten about a previous minor amalgamation. The response rate, therefore, was 105/107 = 98.1 per cent. The sample size was maintained at the projected level of 107 by adding to the sample two replacement holdings of the same size and in the same region as the refusals. Such replacements were chosen in the same way, and at the same time, as the main sample for each of the 12 sub-strata.

Although the response rate was sufficiently high to ignore any bias from non-response, not all the successful interviews were of equal quality. Some farmers were inevitably less communicative than were others and some found particular questions hard to answer in a coherent manner. This is quite natural in any but the simplest questionnaire surveys since the difficult questions were those concerning attitudes to amalgamating. Generally, however, the interviewees appeared by their reactions and their replies to understand the questions and to be able and willing to give an answer to them. There were no cases where an interviewee refused to answer one specific question but did give replies to the rest of the questionnaire. Only one case of obvious evasiveness in answering a specific question was encountered. This was at the question about non-farm sources of income.

The schedule of questions asked is given in Appendix 5.3. The questionnaire was structured with several points in mind. The primary

aim was to produce a questionnaire which could be administered in a reasonably conversational manner without losing the advantages of a standardised format for the questions. Secondly, the early questions - to which the answers were already known by the interviewer - were directly related to the theme of amalgamations. They were simple and easy to answer so as to build up the interviewee's confidence in his ability to cope with the questions and they progressively focused his attention on the specific amalgamation under study. The accuracy of the replies could also be checked to allow the interviewer to assess the truthfulness and memory of the respondent, at least on the simple questions. The second section included questions which were still simple to answer, requiring yes/no answers, but where the answers were not already known to the interviewer. The third section started with questions about any changes there might have been in the occupier's farming as a result of the amalgamation. By this stage, the interviewee has been thinking about the amalgamation for long enough to make a question about benefits worthwhile. This is a question where most farmers did quite a lot of talking and, hoping to use this volubility to overcome any hostility there might be, the next questions about non-farming sources of income were added. Fortunately, these caused little trouble and the following simple and innocuous questions on bidding for other farms were not needed in their rôle as a diversion from the income questions. The long question about attitudes to amalgamating vis-à-vis intensifying (question 25) proved the most difficult for most farmers as was anticipated although quite sufficient replies were received to make this fascinating series of questions valuable. The questionnaire

ended with questions on the farmer's and manager's ages which previous work among Scottish farmers suggested might provoke some resentment (Clark 1972 p 16). This fear was proved groundless in the field on this occasion and the general structure of the questionnaire proved fully satisfactory.

A mixture of styles of question was used according to the type of information required. Questions for simple factual information were designed to give a simple numerical or yes/no answer. In other cases, for example, the questions to discover whether there had been any changes in the farming system due to the amalgamation, there was provision for checking whether any changes mentioned were actually the result of the amalgamation and were not the result of independent changes occurring at the same time as the amalgamation. In other words, the answers were probed to eliminate bias due to interpreting the question too widely. Finally, there were two sorts of open-ended questions. One type is exemplified by the question on the benefits occurring from amalgamation. This question is fully open-ended and the farmers' responses were noted. The other type is exemplified by the question comparing amalgamation and intensification. This, too, is an attitude question but while it is initially open-ended, the replies were probed subsequently in specific directions. The interviewee was asked first what he would do if he had the chance either to amalgamate or to intensify his present acreage. This was followed by a standard sequence of probing questions on his attitude toward amalgamation, focusing on the risk attached to it and on the rates of return on investment in it. The different styles of question seemed to suit the respondents particularly the lengthier attitude

questions where initial response was sometimes laconic until the probing questions were asked after which the replies became more voluble.

The questionnaire was designed with respect to length, content, style and ordering of questions so as to obtain standardised unambiguous information from farmers with a very high response rate and leaving the farmers still well-disposed afterwards to co-operating in similar interviews in the future. The author is convinced from his work carrying out the interviews and analysing the results that the questionnaire was fully adequate and that it achieved the goals it was designed for.

THE REPRESENTATIVENESS OF THE SAMPLE

The method used to sample the population of amalgamations should produce a sample which will be representative of amalgamating in the eleven counties which were studied. In order to test whether this is true for all the measureable features of the amalgamation process, twelve comparisons were made between the sample and the independent population. This independent population is defined as the June amalgamations which were not sampled and which occurred in the eleven sampled counties (Footnote 5.1). The sample consists of either the 107 sampled amalgamators or, if this is a fairer comparison, the 132 amalgamations these amalgamators participated in during the study period. The results are summarised in Appendix 5.4. In order to reduce the danger of inferring falsely that the sample is

Footnote 5.1 The counties of Aberdeen, Angus, Ayr, Berwick, East Lothian, Fife, Kirkcudbright, Lanark, Moray, Perth, Wigtown.

representative of the amalgamations in the eleven counties, the level of significance is set at .05. The test used in each case is shown by KS (the Kolmogorov-Smirnov one sample test, two-tailed), Rs (the Spearman rank correlation co-efficient with a correction for tied ranks where necessary) and χ^2 (the chi-square two-tailed test). The choice of test was made according to the kind of data available, the importance of the data's order and the size of the frequencies to be dealt with. The results of each test are given in the right hand column of Appendix 5.4. The probabilities given there are maxima, that is, the result would have occurred by chance after repeated testing and random sampling with a probability less than that shown in the table. Except for the Spearman test, the null hypothesis which was tested was that there was no statistically significant difference between the sample and the independent population from which it was drawn. In all cases, except for one, this null hypothesis could not be rejected with $\alpha = .05$. For the Spearman test, the null hypothesis was that the sample and its independent population were unrelated with regard to the criterion for that test. With $\alpha = .05$, this null hypothesis was rejected decisively in all cases. These null hypotheses are very generalised and similarly their corresponding alternative hypotheses do not state the nature or direction of the difference under study although the use of very specific alternative hypotheses has been recommended, particularly for the χ^2 test (Cochran 1954). This was not done because these tests were preliminary ones designed to provide a measure of the representativeness which will include the effects of detailed differences in means, skewness, etc. Had they shown up

significant results, more detailed tests would have been carried out to describe the exact nature of the differences between sample and population. Since there were few significant differences, there was no need for detailed alternative hypotheses.

Indeed, the only case where the sample was not representative of its population concerned the number of holdings which had been taken over at any one census by each amalgamator. The proportion of holdings in the sample which had taken over two or more holdings rather than a single one at the census from which they were sampled was 20.6 per cent (SE = 3.8 per cent) compared with 7.0 per cent in the rest of the June amalgamations in the sampled counties. This bias is a product of the sampling method used since it was a sample drawn from a population of individual amalgamations. Data from the interviews was wanted on the distances to holdings taken over, the effects of amalgamation and other matters which required that the amalgamation process should be narrowed down to a specific and single case for farmers who had taken over several holdings. If they had been asked about amalgamations generally, their answers might have been biased toward the more recent amalgamations which might be remembered more easily or it might have been biased toward the larger holdings which were taken over. The policy of sampling amalgamations and not the amalgamators removes these very obvious sources of bias which would have been particularly serious as there would have been little way of checking whether, and to what extent, bias was operating. Consequently, a holding which took over two others had twice the probability of selection compared with the holding which took over only one holding. The probabilities of selection were equal for the amalgamated holdings (which was the

intention) and they were as a consequence unequal for amalgamators. This bias towards the more frequent amalgamators has the advantage of being measureable which means that an account can be taken of it and of its likely effects when the results of the analyses are being interpreted. It can be noted that the over-representation of prolific amalgamators has not significantly biased the sample by the other criteria for which information is available as Appendix 5.4 shows.

To assist further the interpretation of the results, a similar series of twelve tests was made to assess how representative the sample was of all amalgamations in Scotland. In some cases, the comparison was between the sample and all the other amalgamations and in other cases a lack of comparable data reduced this to a comparison between the sample and all other June amalgamations. As before, the level of significance was set at .05 and, as before, three tests were used according to the nature of the data - the Kolmogorov-Smirnov one sample test (two-tailed), the Spearman rank correlation co-efficient with a correction of ties where necessary and the two-tailed χ^2 test. The null hypotheses for the Kolmogorov-Smirnov and chi-square tests were again broad ones of no aggregate difference between the sample and the independent population. The results are given in Appendix 5.5 for each test and the probabilities given in the third column of the table represent the frequency of that result having occurred by chance.

Since the population here includes amalgamations in the 22 counties which were not sampled, one must expect that the sample will not be representative of the population on several criteria. It is perhaps more surprising that the sample is representative of the

population on so many features, for example, the holdings' acreages, the character of the amalgamated holdings and the date of the amalgamations. The sample's biases with respect to amalgamation throughout Scotland are four in number. The sample has:

a) fewer amalgamator holdings under 275 smd in size (18.7 per cent (SE = 3.7 per cent) compared with 30.8 per cent),

b) more amalgamator holdings which are arable farms (29.0 per cent (SE = 3.8 per cent) compared with 16.2 per cent),

c) more amalgamations between holdings in different parishes (20.5 per cent (SE = 3.1 per cent) compared with 13.5 per cent and

d) more amalgamator holdings which take over more than one holding at a census (20.6 per cent (SE = 3.8 per cent) compared with 9.7 per cent).

The first three biases are clearly related to the easterly distribution of the sample since in the eastern counties there are fewer small holdings, more arable holdings and smaller parishes which makes crossing a parish boundary during an amalgamation more likely. The conclusion is that the sample is not significantly different from the other amalgamations in the eleven counties which were sampled, bearing in mind that the sampling design provides an equal probability of selection for all amalgamated holdings but gives a higher probability of selection to multiple amalgamator holdings. The sample is also surprisingly representative of amalgamations throughout Scotland, the four biases being measureable and listed above. This indicates on present evidence the sampling design has been satisfactory.

Representativeness is one of two important aspects of the design of the sample. The other is the effect of the design on reducing the standard errors attached to the sample. The design effect of a sample can be calculated by comparing the sample's standard errors with the errors which would have been found if the sample had been a simple random one. Because of the two-way stratification which was used in constructing the sample, it is to be expected that the present sample will be more efficient and precise than a simple random one in that its standard errors will be lower. The gain in efficiency can be measured by the ratio of the present samples' squared standard error to the squared standard error of the corresponding simple random sample (Moser and Kalton 1972 p 89). The standard error of the estimate from the present sample of the proportion possessing some attribute in the population was calculated for 16 different attributes. The efficiency of the stratification was found to vary directly with the extent to which the proportion of the sample possessing the attribute was confined to a single stratum. The mean design effect was found to be 0.856 (standard deviation = 0.077). The range of design effects was from 0.745 to 0.988. This means that, on average, the standard errors of the estimates from this sample are 15 per cent smaller than those which would have been found if there had been no stratification and the sample had been drawn on a simple random basis. For some attributes the standard errors are over 25 per cent lower and for others the stratification results in only a minimal reduction of one per cent in the standard errors. The stratification never results in a loss of precision in the estimates. These results can be interpreted as demonstrating

the very satisfactory results of the method of proportionate stratified sampling which was described earlier in this chapter. If this method had not been used, a simple random sampling of amalgamations would have needed an increase in the size of the sample from 107 cases to 125 so as to equal the average precision of this present sample's estimates.

The remaining chapters will use the information collected by this sample survey to help explain several puzzling aspects of amalgamating in Scotland, the first being the relationships between the size of holdings and amalgamation.

CHAPTER 6

THE INFLUENCE OF SIZE OF HOLDING ON AMALGAMATION

This chapter will try and explain the influence of the size of the holding on amalgamation particularly with respect to the amalgamator for whom more information is available. The basic relationship was shown in Figure 3.13 where it was demonstrated that the probability of being an amalgamator rises with the size of the holding particularly when size is measured in standard man-days. It was also shown that the probability of being taken over varies, being highest in the small to medium size range. By using information from the survey of changes of occupier (described in Chapter 3), it is clear that the high rate of being amalgamated is not due to a high rate of turnover of holdings in the small to medium range (10-249¾ acres) but is due to a high proportion of those which are vacated being amalgamated as Table 6.1 shows. Had it been possible to classify the holdings by size in standard man-days rather than by acreage, the necessarily close relationship between the probability of being amalgamated and the proportion of vacated holdings which are amalgamated would have been even clearer.

Table 6.1 Rate of occupier change and proportion being amalgamated by holding acreage - Scotland 1969-71 (annual rates)

Acreage (1970)	Estimated annual rate of occupier change	Proportion being amalgamated after 1969	Sample size
0-9¾	7.17 per cent	29.4 per cent	158
10-49¾	5.90 per cent	38.5 per cent	147
50-249¾	5.24 per cent	36.0 per cent	159
> 250	5.01 per cent	29.4 per cent	113
All holdings	5.89 per cent	33.3 per cent	577

The size of the holding clearly affects its probability of being involved in an amalgamation. This applies both to being an amalgamator and to being amalgamated and the latter relationship (between size and being amalgamated) cannot be explained by a high rate of outgoing since the smallest farms have the highest rates of outgoing but a lower rate of amalgamating than is found among farms between 10 acres and 250 acres.

The most obvious hypothesis to explain the greater ability of occupiers of large holdings to amalgamate would be that the farmer's financial resources increase with the size of the holding he occupies. The greater his financial resources, the more successful he will be when he bids for land which is for sale. Such a hypothesis only applies to the owner-occupier sector where a free market exists and to test it requires that one establish a definition of farm income, demonstrate that it increases with the size of holding for all or most types of farm and, finally, show that the incidence of non-farm incomes does not disrupt this pattern. It is a fairly lengthy process to achieve this, so only the conclusions will be given here and the details can be found in Appendix 6.1.

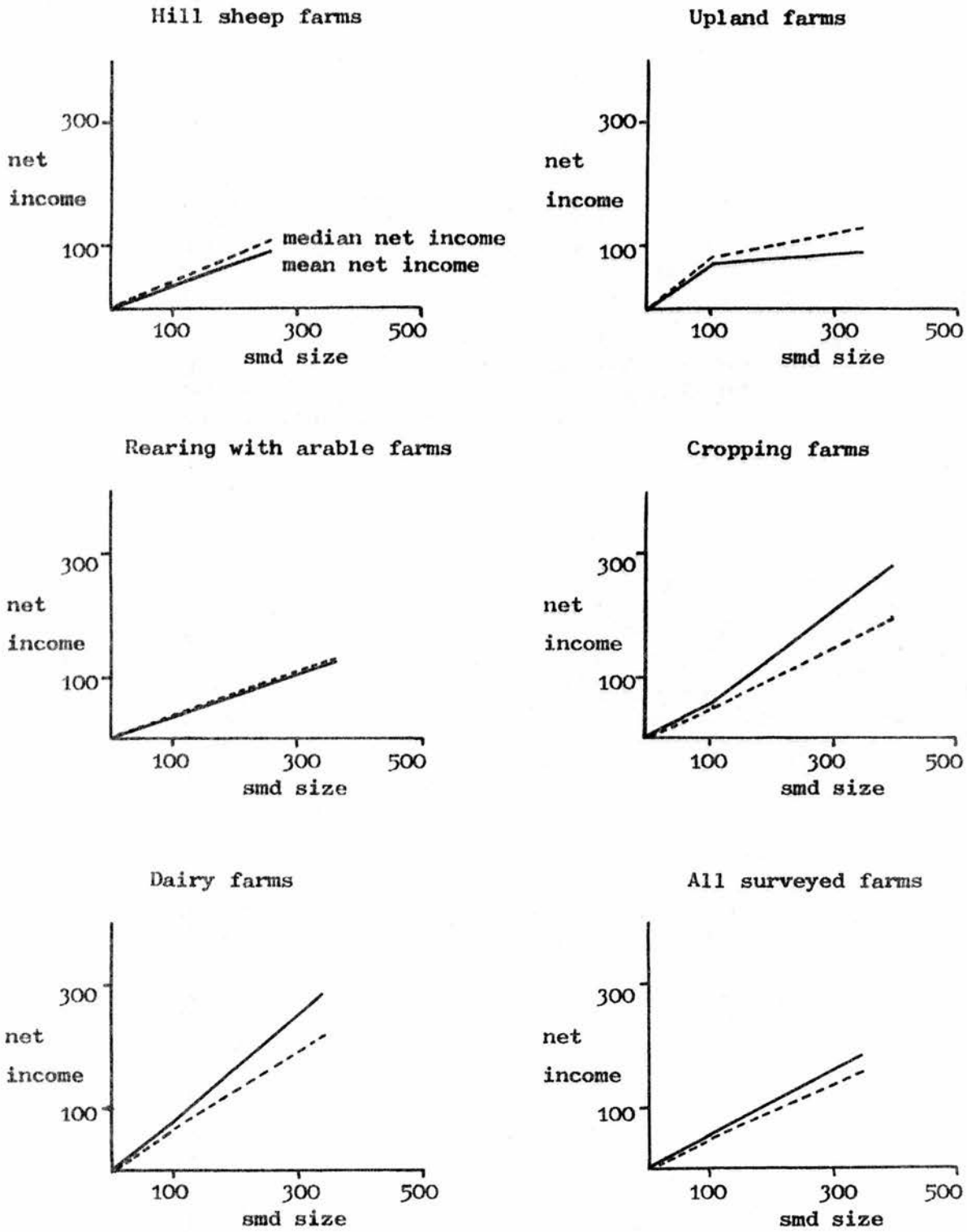
Firstly, financial resources are defined as net farm income modified to take account of imputed rent and interest costs. Secondly, non-farm income is ignored for the present, partly because it cannot be measured in a manner comparable to that of farm income and partly because the scanty evidence available suggests that non-farm income constitutes a minor part of total income for most full time farmers. This point is discussed further in Appendix 6.1. Thirdly, the data on farm incomes are very far from ideal. The representativeness of

the data has to be assumed. The reliability of the mean income figures is unknown since sampling errors cannot be calculated. The sample varies in composition from year to year so that comparability of results from year to year and also between size/type groups is difficult. On the other hand, the Farm Accounts Scheme (FAS) data have the considerable advantages of being susceptible to a precise definition of net farm income and of allowing modifications to the data to be made for this study. The FAS data have the disadvantage that their representativeness is unproven although it is fair to say that such evidence as there is suggests that the FAS data are not misleading, provided one seeks only to establish broad trends from them. Further details on these points are given in Appendix 6.1.

Modified net farm income, as defined above, can now be set beside the size of farm, albeit tentatively given the limitations of the data. In Figure 6.1, mean and median net farm incomes (without modification) are graphed against the three standard man-day size groups of farm for five of the farm types. The mean size per size group for that type of farm is used. The sample sizes are so small in two of the groups that they are omitted. In Figure 6.2 mean modified net farm income is graphed against size, while in Figure 6.3 mean modified net farm income is graphed against size when the effect on income of valuation changes has been removed. By using percentage increases in both size and income over the figures for the small farms, it can be seen readily that income, however measured, increases with farm size and that the rate of increase in income is less than that for size in standard man-days. Equal rates of increase in size and income are achieved most nearly on dairy farms and to a lesser

Fig. 6.1 Percentage increase by farm type in mean and median net farm incomes by percentage increase in mean farm size in standard man-days (1965/66 - 1970/71).

Each diagram shows the percentage increase for medium and large farms in their mean size in smd and their mean and median net farm incomes over those of the small farms of the same farm type.

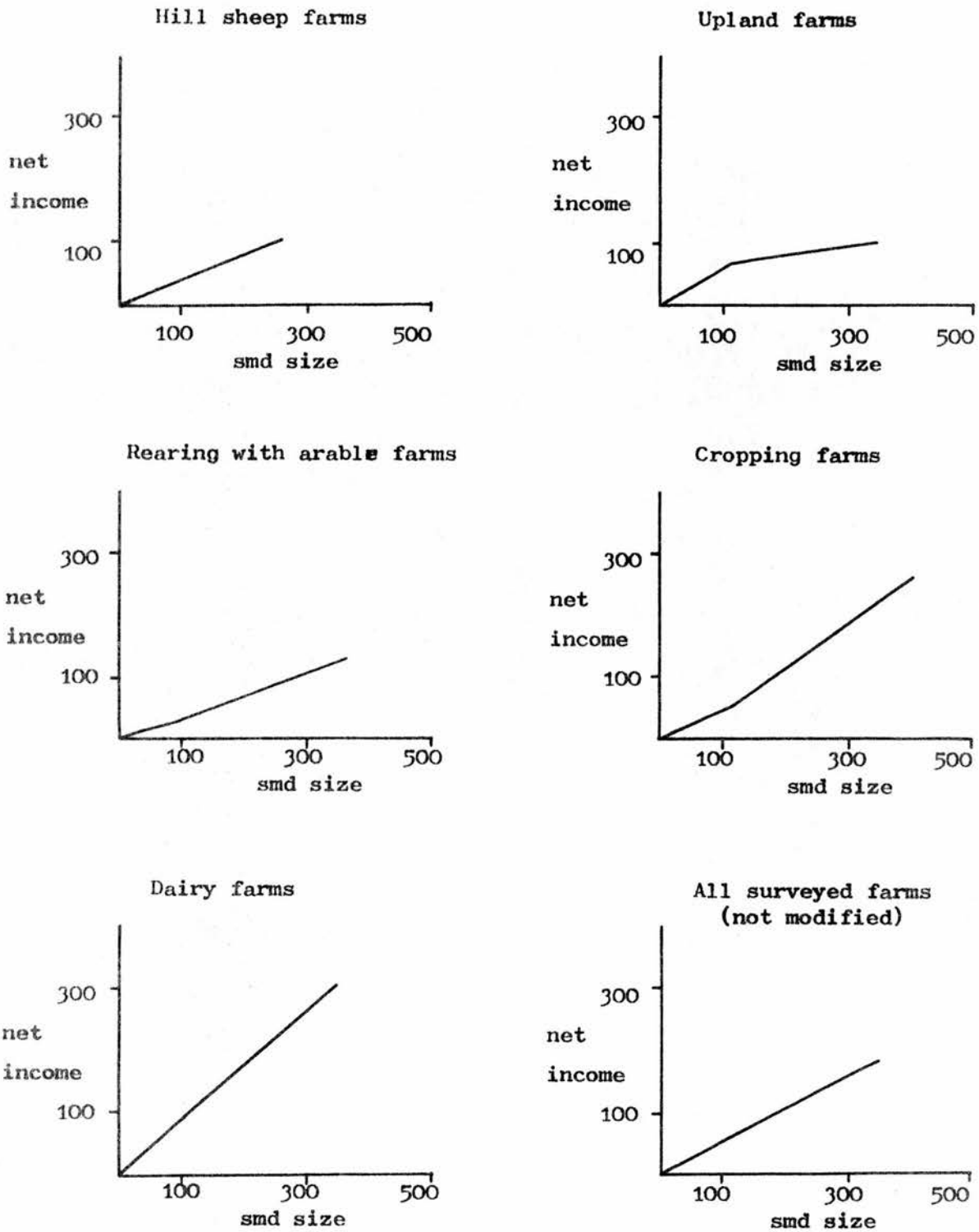


Small farms = 275-599smd ; Medium farms = 600-1199smd ; Large farms = over 1200smd.

Source: Scott. Agric. Econ. 18 (1968) to 22 (1972).

Fig. 6.2 Percentage increase by farm type in mean net farm income (modified) by percentage increase in mean farm size in standard man-days (1965/66 - 1970/71).

Each diagram shows the percentage increase for medium and large farms in their mean size in smd and their mean net farm income (modified) over those of the small farms of the same farm type.



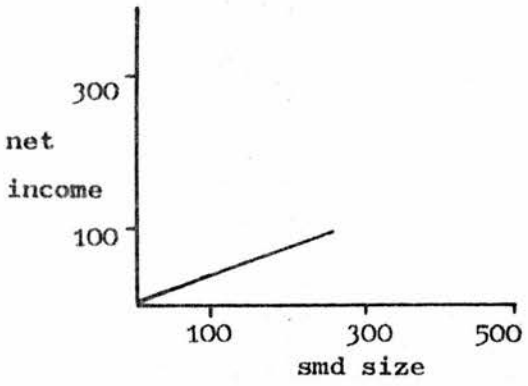
Small farms = 275-599smd ; Medium farms = 600-1199smd ; Large farms = over 1200smd.

Source: Scott. Agric. Econ. 18 (1968) to 22 (1972) and unpublished data from the DAFS.

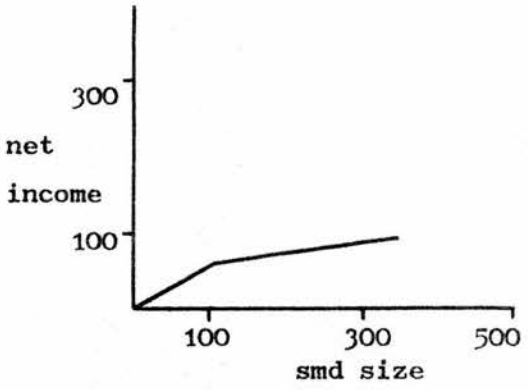
Fig. 6.3 Percentage increase by farm type in mean net farm income (modified and without valuation change) by percentage increase in mean farm size in smd (1965/66 - 1970/71).

Each diagram shows the percentage increase for medium and large farms in their mean size in smd and their mean net farm income (modified and without valuation change) over those of the small farms of the same type.

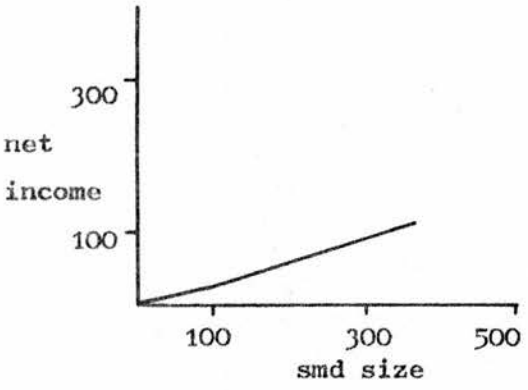
Hill sheep farms



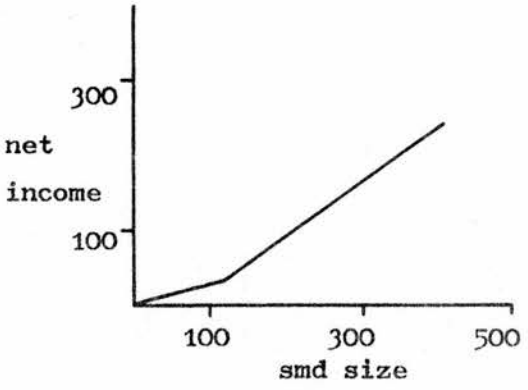
Upland farms



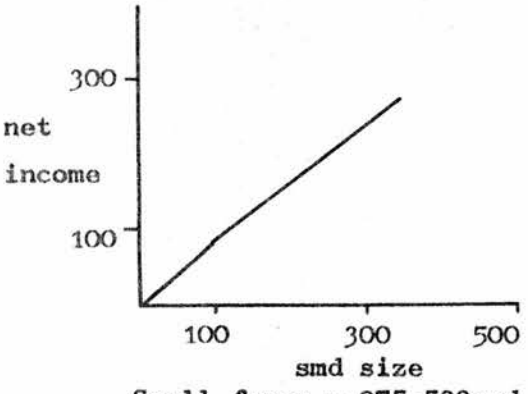
Rearing with arable farms



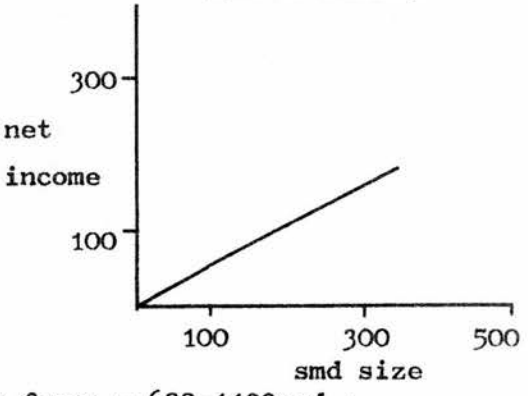
Cropping farms



Dairy farms



All surveyed farms (not modified)



Small farms = 275-599smd ; Medium farms = 600-1199smd ; Large farms = over 1200smd.

Source: Scott. Agric. Econ. 18 (1968) to 22 (1972) and unpublished data from the DAFS.

extent on cropping farms and arable, rearing and feeding farms. On hill-sheep farms, upland farms and rearing with arable farms the rate of increase in income is about a third that of size. The use of mean rather than median incomes and all the modification to net farm income as it is published in Scottish Agricultural Economics seem to make little difference to the conclusion that, to varying degrees, larger farms earn more and so are likely to have greater accumulated financial resources than smaller farms. Using the Farm Accounts Scheme records for 216 farms in the north of Scotland, Robson (1973 p 39) calculated that the overall correlation co-efficient between size measured in standard man-days and net farm income was 0.64 which was significant at the 0.10 level. The relationship was particularly close on cropping, dairying and rearing with intensive livestock farms. Only on upland farms was the relationship a negative one during the mid 1960s. Larger net incomes and large size in standard man-days would imply a greater net worth for the larger farmer which would allow him to borrow more from the commercial banks should he wish to finance the amalgamation by commercial borrowing rather than from his capital reserves. The importance of net worth in determining credit worthiness, and so the amount which can be borrowed, is stressed by Metcalf (1969 p 30). Therefore, the occupiers of larger holdings will be more successful at bidding for holdings than smaller farmers.

This relationship between size of holding, farm income or borrowing power and the probability of amalgamating is, strictly speaking, only relevant where the holding to be taken over is bought. Amalgamations within the rented sector do not require land to be

bought. However, a similar size bias towards larger amalgamator holdings seems to be operating as Table 6.2 shows.

Table 6.2 The probability of amalgamating (June censuses only) by tenure and standard man-day size

	< 150 smd	150-299 smd	300-749 smd	750-2999 smd	⩾ 3000 smd	All holdings
Tenanted	0.0051	0.0308	0.0318	0.0306	0.0579	0.0150
Owner-occupied	0.0065	0.0257	0.0256	0.0317	0.0474	0.0175
All holdings	0.0056	0.0283	0.0286	0.0313	0.0514	0.0170

NOTES:

1. Tenure for all holdings is defined by which category of tenure covers over half the area of the holding. Tenure for amalgamator holdings refers only to June amalgamator holdings and is defined as the category of tenure which covers all or the greater part of the amalgamator holding after amalgamation. The tenure of 7.9 per cent of amalgamator holdings before amalgamation could not be determined, therefore.

2. Size for all holdings is defined as the size of the holding in standard man-days at the census of June 1969. For amalgamator holdings, size is defined as the estimated size in standard man-days before amalgamation of all amalgamator holdings recorded at a June census between 1968 and 1972 inclusive. The estimation of size is based on size after amalgamation.

3. The data in this table are not strictly comparable with those elsewhere in this thesis.

The probability of a tenanted holding amalgamating rises with its size in standard man-days in the same manner as does the probability for owner-occupied holdings. It may be supposed that estate owners view their larger tenants as being more likely to make good use of the land than the smaller tenants and perhaps as having more spare capacity in their buildings and machinery than the smaller tenants (that is, requiring less investment of landlord's capital). Also the larger tenant might be thought to be more likely to be able to

afford the higher rents on the extra land after the amalgamation.

The large owner-occupier has greater financial resources (accumulated or borrowed) to outbid others. The large tenant farmer is probably seen as a more worthy recipient of land by a landowner than is the small tenant. But there could be some less obvious economic reasons as well for the positive relationship between the size of holding and amalgamation. Another possible explanation for the greater tendency for large holdings to amalgamate is provided by Robson (1973 p 105). In his study of the problems of small farms he noted that, particularly in the 1960s, farm incomes, particularly net incomes per acre, have tended to rise less fast than the general income of the population. If one assumes that farmers did not change their husbandry and maintained a constant technology, intensity of farming and level of efficiency, then they would have to increase their acreage to maintain their standard of living vis-à-vis the rest of the community. The most interesting part of this observation is that the amount of increase needed is, both proportionately and in acreage terms, greater for the large farmers than for the small farmers as Table 6.3 shows.

Table 6.3 Increase in acreage needed to maintain relative incomes by acreage class - England and Wales, 1951-52 to 1969-70

Acreage	⩽ 50	50.1 to 100	100.1 to 150	150.1 to 300	300.1 to 500	> 500
1951-52	100.0	100.0	100.0	100.0	100.0	100.0
1969-70	137.5	120.4	132.3	154.1	176.5	173.8

Base year (1951) = 100

Source: ROBSON, N. The problems of small scale farms, Unpubl. Ph.D. thesis, University of Aberdeen (1973) p 105 Table 33

Since larger farms could maintain their relative incomes by changing efficiency or husbandry rather than by areal expansion, this calculation does not show that greater expansion by large farms will necessarily occur, but it goes some way to suggesting that this is likely. Since this study has shown that the larger holdings have a higher probability of expanding than the smaller holdings, this differential effect of the cost/price squeeze on different sizes of farms can be seen as part of the explanation of the influence of size of holdings on amalgamation.

It is possible, also, that large holdings amalgamated more during the study period for various social, or at least non-economic, reasons. They may have had more experience of amalgamation and its beneficial effects. They amalgamated more because they had done so more often in the past. This presupposes that the propensity to amalgamate is the result of a circular causation from (a) initial amalgamation to (b) more favourable attitude to amalgamating and to (c) further amalgamation. Were this true, large holdings would have taken over more holdings during the study period than smaller holdings had. Table 6.4 shows that this is false, however.

Table 6.4 Number of holdings taken over during study period by size in standard man-days of amalgamator holdings (percentages of column totals are in brackets)

No. of amalgamated holdings taken over	Size in smd of amalgamator holding			
	<275	275-599	600-1199	≥1200
1	11 (55.0)	12 (44.4)	20 (69.0)	16 (51.6)
2	9 (45.0)	6 (22.2)	6 (20.7)	8 (25.8)
3 or more	- (-)	9 (33.3)	3 (10.3)	7 (22.6)

There is no evidence to support the view that large holdings were more prolific amalgamators than smaller holdings. What happened was not that the large holdings took over more holdings each but rather that a higher proportion of the population of large holdings amalgamated than happened in the population of small holdings.

It is also possible that large amalgamators will be more expansionist because they have more frequently an heir interested in farming than small farmers. The incidence of amalgamators with and without heirs interested in farming and very likely to take over the holding is given in Table 6.5 for holdings of different sizes.

Table 6.5 Presence of farming heirs by size in standard man-days of amalgamator holdings (percentages of column totals in brackets)

	Size in smd of amalgamator holding			
	<275	275-599	600-1199	≥1200
Heir present	10 (50.0)	12 (44.4)	17 (58.6)	11 (35.5)
No heir	9 (45.0)	13 (48.1)	12 (41.4)	11 (35.5)
Don't know and companies, etc.	1 (5.0)	2 (7.4)	- (-)	9 (29.0)

There is no evidence in this table that the incidence of heirs among amalgamators can explain the size bias in amalgamating. In this respect, the present research agrees with Harrison (1967 p 27) who noted that the presence of an heir was no sure guide to farmers' rates of investment. It must, of course, be noted that the above table only refers to amalgamators. It does not give information about the distribution of heirs in the population of farms. Recent work by Rettie (1975 p 389) has shown that large farms (over 1200 smd) have half as many heirs again as farms under 600 smd. Also, the

proportion of farms with an heir actually working on the farm is two to three times greater on the farms over 1200 smd than on those under 250 smd. This reinforces the point made earlier that the impetus is for more of the large farms than the small farms to amalgamate but, for amalgamators as a group, Table 6.5 shows that there is no evidence of pressure on the large amalgamators to take over more farms each than the smaller farmers. Consequently, the cross-tabulation of the presence of an heir (a) by the number of holdings taken over during the study period and (b) by the acreage of the holdings taken over shows that the presence of an heir is independent on a one-tailed χ^2 test of these two measures of the scale of amalgamating. This is as one would expect given that Table 6.5 has shown already that the amalgamator's size and the presence of a farming heir are independent. It is also clear that the presence of a farming heir is as much caused by expansion (which makes the farm a more attractive and rewarding career) as it is a cause of amalgamating (enlarging so as to accommodate the heir and his family).

It is also possible that large holdings have younger and more expansion-minded occupiers than smaller holdings. The figures in Table 6.6 show that the age structure of occupiers varies little between size groups apart from the spare time group. This table is taken from Wagstaff (1970 p 285) and is based on a survey of a random sample of 2800 farms visited by field officers of the DAFS between July 1967 and June 1968. The ages are the field officers' estimates to the nearest five years of each occupier's age.

Table 6.6 Age structure of occupiers by size group (smd) (percentages of column totals)

	Size in smd of farm				
Age	0-100	101-250	251-600	601-1200	⩾1200
<35	6.8	9.0	10.2	11.7	8.0
35-44	15.7	15.7	17.8	19.8	19.6
45-64	50.6	57.7	59.2	57.6	58.9
⩾65	26.9	17.7	12.9	10.9	13.5

The rather larger proportion of occupiers of 65 and over in the two smallest size classes could well be accounted for by the very elderly age structure of crofters who are found largely in these groups. In short, larger farmers, particularly in the full time sector, do not appear to be much younger than smaller farmers, although many more of them do amalgamate. Nor do they appear to be unduly frequent in the 35 to 44 year group which Harrison identified as containing the heaviest investors. The age structure of the sample of amalgamators in the present study shows again that size of holding and occupier's age are independent (Table 6.7).

Table 6.7 Age structure of amalgamators at time of amalgamation by size group (smd) (percentages of column totals in brackets)

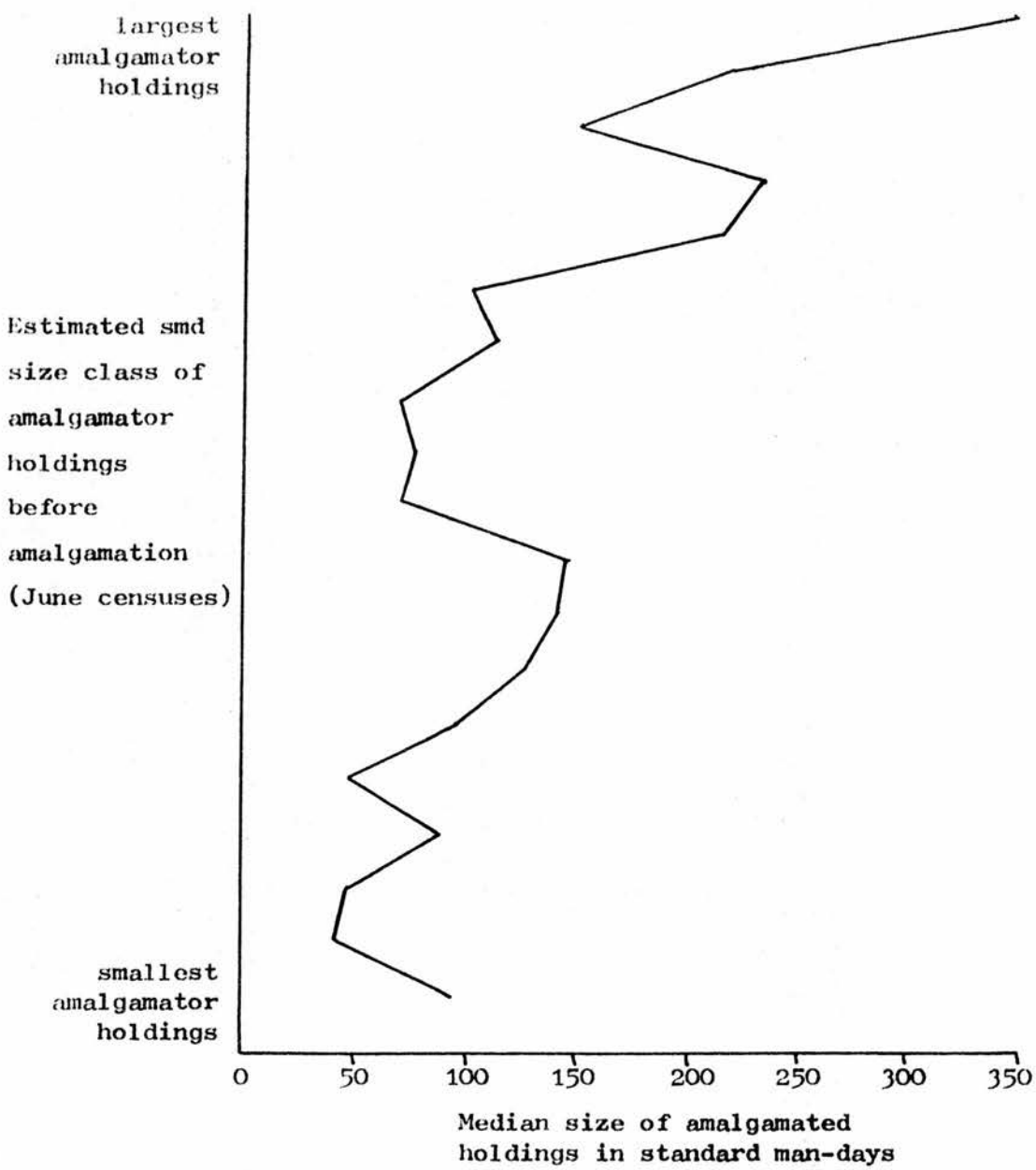
	Size in smd of amalgamator holding			
Age	0-274	275-599	600-1199	⩾1200
<35	3 (15.0)	4 (14.8)	2 (6.9)	6 (21.4)
35-44	8 (40.0)	5 (18.5)	13 (44.8)	7 (25.0)
45-64	8 (40.0)	17 (63.0)	13 (44.8)	15 (53.6)
⩾65	1 (5.0)	1 (3.7)	1 (3.4)	- (-)

One returns, therefore, to the observation that larger occupiers are richer (or can borrow more), are more successful at bidding, are more likely to get land during estate reorganisation than are smaller

occupiers and are more likely to have an heir to build up the farm for. None of the other possible influences on amalgamation seem to explain this bias in the size of amalgamator holdings.

This effect of greater income can be narrowed down further, however. If the larger, wealthier farmers were bidding for large holdings to take over while the small farmers were bidding for small holdings, then there would be no reason why the probability of amalgamation should rise with the size of holding. The fact that it does rise is due to two factors. The first is that the size of holdings taken over by large holdings is not very much greater than the size of holdings taken over by smaller holdings. In other words, the size of amalgamated holdings increases less than proportionately to the size of their amalgamator holdings as Figure 6.4 shows, this less than proportionate increase paralleling the less than proportionate increase is net farm income with farm size (Figures 6.1 to 6.3). The median size in standard man-days of holdings taken over by holdings of over 1500 smd is only four times greater than the median size taken over by holdings under 150 smd although the amalgamators differ in mean size by a factor of over 25. Therefore, the larger the holding, the easier amalgamation should be as it involves a smaller proportionate increase in the holding's size. The corollary of this is that the smaller occupiers set more often a firm upper limit on the amount of expansion they will contemplate than the occupiers of larger holdings do. This is demonstrated clearly by the first column of Table 6.8 which shows the percentage of the sample of occupiers in each of the four size classes who were able to give a clear upper limit for the acreage they were willing to take over.

Fig. 6.4 Median size of amalgamated holdings by the estimated size of their amalgamator holding.



Based on 1016 amalgamations.

Source: Amended census records.

All occupiers would have some limit on how much land they were willing to consider amalgamating but the proportions given in Table 6.8 are those whose limit was very definite. Not surprisingly, the smaller occupiers (under 600 smd) set a limit to expansion more often than did the larger occupiers.

Table 6.8 Proportion of amalgamators setting limit to acreage expansion and proportion of these where limit is greater than present acreage

Smd size of amalgamator holding	Limit set	Limit is > 100 per cent of area of amalgamator before amalgamation
< 275 smd	45.0 per cent	77.8 per cent
275- 599 smd	48.1 per cent	69.2 per cent
600-1199 smd	24.1 per cent	57.1 per cent
> 1200 smd	16.1 per cent	0 per cent

Of greater interest is the second column of Table 6.8 which shows, for each size group of the sample, the percentage of those occupiers with a clear upper limit to expansion who were farming a smaller area before amalgamation than that upper limit. The percentages are, therefore, the proportions of occupiers with a firm upper limit to expansion who were seeking to more than double their pre-amalgamation acreage. These are the occupiers who are going to have the greatest difficulty either to afford such a purchase or the greatest difficulty persuading their landowner or bank manager to allow such a large proportionate increase. The irony of the small farmer's position is that he is the most constrained in the extra acreage he can contemplate and that even these acreages represent the largest proportionate increases - the most unlikely increases to come about or to survive the rigour of interest charges. The large farmer rarely has a firm limit to expansion (an unmanageably large expansion being so unlikely

that he would hardly think about it) and such limits as he has are even more rarely a large proportionate increase in his acreage.

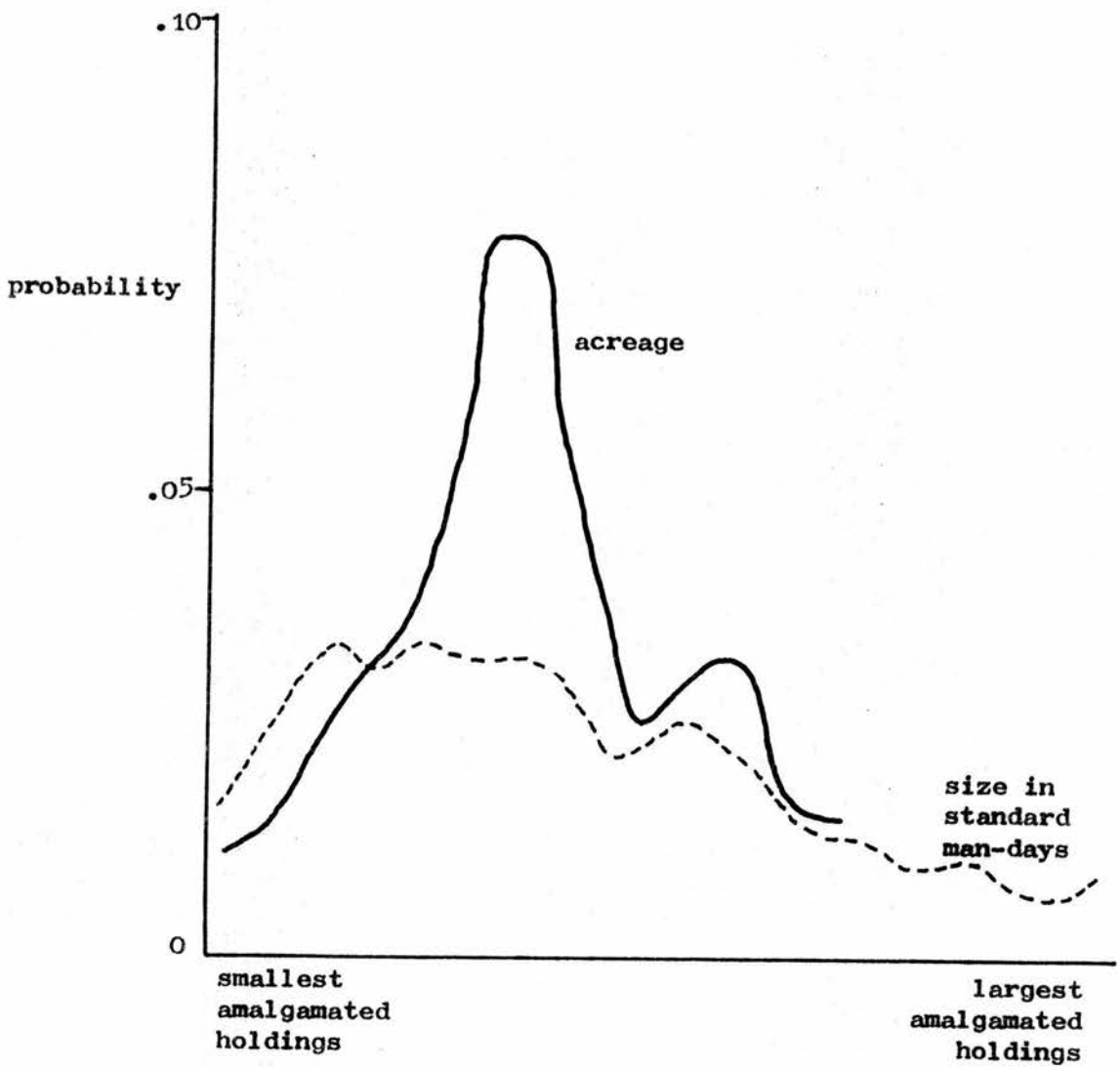
Most farmers want to expand and amalgamation is a much favoured method of expansion as Chapter 10 will show. However, the large farmer not only has greater financial resources and aims for smaller proportionate increases but he is in competition with the smaller farmer for some of the holdings the latter wants near the upper limit for his expansion. The larger farmer has a farming heir more often (probably due to the fact that he is already a larger farmer) and that heir provides a stimulus to expand further - a point not lost on estate owners re-letting vacant farms. Plainly, the increase in the probability of amalgamation with size of holding shows that the larger farmer is winning the competition for land disproportionately often. This may be related to higher marginal products from extra land for the larger farmer and, following Robson, their greater need to expand so as to maintain their relative level of income. Although, as will be shown in Chapter 9, the larger amalgamators do take over holdings at greater ranges than the smaller occupiers, those more distant ones tend to be the larger holdings which the small farmer is not competing for. The small farmer's lack of success in getting extra land is largely due to his lack of bidding power and his lack of influence with landowners for the nearby farms on the estate. The competition on his door-step is too severe and he does not compete for more distant land as readily as the larger farmer does. This is despite the fact that the small amalgamator regards amalgamation as no riskier a way of expanding than does the large amalgamator. Size and attitude to amalgamation are independent by

a χ^2 test when size is measured in standard man-days. The tenure in which the land is held does not appear to affect the size bias (if one excludes crofting tenure which is considered in Chapter 7) although the mechanism by which the size bias is brought about differs between the owner-occupied sector (an open market mechanism) and the tenanted sector (a landlord bias in allocating land).

The other aspect of size and amalgamation, the influence of farm size on being amalgamated, is less easy to study here since the research has been directed more at the amalgamators than at the amalgamated holdings. In Figure 6.5, there is shown the effect of size (measured in acres and in standard man-days) on the probability of a holding being taken over by another.

One would expect that there would be a steady decline in the probability of being taken over as size rose. The bigger the holding, the more expensive it will be to buy, the easier it will be to find a tenant for it, the more likely the outgoer will have an heir willing to take it over as Rettie showed (1975 p 389). One does, in fact, find this general decline in being amalgamated but only on holdings bigger than 50 acres and 250 smd. Below these levels, the probability of being taken over rises with size. This research cannot offer much original evidence to explain this but there is one obvious suggestion which can be made. This is that there is a clear demand for very small farms from retiring farmers and farmworkers and from urban people looking for a house in the country. There is also the possibility that it is connected with the presence of crofts below these threshold sizes. However, the relationship between land tenure and the rate of amalgamation appears to be much less clear-cut than this and this topic will be studied in detail in the next chapter.

Fig. 6.5 The probability of being amalgamated by holding size.



Source: Amended census records.

CHAPTER 7

THE INFLUENCE OF LAND TENURE ON AMALGAMATION

The influence of the tenure under which land is occupied is a topic of considerable interest which generates several important questions. Does the tenure of the land affect the rate of amalgamating? Can the spatial variation in the rate of amalgamation be explained by the varying distribution of tenures?

Previous work in England has suggested that tenure does affect the rate of structural change. It has been noted that "amalgamations seem to be occurring more rapidly in the tenanted sector despite the security of tenure. Many estates have active amalgamation policies, aiming at the expansion of both estate tenancies and home farms by intervention when holdings fall vacant" (A.A.U. 1968 p 32). The latter point was also noted by Simpson (1968 p 39). Harrison observed that the proportion of owner-occupiers rose as farmers were classified by their rates of investment per acre per annum. The owner-occupiers tended to invest more heavily than the tenants in Buckinghamshire in the period 1961-1963. The phenomenon, noted also by Gasson, of part-time and hobby farmers near London who tend to be owner-occupiers without a farming background and who form an important element in areas such as Buckinghamshire (41 per cent of all farmers, Harrison 1972 p 12) needs to be borne in mind when assessing Harrisons's findings particularly since these investing owner-occupiers become more common in the south of the county - the area nearest London (Harrison 1967 p 19). In the central Midlands, Hine and Houston (1973 pp 52-53)

found that small farm tenants were more sanguine about expecting to increase their acreage than were full-time owner-occupiers and they found a similar result in Devon. The influence of tenure on the farmer's decision on whether to retire was much less clear (Hine and Houston 1973 pp 34-38). In Scotland, Russell (1970 p 304) noted that the mean size of rented holdings increased by 12.5 per cent from 173 acres to 193 acres between 1962 and 1968 while the mean size of owner-occupied holdings increased by only 1.6 per cent from 384 acres to 390 acres in the same period. From this, Russell concluded that "this suggests a greater flexibility among rented holdings, since a greater proportion of rented holdings must have disappeared during this period (the overall percentage of rented land having remained constant)."

There is sufficient previous work to suggest that the two principal types of tenure will be experiencing amalgamation at different rates, the tenanted sector being amalgamated faster than the owner-occupied sector. Table 7.1 provides unexpected results, therefore.

Table 7.1 Tenure of June amalgamator holdings before amalgamation (1968-1972)

	Rented	Owned	Indeterminate	Unknown
All holdings in Scotland, June 1968	57.95%	42.05%	-	-
June amalgamator holdings	44.87%	52.40%	1.98%	0.75%

NOTES:

Information on the tenure of holdings amalgamating at a December census is not available. Tenure is defined by the type of tenure which covers over 50 per cent of the holding's acreage before amalgamation. Both the categories "rented" and "owned" may include holdings of substantially mixed tenure. This definition of tenure is necessarily simpler than that used in Chapter 3 in order to allow comparisons to be made with published data on the tenure of holdings nationally. Consequently, these figures are not comparable with those presented in Chapter 3.

SOURCES: DAFS (1970) and amended census records

The previous work suggested that the tenanted sector would be amalgamating the faster whereas the present study shows that it is the owned holdings which are amalgamating faster. The proportion of tenanted holdings which are amalgamators is significantly different at the .00002 level from the proportion of tenanted holdings in Scotland as a whole by the binomial z test.

However, there are grounds for supposing that these results may be misleading owing to the simple classification of tenure which is used. The tenanted sector may be divided into true tenanted holdings and holdings held under crofting tenure. Although crofting tenure is technically a form of tenancy, it has several features which suggest that it may have a different influence on amalgamation than that due to normal tenancy. Therefore, the comparison made in Table 7.1 was repeated but with crofting excluded. That is, the 15,443 crofting units which returned separate agricultural censuses at June 1972 (or June 1970 for holdings under 26 smd) were removed from the total holdings in Scotland (Crofters Commission 1973 p 22). Also the crofts involved in amalgamations at a June census were removed from that tenanted sector and then the balance of tenures was compared again (Table 7.2).

Table 7.2 Tenure of June amalgamator holdings before amalgamation (1968-72), excluding crofts

	Rented (not croft)	Owned
All holdings in Scotland, June 1968	41.74%	58.26%
June amalgamator holdings	40.24%	59.76%

SOURCES: DAFS (1970), Crofters Commission Annual Report (1972) and amended census records

The result of removing the crofting sector, where amalgamating is very slow, is to show that the balance nationally of owned and tenanted holdings among amalgamators is almost identical with that existing in the population of non-crofting holdings. To establish whether this balance exists at a larger scale, the Scottish counties were divided into those with an above average rate of amalgamating and those with a below average rate. The probability of being an amalgamator was calculated in each group for owner-occupied and for tenanted holdings, crofts having to be included in this calculation. The results are shown in Table 7.3.

Table 7.3 Probability of being an amalgamator by tenure and county's rate of amalgamating

		Rented	Owner-Occupied
Rate of amalgamating	above average	0.0269	0.0286
in county is —	below average	0.0076	0.0151

All values refer to June censuses only

SOURCES: Agricultural Statistics (Scotland) 1968 and amended census records

Particularly in the areas of above average rates of amalgamation, the tenure of the amalgamator holdings seems to be irrelevant to its probability of amalgamating. Moving to a county level, the results are the same. Counties with above average rates of amalgamating in one tenure group have above average rates in the other group in 22 cases out of the 33 counties and in seven of the eleven other counties a difference of $\pm$ 3 in the number of amalgamations in the county would lead to the signs being the same. Also, the probability of being an amalgamator by county is highly positively correlated both with the

probability of being a tenanted June amalgamator and with being an owned June amalgamator by the Spearman rank correlation co-efficient (r_s = 0.7265 and 0.6781 respectively). These results apply before crofting is excluded from the tenanted sector.

These tests show that the rate of amalgamating is almost identical for owner-occupied and tenanted holdings provided that "tenanted" is defined so as to exclude crofting tenancies. Also, it can be shown that some less marked similarity of rates of amalgamating is also found at a county level even when crofting is not excluded. Other writers have suggested that the spatial variation in the pattern of farm tenure could explain the distribution of amalgamator or amalgamated holdings. These hypotheses cannot be accepted since the distribution of amalgamator holdings is so closely correlated with the distribution of both tenanted holdings and owner-occupied holdings. It can also be shown that the distributions of amalgamator and amalgamated holdings are highly correlated (r_s = 0.992) so that neither can the distribution of amalgamated holdings be explained by the pattern of land tenure. Areas of rapid amalgamating are marked by rapid amalgamating under both owner-occupied and tenanted tenure and vice-versa for areas of slow amalgamating. This needs to be studied further later in this chapter when the effect of crofting tenure on amalgamating has been clarified.

The division of tenure into just three categories is rather simple and further detail is available from the sample of amalgamators. Each amalgamation in the sample was classified according to whether the amalgamator was a tenant or owner-occupier predominantly, and within each group according to whether he was renting the extra land from the

same estate as his present farm or from a different estate or whether he was an owner who was buying or renting land. A sixth category is recognised for owners who are taking in hand land they formerly rented to a tenant but will farm for themselves in the future. The results are set out in Table 7.4.

Table 7.4 Tenure combinations of amalgamations, by region

	Aberdeen	East	South West	Total %	Number
Tenant expanding in same estate	32.7	35.3	38.9	34.6	37
Tenant expanding in different estate	1.8	-	-	0.9	1
Tenant buying	1.8	5.9	5.6	3.7	4
Owner-occupier buying	50.9	32.4	38.9	43.0	46
Owner-occupier renting	1.8	-	-	0.9	1
Land taken in hand	10.9	26.5	16.7	16.8	18
Total %	99.9	100.1	100.1	99.9	107
Total number	55	34	18		

SOURCE: Fieldwork All values are percentages of the column total

The results of the fieldwork present several points of interest. Firstly, most amalgamations keep to the same tenure class. The owner-occupiers buy extra land while existing tenants rent extra land and usually from their present landlord. There is no evidence that amalgamation is contributing more than minimally to the growth of mixed tenure holdings since only 4.6 per cent of the amalgamations involve tenants buying land or, even rarer, owners renting it. Simpson found that amalgamating in Yorkshire is also overwhelmingly within rather than across tenure classes (Simpson 1968 p 22).

The exception to this maintenance of tenure classes is the amount of land being taken in hand. That is, land formerly rented out to a

tenant is transferred to the control of the home farm so that it becomes owner-occupied land. The advantages to an owner of taking land in hand are two-fold. Firstly, there are the normal advantages accruing to any farmer who expands his scale of operation. These are discussed elsewhere (Chapter 2 and 6). Secondly, it saves money needed for other forms of expansion since there are no costs of land purchase. Thirdly, there are advantages peculiar to the transfer from tenanted status to owner-occupied status which are mostly in the form of savings rather than extra production. Money is saved because the income to the owner from a tenanted holding (the rent) is only part of the land's total income all of which will accrue to the owner-occupier when the land is in hand. Money is saved by having fewer units to administer and is also saved since the re-letting of the farm might prove difficult if the farm is small. Prospective tenants might insist on investment in the buildings or the farm house before they took over whereas such investment might not be needed when the land has been taken in hand since the existing house and steadings of the home farm could be used or slightly extended. The rate of return on this landlord's capital is likely to be smaller than other investments. It has been estimated that, since the Agriculture Act 1958, the overall net return on landlord's capital (as represented by rentals) is about $1\frac{1}{2}$ per cent rising to over two per cent on more recently concluded tenancy agreements (Bosanquet 1968 p 8 and Hill 1974 p 144). The net return to owner-occupiers is put at $3\frac{1}{2}$ to four per cent, at least, depending on how the land is valued. The return would probably be higher than this on the better owner-occupied farms (Hill 1974 pp 144-6). Returns to tenant's capital are higher still,

being between 9.7 per cent and 29.9 per cent in England and Wales in 1964 according to Bosanquet (1968 p 12) or being between 9.4 per cent and 31.4 per cent before deducting salary in England and Wales in 1970-71 according to Britton and Hill (1975 p 93). Elsewhere, Hill estimated the returns on tenant's capital at between 12 per cent and 20 per cent (Hill 1974 pp 144-145), while Raeburn (1972 p 17) estimated them at under ten per cent in the middle 1960s. The differences in the rates of return to tenant's capital may be due to differences in their calculation although all the the authors agree that it is generally a much higher rate of return than is received by owner-occupiers or landlords. Taking land in hand allows the higher rates of return accruing to tenant's capital to come to the landowner rather than to a tenant and so the landowner's rate of return overall on capital rises from the lower rate for landlord's capital to the higher rate normal for the owner-occupier.

From this, one would expect a higher rate of amalgamating by home farms than by other farms and, since 16.8 per cent (SE = 3.2 per cent) of the sample were amalgamating home farms, one might infer that this higher rate was occurring, although the tendency of the sampling procedure to slightly over-represent prolific amalgamators, such as estates, may have raised the proportion by a few per cent. Unfortunately, the number of home farms in Scotland is not known so that their actual rate of amalgamating cannot be calculated. Consequently, it is not possible to control on size either, in order to see if they are amalgamating faster than other holdings of comparably large size. However, one can use the sample's data to compare home farms taking land in hand with tenanted holdings which are expanding within their

landlord's estate. One finds that the former have taken over more holdings than the latter during the study period (a mean of 2.44 compared with 1.78) and that the mean size of the holdings taken over is also greater (235.1 acres compared with 53.4 acres). The difference in mean acreages taken over is quite consistent with Figure 3.10 which shows that larger amalgamators tend to take over larger holdings. For comparison, the mean sizes of the amalgamators before amalgamation are 851.7 acres and 258.7 acres. The home farms are expanding much more frequently and more extensively than tenanted holdings and this is having the effect of reducing the total area available for renting, other things being equal.

These results may be compared with a survey specifically of estate amalgamations which was carried out in 1964 or 1965 by the Department of Agricultural Economics of the University of Nottingham at the request of the Country Landowners' Association (CLA). The survey (Farm amalgamation 1950-1964) covered estates which were members of the CLA throughout England and Wales but, out of 292 estates contacted, only 72 (24.7 per cent) replied and the response rate of usable answers was even lower on some questions. Doubts were, therefore, expressed about the general validity of the survey's findings (Farm amalgamation 1950-64 p 6). Among these findings were the following.

a) "Expansions to Home Farms have been given priority in amalgamation operations (...). Home Farms have been increased proportionately more than other estate holdings as a result of more and bigger holdings being added to them" (Farm amalgamation 1950-1964 p 2 and p 24 - the latter point is

is contradicted on pp 8 and 10). The present sample is smaller than that used by Nottingham (18 to 72) but the response rate is higher (98 per cent rather than 25 per cent) so that similarity of the findings regarding the absolute increases in acreages supports the view that the taking of land in hand is the major structural change on estates in the United Kingdom and that this has been true at least since 1950.

b) The majority of amalgamations which have occurred since 1950 have been carried out only when holdings have become vacant as a result of death, retirement or movement of the tenant" (Farm amalgamation 1950-1964 p 2). On 43 estates, 47.0 per cent of the amalgamations were due to the tenant's death, retiral or movement to another farm (p 31). The comparable figure from the present survey is that 71.8 per cent of amalgamations wholly within the tenanted sector were due to the tenant's death, movement to another farm or retirement due to age or ill health. Amalgamation due to the involuntary removal of a tenant is thought to be rare in Scotland and the Nottingham figures are similar although the possibility of this sensitive matter being under-recorded seems to be higher in the Nottingham survey.

c) The survey found that future amalgamating would be much influenced by "considerations surrounding the supply, maintenance or replacement of fixed equipment" (p 2). There is no corroborating evidence from the present survey for this, but it suggests that the reasons given earlier for the prevalance of taking land in hand are probably correct.

It has been shown already, using national data, that both major types of tenure covary closely with the rate of amalgamation by county. From this, it was concluded that tenure was not a factor affecting the spatial rate of amalgamating, particularly when judgment is suspended on the effect of crofting tenure. The sample allows a more detailed appraisal of tenure since it divides the category of "owner-occupied" into normal owner-occupiers and owner-occupiers taking land in hand - a distinction which cannot be made in the national data. It appears from Table 7.4 that the proportion of owner-occupiers who are taking land in hand is 16.8 per cent (SE = 3.2 per cent) overall but is higher in the East region than in Aberdeenshire. The difference between 10.9 per cent (SE = 4.0 per cent) in Aberdeenshire and 26.5 per cent (SE = 6.4 per cent) in the East region appears to be unusually large by visual inspection (the frequencies are too small for more formal testing), although the proportions of all owner-occupiers are very similar in the two regions (63.6 per cent and 58.9 per cent). Although one is dealing now with very small sample sizes, as the standard errors show, it seems as though home farms in the East are expanding faster than those in Aberdeenshire. It is possible that, since holdings in the East are less easy to buy on account of their greater size, there are fewer opportunities for owner-occupiers to expand than in Aberdeenshire. They are, therefore, disproportionately keen to take as much as possible of their own land in hand. Also, the greater amount of cropping on Eastern holdings may allow a greater degree of fragmentation of home farms after amalgamation than in Aberdeenshire where the close attention needed for the predominant livestock enterprises persuades estates to amalgamate vacated holdings

with the nearest holding, be it tenanted or home farm, rather than with the home farm when this is more distant. This is rather speculative, of course, but it receives some support from the data in Table 7.5.

Table 7.5 Mean range (in miles) of amalgamations by tenure and region

	Aberdeenshire	East region	Total Number
Land taken in hand	0.92	1.64	15
All other amalgamations	0.74	0.57	74
Total Number	55	34	89

SOURCE: Fieldwork

This shows that home farms taking land in hand amalgamate over a greater mean distance than other holdings do, which is consistent with the observations that holdings taking land in hand are large and that the larger the holding, the wider ranging its amalgamating (Appendix 9.1). Also, the range of amalgamating when taking land in hand is much greater in the arable East than in the livestock area of Aberdeenshire, although there is a minor difference in the opposite direction in the rest of the sample. When one compares the regional ranges of amalgamating irrespective of tenure, there are no significant regional differences.

The overall proportion of home farm expansions in the eleven counties suggests an estimate of 90 such amalgamations in the study period or about 20 a year. The number in Scotland as a whole cannot be calculated from this sample but, assuming that the December amalgamations and the other counties have as many home farm amalgamations as the present sample, a figure of about 80 a year would be estimated throughout Scotland. This is rather higher than an estimate of 30

holdings a year being taken in hand which was given in the evidence from the DAFS to the enquiry into land resource use in Scotland conducted by the Select Committee on Scottish Affairs (vol. 5, p 199). Since the DAFS figure is an estimate based on a sample and the present author's figure is an estimate, possibly a slight overestimate, from a sample which has been extended beyond its target population, the discrepancy between the figures need not be a matter for concern.

Crofting tenure

It was noted earlier that holdings subject to crofting tenure are much less likely to amalgamate than holdings of any other tenure. The probability of a croft amalgamating in any one year (using the records of the $4\frac{1}{2}$ years of the study period) is 0.0127 compared with 0.0451 for all other holdings which is nearly $3\frac{1}{2}$ times greater. This is reflected clearly in the very low rates of amalgamating in the areas with many crofts (see Figures 3.1 to 3.7). Perhaps significantly, Orkney, where only 20.0 per cent of the holdings were crofts in 1968, has more amalgamations than had Shetland where 78.5 per cent of holdings were crofts.

There are sufficient grounds for believing that the crofting tenure itself may act as a deterrent to amalgamation. Crofting tenure was instituted by the Crofters Holdings (Scotland) Act of 1886 in response to political pressure in Scotland and elsewhere and it has been modified only in detail since. Land held in crofting tenure is rented land with certain statutory protection for the tenant. The crofter has security of tenure (although not quite absolute security), and he has the right to bequeath the holding, the right to assign it to someone else during his lifetime and also the right to receive

compensation when he retires for improvements made to the croft. Since the crofter is a tenant, he cannot easily use the land he works nor the house or other fixed assets as security for mortgages or other loans. Therefore, he finds it difficult to raise the money to buy extra land. The grants available through the Farm Amalgamations and Boundary Adjustments Scheme are often beyond his reach since assistance under the Scheme requires that both holdings be under one owner. The crofter would often have to buy both the extra land and his present croft to benefit under the Scheme. Therefore, it ought to be less easy for a crofter to take over non-crofting land than it is for another tenant farmer.

Nor are amalgamations within the crofting sector any easier. Firstly, a crofter is entitled to bequeath his croft on his death, which means that most crofts remain within the family, and only if the beneficiary in the family is crofting within about ten miles of the deceased's croft will this allow an amalgamation. The crofter who wishes to expand may not have a relative on a nearby croft and in a parlous state of health. He cannot buy a croft as almost none are for sale. He cannot approach the landlord for another croft as normally they are not his to dispose of although he owns them. It is possible that the rate of outgoing from crofts is being slowed by the common practice of their being retirement homes - the mean age of succession to a croft was 52 between 1967 and 1972 (Crofters Commission 1973 p 6). For such people, the normal procedures of disposing of land when it cannot be farmed effectively any longer are not operating because there is no incentive to vacate the croft. However, it is also possible that the low rate of amalgamation among crofts is due to

their small size. In Chapters 3 and 6, it was shown that very small farms rarely take over other holdings and, as is well-known, the size structure of crofts is much more positively skewed than the size distribution of the other holdings in Scotland. Amalgamations under the Government's schemes are reduced because so many crofts are under 100 smd which invalidates them for aid under the schemes.

There are, therefore, two hypotheses to explain the low rate of amalgamating among crofts. Firstly, the legal nature of crofting tenure is the cause, for the reasons described above, or secondly, the low rate of amalgamating is due simply to the small size of so many crofts. For the first hypothesis to be true, it would be necessary for the rate of amalgamating among crofts to be lower than the rate among non-crofts of comparable size. Consequently, in Table 7.6 the probabilities of amalgamating are given for crofts and non-crofts below 275 smd in size and then for both types above 275 smd. 96.5 per cent of crofts are under 275 smd in size. The data in this table are not directly comparable with any other probabilities in this thesis since they refer only to those June amalgamators for whom the relevant data are available.

Table 7.6 Crofting and non-crofting probabilities of being an amalgamator holding when controlling on holdings' smd size

	$<$ 275 smd	$>$ 275 smd	All holdings
Crofts	0.0042	0.0589	0.0061
Non-crofts	0.0051	0.0331	0.0200
All holdings	0.0047	0.0338	0.0161

SOURCES: DAFS (1970), Crofters Commission (1973) and amended census records (June censuses only)

Table 7.6 shows that when one controls on holding size, the rates of amalgamating for crofts and other holdings become quite similar, particularly for holdings under 275 smd. The rather higher probability crofts over 275 smd seem to have of amalgamating should be treated with some caution since it is based on a very small number of amalgamations among the few crofts which exceed 275 smd. There is no evidence here to support the first hypothesis that crofting tenure itself is reducing the rate of amalgamating to any marked degree since crofts seem to be amalgamating at only a slightly slower rate than non-crofting holdings of comparable size. The low rate of amalgamating in crofting areas is, therefore, due in large part to the size structure of the holdings there rather than to the legal system within which they are operated.

This low rate of amalgamating is unlikely to displease the Crofters Commission despite the fact that since 1955 over 2,600 crofts have been used to enlarge other crofts.

"The 1955 Act (the Crofters (Scotland) Act) places a great deal of emphasis on the reorganisation of crofting townships and the amalgamations of crofts. The Commission have pursued the objectives of amalgamation with caution because it is inadequate and in some contexts mistaken. It is inadequate in an agricultural sense because in many areas amalgamations of 2, 3 or even more crofts would still not produce a commercial unit. And it is mistaken in a social sense because it could bring about the disappearance of a whole township for the sake of creating one barely viable farm." (Crofters Commission 1973 p 4).

Views similar to these have been expressed in the areas of Northern Norway which are characterised by a similarly extreme size structure of farms (Clark 1973 p 90). It seems as though the argument that even multiple amalgamations would not create viable holdings when the original farms are so small is a point realised as clearly by crofters as by the Commission. Only 3.5 per cent of all crofts are over 275 smd (Crofters Commission 1973 p 22) but 34.0 per cent of the June amalgamations involving a crofting amalgamator were carried through by an amalgamator whose croft was larger than 275 smd. Such amalgamating as there is in crofting areas is directed disproportionately toward expanding the crofts which are nearly commercially viable. There is no sign that the Crofters Commission's scepticism of the value of amalgamations in general is having any significant additional effect on the rate of amalgamating, while the amalgamations among full time or nearly full time crofts are likely to be welcomed by the Crofters Commission (Select Committee 1971-72 vol. 3 p 315 Question A1145).

Crofts are changing their occupiers at approximately the normal rate for holdings of their size and the proportion of these changes of occupier which result in an amalgamation is also approximately as one would expect from the experience of the rest of Scotland.

The conclusion from this section is that crofting tenure does not <u>per se</u> affect markedly the process of structural change in so far as this process is amenable to measurement. There follows from this a second conclusion. Earlier in this chapter, the amount of amalgamating within the tenanted and owner-occupied sectors was compared (Table 7.2) and it was felt desirable to omit crofting

holdings from the comparison in case it was a special case. The data showed then that there was the same balance between owner-occupied and rented holdings among amalgamator holdings as there was among holdings generally in Scotland. Now that it has been shown that crofting tenure by itself does not have much special effect on the rate of amalgamating, it is fair to revert to the original data in Table 7.1. This showed that rented holdings (including crofts) were less well represented overall among amalgamators than their overall numbers in Scotland would lead one to expect and Table 6.2 added more precision to this conclusion since this was true particularly of holdings under 150 smd. There was some evidence that tenanted holdings between 150 smd and 750 smd are a little more likely to amalgamate. However, it is not clear whether different definitions of tenure and size would alter the results since there are no size classes where holdings of the two tenures are amalgamating at markedly different rates. The second conclusion is that only among the smallest holdings is amalgamation proceeding rather faster in the owner-occupied sector (which includes the taking of land in hand) than in the tenanted sector. This modifies the conclusion reached by Simpson (1968) and Russell (1970) and the Agricultural Adjustment Unit (A.A.U. 1968) and it suggests that the Crofters Commission's view that a change to owner-occupancy might speed amalgamation among crofts is probably well founded (Select Committee, 1971-72 vol. 3 p 317, Question A1154).

It is possible that the slower rate of amalgamation particularly among the smallest tenanted holdings is due to the greater security and transferability to heirs of tenancies in Scotland. The

introduction in 1977 of similar security of tenancy into England and Wales is likely to reduce the rate of amalgamations in the tenanted sector there, if the experience of Scottish agriculture is repeated.

CHAPTER 8

THE SPATIAL DISTRIBUTION OF AMALGAMATIONS

In Chapter 3, the spatial distribution of amalgamations was described and the marked concentration of amalgamations in the North East was shown. The crofting counties were distinguished by an average number of amalgamations but by a very low rate of amalgamating. These features were mentioned without any attempt at explanation and were based on the information obtained from the censuses. In this chapter, an attempt will be made to construct an explanation of the distribution of amalgamations using the general precepts for forming an explanation set out in Chapter 4 so as to guide the use to be made of information from interviews and other published sources.

The simplest explanation would be that the distribution of amalgamations is simply a reflection of the distribution of holdings with the rate of amalgamating being constant. This explanation was refuted in Chapter 3, where it was shown that the probability of amalgamation was not constant (Figure 3.3). Indeed, the range of probabilities is almost as great as the range in the simple frequencies of amalgamations. Therefore, the rate, as opposed to the number, of amalgamations is also a spatial variable, being high in the North East and Orkney Islands and low in the North West and Lanarkshire. In these two areas, the number of holdings does not account for the number of amalgamations as it does in most of central and southern Scotland where the probabilities of amalgamation in each county lie between the upper and lower quartiles of the distribution of probabilities.

The next simplest explanation would be that the number of amalgamations is a reflection of the number of farms changing occupier - the more changes of occupier, the more amalgamations there will be with the proportion of such changes which result in an amalgamation being constant.

In order to test this, the results of the survey of changes of occupiers were studied. This survey was described in detail in Chapter 3, so it will suffice to note here that a systematic sample was taken from all the holdings which existed in 1969. For every one hundredth holding, a note was taken of whether it changed its occupier and whether it amalgamated between 1969 and 1971 or amalgamated after 1971. When the sample is stratified after selection on the basis of the location of the holding, it is possible to calculate the spatial variation in, firstly, the rate at which holdings are changing their occupier and, secondly, the proportion of those changes which result in an amalgamation. The sample of 577 cases was sufficiently large to allow very precise national estimates of these two statistics and acceptably precise regional estimates, but normally county estimates are not possible except for the larger counties. An impracticably large sampling fraction would have been needed to produce county results.

It can be established quickly that the regional distribution of the sample fairly reflects the regional distribution of holdings (Table 8.1). This table also shows the sample sizes in the regional strata.

Table 8.1 Regional composition of sample and of all Scottish holdings

Region	Percentage of sample	Percentage of all holdings, June 1970	Sample size
Aberdeenshire	11.4%	12.3%	66
North East (rest of)	13.2%	13.8%	76
East Central	11.3%	10.7%	65
South East	6.9%	7.0%	40
Highland	36.4%	35.1%	210
South West	20.8%	21.1%	120
	100.0%	100.0%	577

N.B. The regions are the standard agricultural regions defined by the DAFS except for the division of the North East region into "Aberdeenshire" and "the rest of the North East"

From this spatially representative sample, the annual rate of holdings changing occupier was calculated and the proportion of these changes of occupier which resulted in an amalgamation was also computed. The results for the six regions are shown in Table 8.2.

Table 8.2 Regional rate of occupier change and percentage of resulting amalgamations

Region	Estimated annual rate of occupier change (%)	Percentage of occupier changes resulting in amalgamation between 1969 and 1971	Amalgamation rate 1968-72 (1970 base)
Aberdeenshire	4.54%	44.4%	8.33%
North East (rest of)	6.14%	42.8%	7.41%
East Central	9.74%	21.1%	4.77%
South East	5.00%	16.7%	4.81%
Highland	5.71%	22.2%	1.72%
South West	5.00%	16.7%	3.15%
Overall	5.89%	25.5%	4.16%

The estimated annual rates of occupier changes which are shown in the first column of Table 8.2 are striking for the evenness of the figures. Except for the East Central region, the rates are all very similar ranging between $4\frac{1}{2}$ per cent and just over six per cent. The amount of spatial variation in the changing of occupier is both less than and in different locations from the now familiar spatial variation in the rate of amalgamating calculated earlier from the census of amalgamations and shown in the third column of Table 8.2. The high rate of occupier change in the East Central region is not reflected in a high rate of amalgamation while the high rates of amalgamating in the North East and in Aberdeenshire in particular are set against quite average rates of occupier change. There can be little doubt that the hypothesis of a high rate of amalgamating being due to a high turnover in farmers is false.

In the second column of Table 8.2, the proportion of changes in occupier between 1969 and 1971 which resulted in an amalgamation between those years, is given for each of the regions. When one compares the spatial variation in these figures with the figures in the third column for the actual rate of amalgamating over four and a half years, the similarity is striking. The similarity between the amalgamation rate and the amalgamation percentage in the East Central, South East and South West regions is remarkable. In Aberdeenshire and the North East both figures are about double those in the other three regions and are roughly equal to each other. The only region where the amalgamation percentage appears rather high in relation to the rate of amalgamating is the Highlands. These results refer only to amalgamations recorded between 1969 and 1971. If one

includes those amalgamations which were not recorded until after 1971, the amalgamation percentages are increased but their spatial variation - the important point here - does not change. A more rigorous comparison of the two sets of figures would not be appropriate on account of the approximate nature of the amalgamation percentages which are subject to both their own standard errors and also those of the rates of change of occupier from which they are derived. A direct comparison is precluded also by differences of timing and of definition. It was possible, however, to make the comparison rather more precise geographically. Although it was not possible normally to compute the rate of occupier change and the amalgamation percentage for counties because a sampling fraction of 1 in 100 was used, this was possible sometimes for the larger counties. In Figure 3.3, eight counties were shown where the probability of amalgamation was above the upper quartile of the distribution of probabilities. Four of these counties - Berwickshire, Kinross, Moray and Nairn - were very small, but the relevant statistics could be calculated for the other four larger counties - Aberdeenshire, Banff, Kincardine and Orkney. The results and sizes of the samples on which they are based are given in Table 8.3.

Table 8.3 Rate of occupier change and amalgamation percentage for four selected counties

County	Estimated annual rate of occupier change (%)	Amalgamation percentage (1969-1971)	Sample size
Aberdeenshire	4.54%	44.4%	66
Banff	5.88%	33.0%	17
Kincardine	10.00%	33.0%	10
Orkney	6.94%	40.0%	24
All 8 counties	5.15%	38.1%	136

The results in the last line of this table refer to all eight counties, that is, to the four listed separately in the table and to the four others which were too small to allow their statistics to be calculated individually. Excepting the county of Kincardine where the sample is smallest, the results show average rates of turnover of farmers. The national average is 5.89 per cent and only in Orkney is this slightly exceeded. The national average percentage of changes in occupier which result in an amalgamation is, however, much lower (25.5 per cent) than the percentage in each of the four counties and in the eight counties together. The factor which unites all eight counties is a very high rate of amalgamating which can now be seen to be associated with very high proportions of changes of occupier resulting in an amalgamation.

The importance of the survey of changes of farm occupiers is two-fold. Firstly, it has prevented the spatial distribution of amalgamation being explained solely in terms of the rate at which farmers were leaving the industry. Secondly, it has focused attention on the actual process of amalgamation and on the characteristics of the holdings and farmers involved in it so as to explain why the proportion of outgoings which result in an amalgamation co-varies with the rate of amalgamating. The survey has provided a necessary redefinition of the problem to be solved. The way forward now seems to lie in examining two groups of hypotheses which could explain this continuing spatial component to the incidence of amalgamating.

The first group would hypothesise that the spatial distribution of amalgamation corresponds to the spatial distribution of holdings very likely to amalgamate (that is, to take over other farms). The

second group would hypothesise that the spatial distribution of amalgamation corresponds to the spatial distribution of holdings very likely to be amalgamated (that is, to be taken over). These two groups of possible explanation will now be studied in turn.

AMALGAMATOR HOLDINGS

a) Prolific amalgamators

It would be possible to explain high rates of amalgamating by the presence of a small group of particularly prolific amalgamators in high rate counties. To test for this, the amalgamators were separated into two groups, those which amalgamated once during the study period and those which took over more than one holding. Then, two probabilities were calculated for each county, the probability of being a multiple amalgamator and the probability of being a single amalgamator (that is, of amalgamating only once during the study period). The two probabilities are very highly correlated by a Spearman test (r_s = .8461). This test shows that a high rate of amalgamation is not a product of frequent amalgamating by a few farmers and so the explanation for the rapid and slow rates of amalgamation is to be found among all amalgamations rather than in a small section of them. Although the distribution of amalgamations does not correspond to the distribution of prolific amalgamators, there are other groups of occupiers who are *a priori* more likely to amalgamate than normal. These include:

occupiers with large holdings;

occupiers related to the outgoer of the potential amalgamated holding;

occupiers with existing business links with the potential amalgamated holding;

occupiers with an heir;

occupiers with a high proportion of non-farm income;

younger occupiers;

occupiers with a particularly favourable view of amalgamation

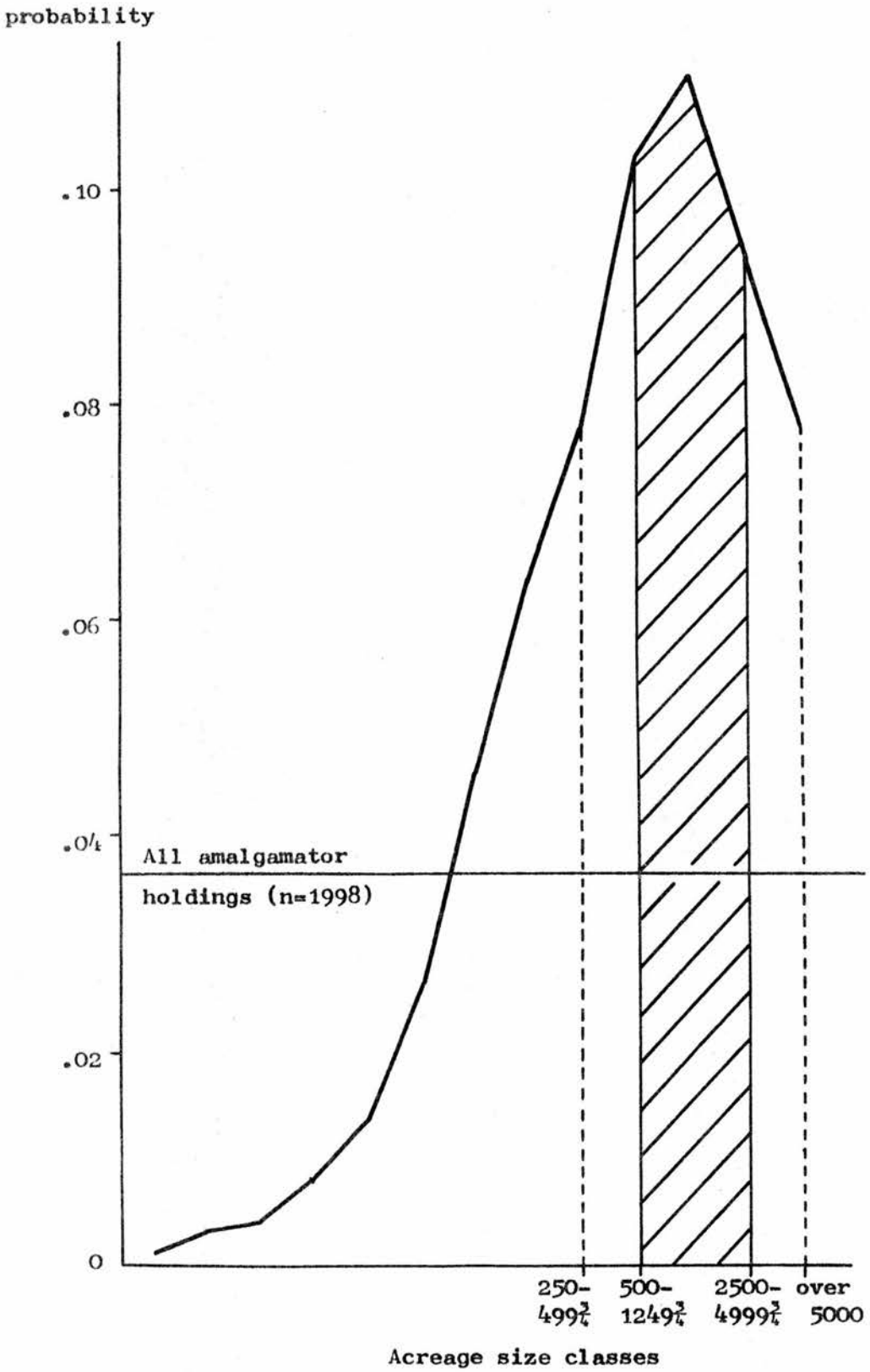
occupiers who hold their land in a particular tenure.

Each of these possible explanations of the distribution of amalgamations will be discussed in turn except for the influence of tenure which has been studied already in Chapter 7. Only the conclusions from that study will be presented again towards the end of this chapter.

b) Large holdings

It has been noted already that amalgamator holdings are characteristically large in acreage and standard man-day size. It is possible that a concentration of holdings in the large size ranges, where the probability of expansion is high, will be found in the counties where the overall rate of amalgamation is high. To test this hypothesis, the Spearman rank correlation co-efficient was calculated for the 33 counties between the probability of being an amalgamator holding and the probability of a holding being in the 500 acres to 5000 acres range which accounts for 14.36 per cent of amalgamator holdings and in which the probability of amalgamating is highest (Figure 8.1). Similarly, the Spearman rank correlation co-efficient was calculated using the probability of being over 250 acres (31.58 per cent of amalgamator holdings), (Figure 8.1). The resulting

Fig. 8.1 The probability of being an amalgamator holding by acreage size class.



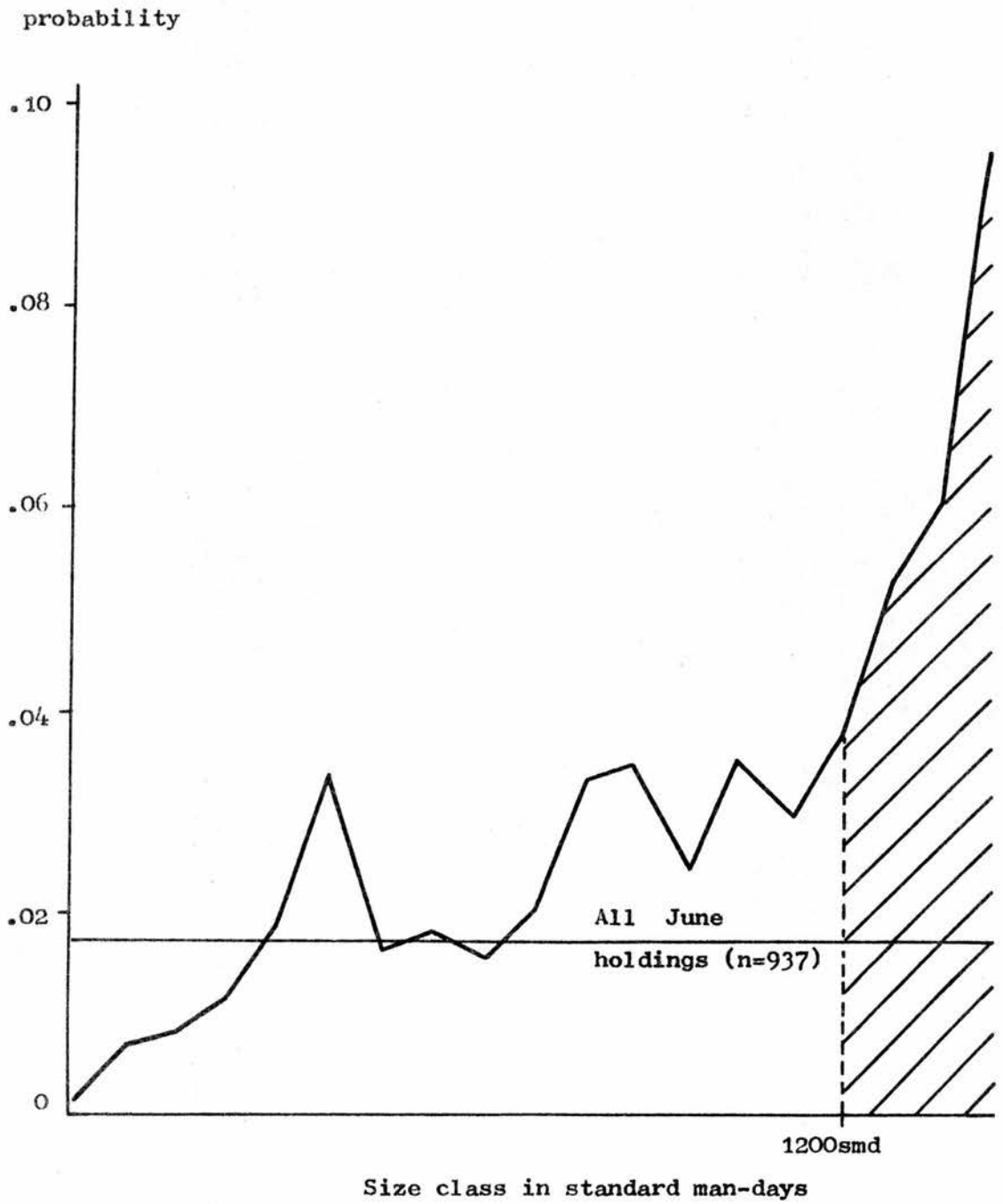
Source: DAFS 1970, and amended census records.

co-efficients of 0.0742 and 0.1608 are very low and are not statistically significant. In case the acreage of a holding was a misleading indicator of its likelihood of amalgamating, the correlation co-efficient was also calculated between the probability of being an amalgamator holding and the probability of being over 1200 smd (33.52 per cent of all June amalgamators) where the probability of amalgamating is highest (Figure 8.2). The co-efficient of 0.2831 is not significant statistically where α equals 0.05, although, since the co-efficients were calculated from population not sample data, the notion of statistical significance is used as only a rough guide to the size of the co-efficients. The areas of rapid and of slow amalgamating do not have, respectively, high and low proportions of their holdings (the potential amalgamators) in the rapidly amalgamating size classes.

c) Occupiers related to outgoers

The hypothesis that occupiers with relations who farm would be more likely to take over their relations' holdings and keep them in the family receives some support from Simpson's work in Yorkshire (Simpson 1968 p 15). He noted that thirteen per cent of the changes of occupier in his sample occurred between relatives while in parts of Northern Ireland, Crawford (1972) noted that 90 per cent of owners had inherited at least a part of their land. In Nottinghamshire and Leicestershire, Hine and Houston (1973 p A18) found that 41 out of 46 complete changes of occupier per 1000 farms annually involved changes between a sole proprietor, a father-son partnership or a family partner. This suggests, but does not prove, a bias towards

Fig. 8.2 The probability of being an amalgamator holding by size in standard man-days after amalgamation



Source: DAFS 1970, and amended census records.

family ties in changes of occupier. The normal processes of open market bidding are being distorted if this hypothesis is correct since preference is being given to relatives during the transfer. Since there is no information available nationally on the number of occupiers with and without heirs and who have or have not amalgamated, the testing of this hypothesis will have to rely on the information collected from the sample. The sample was divided into two strata, occupiers in Aberdeenshire and non-Aberdeenshire occupiers, the overall probabilities of amalgamation in these strata being 0.0706 and 0.0367. They can be taken as representing areas of rapid and of slow to moderate amalgamation respectively. The percentages of amalgamators who had been related directly or by marriage to the outgoer of the holding they took over were 5.5 per cent (SE = 2.9 per cent) in Aberdeenshire and 7.7 per cent (SE = 3.5 per cent) in the other ten sampled counties, the stratum sizes being 55 and 52 respectively. Not only is there little difference between the proportions, but both are so small that they provide no evidence to support the hypothesis that pre-existing family ties between occupiers had any marked effect on the rate of amalgamation. An overall comparison between the proportion of occupiers in each county with relatives' holdings now under their control and the general county rate of amalgamation is not possible but the size of the sample and the decisive numerical insignificance of the amalgamations between relatives leaves little doubt in the correctness of rejecting family ties as an influence on the rate of amalgamation. Such amalgamations are not sufficiently frequent to be important.

d) Occupiers with business links with the outgoer

The next hypothesis which was tested stated that holdings to be amalgamated would be more likely to be taken over by the occupiers of holdings with which there had been previous business links rather than by other occupiers. Their business colleagues would be more likely to hear of the holding's impending availability than other occupiers and they would perhaps be more keen to take over the holding as a way of preserving the business link than would other occupiers. The outgoer might be prepared to favour one of his former business colleagues over other bidders and the same might happen where the land is tenanted and its future occupier is being decided by a landowner. Again, no information is available nationally on the distribution of business links nor on its relationship to amalgamating and the topic does not appear to have been studied before in more detailed work. Therefore, the information from the sample was used, the sample being divided again into the stratum of Aberdeenshire amalgamations and the stratum of non-Aberdeenshire amalgamations in the other ten counties. The proportions of amalgamations occurring between holdings which were in business contact before the amalgamation were 23.6 per cent (SE = 5.7 per cent) and 15.4 per cent (SE = 4.0 per cent). The binomial z test (although not fully applicable in this case) shows that these are not different at a statistically significant level which is intuitively acceptable since the confidence intervals of the percentages overlap even at the 68.3 per cent level. The difference could be accounted for by the size structure of the holdings involved since business contacts tend to be more common between small to medium sized holdings and these sizes of holdings form 78.2 per cent

of the sampled amalgamator holdings in Aberdeenshire but only 63.5 per cent of sampled amalgamator holdings elsewhere. The proportions of small and medium sized holdings in the populations of amalgamator holdings are almost identical. Although the proportion of holdings with prior business links is quite high (1 in 5 in the whole sample), this does not seem to be an explanation of the high rates of amalgamation in some areas (in so far as the sample data allow this to be tested) since there is not sufficient spatial variation in the proportion.

e) Occupiers with heirs

The fifth hypothesis which was tested was that the areas of rapid amalgamation have high proportions of occupiers with heirs. The reasoning behind this hypothesis is that when an occupier has an heir, he is unusually anxious to expand his holding so that there will be sufficent income from it to support the father's family and the son's during the transitional period (perhaps formalised into a partnership). This is in addition to the desire to expand for the normal reasons of raising enough money to pay for the family's upkeep and also of leaving as much as possible to one's son. Although a son has been taken here as an example of an heir, this reasoning could apply to daughters and nephews, although perhaps with lesser force. Occupiers with heirs would be more likely to bid for extra land and might be looked on more favourably by the landowner than would the occupier without a likely heir who might not be able to put up so strong a case for expansion.

This hypothesis was suggested by some previous work. For example, Crawford (1972 Chapter 9) noted that only 13.1 per cent of 61 changes in the family who owned a farm in parts of Northern Ireland had occurred where the selling family had an heir for their farm. Of the purchasing owners, those over forty years old always had a son working full time on the farm. In the central Midlands of England (Hine and Houston 1973 p A32), 44 per cent of those expecting to increase their acreage had a son who was very interested in farming and another 23 per cent had a son who was too young to have decided (see also pp 121-2). In Devon, they found (p 60) that farmers without children were significantly less likely (α = 0.05) than those with a family to anticipate expansion.

However, in a study of changes in investment per acre in Buckinghamshire, Harrison (1967 p 27) was unable to be so emphatic. He found that single farmers tended to have made both the largest positive and the largest negative changes in investment while the proportions of those who were married and had made large increases and decreases ($\pm$ £10/acre) in investment was almost identical for those with children and those without children. He observed that "the presence or absence of immediate heirs is no sure guide to investment rates in individual cases," and was of the opinion that this was because the groups "single", "married with children" and "married without children" are socially diverse. Some of those who are single are very young and some are elderly widowers and those who are married but without children could again be young or could be older, their children having left home. Most previous studies suggest that farmers with heirs will be more likely to expand than

those without heirs but Harrisons's work suggests that the situation may be too complicated to allow the effect of the variable "presence of an heir" to be so easily observed.

Given the evidence (other than Harrison's) which suggests that the presence of an heir, and particularly of a son keen on farming, is a characteristic of expanding although not necessarily amalgamating farmers, tests were carried out to see whether the spatial variation in the distribution of heirs could explain the distribution of amalgamations. A question was asked of each of the sample of amalgamators as to whether there was a member of their family or a near relative who was very likely to take over their holding. The expression "very likely" was stressed so as to avoid including cases where the son was too young to have decided and also to avoid measuring the natural desire of some fathers for their sons to follow in their footsteps. The question referred to the occupier of the holding and not to his manager and cases where the present occupier was himself the heir at the time of the amalgamation were recorded also. In the Aberdeenshire stratum, 65.4 per cent (SE = 6.4 per cent) of amalgamators had an heir who was very likely to take over the holding. In the other counties, where the rate of amalgamating was less, the proportion was 37.2 per cent (SE = 7.0 per cent). These proportions are significantly different at the .005 level by the binomial z test, despite the size of the standard errors. The conclusion from this is that just as other work has shown in England and Northern Ireland that occupiers who have expanded or who expect to expand tend to have heirs more frequently than other occupiers, so the areas in Scotland where amalgamation is rapid tend to have a higher

proportion of occupiers who have amalgamated and have heirs than do the areas of slower amalgamation.

Ideally, one would like to be able to compare the proportion of occupiers with heirs in the sample with the proportion with heirs in the different regions of Scotland, but unfortunately this test is not possible as no national data exist on the spatial distribution of farming heirs. However, Rettie (1975 p 389) has provided figures which show that the proportion of occupiers with a family member who was likely to assume the occupancy eventually is partly a function of farm size. For farms up to 600 smd the proportion with heirs was fairly stable at just over 50 per cent. For farms between 600 and 1199 smd the proportion rose to 65 per cent and for farms over 1200 smd the proportion was 77 per cent. Since the exact wording of the question will affect greatly the answers, these results are not comparable directly with those obtained in the present research where only very likely heirs were enumerated. However, they do suggest the possibility that the finding given earlier of a higher proportion of amalgamators with very likely heirs in Aberdeenshire could be caused by a higher proportion of larger holdings in Aberdeenshire. However, the proportions of amalgamator holdings in the sample over 600 smd is 50.9 per cent in Aberdeenshire and 61.5 per cent in the other sampled counties and the corresponding proportions over 1200 smd are 21.8 per cent and 36.5 per cent in the sample and 9.1 per cent and 22.8 per cent in the population of all holdings. The figures for all June amalgamator holdings (not just the sample) are almost identical. So the possibility can be discounted that it is an excess of large holdings which is responsible for the amalgamating

occupiers of Aberdeenshire having an heir more frequently. Indeed the situation is quite the opposite. Despite a deficit of large holdings and large amalgamating holdings, there are significantly more amalgamators with heirs in Aberdeenshire than elsewhere.

Therefore, the conclusion remains less than fully tested but it is difficult to see how this great difference in the number of amalgamators with heirs can be explained in any way other than by their being more common in the population of occupiers in the areas of rapid amalgamating. The preponderance of occupiers with heirs in Aberdeenshire is further supported by the traditional view of that area as a stronghold of the family farm. The probability is that a higher proportion of heirs is an independent variable which is increasing the proportion of vacated holdings which are amalgamated in Aberdeenshire.

f) Occupiers with non-farm income

The sixth hypothesis was that the proportion of non-farm income earned by an occupier would influence the probability of him amalgamating although it is not immediately clear in which direction the influence would be. It could be that income from off the farm would be a supplement to the farm income appropriate to that size and type of farm, in which case non-farm income would raise the probability of amalgamating since it would give the occupier the extra resources to be more successful in his bidding for land. Equally, one could argue the opposite case. The presence of an outside source of income could indicate a lack of interest in farming, or at least in expanding the farm, since this might require more time to be spent on the

farming to the detriment of the time spent on earning the outside source of income. Non-farm income would then be associated with the less active pursuit of amalgamation. This alternative hypothesis would obtain support from the fact that productivity is not associated with the presence of outside business interests (Agriculture E.D.C. 1973 p 11) and also from the preponderance of non-farm earned income among small holdings which amalgamate less than larger holdings (Table 8.4).

Table 8.4 Non-farm earned income and size of holding, 1967-69

Size group (smd)	Percentages of occupiers with other job
0- 100	53
101- 250	35
251- 600	14
601-1200	8
> 1200	10

Percentages are estimates from a sample of about 5600 occupiers between 1967-69 (p 280). No significant regional differences (p 283).

SOURCE: Wagstaff (1970)

Since a special sample survey was needed to obtain the information on earned non-farm income in Table 8.4, no comprehensive national data exist on this so a question was placed in the author's sample enquiring about the proportion of the occupier's income which came from non-farm sources (jobs or investments) before the amalgamation. The proportion of occupiers who had some non-farm income then was 32.7 per cent (SE = 6.1 per cent) in Aberdeenshire and 25.0 per cent (SE = 5.0 per cent) in the other sampled counties. The χ^2 test and the binomial z test show that there is no significant spatial

variation in the proportions using either two or three strata. The DAFS sample showed that, overall, 30 per cent of occupiers had some other job. Allowing for possible under-recording in the present sample due to the sensitive nature of the question and balancing this against the narrower definition of non-farm income used in the DAFS sample (it appears to exclude investment income), there seems to be a fair measure of agreement between the two results despite the much smaller sample used by the present author. However, such a conclusion could be misleading since the overall proportion with another job in the DAFS survey (30 per cent) refers to a sample with a balance of holding sizes whereas the present sample's proportion (29 per cent) refers to the very atypical distribution of holding sizes characteristic of amalgamator holdings. In Table 8.5 it is possible to compare the incidence of other jobs by size of holding in the DAFS survey with the incidence of all types of non-farm income in the present survey. The wider definition of "other income" used in the present survey would lead one to expect higher percentages due to the inclusion of investment income but the differences seem to be too great to be explained solely by differences in definition. It can be noted again that although the DAFS survey refers to all Scotland and the present survey refers only to eleven counties, this areal difference cannot be used easily to explain the differing proportions, since neither the DAFS survey nor the present survey found much variation regionally in their results (Wagstaff 1970 p 283). Table 8.5 does suggest, however, that the small difference which was noted earlier in the proportions of amalgamators in Aberdeenshire and the other counties with some non-farm income could be due to the

greater proportion of small to medium sized holdings in Aberdeenshire (78 per cent compared with 63 per cent).

Table 8.5 Non-farm income by size of holding and size of amalgamator

Size group (DAFS)	Percentage of all occupiers with other job	Size group (sample)	Percentage with some non-farm income
0-100 smd	53%		
101-250 smd	35%	< 275 smd	50.0%
251-600 smd	14%	275-599 smd	50.0%
601-1200 smd	8%	600-1199 smd	38.1%
> 1200 smd	10%	⩾ 1200 smd	14.8%
	n = ca. 5600		n = 107

SOURCES: Wagstaff (1970 P 282) and field work

Because of the differences in areal coverage and in definitions, a formal statistical testing of these distributions would be quite inappropriate, but there are the clear suggestions that amalgamators may have non-farm income more frequently than other occupiers and yet this definitely does not explain the spatial variation in the rate of amalgamating since the present author and the DAFS found little regional variation in their results. Also, it appears doubtful whether the presence of non-farm income can explain the rapid rise in the probability of being an amalgamator holding with the rise in the holding's standard man-day size since the proportion of holdings with non-farm income falls with increasing standard man-day size in both the DAFS and the present author's surveys.

g) Occupiers' ages

The seventh hypothesis concerns the effect of age on amalgamation, age being one of the most frequently studied influences on decision making. Harrison (1967 p 28 and 1972 p 4) noted that those under 45 years old were more likely to increase rather than decrease the amount of investment in their farms. The Agriculture E.D.C. (1973 p 11) found that there was a highly significant negative relationship between productivity and the farmer's age, the younger farmers tending to be more productive farmers than their elders. In the East Midlands, Hine and Houston (1973 p A31) found that 38 per cent of those under 35 were expecting to increase their acreage while only eight per cent of those between 60 and 64 had such an expectation. A priori, therefore, the age of the farm occupier must be regarded as, potentially, one of the most powerful explanations of the spatial distribution of decision making since it is so closely related to the non-spatial distribution of the results of decision making. It was possible to use information collected in the sample survey of amalgamators to examine their age structure in Aberdeenshire and in the other counties. The results are shown in Table 8.6.

Table 8.6 Age structure of amalgamators (occupiers)

Region	Age: 0-29	30-39	40-49	50-59	⩾60	Total	Not available
Aberdeenshire	2	15	22	12	2	53	2
Rest of sample	3	12	17	12	7	51	1
TOTAL	5	27	39	24	9	104	3

Neither the χ^2 statistic nor the Kolmogorov-Smirnov test show there to be a significant difference between these distributions. Despite the fact that age is usually related closely to the amount of expansion, and despite the fact that the sampled amalgamators as a whole are remarkably younger than the general run of Scottish farmers (see Chapter 3 p67 and Appendix 3.3), their ages do not seem to vary spatially. This result is not unexpected since Wagstaff (1970 p 284) has shown that the age structure of personal occupiers generally varies little between regions. Further work by Wagstaff (1970 p 285) and Rettie (1975 p 388) has shown that the age structure of full time farm occupiers varies little between small, medium and large full time holdings but that part-time and spare time holdings do have rather older populations. Since the proportions of spare time and part-time holdings in the sample are similar in Aberdeenshire and the other counties (18.2 per cent compared with 19.2 per cent), Rettie's observation of a size bias in age structures cannot be held to invalidate the inference from Table 8.6 that amalgamators in areas of many amalgamations are no younger than one would expect. Occupiers' ages do not seem to be a factor in the spatial incidence of amalgamating.

It could be objected that the definition of the amalgamator as the farm's official occupier is misleading since an elderly occupier with a younger farm manager might exhibit the amalgamating zeal of a younger man. To test this, the ages of the farm managers were substituted for those of the occupiers whenever the occupier was the older. The effect of this on the age distributions can be seen in Table 8.7.

Table 8.7 Age structure of amalgamators (occupiers, or their managers if younger)

Region	Age: 0-29	30-39	40-49	50-59	⩾60	Total	Not available
Aberdeenshire	3	17	21	12	2	55	-
Rest of sample	3	15	18	9	7	52	-
TOTAL	6	32	39	21	9	107	-

The effect of including managers is to make the age structure of amalgamators even more similar in the two strata. The hypothesis that differences in the age structure of amalgamators could explain the spatial distribution of amalgamations finds no support in these analyses.

Several writers, particularly Crawford, Nalson and Harrison, have discussed structural change and expansion in terms of the life cycle of the farmer's family. This is a combination of the effects of his age and the presence of an heir for his farm and it tests age and heirs, not as two separate variables as they have been here, but as a single influence on decisions which can be encompassed by the term "life cycle".

To see if this would be a better explanation of amalgamating, a dichotomous variable called "life-cycle" was created from the sample survey data. The first group consisted of occupiers (not managers) over 45 who had no heirs at the time of the amalgamation. The second group consisted of the occupiers (not managers) over 45 who had heirs and also those of 45 or less irrespective of the presence or absence of heirs. The age of 45 was used following Harrison's work which indicated that around this age there occurred, on average, a turning point in many farmers' economic behaviour. It was hypothesised that the younger farmers would amalgamate rapidly while this behaviour

would be prolonged after 45 if they had an heir who would require an income from the farm. The results are shown in Table 8.8.

Table 8.8 "Life-cycle" and amalgamating

	⩽45 or >45 with heir	>45 and no heir	Total
Aberdeenshire	46	7	53
Rest of sample	35	10	45
TOTAL	81	17	98

In 9 cases the occupier's age or the presence of an heir was unknown

By the χ^2 test appropriate for a one-tailed test with one degree of freedom, location and life-cycle are independent. Therefore, neither age alone nor combined with heirs provides an explanation of the distribution of amalgamators.

h) Occupiers' attitudes to amalgamation

The eighth hypothesis which might explain the pattern of amalgamators was that rapid amalgamating would be found in areas with a particularly favourable attitude toward amalgamation as a means of expansion in comparison with, for example, intensification. The difficulties with this hypothesis were two fold. Firstly, "favourable attitude to amalgamation" had to be defined and, secondly, it had to be measured. Since attitudes to one object are usually relative to attitudes to comparable objects, amalgamators' attitudes to amalgamation were assessed by asking them to compare by five criteria amalgamation with intensification of the farm's existing area. These criteria were:

a) the degree of risk attached to each form of expansion

b) the relative speeds of return on investment

c) the relative rates of return

d) the relative amounts of borrowing required and

e) the ease or difficulty of running the farm after each type of expansion

Each criterion is an element in making up the farmer's general attitude towards amalgamation, each attitude is measured on a simple binary scale (better than intensification, worse than intensification) and each comparison should be easy for the farmer to make since he will have had experience of both forms of expansion. These questions about attitudes are discussed in much more detail in Chapter 9. For the present study, the results were studied again on a stratum basis (Aberdeenshire amalgamators, other sampled amalgamators) in order to see if a particularly favourable view of amalgamation prevailed in the stratum with the higher rate of amalgamating. The full results are given in Appendix 8.1.

The results of the comparisons (which used the χ^2 test and the binomial z test) are rather curious. The strata did not differ significantly by the criteria of the relative speeds of return on investment nor of the relative ease of operating the holdings after each form of expansion. By the criterion of the relative amounts of borrowing required, some of the Aberdeenshire occupiers thought that amalgamation needed more borrowing more often than did other amalgamators while others thought it needed less borrowing more often. By the criterion of the relative risks attached to both forms of expansion, the unexpected result is that there are rather more amalgamators in the area of most amalgamating (Aberdeenshire) who view amalgamation less favourably than intensification since the former is regarded as

the riskier way to expand. Similarly, by the criterion of the relative rates of return on investment, more amalgamators in Aberdeenshire than elsewhere view amalgamation less favourably than intensification since the former is regarded as giving the smaller return. However, the most consistent difference between Aberdeenshire and the other areas is that the proportion of farmers who had no opinion on the relative merits of the two types of expansion was lower in Aberdeenshire by the criteria of the amount of borrowing, the rate of return and the relative risks. The differences in the proportions of "don't knows" are significant on a two-tailed test at the .01, .0005 and .05 levels respectively by the binomial z test, although in the last case the test is not fully applicable.

It certainly cannot be claimed that these results are susceptible to a clear and consistent interpretation. The smaller proportion of those without opinions in Aberdeenshire cannot be interpreted as a sign of a more favourable attitude to amalgamation as the greater numbers with opinions seem to contribute disproportionately to those holding less favourable views of amalgamation vis-à-vis intensification as a way of expanding the farm. It is more likely that this is a result of wide experience of amalgamation than a cause of it. This results in a slightly higher proportion of amalgamators with less favourable attitudes to amalgamation in the county with the highest rate of amalgamating. This may be related to the smaller business (smd) size of amalgamators in Aberdeenshire - the smaller the farm, the more difficult it is to amalgamate. This would be in agreement with a view of amalgamation as needing more borrowing, giving lower returns and, consequently, being riskier for the smaller farmer.

This study of the attitudes to amalgamation of farmers who have experience of it provides no support for the hypothesis that a more favourable attitude to amalgamation can explain higher rates of amalgamating, although information from non-amalgamators about their views is unfortunately lacking.

Some conclusions

This section has concentrated on the amalgamator holdings and has shown that high rates of amalgamation are not due to a rapid turnover of occupiers nor to prolific amalgamating by a small group of farmers. Then eight hypotheses were constructed, each providing a plausible explanation of the distribution of amalgamating - a distribution whose origins are unknown and whose existence is puzzling and anomalous. Except for the hypothesis concerning attitudes which was constructed independently, the hypotheses were constructed largely on the basis of other researchers' observations of the features correlated with rapid amalgamating or heavy investing in an aspatial context. Thus, rapid amalgamating (or similar actions such as increasing investment or expansion) has been noted by various authors among farms which are large in area and are large as businesses, and among farmers who have heirs, have prior business links with the outgoer, have non-farm income or are young, or are related to the outgoers. It was not known whether these aspatial causes of expansion were also the causes of the spatial nature of amalgamating. The results of the testing of the hypotheses show that only the unusually frequent presence of an heir and the unusually low incidence of occupiers without any opinion about amalgamation distinguish the amalgamators in Aberdeenshire,

where amalgamating is rapid, from the amalgamators in the other ten counties where it is much less rapid.

Only the tests on the size of holdings can be interpreted as a clear rejection of a hypothesis. In most of the other tests, national data comparable to that for the size of holdings do not exist so one cannot say, as one would wish to be able to, that a particular variable does or does not covary in the population of farmers with the rate of amalgamating. The testing normally proceeds using a sample of amalgamators and consequently the interpretation of the results depends on the unproven assumption that the incidence of the variable in the strata of the sample reflects its incidence in the population from which the sample was drawn. Because the sample was drawn on random principles one can infer with some confidence that it represents the totality of recorded amalgamations in the sampling area.

AMALGAMATED HOLDINGS

So far, attempts have been made to explain the variable rate of amalgamating by relating the number of amalgamators to the influences which may affect their numbers. One may balance this concern with the demand side of the amalgamating equation by looking at the supply of holdings to be amalgamated. If the holdings which fell vacant in one area were disproportionately of a kind which made them particularly suitable for amalgamation, then this variation in the character of the potential or actual amalgamated holdings could explain the spatial variation in the rate of amalgamating.

Since each amalgamation requires a farmer to leave his farm and since most of the departures will be voluntary (there may be some

exceptions to this in the tenanted sector), one could argue that the national rate of outgoing will determine the national rate of amalgamating (A.A.U. 1968 pp 44-45). If this argument holds nationally, it may also be valid as an explanation of the regional rates of amalgamating. Such a hypothesis depends on the proportion of vacated farms which are amalgamated being reasonably constant spatially, otherwise a low rate of farm vacation and a high proportion of amalgamations could generate a high rate of amalgamation.

The results of the survey of changes of occupier have been presented already in Tables 8.2 and 8.3. These showed that the rate at which holdings were changing occupier was fairly constant spatially and certainly did not covary with the rate of amalgamation. What did tend to covary with the rate of amalgamation was the proportion of vacated holdings which were amalgamated (the amalgamation percentage). It has been noted already that the pattern of amalgamation is not to be explained as easily as by recourse to the rate of outgoing.

Just as attempts were made to predict the areas with many amalgamators by reference to socio-economic characteristics or assumed characteristics of the population of holdings, similarly one can try and predict the rate of holdings being taken over by reference to relevant features of the population of holdings or the population of vacated holdings.

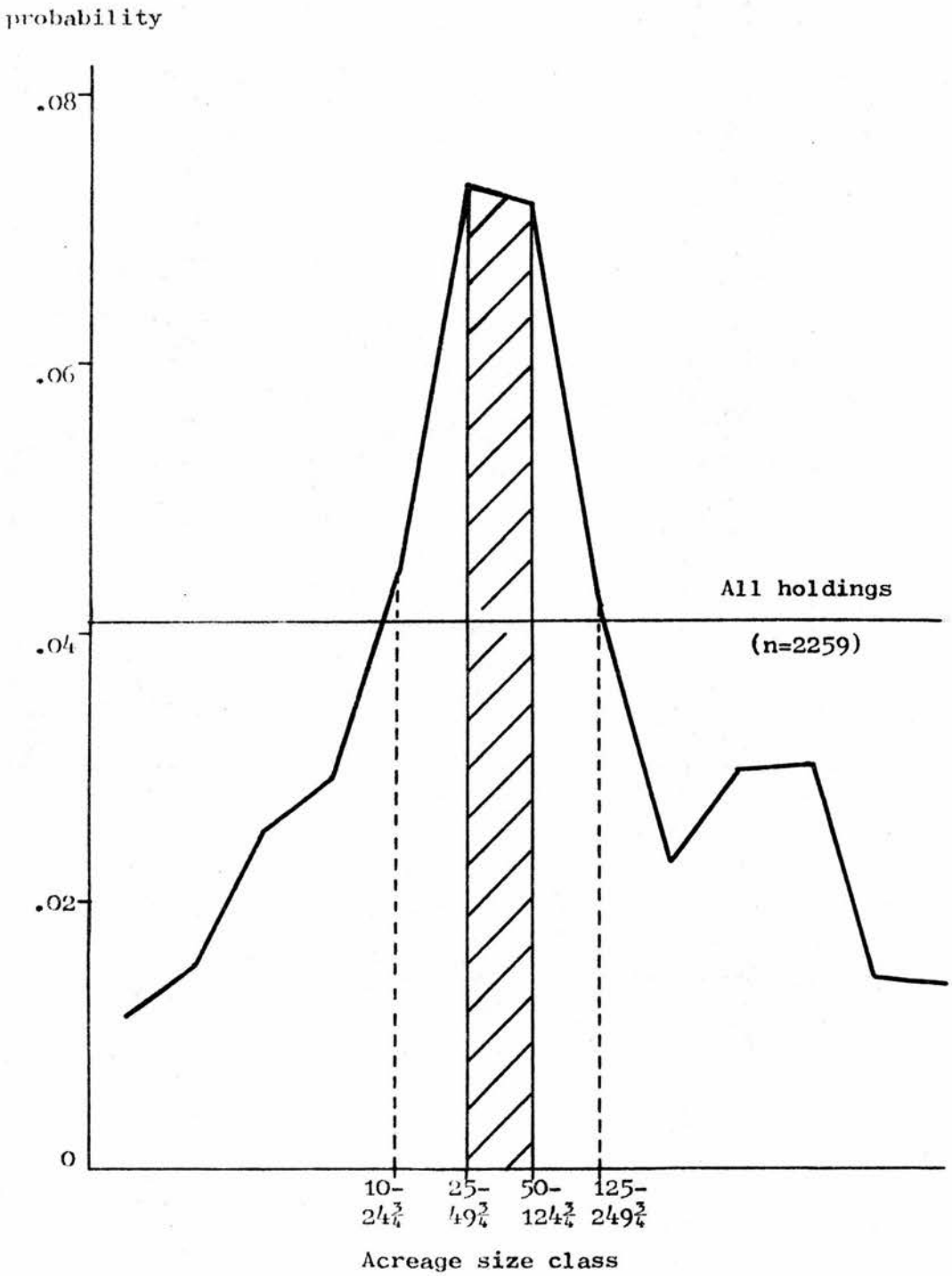
a) Size of holdings

It would be plausible to suggest that areas with a high proportion of their holdings in the size range where amalgamating is greatest would have high rates of amalgamation. The critical size range was

defined in three ways, each being taken from the actual size distribution of amalgamated holdings in the study period. It was defined as lying between 25 acres and 125 acres (45.5 per cent of all amalgamated holdings) or as lying between 10 acres and 250 acres (74.8 per cent) or as lying between 100 smd and 400 smd (32.9 per cent). The probability of amalgamation is greatest in these size ranges (the shaded areas in Figures 8.3 and 8.4) although, in the case of standard man-day size, the range does not account for a very high proportion of all amalgamated holdings. To test the hypothesis that there is a positive correlation between the rate of amalgamation and the proportion of holdings in the critical size ranges, the Spearman rank correlation co-efficient was calculated between the probability of being amalgamated in each county and the probability of any holding in that county being in the critical size range. The correlation co-efficients of 0.39, 0.34 and 0.49 are statistically significant on a one-tailed test at the .025, .05 and .005 levels, although these significant levels are only a guide since a population of data was used to calculate the co-efficients. From these tests, it can be concluded that the proportion of holdings in the part-time to small full time size range is a fairly good indicator of the spatial variation in the rate of amalgamation, particularly where size is measured in standard man-days.

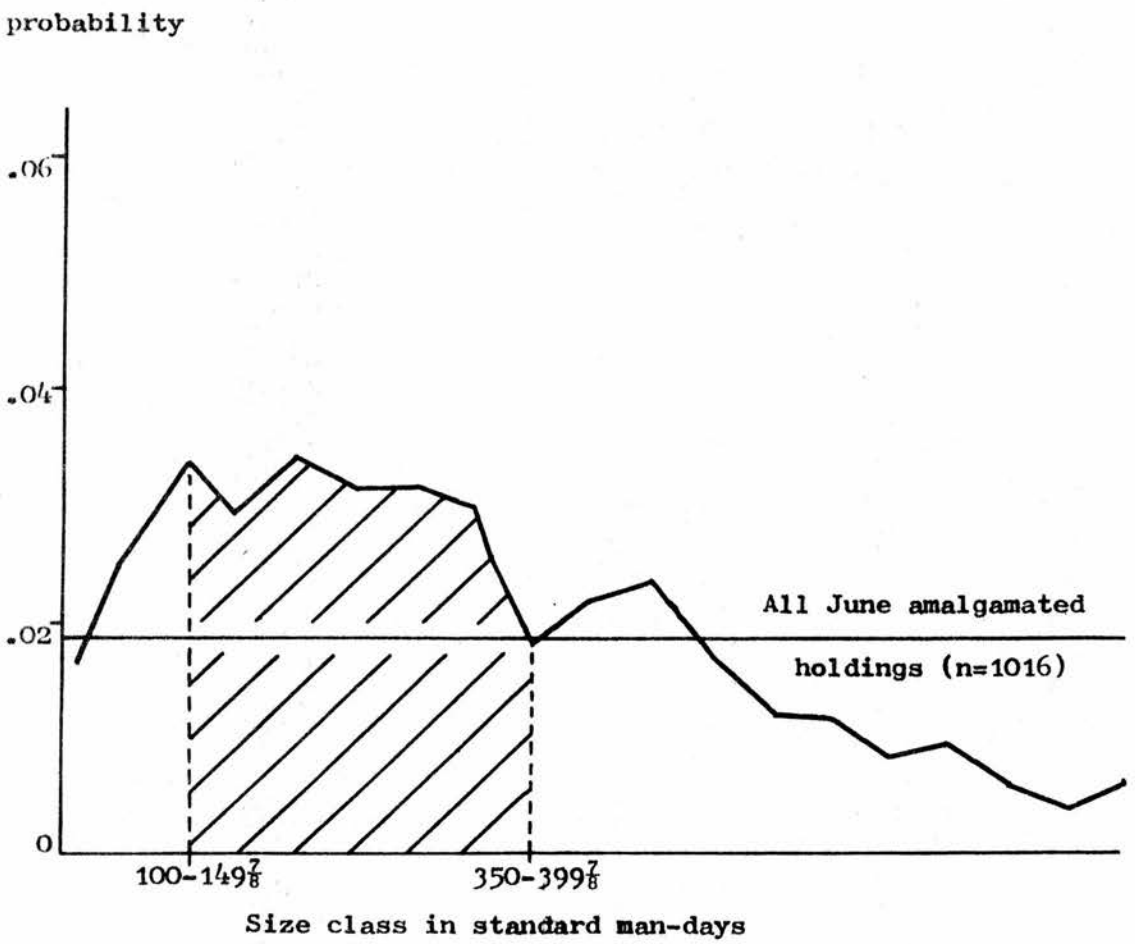
The importance of these size ranges is emphasised by the fact that in Aberdeenshire 76.9 per cent of holdings which changed occupier between 1969 and 1971 were between 10 acres and 249$\frac{3}{4}$ acres while only 46.4 per cent were in this critical range in the Eastern and South-Western regions. Since these figures are calculated from the survey

Fig. 8.3 The probability of being amalgamated by acreage size class.



Source; DAFS 1970, and amended census records.

Fig. 8.4 The probability of being amalgamated by size in standard man-days.



Source: DAFS 1970, and amended census records.

of changes of occupiers, size can only be measured in acres but they demonstrate that the sizes of holdings which are most likely to be amalgamated are disproportionately common among vacated holdings where amalgamation is most common. It has been shown also that the rate at which holdings change their occupier is almost constant spatially (Table 8.2) and it is clear that the excess of small to medium sized holdings among vacated holdings is a reflection of their prevalence in the population of holdings. Thus in Aberdeenshire in 1969, 70.39 per cent of all holdings were between 10 acres and 249¾ acres compared with 52.50 per cent in the Eastern and South-Western regions, so the inference has been confirmed that the size structure of potential and actual amalgamated holdings determines the proportion of vacated holdings which are amalgamated and so determines the rate of amalgamating.

b) Occupiers related to amalgamators

There are some other factors which could be related to the rate of vacating holdings or to the rate at which they are subsequently amalgamated. Occupiers who have relatives farming nearby, for example, or who had business contacts with other farmers would be more likely to see their holding taken over by their relative or erstwhile business colleague than would other occupiers. It has been shown previously that the incidence of occupiers taking over a relative's holding is very low everywhere, being 5.5 per cent (SE = 2.9 per cent) of the sample of amalgamators in Aberdeenshire and 7.7 per cent (SE = 3.5 per cent) in the rest of the sample. The proportion may be higher in crofting areas where kinship ties are stronger but since the rate of amalgamating there is very low indeed, this cannot be used to support

the hypothesis. The hypothesis that the rate at which vacated holdings are amalgamated can be explained by the proportion of outgoers with relatives farming nearby cannot be supported since very few amalgamators take over their relatives' holdings.

c) Occupiers with business links with the amalgamator

The hypothesis that the rate at which holdings are amalgamated can be explained by the proportion of amalgamations occurring between occupiers who were in business contact is similarly dubious. Although the proportion of amalgamators who took over holdings with which they had had some commercial dealings previously is quite high (about one in five), there is no significant difference between the proportions in Aberdeenshire (23.6 per cent (SE = 5.7 per cent)) and in the other ten counties (15.4 per cent (SE = 4.0 per cent)) by the binomial z test although the test is not fully valid in this case. The hypothesis that prior business links affect the rate of amalgamation cannot be supported by the evidence available.

d) Outgoers with heirs

A fourth hypothesis which refers to both the rate of outgoing and the rate of subsequent amalgamation concerns the presence of an heir for the amalgamated holding's occupier. Crawford has shown in two parts of Northern Ireland that only 8 of the 61 holdings changing family ownership since 1940 did so when there was an heir to take over the farm - the outgoer being either childless or without a son interested in farming in the other 53 cases (Crawford 1972 Chapter 9). This feature of the incomplete family cycle was noted also by

Simpson in Yorkshire (1968 p 36) although he was not able to be more precise than to note that the proportion of outgoing farmers who had no farming heirs was "not inconsiderable". Hine and Houston (1973 p 25 and pp 34-38) found the influence of potential heirs less clear but concluded that those with heirs were less likely to retire early if they were owner-occupiers, while those without sons tended to retire earlier if they were married and had some non-farm income. It can be hypothesised, therefore, that the presence of heirs slows the rate of amalgamation which would imply that areas of rapid amalgamating have low proportions of potential heirs on the outgoers' holdings.

Since being amalgamated is most rapid on small to medium sized holdings (Chapter 8, Figures 6 and 7), one can hypothesise that the proportion of occupiers with heirs on these holdings would be lower than the proportion with heirs on larger holdings. Recent work by Rettie (1975 p 389) shows that this is true. Farms under 600 smd in size have only two-thirds as many members of the family who are thought likely to assume the occupancy eventually as the larger farms and in particular the proportion of these farms which have this heir actually resident or working on the farm already is only a third to a half that of the largest farms. Given that it has been shown already (p 165) that Aberdeenshire amalgamators have heirs nearly twice as often as amalgamators in areas of low amalgamating and that this is a traditional area of small to medium sized holdings (see p 166), it ought to be the case that the proportion of the amalgamated holdings in Aberdeenshire whose occupiers' heirs are interested in operating the vacated holdings will be low. Unfortunately, one cannot get

information nationally or regionally on the number of outgoers with heirs for different sizes of farm nor on how many are interested in taking over their father's farm. Nor can one discover from the outgoers in each region how many had heirs who were willing to farm since 10 per cent of the outgoers were dead at the time of the amalgamation, one per cent had emigrated and presumably many of the 60 per cent who had retired normally would not be available for comment today. There can, therefore, be no proper test of the hypothesis that a greater lack of heirs interested in taking over their father's farm among the outgoing occupiers encourages rapid amalgamation in certain areas but one can suggest that it is likely in the light of Rettie's work on the distribution of farming heirs by farm size and of the distinctive size structure of holdings in the North East.

e) Occupiers' ages

The fifth hypothesis concerns the occupier's age. The older the occupier, the more likely he is to retire or vacate the farm. Thus 76.5 per cent (SE = 4.0 per cent) of amalgamations in the present sample took place due to the outgoer's death, illness or retirement, these all being closely associated with his age. If the age structure of an area's occupiers were particularly elderly then one would expect a high rate of outgoing and a high rate of subsequent amalgamations of vacated holdings. No information is available on the ages at amalgamation of the occupiers of the amalgamated holdings in the sample and the data from DAFS on the ages of outgoing occupiers is not available on a regional basis (Rettie 1975 p 390). In addition, it was shown in Table 8.2 that the rate of changes in occupier is fairly

stable spatially, so that the required link between age structure and rate of outgoing is unlikely. Also an examination of the reasons given by the amalgamators for the outgoer's departure shows no significant difference in the proportion of age-related departures in Aberdeenshire and the other counties (75.0 per cent (SE = 6.0 per cent) and 78.3 per cent (SE = 5.0 per cent) respectively). There is clearly no support here for the view that an elderly regional age structure is influencing the rate of amalgamation spatially. There is, in addition, regional information on the age structure of a sample of occupiers in 1967-68 which has been published by the DAFS (Wagstaff 1970 pp 283-285) and the results are given in Table 8.9.

Table 8.9 Age structure of occupiers by region (1967-68)

Age group	Highland	N.E.	East Central	S.E.	S.W.
< 35	7.2	7.1	7.9	10.4	12.2
35-44	16.6	16.2	12.2	17.8	21.5
45-64	52.5	57.6	62.0	50.2	53.6
≥ 65	23.6	19.1	17.9	21.6	12.7

All values are percentages of the total number of occupiers in each region

SOURCE: Wagstaff 1970 p 284 Table 201

The principal variations from the national average in these figures are the higher proportion of occupiers under 45 in the South West (and the correspondingly lower proportion over 64) and the higher proportion over 64 in the Highlands and the South East. The statistical significance of these differences is not given in Wagstaff's article. The higher proportion of older occupiers in the Highland region ought to lead to a higher rate of amalgamating there if the hypothesis is correct than an elderly age structure can explain and predict a high

rate of amalgamating. Since the elderly age structure in the Highlands is accompanied by a very low rate of amalgamating, this suggests either that the hypothesis is false or that the influence of age is overwhelmed by some other influence such as the size of the holding (see Chapter 7). The high rate of amalgamation in Aberdeenshire is accompanied by an average age structure, particularly in the "over 64" group. A low proportion of occupiers over 64 in the South West is accompanied by a rather below average rate of amalgamating. Although the age of the occupier is a guide to his probability of retiring and hence the probability of his farm being amalgamated, age structure does not seem to be able to explain or predict the spatial distribution of the rate of amalgamating.

The last of the possible influences on amalgamation is the tenure of the land. Only crofting tenure has a well-marked spatial component, the other forms of tenure being less clearly separated areally. In Chapter 7, it was noted that amalgamation in the tenanted and owner-occupied sectors when crofting is excluded appears to be proceeding at similar rates and that in crofting areas the rate is very low due largely to the very small size of most crofts rather than to the crofting tenure itself. The inclusion of crofting in the tenanted sector alters the data to such an extent that amalgamation is seen to be proceeding faster in the owner-occupied sector when this is defined to include the taking in hand of land by estates. Since the two principal types of tenure do not have a marked spatial distribution (if one excludes crofting), tenure does not play a major role in explaining the spatial distribution of amalgamations.

CONCLUSION

The explanation of the spatial distribution of amalgamation has proceeded according to the guidelines set out in Chapter 4. A basic description was given in Chapter 3 of as many aspects as were known of amalgamation in Scotland between September 1968 and March 1973. It was clear from this that amalgamation is not a random process but has a structure to it in the sense that its incidence is concentrated. One such concentration was the spatial concentration shown in Figures 3.1 to 3.7. In order to explain this concentration a study was made of the data already collected and of the work of others on amalgamation, expansion and farm investment in order to find as many features correlated with rapid expansion, amalgamation or investment as possible. These correlates were features found disproportionately often among amalgamators or expanders or heavy investors and they may be suspected of affecting the propensity of a farm to amalgamate. They are causes, or, at least, plausible causes of amalgamation when this is treated non-spatially. They can explain why certain socio-economic groups of farmers will amalgamate more than others, irrespective of their location. The principal question in this chapter is whether non-spatial causes of amalgamation will provide an explanation of the spatial aspect of the phenomenon. Or do spatial explanations need to be distinctive from non-spatial explanations?

Generally, each variable was incorporated into a hypothesis which stated the nature of the correlation or the dependence which would be found between amalgamation and that variable if the latter were the cause of the amalgamation. Some variables were hypothesised as having a positive relationship with amalgamation (e.g. size of

holding) and some a negative relationship (e.g. the occupier's age). Because this is is a spatial explanation which is being sought, the correlation is hypothesised between the spatial distributions of the test variable and the rate of amalgamating. The unit used for the correlation is either the county or the sample's strata - which unit was used was determined by the most disaggregated data which were available. Because each test variable has been checked for its relevance against the structure of amalgamating at an individual level, the problem of the ecological fallacy does not arise with the correlations. For example, the significant correlation for the Scottish counties between the rate of amalgamating and the proportion of holdings between 100 smd and 400 smd could be a purely fortuitous one in the sense that small holdings and amalgamations might be unconnected except in so far as they covary spatially. This can be shown not to be the case because, before the correlation was computed, it was established from the data on individual amalgamations that small holdings between 100 smd and 400 smd do participate disproportionately in amalgamations. Spurious correlations and correlations evident only with aggregated data have been excluded therefore because individual data are available to corroborate the logical significance of the results.

The testing of the hypotheses takes the form of their attempted falsification, that is, attempting to show that there is no significant correlation or dependence between the test variable (the plausible cause) and the rate of amalgamation. Where there are county data, the test used is usually the Spearman rank correlation co-efficient, but when only stratum data are available a correlation cannot be

calculated. Instead, various tests such as χ^2 and the binomial z test are used to try and show that the two variables are independent. Where significant dependence is shown, this is taken as the equivalent (with only two or three spatial states) of a correlation with 33 spatial states (that is, with the county data). The Popperian idea of hypothesis falsification being followed by the testing of a broader hypothesis is not pursued since the competing hypotheses are all of equal domain. After testing,there are several hypotheses which have survived the attempts at falsification. The falsification is not, of course, conclusive since it is itself subject to error and since all possible tests of the hypotheses are not possible because the relevant data are not available in some cases.

However, an explanation of the spatial distribution of amalgamations in Scotland can be constructed along these lines.

1. The distribution of the number of amalgamations (Figures 3.1, 3.2 and 3.7) cannot be explained by the distribution of the number of holdings since the probability of amalgamating is also a spatial variable (Figures 3.3 and 3.4).

2. The distribution of the probability of amalgamating cannot be explained by the rate at which holdings are being vacated by their occupiers since this is fairly constant spatially (Table 8.2). The point to be explained is, therefore, re-stated as the spatially variable rate at which vacated holdings are either amalgamated or re-let as separate units (Table 8.2).

3. This cannot be explained by the presence of a few very prolific amalgamators taking over many holdings in areas of rapid amalgamating (p158).

4. There is a general desire by the farmers throughout Scotland to amalgamate as one means of achieving an expansion of their farms. This predisposition is turned into amalgamation more frequently in Aberdeenshire (and the North East agricultural region generally) because there are more farmers there who are in the large part-time to small full time size range (10 acres to 250 acres and 100 smd to 400 smd) which has the highest probability of being amalgamated. The size structure of holdings across Scotland is therefore a contributory cause of amalgamation. Given a widespread predisposition to expand, the spatially variable size structure of holdings can explain the spatial variation in the success of that predisposition (i.e. amalgamation). This greater probability of being amalgamated is because even smaller farms are likely to make little improvement to the expanding farms and larger farms will be more expensive to buy, more likely to be re-let as a separate unit and more likely to have an heir willing to take over the holding when the previous occupier leaves. Farms in the part-time to small full time size range are difficult to re-let since it is not easy to make a livelihood from them and consequently there is little demand from the occupiers' heirs to take them over. They may well require investment in the farmhouse or buildings to bring them up to a standard where a new tenant would wish to rent them, so landowners are keen to amalgamate these holdings and save having to make this investment.

Also, it appears valid to interpret the results of the sample survey as indicating that among the holdings of Aberdeenshire, which are of sufficient size to be taking over other holdings, there are more heirs than on holdings of similar size in other areas. This

second contributory cause would tend to increase the desire to amalgamate among these farmers so as to provide for their heirs. The presence of so many part-time and small full time holdings in the North East would allow them to succeed in amalgamating more often which would have two effects. Firstly, it would make the amalgamator farms a more attractive financial prospect for the prospective heirs which would reinforce their desire to take on the farm which would, in circular fashion, increase further the desire to expand. Secondly, it would mean that since more farmers had experience of amalgamation, more would have an opinion about its merits as a way of expanding (Appendix 8.1). Also, it is likely that the higher the rate of amalgamation, the keener will become the competition among the remaining farmers for the land that is left, this being particularly noticeable on estates as the remaining tenants try to secure land which is at the end of its lease. Both Urquhart's work (1963 and 1965) and Turnock's (1975) suggest a long history of quite rapid amalgamation in the North East, while Parry (1976) has provided evidence of a similarly long history of amalgamation in South East Scotland.

Conversely, a low rate of amalgamation is caused by the reduced incidence of the contributory causes. If the size structure consists of a high proportion of large farms, as it does in the eastern arable areas, then many of these will be easy to re-let separately and their occupiers (owners or tenants) will have heirs willing and legally able to carry on with the farm because it is large and offers the prospect of a good living. Also, they will be so expensive that none of the nearby farms may be able to afford to buy them. This seems to be the explanation of the lower rate of amalgamation in areas such as

the eastern counties and the south west where medium to large farms (particularly by smd size) are more common. Alternatively, the size structure of the farms may be extreme in the opposite direction by virtue of a high proportion of very small farms, as in crofting areas, which causes the low rate of amalgamating in these areas (Chapter 7). There is little evidence that the legal constraints of the system of tenure itself act markedly to reduce further the rate of amalgamation in crofting areas.

So the explanation of the spatial distribution of amalgamation starts with a predisposition to expand. This predisposition, which is a necessary condition, is reinforced in areas of consistently rapid amalgamating by the above average incidence of two contributory causes, the probable existence of an above average number of heirs on the family farms which are of a size to be counted as potential amalgamators and the definite existence of an above average proportion of part-time or small full time holdings both in the population of all holdings and among holdings which are vacated and on which the incidence of potential family successors to the farm is low. The general predisposition to expand is turned into actual expansion less frequently in some areas by the negative influence of an above average proportion of large holdings or very small holdings.

There are no specific causes of amalgamation, that is, no occurrences whose presence is essential to amalgamation and whose absence is by itself sufficient to preclude amalgamation. Every sub-group of farmers has experienced some amalgamation since the general predisposition to expand is so widespread. The explanation of the spatial distribution of amalgamations is not the simple one of

explaining occurrence and non-occurrence (to which the system of sufficient and necessary conditions and the notion of cause and effect are well suited) but rather the explanation consists of accounting by means of the spatially variable incidence of two contributory causes for the differential effectiveness of the widespread predisposition to expand in different parts of Scotland.

Not only is the general structure of the explanation probabilistic in character but the specific explanation presented earlier must be judged as being only probably correct. It is the explanation with the least falsifying evidence against it and most evidence in favour of it. However, one is aware that a shortage of data has prevented the fullest testing of some of the competing hypotheses.

CHAPTER 9

THE SPATIAL STRUCTURE OF AMALGAMATION AT A MICRO-SCALE AND DECISION MAKING BY AMALGAMATORS

The range of amalgamating and amalgamators' horizons

The preceding chapter has demonstrated that the spatial structure of amalgamations at the national scale is not random but has clear concentrations and similarly a structure to amalgamating at a micro-scale is readily apparent. Micro-scale is defined here as the location of a specific amalgamated holding in relation to the amalgamator holding.

The straight line distance between the steadings of amalgamating holdings was obtained during the questionnaire survey and checked from maps and this distance is called the range of amalgamation. The mean range of the 107 amalgamations in the sample was 0.76 miles (SE = 0.07 miles) and the frequency distribution of the ranges is given in the first column of Table 9.1 which shows that this is a very positively skewed distribution.

Table 9.1 Separation in miles of amalgamator and amalgamated holdings in sample

Distance (miles)	Frequency	Probability	Expected Probability	Standardised Frequency Ratio
0.00-0.75	59	0.5514	0.0311	17.729
0.76-1.25	25	0.2336	0.0545	4.286
1.26-1.75	9	0.0841	0.0816	1.031
1.76-2.25	5	0.0467	0.1088	0.429
2.26-2.75	-	-	0.1359	-
2.76-3.25	4	0.0374	0.1630	0.229
3.26-3.75	3	0.0280	0.1902	0.147
3.76-4.25	2	0.0187	0.2173	0.086
	107			

Distances are rounded to the nearest half mile

As one would expect there is a very rapid decline in the probability of an amalgamation occurring as the distance between holdings increases and this rate of decline in the full sample is representative of the number of short and long range amalgamations in each of the regions and size classes of the sample by the χ^2 test. The frequencies have been converted to probabilities (column 2) and may be compared with the probabilities of amalgamation one would expect given that the number of possible holdings to be taken over rises exponentially with distance (column 3). The final column is the ratio of columns 2 and 3 and shows the true rate of decline in the range of amalgamations when allowance has been made for the density of holdings. Whereas with the raw frequencies the nearest ring of ranges (0.00 to 0.75 miles) has 29.5 times as many amalgamations as the most distant ring (3.76 to 4.25 miles), using the standardised frequency ratio the true rate of decline in amalgamating with distance is 7 times greater since the nearest ring has 205.9 times as many amalgamations as the most distant ring. While the raw frequencies correctly show amalgamation as sensitive to the distance between its constituent holdings, they underestimate severely the degree of sensitivity which is measured more accurately by the standardised frequency ratio (Taylor 1975 p 18). The data represent what is, in effect, a spatial demand curve and they allow the "friction of distance" to be defined and measured as a spatial elasticity of demand for holdings.

Such a degree of distance decay is not unexpected since the DAFS employed a guide line during the study period that holdings more than five miles apart should not be amalgamated officially. The rate of distance decay is, however, much more severe than such a five mile

limit would generate by itself (Footnote 9.1).

This distance decay in amalgamation can be compared with Simpson's findings in the West Riding of Yorkshire which are given in Table 9.2 (Simpson 1968 p 21).

Table 9.2 Distances between amalgamated holdings in West Riding of Yorkshire

Distance between amalgamated holdings	Adjacent	Under 2 ml	3-5 ml	5-10 ml	10-16 ml	Total
Frequency	36	30	8	8	7	89
Percentage	40.4	33.7	9.0	9.0	7.9	100%

Despite the gap in the scale of distances between 2 and 3 miles, we can compare tentatively these results with those in Scotland. Whereas 74.1 per cent of amalgamations in the West Riding took place between holdings under two miles apart, some 91.6 per cent of amalgamations in Scotland were within this range and none took place over more than $4\frac{1}{2}$ miles. This more restricted sphere of action seems quite genuine and is not just related to the DAFS definition of an amalgamation during the study period which required the holdings to be within five miles of each other.

This clear indication of the close proximity of holdings in amalgamations is borne out further by information collected on whether or not the holdings involved were contiguous at the time of amalgamation. Table 9.3 summarises the findings nationally and the national figures

Footnote 9.1 In 1973, the guide line for amalgamations was raised to 15 miles

are not significantly different from the figures in each region and size class in the sample using the χ^2 test.

Table 9.3 Frequency of amalgamations between contiguous and non-contiguous holdings

	Frequency	Percentage	Notts 1960-9
Holdings contiguous	83	77.6%	25 (40.3%)
Holdings not contiguous	23	21.5%	37 (59.7%)
Information not available	1	0.9%	
	107	100.0%	62 (100.0%)

These figures can be contrasted firstly with the situation in Ontario, where Fuller (1976) notes that amalgamation leads frequently to the greater fragmentation of holdings and, secondly, with Nottinghamshire where Hine and Houston (1973 p A19) found that in only 25 out of 62 cases where a farm took over a whole farm were the farms contiguous. When allowance has been made for differences in definition (Hine and Houston's category of part farms being taken over is omitted), this shows again the more restricted range over which Scottish amalgamations are occurring and, since the five mile limit in Scotland leaves so much room for non-contiguous amalgamations, this difference cannot be due just to definitions but must reflect a real difference in the way Scottish and English farmers view distance.

The paradoxical interest of these findings comes when one considers the distances over which these amalgamator occupiers said they were willing to consider an amalgamation. They were asked very early in the questionnaire how far away was the holding they had taken over, their answer being checked from the Ordnance Survey one inch map. They were also asked at what distance from their present farm they would consider a holding too distant to be run as one unit with the

home farm. So as to prevent "contamination" from the earlier question, the second question was placed toward the end of the quite long questionnaire. The expression "run as one unit with this farm" was used in preference to the expression "to be amalgamated with this farm" so as to prevent the inclusion of multiple farm businesses in the answers. The expression used is more stringent in the degree of integration it requires and was designed to prevent an over-estimation of distances which might result from the word "amalgamation" being mis-interpreted. The results of this question are given in Table 9.4.

Table 9.4 The maximum distance over which an amalgamation was considered feasible by occupiers with recent experience of an amalgamation

Distance (miles)	Frequency	Percentage	
0 (Do not know)	6	5.6%	
1	19	17.8%	
2	15	14.0%	
3	30	28.0%	)
4	10	9.3%	)
5	7	6.5%	)
6	6	5.6%	)
7	-	-	)
8	2	1.9%	) 62.4%
9	-	-	)
10	8	7.5%	)
12	1	0.9%	)
15	1	0.9%	)
20	1	0.9%	)
40	1	0.9%	)
	107	99.8%	

(Distances always given as a discrete number of miles)

The proportion of ranges greater than 3 miles in the whole sample was used to predict the frequencies in the regions and in the four size classes. The predictions did not differ significantly from the actual frequencies and so the overall figures are representative of the sample's sub-sets.

Although this distribution is still positively skewed (as was the distribution of distances between holdings which had actually amalgamated), the amount of skewness is less. The mean distance of 3.59 miles (SE = 0.24 miles) can be compared with 0.76 miles (SE = 0.07 miles) for actual amalgamations, while the modal category is at three miles instead of 0 to 0.75 miles. The two distributions can be compared in Figure 9.1 which shows the relationship for each amalgamation in the sample.

In an attempt to illustrate more clearly the farmers' perspectives on the world for amalgamation, an attempt was made in Figure 9.2 to show the friction of distance. The rapid radial decline in actual and potential amalgamating can be seen as a manifestation of the friction of distance and this analogy is extended by transforming real distances (shown in the top diagram) by the probability of the actual ranges of amalgamating (middle diagram) and by the farmers' horizons for future amalgamation (lower diagram). The resulting diagrams illustrate the extent to which the immediate vicinity of the home farm looms large in the farmers' perceptions of their world for amalgamating and also illustrates the extent to which distance acts as a disproportionately powerful influence both reducing past expansion and acting probably in a similar, although less severe, manner in the future.

These diagrams raise certain questions, however. How can the spatially constrained character of amalgamations be reconciled with the much wider horizons of those same farmers? If farmers were really willing to consider amalgamations over the distances they claim and if it is fair to assume that the occurrence of holdings available for

Fig. 9.1 The relationship between the ranges of 107 actual amalgamations and the maximum ranges thought practicable.

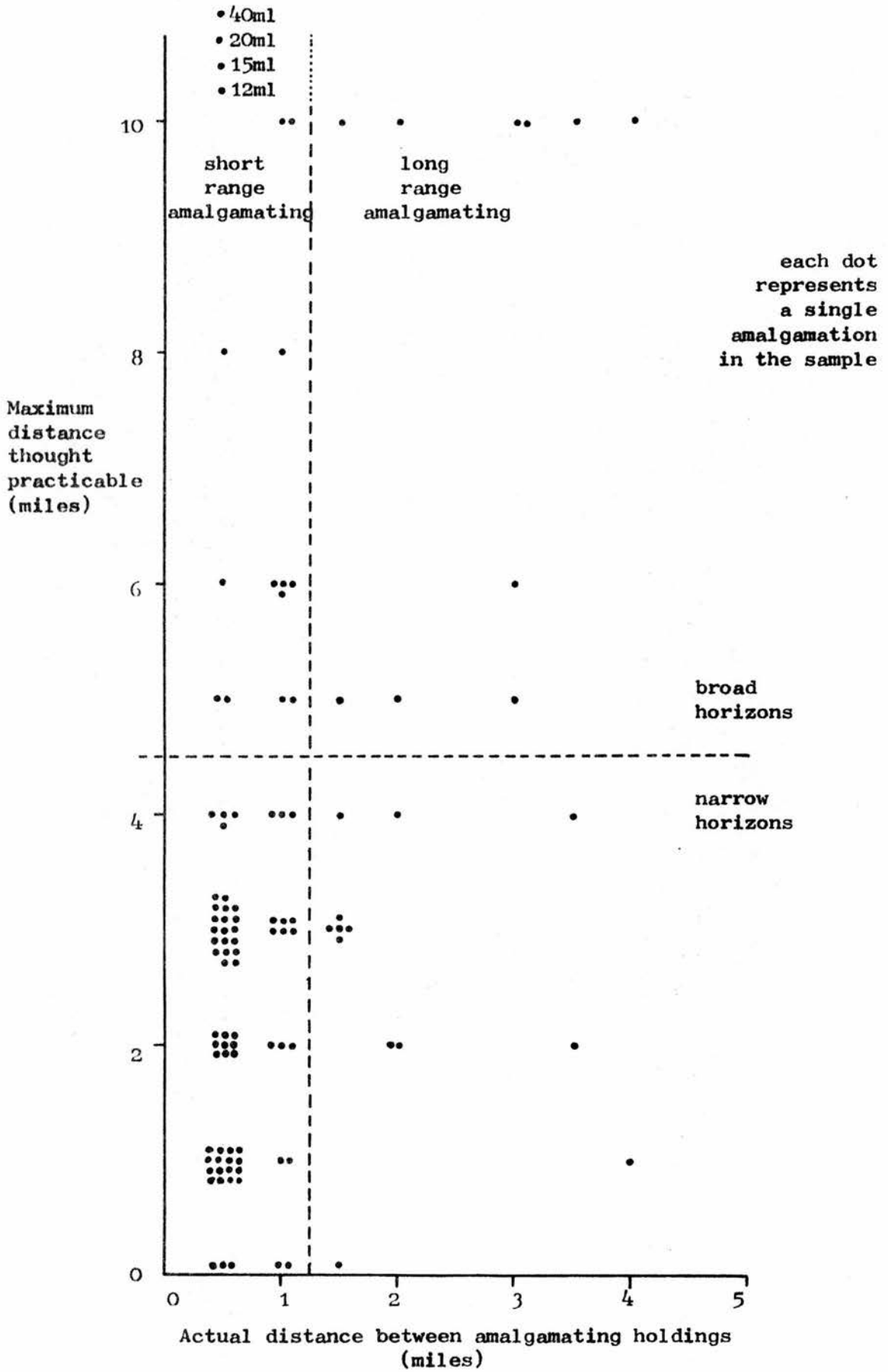
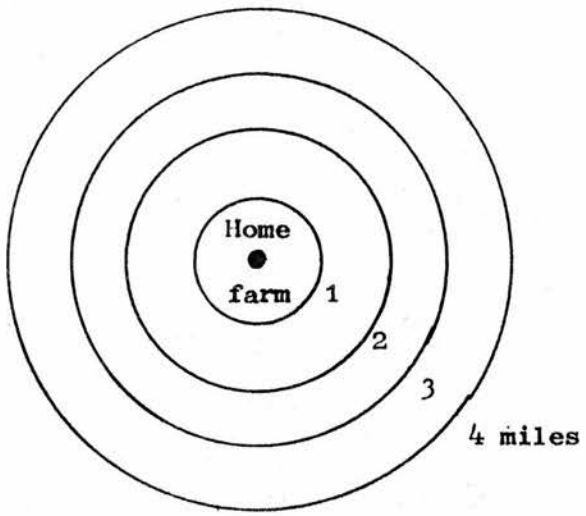
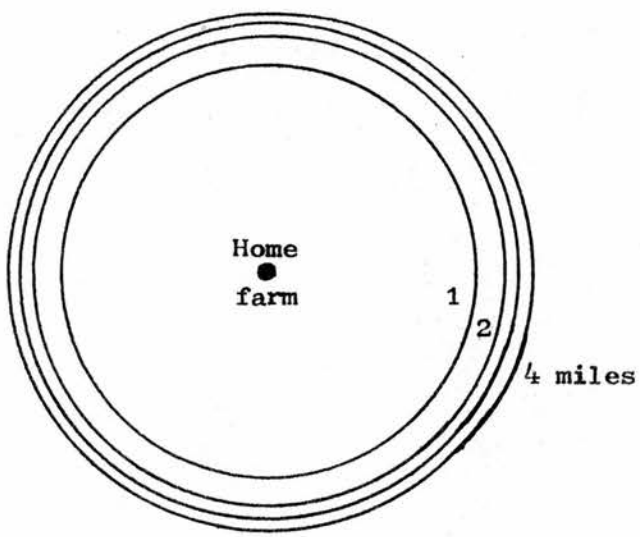


Fig. 9.2 Amalgamators' perspectives.

a) Real distance (miles)

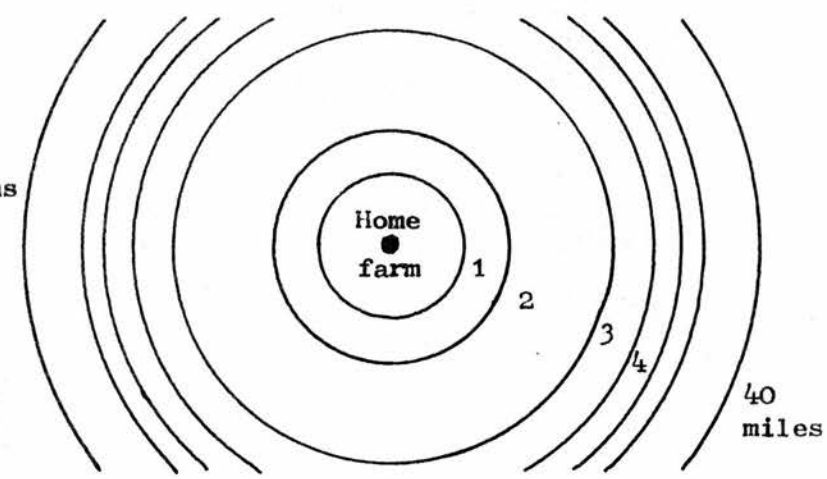


b) Range of actual amalgamations (miles)



In (b) and (c) real distance is transformed by the frequency of ranges or horizons in the sample.

c) Horizons for future amal-gamations (miles)



amalgamation is independent on average of their distance from the home farm, then one would expect that the distribution of actual distances between amalgamating holdings would be nearer than in fact it is to the frequency distribution of maximum feasible distances. Why should there be this discrepancy between past actions and the limits for future amalgamations?

There can be no doubt that the actual distances between holdings for the sample of amalgamations are correct. The holdings were located on maps using DAFS holding names and after asking the occupier for both the name of his new holding and its distance in order to eliminate confusion between holdings of the same name. The data on maximum feasible distances for an amalgamation are less precise since they are the occupiers' own estimates but they appear to be fair estimates. The position of the question in the questionnaire and the wording of the question have already been discussed to shown how bias was reduced. The interviewees are generally people who have been the occupier of the holding for many years - certainly, for sufficient years to get to know the surrounding area. The frequency distribution of the number of years the occupiers had been on their present holdings is given in Table 9.5. The percentage of farmers who have been on their farms for ten years or more is 76.6 per cent (SE = 3.53 per cent) and the frequencies in the strata do not differ significantly from those to be expected given this percentage.

Table 9.5 Frequency distribution of the number of years the interviewees had been the occupier of the sampled amalgamator holding (excludes managers)

Years	Frequency	Percentage	
0-9	24	22.4%	
10-19	34	31.8%	
20-29	25	23.4%	
30-39	13	12.1%	
40-49	4	3.7%	76.6%
> 50	1	0.9%	
"Always" (includes trusts, companies, etc.)	5	4.7%	
n.a.	1	0.9%	
	107	99.9%	

Farmers tend to be mobile both in their work and in every day life. They have plenty of experience of the "friction of distance" while travelling on farm machinery over fields and roads. They all travel into local towns and markets frequently and know well the mileage and time distance of travel in their area. They seem by their experiences of every day life and by their length of time in the local area to be well qualified to give trustworthy estimates of distance in which one can have confidence as accurate estimates of their views. Therefore, both sets of data seem to be reliable and so the paradox of wide horizons and a restricted range of action remains to be solved.

In the questionnaire, an enquiry was made into whether or not the amalgamator had been looking for extra land in the period before the amalgamation. The results to this question are set out in Table 9.6 which shows that a high proportion of farmers were looking for extra land (44.9 per cent (SE = 4.7 per cent)). There is no significant difference in this proportion for each region and size of

holding although the small frequencies meant that only the marginal totals could be tested by χ^2.

Table 9.6 Number of amalgamators looking for extra land before the sampled amalgamation

	Frequency	Percentage	
Looking for extra land	48	44.9%	(SE = 4.7%)
Not looking for extra land	59	55.1%	
	107	100.0%	

From this it could be argued that occupiers are trying to get land at all distances within their maximum range but that they are only successful in getting the nearest holdings, perhaps because of an unwillingness of estates to amalgamate land over larger distances or because of their bids for more distant farms being lower and hence successful less frequently. This is plausible but is not supported by the amount of actual bidding for specific holdings and tenancies done by occupiers in the years before their amalgamation. A question was asked about whether the occupiers had bid previously for other farms and the results are set out in Table 9.7.

Table 9.7 Number of amalgamators who had bid for specific farms or tenancies before the sampled amalgamation

	Frequency	Percentage	
Had bid previously	22	20.6%	(SE = 3.8%)
Had not bid previously	85	79.4%	
	107	100.0%	

Again the χ^2 test failed to show any significant difference between the actual frequency of previous bidders in the regions and size classes and the frequency to be expected given the overall

proportion of bidders, although the small frequencies meant that only the marginal totals could be tested by χ^2.

While Table 9.6 indicates a wide interest in expansion, Table 9.7 shows that this is translated into specific bids in only a minority of cases. The conclusion to be drawn from this is that the spatial distribution of bids which were successful (actual amalgamations) is likely to be representative of all known bids since the successful bids are such a high proportion of total known bids.

Although successful bids are a high proportion of all known bids, there remain the unknown bids. We do not know the location of the unsuccessful bids though they seem few in number and we know nothing of the location nor of the scale (which may be considerable) of unsuccessful bidding by those who never amalgamated and who are, of course, not included in this research. There would be severe problems in trying to sample those who have not amalgamated in a comparable way to the sampling of amalgamators. Also, enquiries into unsuccessful bids might be a sensitive subject which could reduce the response rate if pursued too actively. Therefore, the relationship between successful bids for farms or tenancies and all such bids remains only partially known for practical reasons but there is sufficient evidence from actual bidding to let one conclude that the paradox of wide horizons and a restricted range of actions remains to be explained.

There seems to be no way of reconciling these two sets of distances while accepting that the maximum distances thought feasible today were operative at the time of the amalgamation. If they were both operative then and if one assumes that the location of potential amalgamated holdings is independent on average of their distance from

the home farms, then a much less severe distance decay function would be expected in the range of amalgamations. At this point, however, it is important to remember the chronology involved. Seventy per cent of the amalgamations took place between 1968 and 1970 (Table 9.8).

Table 9.8 Date of change of occupier for sampled amalgamations

	(excluding multiple amalgamators)		(including multiple amalgamators)	
Occupier changed before 1968	20	18.7%	24	18.2%
Occupier changed during 1968	18	16.8%	25	18.9%
Occupier changed during 1969	36	33.6%	41	31.1%
Occupier changed during 1970	21	19.6%	25	18.9%
Occupier changed after 1970	12	11.2%	17	12.9%
	107	99.9%	132	100.0%

The two sets of frequencies do not differ by the χ^2 one sample test nor by the Kolmogorov Smirnov one sample test

The question about the distances over which amalgamation was feasible was asked in 1974 after the amalgamators had had experience of the amalgamation. The distance between holdings which had been amalgamated was never mentioned as a problem during any of the interviews and it can be suggested that the absence of such problems had prompted the occupiers to widen their field of action. At the time of the amalgamation, occupiers considered the undesirability of travel between their holdings as being much greater than they have come to regard it after experience of the amalgamation. This is, of course, an unverifiable hypothesis at present. One cannot possibly discover the occupiers' views on the friction of distance as they were in the past. One can only measure their actions and hypothesise that their

spatial preferences at that period were more in accord with their actions than are their present preferences. Whether the latter will be translated into amalgamations between more widely separated holdings will be subject to test in about five years' time. This hypothesis of an expanding horizon for potential amalgamators presupposes that preferences and actions tend to conform over time although both are subject to change due to third factors and in a reciprocal system between themselves. If there is not a feedback between actions and preferences and back again to actions, then the hypothesis falls. It appears at present that it is the only plausible explanation of the real disparity between actual and feasible amalgamations.

Although the hypothesis of widening horizons cannot be proved or disproved, there are two partial indicators of its validity. The first, and weaker, of these is to measure whether there has been an expansion in the range of amalgamations over time. Are the more recent amalgamations marked by greater distances between the amalgamating holdings than earlier amalgamations? The relationship between the date of the amalgamation and the distance between the holdings is shown in Table 9.9.

Table 9.9 Range and date of amalgamating

Date of amalgamation:	Before 1968	1968	1969	1970	After 1970	Total
Long range amalgamations ($\geqslant$ 1.5ml)	6	4	9	2	2	23
Short range amalgamations ($<$ 1.5ml)	14	14	27	19	10	84
	20	18	36	21	12	107

By the χ^2 test (one-tailed), the frequency of amalgamation in or before 1968 and after 1968 does not differ significantly between long range and short range amalgamations. More recent amalgamations do not occur over greater distances than did earlier amalgamations, so there is no evidence here to support the hypothesis of amalgamators widening horizons.

The second partial indicator of the validity of the hypothesis of widening horizons concerns the relationship between the occupiers' horizons in 1974 for amalgamation and the date of the amalgamation. It can be hypothesised that the earlier was the amalgamation, the more likely it is that the occupier will have had time to discover that distance is less of a barrier to amalgamation than he thought at first. So, earlier amalgamators should have wider horizons than later amalgamators. Information on the date of amalgamation and the occupiers' horizons for future amalgamations is given in Table 9.10.

Table 9.10 Occupiers' horizons for future amalgamations and the date of the sampled amalgamation

Date of amalgamation:	Before 1968	1968	1969	1970	After 1970	Total
Wider horizons ($>$ 4 ml)	10	6	4	4	3	27
Narrower horizons ($<$ 4 ml)	10	12	32	17	9	80
	20	18	36	21	12	107

By the χ^2 test (one-tailed), the frequencies of amalgamations before 1968 and in or after 1968 do differ significantly (at the 0.01 level) between the occupiers with wider horizons and those with narrower horizons. The hypothesis of widening horizons receives some support from this since the amalgamations which took place before 1968 were completed by occupiers with wider horizons today irrespective

of whether the actual amalgamation was a short or a long range one.

Neither singly nor together do these two indicators test satisfactorily the hypothesis that the very real discrepancy between the occupiers' actions and their spatial horizons can be explained by the latter expanding subsequent upon the success of the former. The only valid test will not be possible for five years at least, but the second indicator does at least fail clearly to falsify the hypothesis of expanding horizons.

The relationship between the spatial and socio-economic structures

A feature of this chapter has been that it has taken no account of the socio-economic characteristics of the occupiers and so it cannot explain why some occupiers amalgamated over greater distances than others and it cannot explain why some have wider horizons than others have. Are the characteristics of a wide range of action and wide horizons random in the sample or are they concentrated in certain groups of people? Can these concentrations be used to explain the spatial structure of amalgamations at the micro-scale in the same way as socio-economic criteria were used in the previous chapter to explain the spatial structure of amalgamations at a national scale?

To try and answer this question, 21 variables which could be hypothesised plausibly as affecting the distance occupiers would go or would be prepared to go to find a holding to take over were tested against the range of past amalgamations and against amalgamators' horizons for future amalgamations. These were divided as before at 1.5 miles into short range and long range amalgamations and into occupiers with narrow or wide horizons - those willing to consider

future amalgamations only at less than four miles and those who would be willing to amalgamate over four miles. The 21 variables were subdivided as seemed appropriate for the χ^2 test. In some cases, the test, which cannot cope with low expected frequencies, required only a binary division in the test variable. The results of these 21 tests for independence are summarized in Appendix 9.1. Since in some cases the direction of the research hypothesis was not self-evident, a two-tailed test was used in all cases.

The results show that the occupiers who amalgamated over above average ranges had certain clear characteristics. They farmed significantly more frequently holdings larger than 500 acres and 1200 smd before amalgamation. The holdings they took over were larger than 125 acres and 600 smd more commonly than expected, although in the former case this concentration just failed to reach the .10 significance level. The amalgamators, that is, the occupiers or their managers,were of below average age (under 45 years) more often than expected. However, this relationship disappeared when the managers of amalgamator holdings were excluded since the managers were younger than their employers (the official occupier) in eight out of eleven cases where there was an occupier whose age was known. Not surprisingly, holdings which employed a manager amalgamated with significantly more distant farms than did those without a manager. Managers are commonly employed to run the home farms of large estates and the longer range amalgamations tended to be disproportionately common among amalgamations undertaken by estates taking land in hand, that is, starting to farm land they formerly rented out to a tenant. There was also a negative relationship between

the range of amalgamating and the proportion of the occupier's income which comes from outside farming. Those with high proportions of such non-farm income tended to amalgamate with nearby holdings whereas those without non-farm sources of income were more wide ranging in their amalgamating. Finally, there was a minor but not statistically significant relationship between long range amalgamation and holdings whose occupiers claimed to have taken over three or more holdings during the study period.

The occupiers who had above average horizons for future amalgamations shared most of these characteristics. It has been shown already (Table 9.10) that the occupiers who amalgamated before 1968 had wider horizons than those who had had less time to assess their expansion and this has been used to confer some support on the hypothesis of expanding horizons. The occupiers with wide horizons also tended to be the occupiers of holdings with large acreages and large standard man-day sizes. The holdings they took over tended also to be large in acres and standard man-days. The farmers' horizons appeared to be unrelated to their age although managers tended to be looking for future amalgamations over an above average radius around their holdings. Similarly, above average horizons were characteristic of the occupiers or managers of estates taking land in hand (although, again, this just failed to be statistically significant) and also of holdings which claimed to have taken over three or more holdings during the study period. This again just fails to be statistically significant as does the negative relationship between the occupiers' horizons and the proportion of their income which came from off the farm. The cases which just failed to reach statistical significance

are mentioned because they proved to be particularly important for suggesting a further line of enquiry which will be taken up later in this section.

There are three points to note in these results. Firstly, the proportion of farmers who are in the "long range" category or in the "wide horizon" one and particularly who are in both groups is really quite small (21.5 per cent, 25.2 per cent and 9.3 per cent of the sample of 107 amalgamators respectively). Over 62 per cent of the sample fall into none of these groups. Since the groups are defined with reference to means and since the means relate to positively skewed distributions, it is clear that most farmers have acted and intend to continue to act in a spatially restricted manner. It is a clear minority who constitute this interesting and distinctive group of farmers who see distance as less of an obstacle to amalgamation than do the majority.

The second point is the consistency of the results for actual and for future possible amalgamations. The characteristics of size of holdings, youthfulness, and tenure are shared in large part by both sets of amalgamations.

The third point is that these characteristics are not unexpected. The larger the amalgamator holding, the greater bidding power or borrowing power it will have (see Chapter 6), which will give its occupier an advantage over others. Also, the larger the holding which becomes available, the wider the circle of interest it will attract. It is equally reasonable that the younger farmers (managers or occupiers) will see distance as less of a barrier than the older ones who were brought up with a less favourable view of the friction of

distance. Equally, the financial benefits accruing from an amalgamation will be greater for an estate taking land in hand than for the man with one farm. They not only gain whatever benefits are gained by an occupier spreading his overheads but they gain also as owners of land by not having to invest in the farm to bring it up to a standard at which it will attract a tenant (see Chapter 7). They could be expected to take over more distant land than other farmers simply because the potential financial benefits are greater.

Of equal interest, however, are the relationships with the range and horizons for amalgamating which were not statistically significant but which were hypothesised as being related just as plausibly as in the cases where significance was found. Those particularly eager for land and those with the stimulus of an heir were not spatially adventurous in their actions nor in their sphere for future actions. Neither were those few farmers who were looking for specific types of land or for specific acreages of farms. These conditions they imposed on their amalgamating were reducing the number of potential holdings they could take over in any given radius and yet they were not expanding their area of action to compensate for this reduction. Consequently, their continued adherence to these preferences must, in the long run, reduce their chances of finding a holding to take over.

It was the failure to find significant differences by these quite reasonable criteria which suggested that there might be suppressing variables concealing a quite genuine distinctiveness in the spatially more adventurous (Rosenberg 1968 p 101). So far, the sample of 107 amalgamators has been divided into long range and short range

amalgamations or it has been divided into amalgamators with wide horizons and with narrow horizons as shown in (a) and (b). Instead, the sample was now cross-stratified by both criteria to produce four sub-samples as shown in (c).

(a)

Short range	Long range
n = 84	n = 23

n = 107 amalgamators

(b)

Wide horizons
n = 27
Narrow horizons
n = 80

n = 107 amalgamators

(c)

	Short range	Long range
Wide horizons	n = 17	n = 10
Narrow horizons	n = 67	n = 13

n = 107 amalgamators

From visual inspection, it was obvious that the short range and narrow horizons group were clearly different from the long range and wide horizons group, while the rest of the sample (short range with wide horizons and long range with narrow horizons) tended to be intermediate in character between the other two and so to blur their distinctiveness. The rest of the sample, therefore, acts as a suppressing variable which is based on a less consistent behaviour by farmers. Either their horizons have expanded (assuming this hypothesis is correct) much faster than average or much less than normal. In the first group was an occupier whose last amalgamation was with a contiguous holding but who would travel forty miles for the next one. In the second group were farmers whose next amalgamation would have to be over a shorter distance than the previous one. Both these

groups are per se of interest, but they are likely to be of less relevance in judging which characteristics tend to be associated with a consistently favourable or unfavourable view of distance.

The two sub-sets of the sample consisting of the 67 short range with narrow horizons occupiers and ten long range with wide horizons occupiers were than compared directly to see if either was markedly different from the other. Again the χ^2 test was used - the details are given in Appendix 9.2 - and the same definition of "statistically significant" was employed. The same variables tested previously on the whole sample (Appendix 9.1) were used to sub-divide the two sub-sets and the results of the tests are set out in Appendix 9.2.

These results can be summarised briefly as confirming those obtained from the whole sample but they also extend the distinctiveness of the long range with wide horizons group of amalgamators. As before, these occupiers have significantly larger holdings by acreage and by standard man-days and the holdings they take over are similarly larger than those other farmers take over. They are more frequently than expected estates taking land in hand and a manager is commonly employed. They rarely have any income from outside farming and the proportion of their amalgamations which took place before 1968 is also high. All these characteristics were found previously in the divisions made in the entire sample (Appendix 9.1).

The more marked effect of comparing only two of the sample's four sub-sets was that previously insignificant relationships became apparent now. Statistically significant characteristics of the long range and wide horizon amalgamators now include:

a) more frequent amalgamations claimed during the study period;

b) less frequently looking for a specific acreage to take over;

c) period as occupier (not manager) of the amalgamator holding is more frequently greater than average.

There is general agreement about the characteristics of the more spatially adventurous. They are large scale farmers who are taking over the larger kind of holding. They tend to be owner-occupiers or estates taking in hand land formerly rented out. The less spatially adventurous have the features of small farms with more limited resources. They were looking and bidding for other land in the past, they set clear limits to the size of holding they wanted to take over in a third of the cases and their actual amalgamations confirm that this is a sub-set of mostly small or very small farms. In over a third of the cases, they had some proportion of their income coming from outside farming before the amalgamation (a not uncommon feature of small holdings) and in another third of the cases they had business contact with their new holding before the amalgamation (Wagstaff 1970 p 282; also Dunn 1975 p 374). Clearly, the characteristics in each set of traits are not independent of each other since they form a complex of correlated traits found disproportionately often among these groups of spatially adventurous and spatially restricted amalgamators.

A socio-economic pyramid

When one compares the criteria which distinguish the occupiers who are consistently spatially adventurous from those who are not with the criteria which distinguish all amalgamators from the generality of farmers, one finds that they are remarkably similar (Appendix 9.3).

Amalgamators generally run large holdings (measured in acres or standard man-days) while the spatially adventurous amalgamators in the sample occupy even larger holdings than occupiers who are less wide ranging in their actions and horizons. Similarly, the holdings taken over are normally larger than is usual and this is even more pronounced in the long range, wide horizon group. Comparisons of farm type cannot be made because the sample does not cover all Scotland but the tenure of holdings can be compared. Owner-occupied holdings (here including farms taking land in hand) are probably rather more common than expected among amalgamators (Table 7.1) while the wide ranging amalgamations are even more notable for the proportion of owner-occupiers. Amalgamators employ a farm manager more often than others and managers are even more common on the spatially adventurous holdings. All these differences are statistically significant by the tests described in Appendix 3.3 and Appendix 9.2 . The only distinguishing feature of amalgamators which is not found to an even greater extent among the wide ranging group of occupiers is their relative youthfulness and possibly the frequency of non-farm income although this is only a tentative observation. There are, therefore, substantial grounds for identifying a socio-economic pyramid among farmers. As one rises up the pyramid towards its apex, the number of farmers decreases and they are characterised by their increasingly extreme and homogeneous nature. The broad base of the pyramid represents the diversity and balance of features found in Scottish agriculture generally. In the middle of the pyramid there is less diversity among the population of amalgamators than among holdings generally and at the apex of the

pyramid is the very small group of spatially adventurous amalgamators who are a tight-knit group of large holdings with very distinctive characteristics.

Amalgamation and innovation

Amalgamation is a major change for most farms. If land has to be bought, it will be expensive and so will the equipment and stock for it. An amalgamation may involve a major increase in the farm's size and this may lead the farmer to alter his system of farming even to the extent of starting new enterprises. Potentially, therefore, an amalgamation could be a major change for a farmer. The amount of change in the farming which actually occurs will be described in Chapter 11. One can proceed from this observation and ask two questions. Firstly, what makes amalgamation acceptable to farmers and, secondly, upon what criteria is the decision to amalgamate taken? The questions are clearly inter-related and this section will attempt to provide some answers to them.

An amalgamation has been described as potentially having the power to change the farmer's balance of enterprises in his system of farming. This potential has been described elsewhere in the geographical literature as being the potential one associates with an innovation and the possibility of using usefully the idea of amalgamation as an innovation should be pursued.

Innovation can be considered from either a spatial viewpoint or a socio-economic one. Most geographical research has concentrated largely, if not exclusively, on the spatial structure to the diffusion of the innovation (e.g. Hägerstrand 1953/67 and Bowden 1965). Its aim has been to model the acceptance of a new practice over space and

time and any concern about the nature of the individuals who adopt the innovation at different stages of its diffusion has been secondary among geographers. In contrast to the macro-scale and spatial viewpoint of the geographer, there is the approach of the rural sociologist, the agricultural economist and the farm advisor. This has ignored the spatial aspect largely and has concentrated on the spread of the innovation through societies and economies. This has usually been studied at a micro-scale, the farm advisors in particular being concerned with individual farmers and their socio-economic characteristics. The present research can make little comment on the spatial diffusion of amalgamations despite this being the traditionally geographical viewpoint. There is no "time-zero" for this process, that is, there is no time before which there were no amalgamations in Scottish agriculture and from which their later progress could be traced. The existence of a "time-zero" is a prerequisite for most of the conventional models of diffusion. It is possible that a way round this could be found but the lack of a sufficiently long time-series for the numbers of amalgamations would still be critical. Before December 1968 when the present study begins, there are no data available on the numbers of amalgamations (a point discussed in detail in Chapter 3) and one has to rely on changes in the total number of holdings. This is a thoroughly unsatisfactory surrogate since the total number of holdings is a net figure made up from the gross loss of holdings from all causes (including amalgamations) and the gross gain in numbers of holdings. Even the figure for the net change in the number of holdings is unreliable since there were periods in the late 1950s and early 1960s when

changes in administrative procedure created the illusion of an acceleration in the rate of decline in the number of holdings by a policy of "statistical amalgamations" - that is, the registration of amalgamations carried out some years previously. In short, the spatial spread of amalgamations cannot be traced before 1968, there is no base point from which to study the process and there is no state of saturation (the 100 per cent acceptance of the innovation) other than there being only one farm in all Scotland. Therefore, there is little likelihood that the spatial incidence of amalgamations at different times will be a practicable field for study. The only observation which can be made is that nearly all diffusion models attempt to describe or to simulate a pattern of adoption which is clustered particularly at the macro-scale. The pattern of amalgamation shown on Figures 1 to 8 of Chapter 3 is also a clustered one with two or three centres in the North East and lesser concentrations in Orkney, Caithness and Northern Shetland. This must remain no more than an interesting coincidence of patterns because of the impossibility of stepping outside the study period of 1968 to 1972.

Although the picture of amalgamation as an innovation from the spatial viewpoint is hazy, from the socio-economic viewpoint it is much clearer and it is from this viewpoint that all further remarks will be made. The notion was introduced earlier of a socio-economic pyramid which would describe the distinctiveness of amalgamators in relation to all farmers and the distinctiveness of spatially adventurous amalgamators in relation to other amalgamators. The specific socio-economic variables which distinguish amalgamators from other farmers are almost the same as those which distinguish

innovators (that is, the early adopters of innovations) from other people who adopt the innovation later. In Appendix 9.4 there are listed all those features of innovators which distinguish them from the rest of the population. The list is a composite one taken from Jones (1967), Jones (1972) and Rogers (1962). These three articles review a large proportion of the vast literature on the diffusion of innovations in agricultural areas, Jones (1967) alone reviewing 468 articles from many countries. Rogers' work in the mid-West of the United States has been particularly influential and his findings have been largely verified by the more limited work studying the characteristics of British innovators (Jones 1960, 1962A, 1962B, and Maclennan 1973). The characteristics which have been least securely verified as applying in the British situation are those about the innovators' greater sociability and their tendency to be leaders of opinion. There has also been included in Appendix 9.4 a number of asterisks to indicate which of the innovators' characteristics are shared by amalgamators. A double asterisk in the right hand column indicates that the spatially adventurous amalgamators share the characteristic as well but to an even more marked degree than other amalgamators. Some of the comparisons are somewhat conjectural, however. The greater financial resources of amalgamators, for example, was not measured directly but is inferred from these farms' greater size both in acres and standard man-days. The relationship between size and financial resources is discussed in more detail in Chapter 6 which provides the evidence to support the inferences which have been drawn here. The greater tendency of amalgamators to seek out professional advice is inferred from the greater number of amalgamators

who employ professional farm managers to run their lands. A few comparisons could not be made for practical reasons. The sources of information leading the amalgamator to consider an amalgamation could not be discovered with accuracy since the amalgamations took place up to seven years previously and the greater rationality of amalgamators could not be assessed for the lack of a working definition of rationality.

The conclusion to be drawn from Appendix 9.4 is that where comparisons are possible, the amalgamators of holdings in the study area share the same socio-economic traits as innovators have been found to have in other parts of Britain and in the U.S.A. This is not to claim that the sample of amalgamators were innovators with regard to the combine harvesters, the bulk milk tanks and the other technical improvements which form the normal field of innovation studies. A formal study of the relative innovativeness in technical matters of amalgamators and other farmers would be impossible. There is no satisfactory way of testing whether amalgamators and innovators are one and the same people or are independent sets although two impractical ways suggest themselves. The first way would be to select two sets of farmers who differed from each other only because one group had been amalgamators and the other group had never taken over another farm. One could then compare the degree of acceptance of various innovations between the two sets. If the amalgamators had a significantly higher degree of early adoption than the non-amalgamators, one could infer a substantial correlation between amalgamators and innovators. This method, however, is impractical because of two weaknesses in the data. A sampling frame of farmers

who have never amalgamated could not be constructed since the data on amalgamations only covers the study period. Also, one could not control on all the factors correlated with innovativeness (such as those listed in Appendix 9.4) so that the only difference between the two sets would lie in their respective experience and lack of experience of amalgamating. This lack of control would invalidate any inferences one might try to make from the relative degrees of innovativeness in the two groups. If the degree of adoption was higher among amalgamators one could not infer a correlation between amalgamators and innovators since the set of non-amalgamators could be, for example, disproportionately older or contain more small scale farmers who would innovate less rapidly regardless of amalgamation.

The other impractical way of testing for the degree of overlap between amalgamators and innovators would be to compare the chronology of adoption between amalgamators and the rest of the population. The problems here are threefold.

a) One could not define the "rest of the population" as non-amalgamators but only as those who did not amalgamate during the study period.

b) It would be difficult to establish the national chronology of adoption of each innovation and impossible to establish for the population of those who did not amalgamate during the study period.

c) It would be difficult to establish a chronology of adoption among amalgamators due to the lack of data on machinery diffusion and the confidentiality of such official data as there are at a holding level. One would have to resort to a postal questionnaire which

would almost certainly lead to the problem of assessing the direction of the bias introduced by substantial non-response to the questionnaire. The probability of being an amalgamator is known but the probability of a farmer being either an innovator or of being both cannot be calculated by either method.

There appears to be no satisfactory way of assessing whether the specific farmers who have amalgamated recently are early or late adopters of those technological investments which are the usual object of innovation studies. Therefore, the inference to be drawn from Appendix 9.4 cannot be that amalgamators are innovators although the correspondence of their traits suggests that they are co-incident groups. The inference can only be that in most respects, the characteristics of amalgamators and innovators are so strikingly similar that the coincidence of the two groups is both likely and plausible. Amalgamation is the socio-economic equivalent of a diffusion process and amalgamators are similarly the equivalent of early adopters of innovations.

The attractiveness of expansion by amalgamation

An amalgamation is, by definition, a change - indeed, in some cases a major change - for any farmer and so can be called, a priori, an innovation, particularly since the types of farmers who amalgamate are so similar to those who innovate. It has been shown that those farmers who adopt the innovation of amalgamating are socio-economically similar to those farmers in Britain and elsewhere who have been observed to adopt more traditionally defined innovations. Consequently, the process of farm amalgamation can be seen as the socio-economic equivalent of a diffusion process.

The question arises as to why some farmers decide to amalgamate. Upon what criteria do they judge areal expansion to be desirable and can the body of literature on innovation diffusion and decision making help to establish why the distinctive groups wish to amalgamate and why they succeed in doing so? In its turn, can the present research shed light on farmers' decison making in present-day Scotland by drawing on both the fieldwork among amalgamators and on the literature and theories of innovation diffusion? This section will now concentrate on answering these questions.

During the interview of amalgamators, questions were asked which required the effective occupier of the amalgamator holding to compare by five criteria the areal expansion of his farm as against its expansion by intensification (see Appendix 5.3 for the full questions). The word "intensification" was used to mean whichever form of investment in the farm's present acreage the farmer would consider feasible. No specific directions of such investment were specified because of the range of types of farming which were encountered. The questions could apply equally to all the interviewees. The thinking behind these questions was that whenever a farm became available, each farmer had a choice. He could, as tenant or owner-occupier, invest in extra land - and all these comparisons assume the amalgamator will buy the land in which case the decision is entirely his own. Or he could keep his investment (either internal profits or borrowed capital) for the purchase of extra inputs to raise production from his present acreage. Which aspect of amalgamation made this such a desirable course of action that, by definition, all the interviewees had pursued it?

Four economic criteria for comparing different options for one's investment were established. They were the speed of the return on investment, the size of the return in the long run, the amount of borrowing required for either option and the comparative ease or difficulty the farmer would have in running the farm after either option. In all cases what was being compared was not objective measures of return or borrowing, which are not directly related to the decision, but each individual farmer's perception of the likely returns from either option. This perception will be influenced to an unknown but probably varying extent by the objective returns, by the type of farming practised and the farmer's skills and goals. None of these influences is important by itself. They become important only in combination and that combination is the farmer's view of, say, amalgamation as judged by the criterion of, say, the rate of return on capital it provides. It is also not necessary, and indeed would be impossible, to attempt to measure the actual or perceived values each farmer attaches to the rates of return. It is only important to know which course of action will provide the greater return or need less borrowing or to know that the farmer does not know himself, either because the rates of return are equal or because it is not a comparison he has ever made. Either way, the reply of "Don't know" is just as significant as either a positive or negative answer since it means that the criterion is not important in influencing that farmer's view of the relative merits of amalgamation and intensification. In order to prevent farmers being "yes-men" - that is, saying yes to every question in an attempt to please the interviewer when they had no real answer, two of the

questions were phrased to that the answer favourable to amalgamation was "No" and these were spread out through the five questions so that a consistent viewpoint favouring either amalgamation or intensification required the respondent to change his answers between "yes" and "no". By this, it was hoped to make the respondents think about the comparison, to prevent a constant stream of the same answer from those determined to please or displease and to ensure that "yes" and "no" answers really meant "yes" and "no" by encouraging those who were confused, and so probably did not have a viewpoint, to reply "don't know". The term "don't know" is used fairly liberally to include both incoherent replies and also complete silence.

Table 9.11 Comparison of amalgamation and intensification by the sample of amalgamators

Criterion	Agree	Disagree	Don't know
Amalgamation			
- is riskier	9.3	63.6	27.1
- provides a faster return on investment	16.8	9.4	73.8
- provides a greater return on investment	38.3	23.4	38.3
- requires more borrowing	37.4	23.4	39.2
- makes the farm easier to run	31.8	13.1	55.1

For each row, N = 107. All values are percentages of the 107 amalgamators in the sample.

Leaving aside for the moment the first criterion concerning relative risk, the clearest point to emerge from Table 9.11 is the high proportion of the sample who were not able to differentiate between amalgamation and intensification and who gave a "don't know" reply. The criterion of speed of return on investment produced a particularly high proportion of non-responses. The question on whether

amalgamation made the farm easier or more difficult to run than intensification also produced many non-responses although in the cases where a reply was given the balance was clearly in favour of regarding amalgamation as making farms easier to run than would intensification. Non-response was under 40 per cent for which option provided the greater return on investment and although more felt the advantage lay with amalgamation on this criterion despite the rapid rise in land prices recently, there was less than a two to one majority for this view. This was counter-balanced by a similar majority holding an equally unfavourable view of amalgamation as the option requiring the greater borrowing which is clearly related to the rise in land prices and to the assumption that the land will be bought and not rented. By two of the four criteria, amalgamation is fairly favourably compared with intensification, by a third criterion it is seen as the rather less acceptable course of action and by the fourth criterion there was no sign that the occupiers had firm views either way. On balance, the merit lies with amalgamation as the preferred way to expand but the case in its favour does not appear overwhelming. Using a χ^2 test, the amalgamators' attitudes and their holdings' sizes in standard man-days are independent so that these findings are true of the smaller as well as the larger amalgamator holdings.

It is really only by the criterion of the relative risks involved in the options that a concensus of replies emerged. This was the first question to be asked in the section of the questionnaire dealing with these comparisons so that there is no likelihood that the answers to this question have been contaminated by favourable

views on amalgamation by other criteria. The reply in favour of amalgamation is a negative one ("Is amalgamation riskier than intensification?") so that genuinely favourable views would not be aggregated with the replies of those who wanted to please the interviewer by saying "yes" all the time. It could be argued that since the sample were all amalgamators there would be a tendency to look favourably on amalgamation simply because it was the option they had chosen. In this case, their favourable view of amalgamation would be a consequence of their having amalgamated rather than a cause of it. This idea of reducing internal conflict and cognitive dissonance is plausible until one notes that, by the other four criteria, amalgamation provokes only a mildly favourable response in two cases and an unfavourable one in a third case. The amalgamators were prepared to see their actions as being less than ideal on the grounds of its initial cost so that the overwhelmingly favourable view of amalgamation by the criterion of relative risk appears to be a genuine expression of amalgamators' views on amalgamation in comparison with intensification. The replies here are impressive both for the 7 to 1 dominance of the favourable view over the unfavourable one and also for the percentage of "don't knows" (27.1 per cent) which is the lowest for any of the questions. We may also assume that these amalgamators have all had some experience of intensification and since they are still farming, they presumably had some success with that form of expansion. Thirdly, the question was asked with regard to a future amalgamation. They were not asked about their past actions. If these had been less than satisfactory, an answer unfavourable to amalgamation would not have reflected on their past

decisions. Considering Table 9.11 as a whole, the inference to be drawn from it is that by two of the criteria amalgamation is regarded with very moderate approval and that the only clear distinction between the merits of amalgamation and intensification when both are presented for comparison in a future hypothetical situation is that the risks attached to investing in land are less than those attached to investment in other factors of production. This does not seem to be simply a consequence of past decisions but seems to be a reflection of a basic opinion. A surer return rather than greater or faster returns is the clearest advantage amalgamation has for amalgamators in cases where the land is to be bought or taken in hand, and this is true of all sizes of amalgamator holding. It is also true of the three regions although the smaller proportion of "don't know" replies in Aberdeenshire contributes disproportionately to the small group who saw amalgamation as the more risky alternative (see Appendix 8.1). Equally, the results are valid for long range and short range amalgamators, for those with wide as well as those with narrow horizons and for those who were defined earlier as being spatially adventurous and spatially restricted in their amalgamating. By way of comparison, Dunford (1961) found in a rather questionable sample of 37 farmers that they regarded land purchase as a very safe reason for borrowing, although he found the larger farmers were more willing to take risks than the smaller farmers.

Further tests were carried out to see whether this favourable attitude to amalgamation by the criterion of risk was concentrated in a particular section of the sample. Were younger occupiers less concerned about risk than older occupiers? Using the χ^2 test, there

was no difference in the balance of favourable and unfavourable replies between occupiers under 45 (the mean age) and those over 45 although the older occupiers did have a significantly higher proportion of "don't know" replies. Were the attitudes of farm managers, with their different educational backgrounds, more or less favourable to amalgamation? In fact, they were not, since the degree of risk attributed to amalgamation was similar for managers and other occupiers just as it was similar for occupiers with a non-farm source of income and those without any. The proportion of "don't know" replies was, however, higher among those with no outside income although this did not reach the .05 level of significance. It was also hypothesised that those amalgamating for the first time during the study period would see this as a riskier development than would those who had already taken over several other farms. This hypothesis received no support from the survey data since the attitudes of those amalgamating for the first time (as far as one can know this) hardly differed from those of the more frequent amalgamators. Neither did those looking for extra land before their amalgamation have a more favourable view of amalgamation than those who were presumably less keen to expand their acreage because they had not been looking for land prior to their amalgamation. Even amalgamators who had been the occupiers of their farms for less than ten years and who might be supposed to have smaller financial resources to cushion them against set-backs had the same view of amalgamation as their longer established colleagues.

The conclusion reached earlier for the whole sample that amalgamation was unequivocally differentiated from other forms of

expansion predominantly on the grounds of the returns from it being surer, can now be extended to include each of the sub-samples formed by partitioning the sample in ten different directions. It is a balance of opinion in favour of amalgamation using the criterion of degree of risk which is almost universal among the sample of amalgamators in the study area. This is the principal criterion on which areal expansion is favoured over other forms of expansion.

Attitudes to risk and farmers' goals and values in amalgamating and innovating

This conclusion places a dilemma in the way of further work. In Appendix 9.4, there is a summary of the tests carried out to show that the socio-economic traits of amalgamators appear similar to those of innovators in most principal respects where comparisons are possible. The case where a trait differed between amalgamators and other innovators concerned their view of risk taking. Other innovators are traditionally characterised as being risk takers or more venturesome than later adopters (Mansfield 1961 pp 745-747; Jones 1967 pp 14-15). Amalgamators are farmers who have chosen to expand in a way which is consistently viewed as the less risky way of expanding. It seems that there are two ways of reconciling these findings if one accepts them as correct. Amalgamators and innovators may be independent groups in which case the findings can be accepted as they stand. Alternatively, amalgamators and innovators may be groups which overlap considerably and they may include both risk minimising with venturousness in their decision making. This would require a new appraisal of their decision making and the role of risk in it.

The first alternative has been discussed already. The balance of plausibility is against them being independent groups although a formal test of this is not practicable. It will have to be borne in mind that this is a subjective and not an objective probability.

The other alternative is that amalgamators are both risk minimising and, like other innovators, venturous. The specific features of amalgamation which contribute to its image as a surer investment are quite easy to list. Firstly, investment in land is investment in an appreciating asset for the owner-occupier. Investments in fertilisers or other chemicals have no capital value once used, while investment in buildings or machinery is investment in an asset of depreciating capital value. Figures are given in Appendix 9.5 which show the rise in land values in Scotland, these values being inferred from the prices paid for holdings over 20 acres. There is an erratic increase in prices per acre for land with and without vacant possession and for land remaining in or being sold out of farming, the increases being brought out in Figures 9.3 and 9.4. Particularly at a time when prices per acre are increasing, investing in land raises the likely sale price of the farm should the farmer want or need to sell it and,before then, the rising book value of the land will correspondingly raise the farmer's borrowing potential from banks irrespective of whether he is owner or tenant. This gives expansion through land an advantage over other forms of expansion since it provides the farmer with an increasing borrowing capacity to see him through any difficult periods which may arise and it provides a greater capital gain on retirement for the owner if and when the farm is sold (Dunford 1961). This aspect of amalgamation has been a

Fig. 9.3 Sales of equipped farms over 20 acres remaining in agriculture in Scotland, 1963 - 1972.

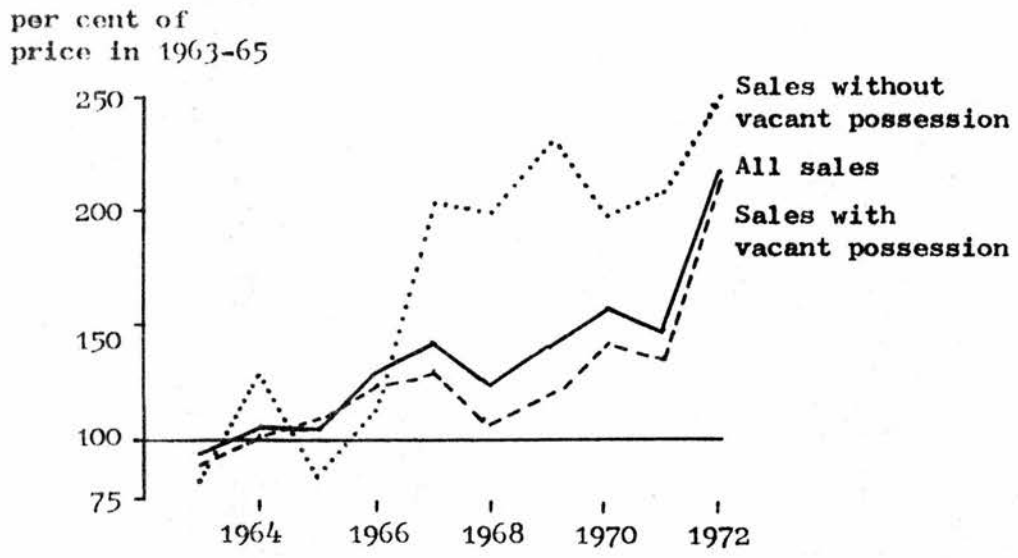
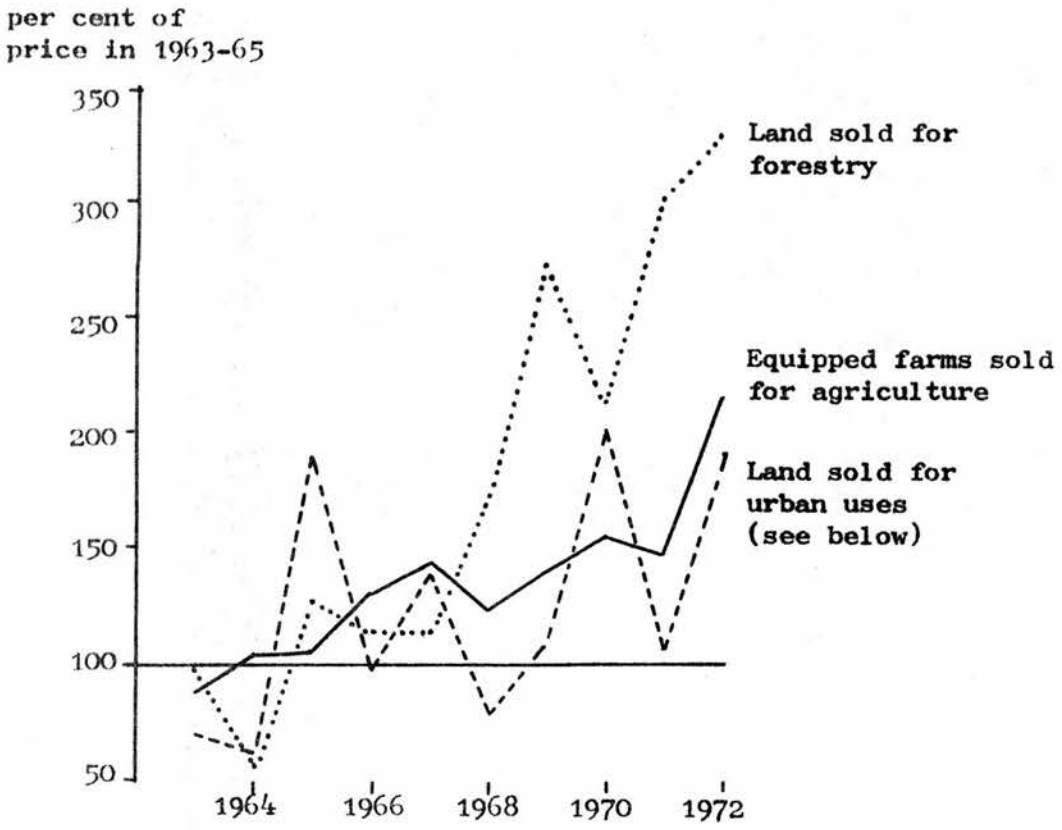


Fig. 9.4 Sales of land over 20 acres in Scotland, 1963 - 1972. (see also Appendix 9.5)



Urban uses are roads, housing and industrial development.

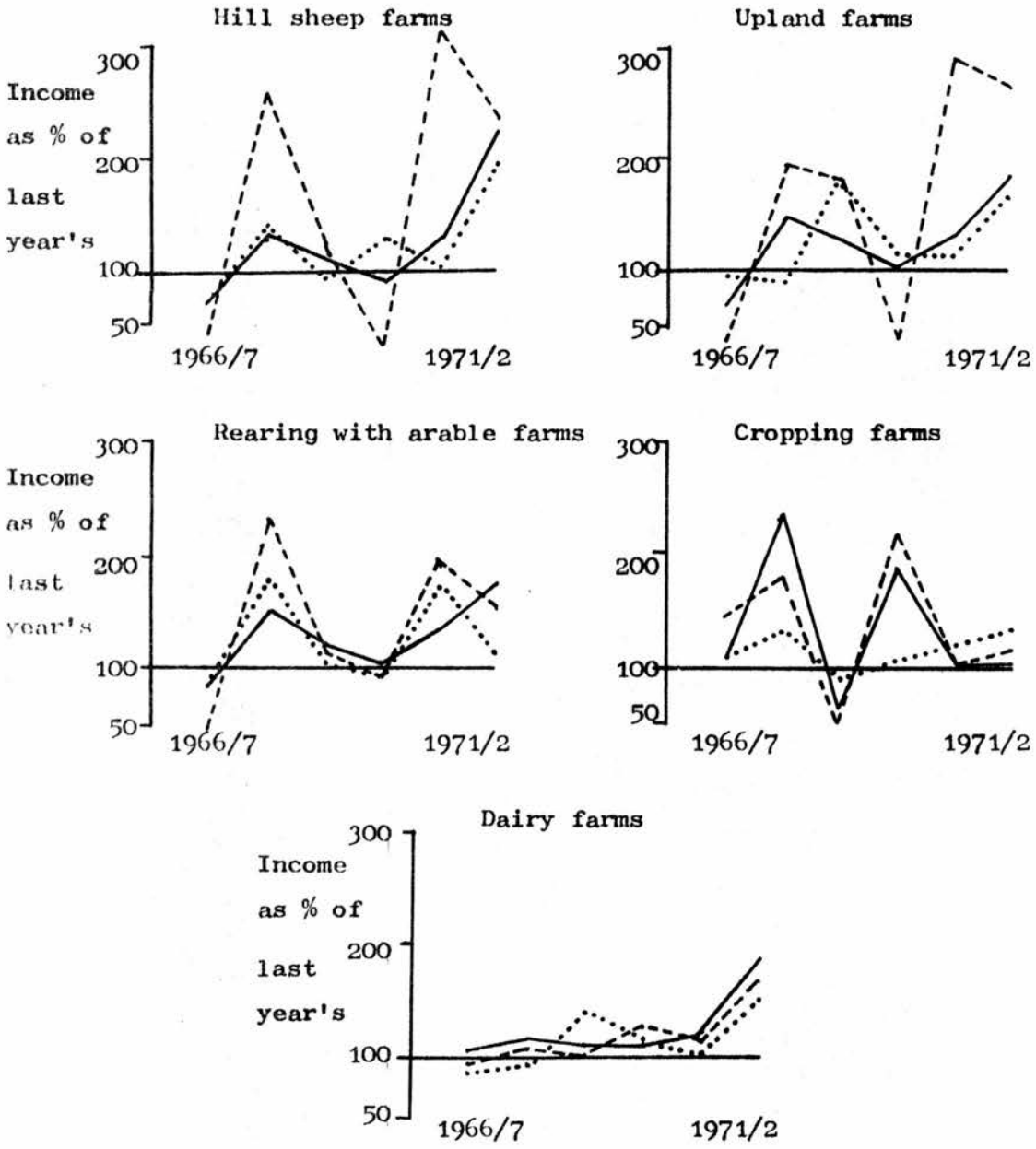
In both Figures 9.3 and 9.4, 100 is the mean price per total acre in 1963-1965.

Source: Fig. 9.3 Mackenzie (1974) 302 ; Fig. 9.4 Mackenzie (1974) 306-7

little tarnished by the recent fall in land values but probably few farmers would regret the decline from unfavourably high prices.

If an expanding farmer invests in a combine harvester or in a new and larger milking parlour, then he is committed to grain and milk respectively until the investment is fully depreciated. When dealing with capital intensive innovations among large American industrial firms, Mansfield (1961 p 755 and p 763) noted that there was a tendency - although not a statistically significant one - for the rate of innovation to be reduced when there was existing productive capacity which was not fully depreciated. So it is in farming. Land can be used for a variety of enterprises while it is paying for itself provided it is not too high nor the soil too heavy, whereas one reduces the flexibility of one's farming system by intensification which tends to wed one more firmly to the existing pattern of cropping and stocking until after any equipment for the intensification has been depreciated. A lack of flexibility in enterprises can be particularly serious when farm income is highly volatile. Figure 9.5 shows that farm income is especially erratic on hill sheep, upland, rearing with arable and cropping farms. Each graph shows the mean net farm income for each size class of a particular type of farm as a percentage of income in the preceding years. Apart from on dairy farms, it is rare for the rate of change to be similar to that in the previous year. Each data point is a mean figure for the net income of a group of between four and about 70 farms. Greater disaggregation is not possible because of confidentiality, but it is likely that the variation annually in income on individual farms will be greater than the variation in the

Fig. 9.5 The variability of net farm incomes by type and size of farm in Scotland, 1965 - 1972.



..... small farms (275 - 599smd)

——— medium farms (600 - 1199smd)

– – – – large farms (1200 and over)

The graphs show the mean net farm income for the type/size group as a percentage of the group's income in the preceding year. The size of the groups varies from 9 to 70 in 1971/2.

Source: Scott. Agric. Econ. 18 (1968) to 23 (1973).

mean incomes of groups of farms (see also Footnote 9.2). Therefore, in an industry where net income is subject to major changes from year to year, and where even large farms are dwarfed by the size of their markets, it is undesirable to expand the farm in a way which could limit the farmer's choice of enterprises and so limit his ability to protect his business from its unstable milieu. Amalgamation is less likely to increase the limits on the farmer's choice of action than is intensification.

To balance this, it must be noted that the flexibility of enterprises provided by amalgamation is as much a potential as an actual flexibility. In the survey of amalgamators, a question was asked about whether there had been any new enterprises started on the farm or any alterations to existing enterprises as a consequence of the amalgamation. The results, which will be discussed in detail in Chapter 11, are given in Table 9.12 which shows that 86.9 per cent (SE = 2.8 per cent) of amalgamator holdings had experienced no such change due to the amalgamation.

Footnote 9.2 In a similar view Robson (1973) chose 80 farms in the area of the North of Scotland College of Agriculture for which continuous accounts data were available under the Farm Accounts Scheme during the period 1956-7 to 1967-8. On all these farms the crops and grass acreage varied by less than ten per cent, the ratio of rough grazing to other crops and grass was less than 3 to 1 and none of these farms were "hobby" farms. The co-efficient of variation of an index of aggregate profits on these farms was 17.54 per cent $\pm$ 3.6 per cent. On farms with under 100 acres of crops and grass, the co-efficient of variation was 22.61 per cent $\pm$ 4.62 per cent and on farms larger than 100 acres of crops and grass it was 16.34 per cent $\pm$ 3.34 per cent. Data relating to the variation in income on individual farms are not available.

Table 9.12 New enterprises consequent upon an amalgamation

	Frequency	Percentage
No new enterprises	93	86.9
Start sheep or cattle	6	5.6
Start dairying	2	1.9
Start pigs	2	1.9
Breed cow replacements	1	0.9
Start hay production	1	0.9
Start growing cereals	1	0.9
Stop barley beef	1	0.9
TOTAL	107	99.9%

Only 13.1 per cent of the sample had started or stopped an enterprise due to their having extra land. By the χ^2 test, this proportion of holdings with new enterprises is not significantly different in either the three regions studied nor in the four sizes of holdings sampled. Of course, amalgamation could induce a flexibility in the farming system which fell short of starting a new enterprise. In particular the extra land could allow farmers to carry on their livestock longer so that they could be sold fat rather than as stores. An enquiry was made during the fieldwork into changes in the age at which livestock were sold off the farm which were a consequence of the extra land and the results are summarised in Table 9.13.

Table 9.13 Change in the length of time livestock are kept on farm after amalgamations

	Frequency	Percentage
Over 6 months less	1	0.9
1-6 months less	3	2.8
No change	74	69.2
1-6 months more	12	11.2
7-12 months more	12	11.2
13-18 months more	2	1.9
19-24 months more	3	2.8
TOTAL	107	100.0%

Although over two thirds of the amalgamators had not altered the length of time they kept their stock, nearly a quarter kept them up to a year longer. This usually meant that the age at which they were bought was unchanged and they were sold at up to a year older by which time they were usually fat. Since the question asked very specifically for change due to the amalgamation, these figures should be free from changes occurring independently of the amalgamation. The frequency of age changes did not vary significantly from the overall proportions in the three regions nor in the size classes although there was a slight tendency for large farms to keep stock longer due to their greater acreage. Adding these two sorts of changes together, Table 9.14 shows that just under two thirds of the amalgamators had neither started a new enterprise nor altered the ages at which they bought and sold their livestock.

Table 9.14 Changes in farming due to amalgamation

	Frequency	Percentage
Change period stock kept AND start new enterprise	8	7.5
Change period stock kept OR start new enterprise	32	29.9
No change	67	62.6
TOTAL	107	100.0%

It is difficult to assess the magnitude of the statistic that 37.4 per cent of amalgamators had changed either the time they kept their stock or had started a new enterprise or had done both as a consequence of their amalgamation since there are no comparable data for non-amalgamating expanding farms in the study area. One cannot

assess, therefore, whether the amount of change in the farming system consequent on an amalgamation represents a real flexibility in comparison with other expanding farmers or whether it is a potential flexibility which is not often exploited but which remains a perceived advantage and a component of the image of greater security of returns which amalgamation possesses. There is one indicator that the flexibility may be actually used rather than potential. In Table 9.14 it was noted that 37.4 per cent of amalgamators had started a new enterprise and/or had changed the length of time they kept livestock due to the amalgamation. If this represented a greater amount of change than occurs on non-amalgamating holdings during their expansion one would expect that the holdings which amalgamated frequently or which took over larger acreages would have a greater proportion of occupiers who had changed their system than had the holdings which amalgamated less frequently during the study period (Table 9.15).

Table 9.15 Relationship between frequency of amalgamation and amount of change in the farming system

	1 amalgamation	>1 amalgamation
Change period stock kept AND start new enterprise	6.8%	8.3%
Change period stock kept OR start new enterprise	25.4%	35.4%
No change	67.8%	56.2%
TOTAL	100.0%	99.9%

The χ^2 test shows that the greater amount of change in the farming system found among repeated amalgamators when compared with the amount of change among single holding amalgamators is

statistically significant at the .05 level on a one-tailed test. It will also be shown in Chapter 11 that the number of amalgamators who alter their farming system either by altering the period stock are kept or by starting a new enterprise is significantly greater at the .10 level (one-tailed) for amalgamators taking over more than 50 acres than for those taking over less than this.

The suggestion is reasonable, therefore, that amalgamators are in fact making use of the greater theoretical ability to alter the farming system provided by extra land and, if this is true, the greater security of areal expansion is a characteristic in favour of amalgamation which is as much born of experience as it is imputed a priori to amalgamation.

So far, the lesser perceived riskiness of amalgamation has been ascribed, firstly, to the uniquely appreciating capital value of land compared with buildings and machines and, secondly, to the ability to use land for many enterprises while other forms of investment restrict much more the enterprises the farmer can expand into. There is the assumption implicit in both these points that the farmer's concern is with the financial health of his business and that financial health is measured by the book value of his holding and the ability to alter the farming system so as to "play the market". Although farmers are concerned with the financial health of their business, Harle (1974) has proposed recently that the plans followed by practical farmers should be viewed as seeking to raise technical efficiency towards a continually rising target rather than as trying directly to maximise profits.

He suggested that farmers' actions should not be seen as tending directly to maximise profit (or, for that matter, utility) for two reasons. Firstly, it has been noted repeatedly that the maximisation of profits is impossible in practice because farmers do not have sufficient data for this, their powers of computation and prediction are limited and they cannot solve optimally the maximisation of both short and long run profits. Secondly, the level of profits is not entirely determined by the farmer since the profits depend firstly on the level of output (or rather the efficiency of producing that output) which the farmer can control in theory, secondly on the prices he receives which he is less likely to be able to control and, thirdly, on the variation in output due to the environment which he is also unlikely to be able to control entirely. Since farmers cannot control fully their profitability, Harle sees their goal as controlling the one element in their profitability which they can influence decisively, namely the technical efficiency of their production. This is largely internal to the farm firm and so can be controlled in practice. This is not control in the sense of "maximisation", which is as impracticable as profit maximisation and for the same reasons, but is control in the sense of progress towards a target level of technical efficiency which is determined in relation to past efficiency and the past profits they contributed towards and also in relation to the standards of technical efficiency the farmer learns about from his fellow farmers and the advisory services. The target level will normally be rising continually, of course. The idea of farmers aiming to raise technical efficiency as measured by tons per acre or gallons per cow and only indirectly to raise profitability is attractive as a

description of farmers' goals as they are, rather than as they ought to be, because of its practicality.

Assuming Harle's description of farmers' goals in choosing a farm plan is correct (and it does not appear to have been tested in the field), this can be seen as important for the image of amalgamation in relation to intensification. Provided that the farmer believes that he is not raising the value of his total inputs to the farm (including his own labour) by as much as the value of his output rises after the amalgamation, then the amalgamation is almost certain to be perceived as making for greater technical and economic efficiency - a point discussed extensively in Chapter 2. This will be particularly true for the tenant farmer who need not account for the capital costs of the extra land. Since the costs of buildings and machinery assume major importance in farmers' views of efficiency, (which their own labour and their land tend not to), intensification is likely to appear less obviously an improvement on efficiency than is amalgamation where the major cost (the land) will be less frequently added fully to the costs of the expansion than will the major costs in machinery and buildings of intensification. In cases where the farmer regards his efficiency as fixed and where he is " 'building up to a herd of X cows' or 'expanding cereals storage facilities to Y tons' " (Harle 1974 p 156), the certainty of his position appearing to improve becomes even greater by amalgamation than by intensification.

Unfortunately, Harle does not give any evidence to support this view that farmers aim to improve their technical efficiency rather than try to control profitability directly. However, some recent

work reported by Tversky (1974) does provide independent, although abstract, support for Harle's hypothesis. Tversky (p 158) noted that people who are faced with trying to predict uncertain outcomes prefer to predict the outcome of a process to which there is a discoverable structure which they can find with skill rather than attempt to predict the outcome of a fully random process in which they feel they are powerless. He noted that this preference for dealing with situations which are not random (even in the face of a process which is patently random) could explain the "gamblers' fallacy" where a random process (e.g. the toss of a coin) was treated as though there was a pattern to the results (see also Simon 1959 pp 257 and 260). After five "heads", the gamblers' fallacy would lead one to believe that the probability of a "tail" was greater than .5 so as to "correct" the run of "heads" whereas the objective probability of a "tail" remains at .5 as before. The fallacy is to assume that there is a structure to the results which precludes long runs of the same outcome and that the structure can be detected and used to extrapolate future results. Harle's hypothesis was that in the process of making profits there were some elements which were internal to the farm and which could be controlled in large part while other elements were substantially beyond the farmer's control and were as difficult to predict as is the outcome of a random process. The environmental influences on output and so on profits are quasi-random on account of their unpredictability while the prices received for products are rather easier to predict within limits but even here a substantial element of uncertainty remains. Harle suggested farmers concentrated their planning on the control of their technical efficiency which their skills could improve rather than on the

essentially unpredictable influences of market prices and the weather. In Tversky's terms, they are demonstrating their preference for determining the subjective probabilities of outcomes from that part of the process they believe they can predict (their skill as a farmer) while ignoring those parts of the process they know they cannot either control or understand. This idea that people have a preference for decision making in a structured system rather than in a random one is also in agreement with the work of Adams (1973 p 296) on risk manipulation among recreationists and the work of Burton and Kates (1963 p 437) on the ways used by lay people to rationalise their living in areas subject to natural hazards. This does not prove that Harle's hypothesis is correct but it does provide evidence from an independent discipline for its plausibility since such behaviour by farmers is in line with the behaviour predicted by Tversky's model of decision making.

To conclude this section, the lesser degree of risk attached by farmers to amalgamating is both reasonable and understandable. It is an investment of appreciating value normally, whereas other forms of expansion do not safeguard the capital value of the original investment. It is a form of expansion which normally places fewer constraints on the farmer's choice of enterprises and choice of quantities to be produced than does intensification. If it is accepted that the farmer's immediate aim is to improve his technical efficiency and that this is often synonymous with the volume produced, then the more favourable view accorded to areal expansion is sensible.

The tendency for farmers to expand in the least risky way is not only plausible given the nature of farm firms and of the farming economy but also it is co-incident with the findings of other researchers. In

a study of farmers' goals and values, Gasson (1973 p 526) quotes the work of Herzberg and others (1957) who analysed the views of 11,000 employees in the U.S.A. and Britain as to what was important in their work. The most frequently mentioned factor was security in the job. A similar study by Rosenberg (1957) of students' values for a career found again security as the dominant value (Gasson 1973 p 527). Although students and factory workers view security as the most important aspect of their work and so might be expected not to act in a way which reduced security (such as expanding their farms in the riskier of two ways), there is no reason to assume that farmers hold similar views. Gasson's work on farmers' values is a pioneering study but its results are very difficult to interpret in terms of farmers' attitudes to risk. Security (however Gasson and her respondents defined this) tends not to be highly ranked (Gasson 1973 p 529 Table 3 and p 530 Table 4) although there is a suggestion that security refers to the threat of being dismissed rather than to the risk of particular incomes. "Doing the work you like and enjoy" is consistently the highest ranked attribute (pp 529-530) which could be interpreted as indicating that farmers' actions would tend to avoid adding to the uncertainty of their incomes and so reducing the enjoyment they got from their work.

Work by Jones on the adoption of bulk milk tanks on dairy farms in Lindsey, Lincolnshire, is considerably easier to interpret from the viewpoint of assessing the role risk plays in farmers' values. Bulk milk tanks have been bought by an increasing number of farmers to serve as stores for their milk before it is collected by a tanker from the dairy. These stainless steel tanks are expensive to buy and, by

themselves, they do not either increase production or reduce production costs. There is a small premium paid on each gallon of milk collected from a tank rather than in churns but this is quite minor. When the farmers were asked why they had adopted this innovation, they gave five reasons.

1. The possibility of receiving and using dirty churns from the creamery and consequently of their milk being sent back as unusable was removed.

2. The possibility of the milk sent in churns to the dairy being undermeasured was removed because gallonage was measured at the farm when the tanker arrived to collect it.

3. The possibility of the milk souring in the churns while awaiting collection was removed because the tank was refrigerated.

4. The possibility of milk souring due to a lack of cooling water in a dry summer in Lincolnshire was removed because the amount of cooling water needed was reduced by refrigeration.

5. The possibility of the dairy enterprise being forced to close because the dairyman left for another job was reduced since the arduous task of lifting heavy churns was removed.

Each of these reasons is concerned with reducing the risks attached to the income from the dairy enterprise. This considerable capital investment does not improve income directly by cutting costs or raising production, it only makes it more secure and to achieve this security the farmers are willing to invest a considerable amount. Of course, this is only one study based on 71 dairy producers in Lindsey in the late 1950s and early 1960s so that inference from this sample to the farming population is difficult but it would be

difficult also to find any other studies where the possibility of financial gain could be so firmly discounted as a contaminating influence on actions. Although Jones did not plan this as a study of risk minimising, it serves well to show unequivocally that increasing the stability of income is one of the aims of farmers and that they are willing to invest capital to achieve stability without this necessarily raising their production or reducing costs. The parallel between amalgamation and the innovation of bulk milk tanks is instructive since the confirmation by Jones that reducing the risks of low incomes does occur lends support to the contention that the amalgamators' view of their expansion as being the least risky means of expansion is in agreement with other work on farmers' values. A survey by the Agriculture Economic Development Committee (Daw, 1973 p 11) of factors affecting productivity found similarly that farmers ranked security as the highest goal. The present research into the expansion of holdings has shown the specific effects - amalgamation rather than intensification - which this great desire for security produces.

Some work in South Wales by van der Vliet (1972 pp 149 and 155) and by Henderson and Ilbery (1974 p 64) has shown that the provision of a regular income and the existence of a stable market or demand were in the top three criteria by which farmers in that area chose which enterprises they would pursue. This would suggest that minimising risk may be a factor in farmers' decision making which influences both land use (enterprises) as well as the method of expansion (amalgamation).

This section has shown that the amalgamators' opinion that areal expansion is less risky than intensification is both realistic and in agreement with such work as has been done on farmers' aims as seen in their technical innovations and in how they choose their enterprises. This serves to make all the more intractable the situation that amalgamators, in all other respects so similar to innovators, are acting to minimise the risks to their incomes while innovators are regarded as being particularly venturesome and willing to take risks. These two findings need to be reconciled in a model of farmers' decision making.

There can be little doubt that innovators have been characterised as more willing than others to take risks. Jones's review article on diffusion research in agriculture shows this quite clearly (pp 14-15). Gasson's work on farmers' values (1973 p 534) suggests that larger farmers are more concerned than smaller farmers to farm so as to meet a challenge, to expand the business and to make as high an income as possible. This would imply greater risk taking among larger farmers (an observation also made by Dunford (1961)) and, as has been shown, amalgamators and innovators are disproportionately large in their scale of farming.

The solution to the paradox seems to lie in the idea of some people being venturesome, that is, unusually willing to act in a way where the outcome could lead to financial losses or willing to make decisions where the outcome of the decision is highly uncertain. This seems to be a quite unrealistic view of the character of innovators. Instead, it can be proposed that innovators like amalgamators and most of the rest of the population, tend to choose the least risky course

(they tend to reduce uncertainty). What differentiates the innovators and amalgamators from the rest can be summarised under three headings.

a) The perception of what constitutes risk varies. We know from the many studies of innovators and the present study of amalgamators that these groups have certain well defined socio-economic characteristics which will affect their perception of what constitutes a risk. They tend to be large operators and to be wealthy. Their wealth provides a cushion against failure. Actions which could bankrupt the farmer with few resources if events turned out badly would pose fewer problems for the large farmer who could absorb the loss without bankruptcy. Remembering that 7.1 per cent of the sample of amalgamations occurred after a farmer was declared bankrupt, the small farmer would obviously regard as risky an action the large farmer would view more favourably since the maximum loss would be a smaller proportion of his financial resources than of the smaller farmers' resources. The larger and the wealthier the farmer, the higher his tolerance of risk will be, other things being equal, a point confirmed in Dunford's small survey of farmers in S.W. England.

b) The perception of risk not only varies with economic power but also the attitude to risk varies with farmer's size. Gasson has noted (p 542 and p 534 Table 8) that larger farmers rate "meeting a challenge" and by implication the acceptance of risk as positive features of farming while smaller farmers are repelled by these aspects. Such risk as there is in any action may be viewed by the larger farmer as a positive element - a challenge to be overcome rather than a threat to be shunned. The link between this attitude and the presence of the financial backing to sustain it is obviously strong.

Again, it may be noted that there is a bias toward larger farmers among innovators and amalgamators.

c) Finally, the ability to avoid risks differs with farm size. Innovators and amalgamators are those with the power (income, borrowing potential, influence, drive, etc.) to be willing and able to afford the cost of choosing the less risky option if and when it becomes available. Jones's work on the adoption of bulk milk tanks and the present work on amalgamations (Table 9.11) demonstrate that those actions which reduce the probability of low incomes are recognised as having a major capital cost (a greater cost than other ways of expanding) which only certain farmers can afford. There is a price to pay in avoiding risk and amalgamators are drawn disproportionately from those who are willing and able to afford to pay that price.

In summary, the role of risk in decision making which emerges from the present study in its context of prior research is one of conditional risk reduction. Farmers act to reduce the probability of low incomes conditional upon their perception of risk, their tolerance of it and their ability to meet the cost of the reduction which varies within the industry. The larger farmers, exemplified by the amalgamators in this study, do not regard amalgamation as risky and they are able to meet the greater perceived cost of this form of expanding (see Table 9.11). The tendency in decision making to reduce risk is also conditional upon a less risky option being available which is not always so - farms become available spasmodically, for example, so the greater range over which larger amalgamators are willing to look for farms means that they have more

chances of obtaining what they perceive as the less risky option. Where the less risky option (amalgamation, for example) is not available, innovators are those who are able and willing to take more risky actions (the adoptions of the innovations normally studied, for example). Few deliberately set out to take risks. However, some will regard as safe what others regard as dangerous and some too will be willing and financially able to take risks, if forced to by the lack of less risky alternative means of achieving their goals (e.g. by the absence of farms to take over when the goal is the expansion of the farm business). These people include amalgamators when the expensive but less risky form of expansion is available and innovators when it is not.

The theory of decision making - an extension

Much decision making has been characterised by the maximisation of utility. When utility is defined to include only money income, this special case is the "economic man" argument of profit maximisation. As a description of how real world decisions are made this is subject to the following criticisms.

a) It assumes the entrepreneur can predict his business environment.

b) It assumes he has perfect knowledge of his situation, and perfect ability to handle that knowledge so as to discover which course to take.

c) It assumes that perfect competition exists.

d) It assumes that by one set of actions one can reconcile the maximisation of profits both in the short run and in the long run.

e) It assumes the success of one person to maximise profits in no way affects the ability of others to maximise profits, particularly where imperfect competition exists.

Since these assumptions are held to be inadequate, the description of decision making as profit maximising has been modified by defining utility so as to include both money income and "psychic income". In this case, decision makers act so as to do what gives them the greatest utility - this not necessarily being co-incident with maximum profits but being subject to similar criticisms as a description of decision making because of the complete impossibility of operationalising any type of maximisation. Simon's concept of man the decision maker as a boundedly rational satisfier replaced the goal of maximising by the goal of making some improvement to one's situation by the decision. This is Braybrooke and Lindblom's idea of incrementalism. The complementary notions of satisficing and incrementalism are subject, however, to the criticism that it is hardly a great advance to say that people take decisions on the basis of what pleases them or will add to their general satisfaction. At least the economic man hypothesis had the merit of suggesting what it was that they were aiming for (maximum profits). While accepting the general principle of satisficing, one must define what it is in the business environment that leads to satisfaction if the term is to be useful.

For this research, it has been possible to show that the general desire to expand is translated into amalgamation in preference to intensification not because the former is seen by the majority of farmers themselves as leading to greater profits or to faster profits

or to an easier farm to run or to a lesser borrowing requirement. Rather, the source of their increased satisfaction is the lesser risk believed to attach to this way of expanding. The term "lesser risk" has been defined further as (a) land - a uniquely appreciating asset; (b) land - a more flexible form of expansion and (c) land - a more certain way of achieving technical efficiency and increasing output following Harle's hypothesis of farmers' decision making. Thus raising satisfaction involves making an improvement to the farm in the least risky way and the plausibility of this has been demonstrated. This has also been shown to be in line with other work on farmers' goals.

CHAPTER 10

AMALGAMATION AS A SPONTANEOUS PROCESS

It is a major investment of capital and perhaps of labour to take over another farm even if this is a low risk method of expansion. It may require a lot of work to bring the new land up to the standard of the home farm and it could be that the entire farming system will have to be altered. Clearly, such a major event as the decision to amalgamate ought to be the result of careful planning as to the nature of the amalgamation. The sizes of the increment in acreage should be planned since too small an increase could have no effect on the farm and too large an increase could be financially, if not physically, unmanageable. The type of land taken over may have to be planned if the farm's future husbandry is to be specialised. The farmer may wish to control the timing of the amalgamation so that he will be in the best position to meet the cost of it and to gain the rewards from expansion through the prices of the products he will produce. He may wish to control the specific farm he takes so it is one whose characteristics or potential he knows already, and this will apply particularly to its distance from his present farm as Chapter 9 showed. This section will examine the degree of planning apparent in the decision to amalgamate in the sample of cases studied in detail.

The influence of planning and selection in the amalgamation process is seen most clearly in the range over which amalgamating occurs (Table 10.1). This table, which has been discussed in greater

detail in Chapter 9, shows that there is a clear spatial pattern to the amalgamations with respect to the distances between the participating holdings. The structure takes the form of a distance decay function which is even steeper than it appears at first when it is converted to take account of the greater number of possible holdings for taking over as distance increases. This corrected distance decay function is given in Table 10.1 as the standardised frequency ratio (Taylor 1975 p 18).

Table 10.1 Separation in miles of amalgamator and amalgamated holdings in sample

Distance (miles)	Frequency	Standardised Frequency Ratio
0.00-0.75	59	17.729
0.76-1.25	25	4.286
1.26-1.75	9	1.031
1.76-2.25	5	0.429
2.26-2.75	-	-
2.76-3.25	4	0.229
3.26-3.75	3	0.147
3.76-4.25	2	0.086
	107	

Distances are rounded to the nearest half mile

It can be shown also that the actual distances between amalgamating holdings are mirrored in a parallel distribution of maximum distances for amalgamating (Table 10.2). These are the farmers' estimates of the greatest distance over which they would be willing to consider amalgamating their present farm with another. The validity of this measure is discussed in Chapter 9 as is the difference in the skewness between the distribution of actual amalgamation ranges and the distribution of maximum ranges.

Table 10.2 The maximum distance over which an amalgamation was considered feasible by farmers with recent experience of an amalgamation

Distance (miles)	Frequency	
0	6	(= no preference)
1	19	
2	15	
3	30	
4	10	
5	7	
6-10	16	
>10	4	
	107	

Chapter 9 also showed that the results of this planning (in terms of the distance to the actual or to future amalgamations) are peculiar to distinctive groups of amalgamators (Appendix 9.2). The long range, wide horizon amalgamators have the following characteristics:

a) they are already farming large holdings (by acreage and smd size) and they take over large holdings (again by acreage and smd size)

b) they are unusually common among estates taking land in hand

c) they employ farm managers more often

d) they tend to be prolific amalgamators

e) they rarely had non-farm sources of income

f) they were rarely looking for a specific acreage

g) they were more common among the longer established farmers (over 30 years on the amalgamator holding)

h) their amalgamations tended to be earlier ones in the study period

The results of the spatial planning of amalgamations serve to partition the sample of amalgamators by eight socio-economic features.

The point of interest is that all the occupiers in the sample had a preference with regard to the range over which they would amalgamate - the specific question they were asked determined that their preference would be expressed as an outer limit for amalgamating. The actual distances in Tables 10.1 and 10.2 need not concern us here except to note that the overall proportions of long and short range amalgamations (Table 10.1) and of farmers with wide or narrow horizons (Table 10.2) are not significantly different by the χ^2 test ($\alpha = 0.05$) from the proportions in the three regions and the four size classes of the sample. All except 5.6 per cent of the occupiers had a spatial preference - that is, they were planning their amalgamation with a constraint on maximum range - and their past actions usually lay within this constraint.

The influence of planning also appears in the number of occupiers who claimed to have been looking for extra land before their amalgamation (Table 10.3).

Table 10.3 Number of amalgamators looking for extra land before the sampled amalgamation

	Frequency	Percentage	
Looking for extra land	48	44.9%	(SE = 4.7%)
Not looking for extra land	59	55.1%	
	107	100.0%	

Table 10.4 Number of amalgamators who had bid for a specific farm or tenancy before the sampled amalgamation

	Frequency	Percentage	
Had bid previously	22	20.6%	(SE = 3.8%)
Had not bid previously	85	79.4%	
	107	100.0%	

While 94.4 per cent of the occupiers were controlling the distance to the amalgamated farm, there is less evidence that the timing of the amalgamation was being controlled. Only 44.9 per cent (SE = 4.7 per cent) of occupiers claimed to be controlling the time when they amalgamated by looking for extra land before their amalgamation and only 20.6 per cent (SE = 3.8 per cent) had bid for a specific farm or tenancy before the amalgamation. These proportions are not significantly different from those in the regions of size classes by the χ^2 test where $\alpha = 0.05$. There is little evidence here to support the view that farmers amalgamate as the culmination of a period of active searching for land. In Table 10.3 there is sufficient evidence to suggest that there is a widespread desire to expand acreage but this seems to be a general aim rather than a stimulus to widespread action in order to achieve this aim.

The suggestion that farmers do place controls on the range of amalgamating but less on the timing of the amalgamation is further supported by the very low proportion of occupiers who admitted to having had any control over the timing of the amalgamation (Table 10.5).

Table 10.5 Number of amalgamators who admitted to having had control over the timing of their amalgamation

	Frequency	Percentage
Had control over timing	4	3.7%
Had no control over timing	103	96.3%
	107	100.0%

Since it is not immediately apparent how ready occupiers would be to admit to having been able to determine when the outgoer left his farm, too much weight should not be attached to Table 10.5. Probably it is safe to interpret it as failing to support the contention that farmers plan the timing of their amalgamation. Amalgamators appear not to control the departure of the outgoer nor to precede their amalgamating by a period of active bidding for holdings or tenancies. About a half of them were on the look out for land, however.

The idea that the timing of amalgamating tends towards the spontaneous or, at least, towards the unplanned, is supported by the unpredictability of the timing for the outgoers leaving their farms (Table 10.6).

Table 10.6 Reasons given by amalgamator for departure of the occupier of the amalgamated holding

Reason	Frequency	Percentage
Normal retirement	59	55.1%
Died	10	9.3%
Move to other job	10	9.3%
Bankruptcy	7	6.5%
Illness	6	5.6%
Move to other farm	5	4.7%
Emigration	1	0.9%
Unknown	9	8.4%
	107	99.8%

Since previous research has shown how difficult it was to contact workers who had left the land (McIntosh 1969 p 194), no attempt was made to discover the reason for outgoing from the outgoers themselves. Instead the amalgamator was questioned and although this might conceivably introduce bias (the termination of a tenancy might be called a move to another job, for example) the degree of coverage obtained from the amalgamators (91.6 per cent) is so high compared with what could be achieved feasibly by attempting to trace outgoers that this course seems valid. There may be deliberate bias in the replies but it is likely to be less than the bias which would have been introduced by the non-response, death or unknown whereabouts of the outgoers. The results given in Table 10.6 for the whole sample are representative of the reasons for leaving in each of the regions and in each of the size classes by the χ^2 test with $\alpha = 0.05$ (two-tailed).

These results appear plausible when compared with other work on the departure of farmers although most other surveys are not strictly comparable with the present one (nor with each other) since some relate to all changes of occupier and some only to such changes as result in amalgamation. They also cover different periods, the method of sampling varies and most cover a much more restricted area than does the present study. Nonetheless, from each study of the reasons occupiers had, or were said to have had, for leaving their farms, a group of reasons called "natural causes" has been extracted. This is defined as including departures due to normal retirement or to death with the exception of the Devon and Nottinghamshire studies which include also illness as a natural

cause of outgoing. Details of this comparison between studies are given in Table 10.7.

Table 10.7 Proportion of outgoers or amalgamating outgoers leaving due to "natural causes"

	Area	Natural causes	Period	Nature of change	Percentage
A	Devon	(Death, normal (retirement or	1959-69	Change of occupier with or	36.1%
A	Notts.	(illness		without amalgamation	62.2%
B	Clough and Greenan Electoral Division (Northern Ireland)	Death or normal retirement	1940-70	Change of family ownership	86.9%
C	East and West Ridings (Yorks)	Death or normal retirement	1965-66	Change of occupier	51.6%
D	Upland England (Six parishes)	Death or retirement	1939-55	Change of occupier	55.3%
E	Northern Ireland	Death or retirement	n.a.	Change of occupier	93.0%
	Present sampled counties (Scotland)	Death or normal retirement	1968-72	Change of occupier with amalgamation (excluding where reason unknown)	70.4%

A = Hine and Houston (1973) p 8; B = Crawford (1972) Chapter 9; C = Simpson (1968) p 37; D = Nalson (1968) p 113 (based on 161 moves - reasons for 38 moves unknown); E = Alexander

Since there are differences in the definitions used, formal statistical tests are not valid for comparing the percentages, but

simple visual inspection indicates that the proportion of outgoing in Scottish amalgamations which is ascribed as being due to "natural causes" is intermediate between the proportions in England and Wales (lower - around a half) and the proportions in Northern Ireland (higher - around nine out of ten). For the amalgamator, the timing of death, bankruptcy, emigration, movement to another farm and even of retirement without a succeeding heir is largely unpredictable and the comparison with other studies in the United Kingdom suggests that the reasons obtained from the amalgamators for the outgoers' departure are not implausible particularly when this is coupled with the low proportion who claimed to be able to control the timing of the amalgamation.

There is little evidence to suggest detailed planning for the timing of amalgamating. The data given in Table 10.6 for the reasons for departure and its unpredictability can also be interpreted in another way. Each occupier was asked why the outgoer of the holding he took over had left. Since the results show outgoing to be weakly predictable with regard to timing, they must show it also to be weakly predictable with regard to which holding is taken over. There is no evidence that farmers are taking over a specific farm they have designated since the availability of most farms is not easily foreseeable. This lack of control over which holding is taken over is supported by the fact that most occupiers were taking over holdings with which they appeared to have had no previous contact other than the neighbourliness implicit in the narrow range of most amalgamations. Few occupiers were related to the occupier of the holding they took over as Table 10.8 shows.

Table 10.8 Number of amalgamators related directly or by marriage to the occupier of their amalgamated holding

	Frequency	Percentage	
Occupiers related	7	6.5%	(SE = 2.3%)
Occupiers not related	90	84.1%	
Unknown	10	9.3%	
	107	99.9%	

Only in 6.5 per cent (SE = 2.3 per cent) of the amalgamations (that is, 7.8 per cent of those where the information is available) were the occupiers of the participating holdings related directly or by marriage. Amalgamation appears not to be structured along family lines either in the sample as a whole or in the regions or size classes where the full sample fairly reflects the same lack of family links in amalgamating. Because of the low frequencies, a formal statistical testing for the significance of differences between regions and size classes had to be replaced by visual inspection.

Nor does amalgamation appear to be channelled by pre-existing business contacts between the particpating holdings. Amalgamators were asked whether there had been any business contact between themselves and the occupier of the holding they eventually took over and their replies are shown in Table 10.9.

Table 10.9 Number of amalgamators with business contact with outgoer's holding before the amalgamation

	Frequency	Percentage	
No business contact	86	80.4%	(SE = 3.5%)
Regularly shared labour and/or machinery	7	6.5%	
Outgoer was employee of amalgamator	2	1.9%	
Amalgamator worked the amalgamated holding before the amalgamation	12	11.2%	
	107	100.0%	

Four out of five of the amalgamators had had no prior business contact with the holding they took over (the proportion for each region and size class does not differ significantly by a χ^2 test) and the only minor form of contact was where the amalgamator worked the holding for the eventual outgoer for some years prior to the amalgamation. Neither Table 10.8 nor Table 10.9 provide any evidence to support the view that the amalgamators were taking over holdings whose characteristics were known to them before amalgamation because of family or business contact with the eventual outgoers. The implication is that the amalgamators did not have prior first hand or personal knowledge of what they were getting from their amalgamations in terms of the potential of the new holdings. This is probably not a matter of concern to most amalgamators, however, since most had no preference for a particular type of land when they were looking for new holdings as Table 10.10 demonstrates.

Table 10.10 Type of land sought by amalgamators before their amalgamation

Type	Frequency	Percentage
No preference	83	77.6%
Grass land	6	5.6%
Arable land	15	14.0%
Hill land	1	0.9%
Heavy land	1	0.9%
Land for raspberries	1	0.9%
	107	99.9%

Over three quarters of eventual amalgamators were not looking for a particular type of land - a proportion which was found also in each region and size class of the sample using a χ^2 test. Where one type was specifically sought, it was usually arable land that was

wanted. Although it can be shown that most occupiers did not plan the type of land they expanded on to, there is rather more evidence that the size of holding they would take over was planned as Table 10.11 shows.

Table 10.11 Acreage of holding sought by amalgamators before their amalgamation

Acreage class	Frequency	Percentage
No preference	73	68.2%
$\frac{1}{4}$- $24\frac{3}{4}$	1	0.9%
25- $49\frac{3}{4}$	2	1.9%
50-$124\frac{3}{4}$	20	18.7%
125-$249\frac{3}{4}$	7	6.5%
250-$499\frac{3}{4}$	3	2.8%
$\geqslant$ 500	1	0.9%
	107	99.9%

The proportion without a preference is two-thirds and the modal preference is in the 50 to $124\frac{3}{4}$ acres class. The overall proportion without a preference is not significantly different in the three regions and in the four size classes by the χ^2 test.

These preferences can be compared with the actual acreage taken over at the sampled amalgamation in Table 10.12.

Table 10.12 The acreage amalgamated as a percentage of the acreage sought before the amalgamation

	Frequency	Percentage of 34 cases
No preference = 73		
0% to 19%	8	23.5%
20% to 39%	7	20.6%
40% to 59%	8	23.5%
60% to 79%	4	11.8%
80% to 100%	3	8.8%
$>$ 100%	4	11.8%
	34	100.0%

Just over ten per cent of the amalgamators who expressed a preference for some acreage actually took over a greater acreage than their preference while 55.9 per cent took over fifty per cent or less of their preferred acreage. It could be argued that the preferred acreage was reduced by the occupiers after the amalgamation so as to reduce their sense of relative failure at having got such a small increase, yet, the fact that the actual increases in acreage are still so far below the preferred acreages suggests that this reducing of the preferred acreage after the amalgamation is not very great. Were it a marked feature, one would expect the correspondence between actual and preferred increases in acreage to be closer. Conversely, it could be argued that if the amalgamation were successful, the occupier might inflate the acreage he had been looking for before the amalgamation and the prevalence of preferred acreages which were "round numbers" (particularly 100 acres) might support this. The question the occupiers were asked was for the acreage they were looking for and, to reinforce that the questions concerned the period of the sampled amalgamation, the question was preceded by two others which specifically concerned the occupier's actions before the amalgamation. While every effort was made to ensure that the preferred acreage the occupiers gave was that related to their aspirations before the sampled amalgamation, the success of these efforts cannot be measured and the possibility cannot be excluded of an inflation of preferences after successful amalgamations and a reduction of preferences after amalgamations which were smaller than hoped for. This discordance between actual and preferred amounts of increase suggests that there is still an unsatisfied

demand for land which may occasion further amalgamations.

A series of tests was also carried out to see if the planning of the preferred acreage to be taken over was a characteristic of certain amalgamators. There were hypothesised to be eight variables which might be related to the farmer having a strong preference for the size of increase he would wish. It is worth noting that while all farmers will have a preferred amount of expansion, some farmers will find that their holding's size, their financial resources or other factors may give rise to a stronger preference or a more rigid upper limit to expansion and it is these stronger preferences which were being measured in Table 10.11. The results of the eight tests are given in Appendix 10.1.

Only three features were found to be related to the expression of a strong preference for the amount of expansion. Those expressing such opinions tended to be the smaller occupiers with less than 125 acres before the amalgamation. The larger occupiers could afford presumably a greater flexibility in their expansion, their upper limit being so high that the chances of a holding above that limit becoming available would be so low that, in terms of possible amalgamations, there would be no effective constraint on size. There was also a significant tendency for the more recent occupiers (those of less than 20 years' standing) to set more limits and also more stringent limits than the longer established occupiers. The latter were less encumbered presumably by debts connected with buying or equipping their first farm while the more recent occupiers would suffer greater indebtedness and could only contemplate smaller

increases in acreage - that is,smaller additions to their indebtedness. Consequently, the more recently established occupiers have an acreage preference more often that the longer established occupiers and that preference is more often below the modal acreage (125 acres) than above it. The longer established occupiers expressed fewer preferences and such that were expressed were almost evenly balanced between preferences above and below 125 acres. A not unrelated feature is the tenure of the holding which also affects the acreage preferences. Estates taking in hand land they own already had almost no acreage preferences whereas owner-occupiers had disproportionately frequent preferences. Clearly, the owner-occupier who expands has to meet the cost of the purchase of the land himself (few owner-occupiers expand by renting (Table 6.13)) and so he will take account of how much he can afford and set an upper limit to expansion accordingly. Occupiers taking land in hand do not have to buy it, although some re-equipment or repairs may be needed, and so, often having large holdings already, they are prepared to take over and can afford to take over any of their land that becomes available.

At the start of this section, it was suggested that such a major change as an amalgamation would probably be a planned process. It has been shown that there is clear evidence of planning for the distance between amalgamating holdings with the planning operating differentially for different socio-economic groups of amalgamators. There is little evidence that the timing of the amalgamation is planned in detail beyond there being a general awareness of a need to expand in a large minority of amalgamators. The lack of planning or inability to plan the timing of an amalgamation is supported by the

lack of previous bidding for land by amalgamators, their claim not to be able to control the timing of the outgoer's departure and finally by the reasons given for the outgoer's departure by the amalgamators. There was rarely any connection through family ties or through business contacts between the amalgamating holdings. Finally, the type of land taken over is rarely a matter for strong preferences while the acreage is a strong preference in about a third of the cases particularly among the amalgamators with smaller holdings, the owner-occupiers and the more recently established occupiers. There are also some parallels between those who actively plan their range of amalgamating and the size of holdings to be taken over. The smaller farmers restrict their choice of possible holdings to take over by setting narrow limits on the distance to the extra land and on that land's acreage. Those taking land in hand set fewer limits on their choice of holdings for expansion by setting their horizons wider, by amalgamating over greater distances and by having almost no strong preferences over the acreage they take over. A partially overlapping group - the longer established amalgamators - are similar (irrespective of their tenure) to those taking their land in hand. They set wide limits to the distance over which they will amalgamate, they have fewer preferences over the acreage they take and such limits on acreage as they do set tend to be over 125 acres.

There seem to be two points to note from this. Firstly, the only feature of amalgamating which is universally planned is its range. The timing, the type of land, its acreage and which farm is taken over all tend to be less planned to varying degrees - one might almost call these aspects of amalgamating spontaneous. The

paradox is that distance has the least definable effect on the costs of and returns from the amalgamation and yet it is the most commonly planned aspect of the process. The acreage or type of land or even the timing of the amalgamation could be thought to have more obvious financial implications and yet they are, to varying degrees, less planned and, with respect to the timing and type of land, they seem unplanned to the point of being spontaneous.

The second point worth noting is that those who seem to be amalgamating within the severest constraints on the acreage taken over, on the range of amalgamating and so on the choice of potential holdings to take over, are the smallest farmers, the younger farmers and the more recently established farmers. These are the ones who need to expand most, who have the heaviest costs of family upkeep and yet who can least afford to amalgamate and who look for possible holdings within the narrowest of horizons thereby reducing their chances of succeeding in amalgamating.

There is a certain irony in farmers expanding in the least risky way (amalgamation) but doing so in a very unplanned manner despite the considerable cost of it. It is not clear whether the lack of planning is a reflection of the low probability of amalgamation being a failure (which would tend to support the view of amalgamation as the least risky way to expand) or whether it is due to an inability to do any planning. It is probably the result of a happy coincidence of both reasons.

CHAPTER 11

THE EFFECTS ON LAND USE OF AMALGAMATIONS

One of the central concerns of agricultural geographers has been the distribution of crops and livestock. While the incidence of amalgamating is so low that any effects it might have on such distributions at a national scale are likely to be sufficiently small to be masked by changes affecting farming generally, it is still possible to consider the micro-scale effects on land use of amalgamation. Here, one is trying to indicate changes in land use arising from and consequent upon the amalgamation of two specific farms.

The most complete information on land use is stored in the records of the Agricultural Census. However, this source is quite unsuitable for a study of the kind proposed here. It is easy to compare the census returns of a holding before and after amalgamation, but it is impossible to provide a standard interpretation of these comparisons. If a change is detected from the census returns, one cannot say whether it is a consequence of the amalgamation or of some other influence which would have produced the change even without an amalgamation. If one takes census returns for the year before and the year after the amalgamation, one reduces the influence of autonomous changes in land use but, equally, one biases one's work against detecting changes in land use which are due to the amalgamation but which take more than a year to develop. If the comparison is over a longer period than one year, one provides sufficient time for any changes there may be, but one raises the

probability of detecting changes due to outside influences unconnected with the amalgamation. If one avoids these problems of time scale and of the separation of changes due to different causes by not using the census records, then one confronts the problems of using some less complete and less accurate source of information on land use.

In order to try and find an acceptable solution to these problems, a procedure was developed for using the questionnaire survey of amalgamators to obtain information on the effect of amalgamation on the husbandry practised by the amalgamator. The procedure does not attempt to compare the land use of the amalgamated holding before and after the amalgamation for two reasons. Firstly, although information is available on the crops and livestock of the amalgamated holding before amalgamation, no comparable information exists for that holding after amalgamation since it is included in the returns of the amalgamator holding. Secondly, such a "before and after" comparison for the amalgamated holding is not only impossible, but would be quite false since it would be a comparison of unlike objects. Even if there were no change in the farming of the amalgamated holding, simply its integration into the crop and livestock rotations of the amalgamator holding would produce the illusion of change. Therefore, change in land use is defined here as a change occurring in the farming of the amalgamator holding which is a consequence of its areal expansion and which excludes the simple proportionate expansion of its prior husbandry in order to use the extra land.

The expression "change in land use" is a useful one in reporting results but it will not suffice for use in the field. Therefore, the broad term "a change in land use" was divided into three more easily

measurable components. Firstly, the amalgamator's use of his land can be said to have changed if he starts any new enterprises because of the amalgamation. He might use the extra land to start growing cereals so as to reduce his expenditure on feeding stuffs or he might let his son develop a dairy enterprise on the new land. The second possible manifestation of land use change is where the amalgamator concentrates one of his enterprises on the extra land. He might grow cereals on it since they need limited attention throughout the year or he might use it to pasture stock which will need few visits from the farmer. The third component of changing land use would be where a pre-existing livestock enterprise was altered by the stock being kept on the farm for a longer time. The extra land might allow the farmer to breed his own young stock rather than have to rely on the stores' market to buy them, or it might allow the farmer to see his animals through to fatstock sale rather than having to sell them as stores. In industrial geography, this change would be called vertical integration. Each amalgamator in the sample was asked if there had been any changes in his husbandry under the three headings of new enterprises, concentration of an enterprise on the amalgamated holding and changes in the period for which livestock were kept. The three questions asked are given in the questionnaire (Appendix 5.3).

By asking the occupiers themselves, there is the problem that the replies will be biased by the weaknesses of their memories, although one of the weaknesses will be to recall only the major changes which is the least unhelpful of weaknesses. The strength of this approach is that it provides the only way which may

differentiate between changes due to amalgamation and those caused by other factors. The differentiation will not be consistent and fully accurate, of course. Some occupiers may attribute any developments after amalgamation to the amalgamation on the principle of "post hoc ergo propter hoc", while others may not realise the importance of their extra land in allowing developments to proceed. The two trends may partially nullify each other but since the former tendency (over-estimation of changes) is probably the more likely and more important error to counteract, the three questions which were asked all had a subsequent probing question of the form "And was this change the result of your amalgamation?"

This methodology is, of course, a compromise which tries to achieve a combination of two mutually exclusive aims - completeness and accuracy of recording changes and differentiating those changes due to amalgamation. The results will, therefore, be more liable to error than others produced by the interviewing but they appear to be acceptable given the more serious weaknesses and the more obvious biases of other ways of assessing the results of amalgamation on the use of agricultural land.

New enterprises

Very few farms saw their amalgamation as a cause of their having started a new enterprise. Out of 107 amalgamators, 93 (86.9 per cent, SE = 2.8 per cent) had not started a new enterprise while the nature of the new enterprises started by the fourteen others is given in Table 11.1.

Table 11.1 New enterprises resulting from amalgamation

Enterprise	Frequency	Percentage
Start sheep or cattle enterprise	6	5.6
Start dairying	2	1.9
Start pig production	2	1.9
Breed cow replacements	1	0.9
Start hay production	1	0.9
Start cereal production	1	0.9
Cease barley beef production	1	0.9
No new enterprises	93	86.9 (SE = 2.8%)
TOTAL	107	99.9%

With such low frequencies, it is difficult to see any clear pattern to the adoption of new crops or livestock apart from the development of sheep and, more often, beef cattle enterprises. Considering the rapid increase in beef cattle numbers in Scotland during the study period (Beilby 1974), this trend is not unexpected. There is no tendency for a concentration of the few new enterprises in any single region nor among a particular size class of holding. The conclusion from this table is that whatever other effects amalgamation has on land use, the development of a new enterprise is rarely one of them. The weakness of this conclusion is that while it is correct for the sample which was interviewed, it is not possible to compare the results for the sample with the propensity to start new enterprises in the rest of the population of farmers in the areas studied since there are no comparable data available for non-amalgamating holdings. All that can be said is that the proportion of the sample which started a new enterprise is low.

Concentration of functions on the amalgamated holding

In sharp contrast to the limited incidence of new enterprises resulting from an amalgamation, the proportion of amalgamators who concentrated a particular type of crop or livestock on their new land is quite high as Table 11.2 shows.

Table 11.2 Concentration of enterprises on the amalgamated holding

Concentrated enterprise	Frequency	Percentage
Grazing	20	18.7
Young or dry stock	6	5.6
Cereals	6	5.6
Intensive enterprise (Type 8 DAFS)	5	4.7
Breeding stock	4	3.7
Calf rearing/fattening	3	2.8
Early crops	3	2.8
Dairy unit	1	0.9
Cropping, grazing, dairying	1	0.9
No concentration	58	54.2
TOTAL	107	99.9%

The number of occupiers practising some kind of spatial segregation of functions between their old farm and their new one is quite high (45.8 per cent, SE = 4.5 per cent) and this is true of all the regions and the sizes of holdings. There were rather more cases of a concentration on the amalgamated holdings in the South West and on the very large farms (by smd size) but the χ^2 test failed to show these as statistically significant at the .05 level. On 33 of the farms (30.8 per cent), the enterprise which was concentrated on the new land was grazing for normal stock or for special types of stock such as the dry dairy cows, young stock being reared or breeding stock. The concentration of young and dry stock

was most common in the South West where many of the interviewees were dairy farmers, while the breeding stock was sent to the new land in the North East. A concentration of cereals was found both in the East (where a clear majority of the amalgamator holdings were cropping farms) and the South West. A concentration of grazing in general was found in the three regions which is what one would expect given the number of farmers interviewed in each region who specialised in some form of livestock enterprise.

The pattern of concentrations is probably not fortuitous and is worth pursuing further. If one excludes the dairy unit set up for a son and heir and the cases of crops being grown on early land (where the physical environment is obviously important), 75 per cent of the 44 remaining cases of concentration concern livestock and grazing land. Pasture is assigned the lowest standard man-day conversion factor of all land uses by the DAFS which indicates that its labour requirements are very low. Similarly, the labour requirements of young and dry stock and of cattle being reared or fattened are also low. There are only fifteen cases of labour intensive enterprises being placed on the extra land and only nine cases if cereals are defined as a labour extensive enterprise. Of these, the dairy unit has been mentioned already as a special case. There seems, therefore, to be sufficient evidence to support the conclusion that the areal expansion of farms causes a redistribution of farm activities such that in about half the instances there is a concentration of a particular enterprise on the amalgamated holding and in about three quarters of these cases of concentration the extra land bears a grazing enterprise which probably has low labour requirements. In

this way, the extra land, which is probably the most distant part of the expanded farm, will require the fewest visits and the inevitable increase in time spent travelling around the expanded farm will be minimised. A similar finding has been reported from work among expanding farmers who took over distant land in Ontario (Fuller 1976).

The spatial segregation of farm functions seems, therefore, to be quite common as a means of reducing the time and cost of travelling following amalgamation. Despite the short distances involved in most amalgamations, distance still appears to possess sufficient power to alter the distribution of crops and livestock at a micro-scale. The principle behind the power of distance is not the maximisation of economic rent as von Thünen (1826) postulated for his model of micro-agricultural geography but rather it is the principle of least effort proposed by Zipf (1949). The rationality is that of conserving energy (the farmer's own or his diesel) in a manner comparable to that required of shoppers by Christaller (1933), Lösch (1940) and Hotelling (1929). As a form of rationality it appears to be quite in accord with the traditions of classical location theory, perfect competition and economic man and it is also in agreement with the evidence presented by Chisholm (1968 (2nd edn.) pp 53-61) on the reduction in the labour expended on land at above average distances from its farmstead.

Hine and Houston's work (1973 p 73) in the East Midlands and Devon also revealed the trend for dairy farms to use discontiguous extra land for their dry or replacement stock or hay and for arable farms to tend to use the extra land for more arable, the latter point also being noted by Simpson in Yorkshire (1968 p 24). The

present work agrees with these points but modifies them in so far as the concentration of pasture on the new land is not confined to dairy farms in Scotland and it is a clearer function of the distance between the holdings than of their simple discontiguity.

Change in the period for which livestock are kept

The third aspect of the changing use of land by the amalgamator concerns the vertical integration of a livestock enterprise by extending the period for which the stock are kept on the farm. The fattener could start to breed and rear his stock and the breeder could fatten what he used to sell as stores. In this way, the amalgamator would forgo some of the simple numerical expansion of his herds so as to increase the value he adds to his products. The amalgamators were asked whether there had been any changes as a result of the amalgamation in the ages at which they bought or sold their livestock. From their answers, it was calculated how much longer they kept their stock as a consequence of the amalgamation, the results being shown in Table 11.3.

Table 11.3 Changes in the period for which livestock were kept as a result of an amalgamation

Change in period kept (months)	Frequency	Percentage
- 7	1	0.9
- 1-6	3	2.8
No change	74	69.2
+ 1-6	12	11.2
+ 7-12	12	11.2
+ >13	5	4.7
TOTAL	107	100.0%

The proportion experiencing a change is 30.8 per cent (SE = 4.2 per cent) and the proportion in the regions and size classes of

the sample does not differ significantly from this by the χ^2 test. This proportion is intermediate between the larger proportion of the sample recording the concentration of an enterprise on the amalgamated holding and the smaller proportion starting a new enterprise. Most of the extensions in the period for which the stock were kept were for up to a year extra. Few of the changes were greater extensions than this and even fewer cases were found where the period was reduced. The livestock referred to were cattle in all cases since extended husbandry was not found with other animals.

Table 11.4 The incidence of changes due to amalgamation

		Frequency		Percentage	
No changes		42		39.3	
One change only	- new enterprise	4)		3.7)	
	- concentration	25)	40	23.4)	37.4
	- age change	11)		10.3)	
Two changes		17		15.9	
Three changes		8		7.5	
	TOTAL	107		100.1%	

Just over sixty per cent of all the sampled amalgamations resulted in some change in the husbandry which the amalgamator practised (Table 11.4). As has been shown, the most common change was a re-arrangement of activities on the enlarged farm so that a labour extensive enterprise such as the grazing of non-milking stock was moved on to the new land probably to minimise the increase in travelling around the farm after the amalgamation. The other fairly common change was an extension in the period for which cattle were kept on the farm. Starting a completely new enterprise and undertaking more than one change in the farming were not very frequent.

The distribution of land use changes consequent upon an amalgamation

The previous section described the incidence of three types of land use changes thought by farmers to be a consequence of their amalgamation. In this section, the socio-economic distribution of these changes is studied on the grounds that it is reasonable to presuppose *a priori* that certain types of amalgamations will be more prone to changes in the subsequent husbandry than others. For example, if the amalgamated holding lay at a considerable distance from the amalgamator it would be reasonable to look for a greater concentration of function on it. Also, if the amalgamated holding were quite large, there might be more likelihood of a new enterprise being started or of the farmer extending the period stock were kept.

Seven socio-economic aspects of the amalgamation were hypothesised as being positively related to the amount of change in land use. These were the sizes of the two amalgamating holdings, the type of farm the amalgamator holding was, the number of holdings the amalgamator took over during the study period, the length of time he had been the occupier of the amalgamator holding, the contiguity of the holdings and finally, the distance between the holdings. Details of the tests used to assess the degree of dependence between the amount of change and each of the test variables are given in Appendix 11.1 as are the results of the tests.

The most minor change, the starting of a new enterprise, is the least dependent on the test variables, being positively related only to the acreage of the holding taken over. The concentration of functions on the amalgamated holdings is greater where the holdings are not contiguous, where the distance between the holdings is above

average, where the amalgamator has taken over several holdings during the study period and also for upland and dairy farms. The proportion of farmers changing the period for which they keep their cattle is also well connected with the test variables, being significantly and positively related to the sizes of both holdings and also to the number of holdings taken over during the study period. The larger and more frequent amalgamators and the larger amalgamated holdings have more cases of extended husbandry than do other amalgamators. The larger holdings taken over seem to offer the most scope for altering rather than just expanding the farming system. Also, farmers who have amalgamated frequently can achieve over a short period the equivalent increase in size to that enjoyed by the farmer taking over a single large holding and so prolific amalgamators are seen to alter their farming system significantly more than the single amalgamator. Since the method of sampling is based on amalgamations and not on amalgamator holdings, it is likely that the tendency to over-represent prolific amalgamators (noted in Chapter 5) will have raised by a few per cent the proportions of amalgamators experiencing concentration of functions and extended husbandry. The type of holding and the period the farmer had been the occupier of the amalgamator holding appear to be unrelated to the amount of change except that upland and dairy farms tend more often than expected to concentrate functions on the amalgamated land.

Of particular interest is the observation that the more distant amalgamated holdings and probably the discontiguous holdings are more likely to have a particular function concentrated on them. This is the sort of observation one would expect if it were correct that

the concentration of functions is a means of minimising the increase in travelling time due to amalgamation. The operation of a principle of least effort is confirmed by this positive relationship between the range of amalgamating and the amount of concentration. If this conclusion were true, it would postulate further that the specific functions concentrated on the more distant holdings would be disproportionately grazing or the rearing of the young, dry or breeding stock where the labour requirements will be low. The functions with higher labour requirements, such as the intensive enterprises and dairying, would be concentrated more often on the nearer holdings (if they were concentrated at all). When tested by the χ^2 test (one-tailed), the postulated relationship between range of amalgamating and the concentration of labour extensive functions is statistically significant at just over the .15 level, there being only 48 observations on which to base the calculation. This leaves something of a question mark but, on balance, the interpretation of the spatial re-arrangement of farm enterprises consequent upon amalgamation as a means of minimising aggregate travelling within the farm is confirmed since it is consistent with the evidence. It appears, therefore, that although the difference between a short range amalgamation and a long range one is small in terms of miles, nonetheless it is sufficient to cause a change in the micro-scale agricultural geography which can be interpreted as entirely rational.

CHAPTER 12

AMALGAMATION WITHIN THE STRUCTURE SCHEMES

In Chapter 2, the evolution of the Government's schemes to assist the amalgamation of holdings was described and in this section the farmers' responses to the schemes will be studied.

The present (1973) schemes did not come into force until six months after the end of the study period, so attention will focus on the 1967 and 1970 farm structure schemes. The Farm Structure Branch of the DAFS kindly provided a list of the code numbers of all the holdings which had received either an outgoer's grant or an amalgamator's grant under the 1967 scheme and a similar list for the 1970 scheme. The names and addresses of the farmers occupying the holdings with these code numbers were not disclosed so as to preserve confidentiality. The list contained 2376 entries each of which represented a holding which had received some grant between the inception of the schemes in 1967 and the end of March 1974. A slight adjustment for errors and double counting is made in reaching this figure which does not include the six cases where grant was paid for a boundary adjustment between 1967 and March 1974. It is not possible to say how many amalgamations this represents since some amalgamations result in only one grant being paid, for example, a grant to the amalgamator when the outgoer is ineligible or a grant to the outgoer only when the amalgamator is the Secretary of State for Scotland. Other amalgamations may result in several grants being paid when there is an eligible amalgamator and several eligible outgoers. It

proved possible to measure the number of assisted amalgamations as 1281. This is the number of outgoers' grants paid between 1967 and 1974 (DAFS 1975 p 34). When estimates have been made of the number of these assisted amalgamations which would probably have been recorded by the Statistics Branch either before the study period for this research (before September 1968) or after it (after March 1973), there were probably about 1020 assisted amalgamations during the study period.

However, some of these amalgamations would not meet the criteria used in this research to define an amalgamation. They might involve the transfer of only a part of an uncommercial holding with the remainder being farmed. Or they might involve the bringing under common ownership of a holding of mixed tenure which was already being worked as a unit with a single occupier. It is thought that there might have been about 150 such cases in the study period. This suggests that during the study period there were about 870 assisted amalgamations which might be expected to qualify as amalgamations by the definitions of the agricultural census. In fact, 613 of these assisted amalgamations were recorded by Statistics Branch, the remaining 257 amalgamations being recorded, one must assume, after the study period. Many would have been brought to light probably by the amalgamation exercise carried out by the DAFS after the finish of the study period used here.

It is extremely difficult to say how large a proportion of the total number of amalgamations is being assisted by the schemes for three reasons. Firstly, a different definition for an amalgamation is used in the agricultural census and the farm structure schemes.

The definition used in the structure schemes is rather broader so that one is not comparing like with like. Secondly, the farm structure schemes do not seek to assist all amalgamations, only those which meet the schemes' conditions. The clearest example of the effect of these conditions concerns the necessity for an outgoer's farm to be between 100 smd and 600 smd in size before grant will be considered. Only 44.7 per cent of all the holdings which were amalgamated in the census during the study period lay between these two sizes at the June census before their amalgamation. It is, however, difficult to calculate exactly the eligible population of amalgamations since the gain or loss of a few livestock between the previous June census and the date of the amalgamation could change the man-day size sufficiently to move holdings into or out of the eligible size range. Also eligibility may be affected by the proportion of the amalgamator's income from off the farm and no estimate of the effect of this condition of eligibility can be made. The third point is that the chronology of recording and approving amalgamations is quite variable in both the census and the structure schemes depending on several clerical and legal factors. The study period of four and a half years is really too short to allow the variations of one or two years in recording an amalgamation and/or approving a grant to be balanced out.

Allowing for these serious uncertainties, one can estimate that about 27 per cent of all amalgamations were grant aided (613 out of 2259) or about 38 per cent if one includes the estimated number of assisted amalgamations which probably occurred during the study period but which were probably recorded at a census after the study period. If one compares the number of assisted amalgamations, not

with the number of amalgamations, but with the number of amalgamated holdings in the eligible size range (100 smd to 600 smd), then the two proportions rise to 64 per cent (613 out of 956) and 91 per cent (870 out of 956). Although there is considerable uncertainty over these figures owing to differences of definition and to the difficulty of measuring the number of eligible holdings, it seems as though about a third of all amalgamations and a much higher proportion of eligible amalgamations (upwards of two-thirds) were assisted under the 1967 and 1970 schemes.

It is also possible to ask whether the proportion of amalgamations being assisted is constant across Scotland or whether it varies. Again the uncertainty over the data must make an answer to this question very tentative but an attempt at an answer can be made. If the rate of uptake of grant were spatially constant, then there could be a zero correlation between the proportion of all amalgamations in each county which were assisted and then recorded by the census and the total number of amalgamations in the county. In fact, such a correlation exercise (using the Spearman test because of the uncertain data) produces a coefficient of 0.613 (SE = 0.177 and corrected for tied observations). In a one-tailed test with 31 degrees of freedom such a large coefficient causes one to reject the null hypothesis of no correlation at the 0.0005 level. If one recalculates the coefficient by correlating the proportion of amalgamations which were assisted with the overall probability of amalgamating in each county, then the coefficient becomes 0.626 (SE = 0.177) which is significant again at the 0.0005 level. If one computes a third correlation coefficient between the proportion of assisted

amalgamations in each county and the number of eligible amalgamated holdings (that is, between 100 smd and 600 smd), the coefficient of 0.444 (SE = 0.177) again allows one to reject the null hypothesis at the 0.005 level. Because of the uncertainty over the data, the actual values of the coefficients are not important and the standard errors and significance levels are included only as rough guides to the magnitude of the coefficients since the data used, although not population data, were not random samples either. The interesting point is that by three different comparisons there is a marked tendency for the proportion of amalgamations which were assisted under the 1967 and 1970 schemes to be greatest where the amalgamating is most rapid. This is true whether one defines 'rapid' as meaning 'having the most amalgamations' or as meaning 'where the probability of being amalgamated is greatest' or as meaning 'having the most amalgamated holdings of about the right size to be eligible for outgoers' grant'. The schemes have been most used where there is the most amalgamating and least intensively used where amalgamations are uncommon. The uptake of the grant seems to be in part a function of the intensity of the potential demand for it. Clearly, there is a cumulative effect at work here. The more people accept the grant, the more favourable reports about it are disseminated and the more potential applicants there will be. This is of considerable interest when one considers the criticisms which were made of the 1967 and 1970 schemes (Hine and Houston 1973 chaps. 5 to 7). Despite these criticisms, the force of which was recognised implicitly by the introduction of the 1973 schemes, the schemes had their greatest use where the need for them was greatest - in the north east of Scotland.

It would be interesting to pursue further the characteristics of the amalgamations within the schemes to see if they were distinctive for the sizes of farms involved, their tenure or the ages of the farmers. This was not possible, however, because of the large number of assisted amalgamations about which no further information is available (about 30 per cent of those thought to have occurred during the study period and about 50 per cent of all assisted amalgamations up to March 31st 1974). Any discussion of these points with reference only to the proportion of assisted amalgamations for which information is readily available would be open to serious charges of bias. It would be possible to obtain comprehensive information on the characteristics of all assisted amalgamations so as to compare them with all other amalgamations, but this would have entailed a major increase in the work to be done by the staff of the DAFS. This would have been an imposition on their generosity which it would have been difficult to justify fully.

No attempt was made to assess the extent to which the introduction of the schemes had affected the rate of amalgamating rather than just subsidising the normal rate of amalgamating. This was due to the unavailability of data comparable to that presented here on the rate at which farms were amalgamating before the farm structure schemes were introduced in 1967.

The studies presented here are not the most satisfying in the thesis although it was the intention to study closely the effects of the structure schemes on amalgamation. This proved not to be a fruitful line of enquiry for two reasons. In the first place, an assessment of the schemes in England and Wales became available to

the DAFS soon after this research started and because the schemes in Scotland are the same as those in England and Wales, there was little reason to duplicate this work (Hine and Houston 1973). Secondly, other work on the characteristics of those who took up the grants with a view to predicting which sections of the population were particularly susceptible to adopting official schemes was not possible because of the severe difficulties involved in reconciling the information about assisted amalgamations and the information about all amalgamations. A greater comparability of information would have eased this work greatly and this comparability could be achieved quite readily in the future by adopting an extended system of sampling indicators on the computer tapes holding the results of the census.

CHAPTER 13

CONCLUSIONS

All industries evolve in order to adapt better to their changing environment. The weaker organisations fall by the wayside, new groupings are created, owners change or new products are produced. Despite the well-founded view that agriculture is a stable sector of the economy, this is only true when it is compared with the other sectors of the economy which are changing more rapidly. At whatever scale it is viewed, agriculture is not static since it has its own adjustments to make which are born of national economic pressures such as inflation and also are due to the changes induced on individual farms by each farmer's ageing. For strategic, economic and social reasons, successive governments have studied agriculture and sought to modify or hasten these adjustments. Because of its slower rate of change and its long history of centralised investigation, agriculture is a good case study of the processes by which a sector of the economy adapts itself to new situations.

Agriculture is also a good case study of those economic adjustments which may be classed as structural. The nature of the structural problem in agriculture can be summarised easily. Often, farming as a whole cannot prosper by expanding output because of the price inelasticity of demand for food in general. This means that increasing total output tends to depress prices and farm incomes and so, although an individual farmer may sometimes prosper by expansion, each expanding farmer reduces the chances of other farmers expanding output

profitably. Thus, the agricultural industry as a whole depends on structural changes for its prosperity more than most other industries. However, structural change is rarely as rapid as the rate of technical advances which allow a concentration of productive potential on the most important ten or twenty per cent of farms. This leaves a large amount of farm land occupied by a large proportion of the farmers who are each producing only a small amount of food and who are probably earning incomes below the agricultural and national average by doing so. In a rational economy this would result in the smooth transfer of the low productive land into the occupation of the high production farmers whose farms would expand rapidly. However, such rationality does not exist in the real world. The low production farmers are slow to leave farming because they value the independence of their self-employment more than they desire being high wage earners in a factory. Their occupational immobility in a situation where the best technology is concentrated on the most productive farms is the real basis of the structural problem in agriculture. Their occupational immobility slows the transfer of land and the farm structure schemes of successive British Governments have been in the nature of lubricants to reduce occupational immobility through the Payments to Outgoers scheme and to increase the transfer of land to amalgamators rather than single farm occupiers through the Farm Amalgamations Scheme. Structural changes, which in reality mean the orderly reduction in the number of producers, are more important for agriculture than for most other sectors of the economy and so it is particularly appropriate to study these changes in an agricultural context.

This research has concentrated more on the farmers who have survived and succeeded in expanding - a category which potentially includes nearly every farmer in Scotland today since there are a few which have not expanded at some time. These farms are as inextricably bound up with the outgoing farmers as supply is with demand but on the purely technical ground that more is known and can be found out about the surviving farmers, the research has concentrated on them. The future of British agriculture depends on them and both the fieldwork and the initial study of the census records were directed in large part towards describing them.

In the first stage of this research, it was possible to assess the basic dimensions of the process of amalgamation, mainly because of the co-operation of the DAFS and the sample of farmers who gave of their time to be interviewed. Since the study covered four and a half years, the measurements of structural change in Chapter 3 have a high degree of precision. Each year an average of 0.8 per cent of holdings took over another holding by amalgamation and since amalgamator holdings are usually full time concerns, it is valuable to note that the annual rate of amalgamating for full time amalgamators over 250 smd was 1.68 per cent. About 0.9 per cent of holdings disappeared each year because of their amalgamation. Although amalgamation is a slow process as these figures show, it is still the major component of the changes in the size structure of Scottish agriculture. Although only a quarter to a third of changes of occupier resulted in an amalgamation, amalgamation was the way 97.5 per cent of holdings expanded their acreage within the agricultural sector. Similarly, most holdings which were fragmented

went to form two or more separate holdings, at least in the short run, and so the fragmentation of existing holdings rarely resulted in an amalgamation.

Clearly, therefore, amalgamation is not a rapid process, nor is it a random one since it affected different areas and different groups of holdings to a markedly varying extent. Large holdings (except for hill sheep farms) amalgamated more than smaller holdings and it was predominantly small to medium sized holdings which they took over. The younger occupiers and those who employed a manager to run their farms were disproportionately common among amalgamators. The process was particularly rapid in the North East of Scotland, and in Orkney and was very slow in other areas, particularly the crofting areas of the North West.

When set against the general influences of products' prices, gross margins, and subsidies, the effect of amalgamation on the way land is farmed is probably minor in the short run. Few farmers started a new enterprise as a result of an amalgamation while rather more than a quarter (often the larger and more frequent amalgamators) extended the period for which they kept their cattle. Nearly half the amalgamators, however, practised a systematic reorganisation of their enterprises and this was particularly prevalent when several holdings had been taken over or when the extra land was not contiguous with the home farm or when it lay at an above average distance from it. This reorganisation tended to place enterprises with low labour requirements on the new and usually more distant land.

In contrast to these short-term changes, the long-term effects of amalgamation are less predictable <u>a priori</u> and could not be measured

in this study since the four and a half years it covered was too short for them to develop. Yet it is to the long-term effects of amalgamation that successive British Governments have looked when financing the Farm Structure Schemes. The likely long-term effects would include a general upward shift in the efficiency of the industry as the average size of holdings rose and an alleviation of the social problem of small farms which provided only low incomes. The evidence is not easy to interpret, but it seems as though the Farm Structure Schemes have been used intensively during those types of amalgamation which the schemes were designed to assist and this is particularly true in the areas of the North East where there was a high rate of amalgamation.

Despite the fact that amalgamation is a major and, particularly for those buying land, a costly venture, it is one which is only sketchily planned in most respects. A quite widespread desire to expand was turned into specific bids for farms and actual amalgamations much less often and most of the seemingly important aspects of the amalgamation, such as its scale, its timing and the type of land acquired, were unplanned in large part. The aspect of amalgamation which was planned most often was the distance between the two holdings which has fewer obvious financial consequences for the success of the expansion.

This lack of planning is probably less strange than it seems because, when land becomes available, the farmer has to decide rapidly whether to bid for it or not. Similarly, the landowner has to decide in a short time whether or not to re-let the farm or to farm it himself or to rent or sell it to another farmer. The results of these rapid decisions are not random. There is a clear spatial and socio-economic

regularity to who take over vacant land. The successful farmers are, by and large, the same types of farmers socio-economically as those who have been identified repeatedly as the early innovators in farming communities. The amalgamators are almost identical to the initiators of change in the community's technology. This group of people seem to be in the forefront of the structural changes in the industry as well as in its agronomic advances. The process of farm amalgamation is, therefore, the socio-economic equivalent of a diffusion process. However, subsequent investigation discovered that the use of amalgamation as the preferred means of expansion was based on the belief that the risks of amalgamation failing to give an adequate return on investment were less than the risks associated with other, more frequently available methods of expansion. This is a very reasonable view to take since land is advantageous because, for those purchasing it, it represents investment in a capital asset of, until recently, appreciating value and most kinds of land allow a wide range of enterprises to be practised on them. This characteristic of land may explain why so few farmers were looking for a specific type of land. In contrast to this, investment to intensify production from one's present acreage is usually investment in a depreciating asset such as a building or machine which also limits the farmer's flexibility of enterprises by tying him more firmly to his present enterprises until the new building or machine is fully depreciated. The remarkable feature of this differential perception of risk among farmers who had experience of both amalgamation and intensification was that it was found so uniformly among them. By whichever criterion the sample was partitioned, there was a clear majority of amalgamators who regarded

it as the safest method by which to expand and for whom this was the only obvious criterion by which these two methods of expansion could be differentiated.

The research has shown that the minimisation of risk while expanding is a major objective for farmers. This raised three important questions, the first of which was how this attitude to risk could be incorporated in our theory of decision making when the existing theory of innovation diffusion requires the opposite attitude to risk by entrepreneurs. This apparent contradiction between theory and observation was resolved in Chapter 9 by redefining the role of risk in decision making to one of conditional risk reduction. The second question is to what extent this objective influences other aspects of decision making in economic geography and the third question is how this objective is translated into spatial patterns of economic activity and economic change.

Some independent evidence is available on the second question and has been reviewed in Chapter 9. This suggest that actions which tend to minimise risk are preferred also when farmers choose between different enterprises and when they choose technical equipment. However, it is not clear yet whether this principle is confined only to cases where there are fairly defined costs of acquisition and less clearly defined (but obviously substantial) costs accruing from failure or whether the principle can be regarded as a more universal criterion for choosing between options irrespective of their costs. It is also unclear what is the mechanism which links risk avoidance to the other cardinal principle of decision making, namely, the use of precedents as a way of avoiding the decision by simply copying past decisions

rather than assessing each situation afresh. Are there, perhaps, other patterns of change in economic behaviour which are moulded by risk avoidance?

This is a major aspect of location theory and is one of the fields the agricultural geographer ought to pursue. The author hopes to continue this line of research by studying the links between the individual's perception of his present and future business environments and the spatial consequences at different scales of his actions to cope with the future he expects. Of course, this is likely to require a familiarity with the accumulated experience of psychologists in the techniques of studying farmers' perceptions, motives and values which is as formidable, dangerous and yet potentially rewarding an extension of the geographer's armoury as was the quantification of the subject. The dangers in the two extensions are the same - over-simplification, initial lack of understanding of the relevant theoretical background and the use of techniques in inappropriate circumstances - yet the potential gain in being able to link the action of the individual to the resulting spatial trend in a broader area and the possibility of generalising individuals' motives and attitudes is so great that the effort is worth making.

Another dimension of the problem of explanation concerns whether the adoption of a spatial viewpoint for research requires that the explanation of the spatial distribution of a process should be a distinctively spatial explanation or whether it can be similar to the explanations of the non-spatial aspects of the process. This problem was explored in Chapter 8 in the specific context of the amalgamation of holdings. Many possible non-spatial explanations of the process of

amalgamation were put forward for the spatial incidence. Most of these non-spatial explanations appeared not to be causally related to amalgamation, but those which were (the incidence of farming heirs, the existing size structure of holdings and a general predisposition to expand) are all potential non-spatial explanations of the rate of amalgamation as well. The spatial explanation is not distinctive because the factors which affect the distribution of amalgamations are unique to the spatial aspect of the process. Rather, it is distinguished from the non-spatial explanations by virtue of which specific non-spatial components are included in the explanation. It is the combination of explanations of a spatial process which is unique - and not the reasons themselves.

One of the most interesting aspects of this research has been that is has shown how important the historical development of the size structure of holdings is for present day processes. It is the historical fact of a large number of part-time and small full time holdings in the north east and a very large number of spare time holdings in crofting districts which has been responsible in large part for the spatial variation in structural change today. Existing size structure largely determines the spatial distribution of amalgamation. This suggests that the historicist use of Markov chain analysis in studying changes in farm numbers is sensible a priori even although the actual results in this field are not greatly impressive (Krenz 1964, and Power and Harris 1971). The corollary to such a view would be that the faster rate of change in the north east will make the size structure of holdings there progressively more akin to that elsewhere in lowland Scotland. Conversely, the low

rate of amalgamation in crofting areas will leave that area more atypical still in its size structure of holdings. The future in crofting areas would seem to lie between massive de facto amalgamation by croft enlargement and the rapid decline of agricultural activity on crofts. The latter would not mean necessarily the depopulation of crofting areas if alternative full time work were provided within commuting distance and if the croft house could be separated from the farm land. However, it does mean that the commercial agricultural future of most crofts is dubious. The few crofts which are approaching commercial viability will survive since this small group includes many of the amalgamating crofts. For the rest, an agricultural future depends on a continuing supply of the late middle-aged and the elderly who will be content with the subsistence earnings from the crofting land. When the proposed changes to crofting tenure are enacted, the situation could change by allowing newcomers from outside traditional crofting districts to come into the townships. Whether such an influx is likely to inject the capital into crofting that their agricultural viability requires, or indeed whether it will affect the rate of croft amalgamation, is rather uncertain.

The future for the part-time and small full time farmer is widely believed to be bleak since these farms cannot provide an adequate living by themselves and are inefficient producers of food. Modernisation and intensification of farming is difficult for these farmers because the capital required is often not forthcoming. In time, the small farm problem will be solved by the choices of careers outside agriculture made by the small farmers' sons. When they leave the farm and it is taken over by another farmer, it may become part of a

multiple unit business. The relationship between multiple unit businesses and amalgamation was explored briefly in Chapter 3. Although the official difference between the two forms of expansion is based on no more than the distance between the participating holdings, in practice, this seemingly minor difference is likely to lead to very large differences in the organisation of production following these two types of expansion. It was shown in Chapter 11 how very small increases in the range of an amalgamation could lead to a significant reorganisation of enterprises on the expanded holdings. The more distant land was used for enterprises which often had low labour requirements. It is likely that in multiple unit businesses, where the holdings may be tens of miles apart, the effects of such distances on land use will be very marked in certain aspects of husbandry. Where the multiple unit business straddles hill land and lower land, this might lead to distinctive farming systems which would be marked by an unusually high degree of self-sufficiency and vertical integration of livestock enterprises. A valuable extension of the research in this thesis would be a study of the comparative effects on different farming systems of amalgamation and multiple unit businesses and the author hopes to be able to pursue this in the future.

When considering the future, it would be desirable to try and predict the rate of amalgamation in the rest of this decade. Since a firm basis for such a prediction is lacking, the obvious course would be to predict that the rate of amalgamation between 1968 and 1973 would be continued through the 1970's. Such prediction is really only valid when it is reasonable to assume a constant level of business confidence in agriculture and an unchanging economic and legal

milieu for farming. The correctness of such assumptions is not self-evident.

There is a proposal in the Agriculture (Miscellaneous Provisions) Bill which is presently (1976) before Parliament to allow amalgamation as a reason for not renewing a farm's lease. It is not clear to what extent this will affect the rate of amalgamation in the tenanted sector.

It is also necessary to consider the effect on farm structure of capital transfer tax. The tax was introduced in 1974 and the Finance Bill (1976) proposes to amend the tax in order to reduce further the tax payable on the transfer of agricultural assets. If liability under capital transfer tax is heavy, then payment of the tax may require part of the farm to be sold. There would be a ready market for such land since it was shown in Table 10.12 that even most amalgamators were still seeking more land because they had been unable to expand by as much as they wanted. Such fragmentation as occurred would be greatest on the largest holdings whose liability to tax is greatest and it is likely that some of this fragmentation would result in amalgamations. Therefore, the number of amalgamations could be increased by the incidence of capital transfer tax if the recent concessions on the transfer of agricultural assets have not been large enough to allow the tax to be paid without the sale of land. It is not clear how one can judge <u>a priori</u> the effect of the tax on the size structure of farms since the influence of capital taxes such as estate duty and capital transfer tax is one of the last researched areas of agricultural geography. Conventional wisdom proposes that these taxes act to break up the ownership of large farms but this has not been

tested rigorously. We do not know how the occupation of the land, as opposed to its ownership, is affected. The taxes could lead to more tenants becoming owner-occupiers and it could lead to the fragmentation of farm occupation with new occupiers coming in or it could lead to amalgamation as land is sold to neighbours. We do not know the pre-conditions for these effects nor do we know how commonly each is caused by the tax system. There is the clear probability that estate duty has not affected the size structure of farms as much as it might and at a time when the dire effects of capital transfer tax are being predicted, it is clearly desirable that the effects of the tax system on farm structure should be understood better. The need for such understanding can be illustrated simply by asking whether the amalgamations studied here are purely temporary and whether they will be broken up back into their constituent holdings by the tax system so as to start a new cycle of structural change. The author feels that the influence of capital taxes on farm structure is a field which needs exploring now more than ever although one must recognise the severe practical difficulties which are likely to be involved in this research.

The assumption of a constant legal environment also includes the presumption that Government will not seek to intervene in the land market itself. Such powers of intervention are common in France and were given to the North Pennines Rural Development Board during its short life though were rarely used (Whitby, et.al. 1974 p 103). Active intervention could easily raise the rate of amalgamation by directing land on the market to existing farmers although it must be admitted that there are no signs of such intervention being undertaken

in the near future.

There is also the possibility that agricultural assets will be subject to an annual tax on their value - that is, to a wealth tax. This could affect the size structure of farms by means of an increase in the fragmentation of farms and so in the rate of amalgamation. Also, a radical change in the general level of agricultural prosperity would be likely to affect the desire farmers had to expand but it is uncertain in which direction the effect would be. Lower real farm incomes, for example, could reduce the desire to expand and amalgamate by reducing confidence, and reducing the ability of farmers to afford land or to pay off the loans needed to buy it. This assumes that the reduced profitability of farming would not produce a compensating reduction in land values which is not a solid assumption now that the gap between the selling price of land and its agricultural value is narrowing. Conversely, a fall in agricultural incomes could raise the desire among farmers to expand so as to maintain their incomes under the conventional argument that a cost/price squeeze on farm incomes raises the average farm's output in the short run. Similarly, higher real farm incomes could either raise or lower the desire to expand. Since there are no grounds, a priori, for postulating the direction in which the rate of amalgamation would change as real farm income altered, it is difficult to use predictions of farms' incomes (scanty and very short range as they are) as guides to the rate of amalgamation.

One concludes, therefore, that amalgamation will continue as a slow and unspectacular process, probably of greater benefit to the individual farmer than to the industry as a whole in the short term. It will probably continue to be overshadowed by more pressing matters

of prices, marketing and the concentration of production on a few large farms - the latter being due only in small measure to the concentration of the land itself into fewer hands by amalgamation. It is likely that forms of co-operative marketing, co-ordinated planning and the joint use of expensive machinery will be ways the individual farmer will be subsumed into larger units more rapidly than through direct amalgamation.

APPENDICES

APPENDIX 3.1

THE CONSTRUCTION OF A POISSON PROBABILITY MAP

Figure 3.4 is a map of those parishes where the observed number of amalgamators differs significantly from an expected number. The mean rate of occurrence of amalgamators per 100 holdings was calculated using the total number of holdings in Scotland at June 1968 and also the total number of amalgamator holdings recorded between December 1968 and December 1972. Since the data refer to a fairly long period, they should be representative of the true distribution and the mean rate of amalgamating (Choynowski 1959 p 387; McGlashan 1972 p 187). If the assumption were correct that this mean incidence of amalgamators actually occurred in every parish, then the number of amalgamators which would be found in each parish could be calculated as the product of multiplying the mean incidence by the total number of holdings in the parish. Since there is a marked spatial variation in the rate of occurrence of amalgamators, the observed number of amalgamators differs often from the expected number.

In order to measure the significance of these differences, it was assumed that the observed number of amalgamators in a single parish was a variable influenced by essentially random sampling factors. Since the overall frequency distribution of the expected and observed numbers of amalgamators are both very positively skewed (Footnote A3.1) and since the mean incidence of amalgamators is very low (< 4 per 100 holdings), it was felt that the Poisson distribution provided a good simulation of the probability distribution of the

observed numbers of amalgamators in a single parish. The expected number provides the mean of that Poisson distribution and since the mean of a Poisson distribution equals its variance, this expected number is sufficient to describe a Poisson distribution of observed values which is unique to each parish. Again, knowing only the distribution's mean (the expected frequency for the parish), the probability can be calculated for the occurrence of the observed frequency. The probability of a Type 1 error was set at .05 at either tail of the distribution and Figure 6.4 maps the parishes where the observed frequency will occur less then five times out of 100 given the null hypothesis of a uniform rate of amalgamating across Scotland. The 37 parishes where the observed number of amalgamators is significantly less than expected are differentiated from the 77 parishes where the number is significently higher than expected. Nearly 13 per cent of the 881 parishes for which calculations were possible had significantly abnormal numbers of amalgamators. This technique follows that described by Choynowski (1959).

Footnote A3.1 The amount of positive skewness in these distributions is a function of the size of areal unit used. Dacey noted that small areal units give a highly skewed distribution of the number of occurrences per unit area while larger units give a broader and less skewed distribution (Dacey 1969 p 36). The Poisson parameter lamda is therefore small (< 1.0) where the distribution of amalgamation is described by parishes and is greater (> 1.0) where a county framework is used.

APPENDIX 3.2

THE TYPES OF FARMS PARTICIPATING IN JUNE AMALGAMATIONS

FARM TYPE OF AMALGAMATED HOLDINGS

TYPE OF AMALGAMATORS	1	2	3	4	5	6	7	81	82	83	91	92	Total
1	19	4					2				8	15	48
2	6	48	16	2	2	4	13				40	95	226
3		9	31	3	6	7	3		1		52	68	180
4			3			2					5	9	19
5			9	1		4	1				12	23	50
6		4	10	2	7	49	5	2		2	33	45	159
7		16	14	1		6	13			1	20	56	127
81								4			3	8	15
82						2	1		2			4	9
83					1					2	5	4	12
91					1		2				10	65	78
92			1									59	60
Total	25	81	84	9	17	74	40	6	3	5	188	451	983

All values are frequencies.
The type for the June amalgamator holdings refers to their type at that June census after amalgamation.
Coverage = 92.47 per cent. Data are not available for new amalgamations nor for reversed amalgamations (these are defined in Chapter 3).

Farm type key

1	Hill sheep	7	Dairying
2	Upland	81	Horticulture
3	Rearing with arable	82	Poultry
4	Rearing with intensive livestock	83	Pigs
5	Arable, rearing and feeding	91	Part-time (100-250 smd)
6	Cropping	92	Spare time (< 100 smd)

The data on farm types in December amalgamations (Table 3.2) are not strictly comparable with this appendix.

The farm type classification is that employed by the DAFS.

APPENDIX 3.3

THE DISTINCTIVENESS OF AMALGAMATORS AND OF THEIR HOLDINGS

This appendix provides details of the tests carried out to determine the criteria by which amalgamators could be considered significantly different from the universe of Scottish farms. The table gives the following information:

a) the criterion for the comparison
b) the source of the data for the comparison
c) the test used
d) the result of that test

Since the results of these tests will be used in later work, it was felt to be of prime importance to avoid identifying some characteristic as distinctive of amalgamators when in fact it was not. Consequently the level of statistical significance was set at .01. The increased probability of overlooking a minor distinguishing feature of amalgamators seems less serious than the consequences of a Type 1 error.

Criterion	Data	Test	Result
Acreage of amalgamator holdings before amalgamation	All amalgamator holdings (Dec) and all holdings in Scotland, June 1968	K-S (A)	.01 (D)
Acreage of amalgamated holdings	All amalgamated holdings and all holdings in Scotland, June 1968	K-S	.01
Smd size of amalgamator holdings after amalgamation	All amalgamator holdings (June) and all holdings in Scotland, June 1968	K-S	.01
Smd size of amalgamated holdings	All amalgamated holdings and all holdings in Scotland, June 1968	K-S	.01
Farm type of amalgamator holdings before amalgamation	All amalgamator holdings (Dec) and all holdings in Scotland, June 1968	χ^2 (B)	.001

Criterion	Data	Test	Result
Farm type of amalgamator holdings after amalgamation	All amalgamator holdings (June) and all holdings in Scotland, June 1968	χ^2	.001
Farm type of amalgamated holdings	All amalgamated holdings and all holdings in Scotland, June 1968	χ^2	.001
Location of amalgamations	All amalgamator holdings and all holdings in Scotland, June 1968	χ^2	.001
Age of amalgamators (11 sampled counties, see Chapter 5)	Age of occupiers (not managers) of sample of amalgamators and estimated ages of personal farm occupiers 1967-8 (DAFS survey, all Scotland) (Wagstaff 1970 p284)(E)(H)(K)	K-S	.01
Age of amalgamators (11 sampled counties see Chapter 5)	Age of occupiers (not managers) of sample of amalgamators and age structure of self-employed persons in agriculture and crofting (Population Census, Scotland 1966) (Dunn 1969 pp209-10) (F)	K-S	.01
Tenure - balance of rented and owned amalgamator holdings	All classifiable June amalgamators' tenure after amalgamation and all holdings in Scotland, June 1968 (G)	χ^2	.001

Criterion	Data	Test	Result
Tenure - frequency of amalgamator holdings in sampled counties with institutional owners	Frequency of amalgamator holdings in sample with institutional owners (as defined by Wagstaff 1970 p277) and freqeuncy in all Scottish farms (raised from DAFS sample survey) (H)(J)		Frequencies too low for χ^2. No difference detected by visual inspection (1.87 per cent in present sample, 1.1 per cent in all Scotland and 2.47 per cent in the SE and East Central regions by DAFS estimates)
Presence of a manager on amalgamator holdings	Sample of amalgamators (sampled counties) and estimate for all Scotland (Wagstaff 1970 pp277-8) (H)(J)	χ^2	.001
Proportion of amalgamators with some non-farm income before amalgamation	Sample of amalgamators (sampled counties) (income = unearned and earned non-farm income). Scottish estimates given in Wagstaff 1970 p282 for earned non-farm income only (I)	χ^2	(C) n.s.

NOTES

A The Kolmogorov-Smirnov one sample test (two-tailed)

B The chi-square one sample test (two-tailed)

C n.s. = $p > .01$

D In all the tests, the null hypothesis which was tested (and usually rejected) was that there was no significant difference between the occurrence of the criterion under test among amalgamators and its occurrence among farms generally. The rejection of the null hypothesis means that the amalgamators are not drawn at random from among the population of Scottish farmers.

E WAGSTAFF, H.R. Scotland's farm occupiers Scott. Agric. Econ. 20 (1970) 277-85

F DUNN, J.M. Some features of small full-time and larger part-time farms in Scotland Scott. Agric. Econ. 19 (1969) 205-220

G For all Scottish farms, "rented" is defined as a holding where the area rented exceeds a half of the holding's total area.
For amalgamator holdings after the amalgamation a more stringent definition of rented was used so as to prevent holdings which were owner-occupied before the amalgamation but which rented extra land, being classified as rented. Rented here is defined as a holding where the area not rented after the amalgamation is less than half the area of the holding or holdings which were

NOTES (continued)

taken over. A similar definition is used for "owner-occupied" and holdings of sufficiently mixed tenure to fall into neither category are given separate status and are not included in these calculations. They form only 7.9 per cent of all June amalgamators. Even if two thirds of these mixed tenure holdings were "rented" by the DAFS definition, the amalgamators would remain significantly different from the population of holdings by virtue of their more frequent owner-occupation.

H The variation in the distribution across Scotland is small. See Wagstaff (1970) p284 (age structure); p278 (the distribution regionally of holdings with institutional owners and with a manager).

I Scottish estimates by Wagstaff concerned earned non-farm income. Data for amalgamator holdings includes earned and unearned non-farm income. The difference in definition will raise the frequency recorded among amalgamators but this will be counter-balanced by a possible under-recording during the field work. The only case of a respondent evading answering a specific question during interview occurred with the question about non-farm income.

J More recent information on the numbers of managed holdings and holdings owned by institutions for 1972-73 is available in DUNN, J.M. Some aspects of the structure of Scottish farming. Scott.Agric.Econ. 25 (1975) 373-375. Only statistically significant holdings (over 40 smd) were surveyed and so this survey's results were not used since they are not fully comparable with the data from the author's sample. The results for 1972-73 are not greatly dissimilar to those given by Wagstaff (1970) for 1967-68.

K Information on the age structure of the occupiers of statistically significant holdings in 1972-73 is available in RETTIE, W.J. Scotland's farm occupiers. Scott.Agric.Econ. 25 (1975) 387-393. When compared with this information (p387) amalgamators (occupiers, not managers) are still significantly younger than even full time farmers - part-time farmers being older than full time farmers.

N.B. The symbol χ^2_2 is used to indicate the distributional form and the symbol $_2{}^{X}{}^{2}$ is used to indicate the statistic calculated from a χ^2_2 test (Kendall and Stuart 1967 p421).

APPENDIX 5.1

A COMPARISON OF THE CHARACTERISTICS OF JUNE AND DECEMBER AMALGAMATIONS

Criterion for comparison		Test	Result/ Significance
Acreage	- amalgamator holdings	R_s	.0005
	- amalgamated holdings	KS	n.s.
	- cross-tabulation of amalgamators before and after amalgamation	R_s	.0005
Smd size	- amalgamator holdings	no suitable data	
	- amalgamated holdings	KS	.05
Farm type	- amalgamator holdings	R_s	.0005
		χ^2	n.s.
	- amalgamated holdings	χ^2	.001
Range of amalgamating		χ^2	n.s.
Frequency of single and multiple amalgamators		χ^2	n.s.
		KS	n.s.
County distribution	- amalgamator holdings	R_s	.0005
	- amalgamated holdings	R_s	.0005

n.s. = not statistically significant at the .05 level

KS = Kolmogorov-Smirnov two sample test (two-tailed)

χ^2 = Chi-square two sample test (two-tailed)

R_s = Spearman rank correlation co-efficient (one-tailed)

The size distributions in standard man-days of June and December amalgamator holdings cannot be compared since such data do not exist for amalgamations recorded at a December census.

The Spearman rank correlation co-efficient rather than the Kolmogorov-Smirnov two sample test was used to compare the farm type distributions and the acreage distributions of amalgamator holdings because of definitional problems. The June data refer to farm type and acreage after the amalgamations while the December data refer to the situation before the amalgamation. Since the comparisons are not strictly of like with like, a less demanding test than the Kolmogorov-Smirnov was used. The use of the notion of statistical significance is valid here only as a general guide to interpreting the results since the tests were carried out using population data rather than sample data.

In only two cases are there significant differences between the June and December amalgamations. These are in the size distributions by standard man-days and the farm type distributions of the amalgamated holdings. This is, in fact, one source of difference in two guises. At the June censuses, more of the amalgamated holdings were spare time or part-time holdings (that is, of less than 250 smd) and these re-appear in the farm type distribution as the unclassified types 910 (part-time) and 920 (spare time).

There are no other cases where the two sets of amalgamation differ significantly from each other. The June amalgamations are, in all other measureable respects, similar to the December amalgamations.

APPENDIX 5.2

CLUSTER ANALYSIS AND STRATIFICATION FOR SAMPLING

The following clusters have been selected from the dendrogram in Figure 5.1. The clusters have been mapped in Figure 5.2.

	Cluster	N	Average Co-efficient
1. Aberdeen	1	1	0.0
2. Angus, Berwick, East Lothian, Fife, Moray and Perth	2	6	0.3764
3. Argyll, Dumfries, Caithness, Inverness, Zetland	5	5	0.7483
4. Ayr, Kirkcudbright, Lanark, Wigtown	3	4	0.2130
5. Banff, Orkney	6	2	3.2292
6. Kincardine, Midlothian, Ross, Roxburgh, Stirling, Sutherland	4	6	0.2039
7. Bute, Clackmannan, Dunbarton, Kinross, Nairn, Peebles, Renfew, Selkirk, West Lothian	7	9	0.0453

N = number of counties in the cluster

Average co-efficient = the aggregated (total) distance between the cluster's centroid and each county in the cluster averaged over the number of counties in the cluster. The term distance is to be interpreted as the error sum of squares of Ward's method of hierarchical classification. The lower the co-efficient the more compact the cluster, that is, the more similar its members. The single county cluster of Aberdeen cannot, obviously, have an average co-efficient calculated.

These clusters are to be interpreted as the seven clusters of lowest average co-efficients, that is, the lowest error sum of squares and so minimum variance (WISHART 1972 p 40).

The program used was CLUSTAN IA with ERCC amendments of 1972.

The distinctiveness of the clusters

Cluster number	1	2	3	4	5	6	7
1	-	-	-	-	-	-	-
2	16.18	-	-	-	-	-	-
3	16.27	1.06	-	-	-	-	-
4	17.31	0.63	0.72	-	-	-	-
5	11.26	2.54	2.07	2.47	-	-	-
6	16.63	0.31	0.55	0.23	2.34	-	-
7	17.63	0.46	0.86	0.21	2.73	0.09	-

The figures given in this matrix are the distances between the centroids of the clusters. The larger the figure, the more distinctive is that cluster.

The internal homogeneity of the clusters is measured by their average co-efficients which, for the purpose of stratification, should be as low as possible. The distinctiveness of the clusters is measured in the matrix above and for the purpose of stratification the figures should be as large as possible. Given the number of clusters, Ward's algorithm privides the optimal classification for stratification given the criteria of internal homogeneity and distinctiveness of clusters.

WISHART, D. CLUSTAN IA. PLS No. 8, Edinburgh Regional Computing Centre (1969, re-issued 1972), Edinburgh and St. Andrews.

MIDDLETON, R.L. ERCC amendments to CLUSTAN IA. PLS No. 9, Edinburgh Regional Computing Centre (1972), Edinburgh

APPENDIX 5.3

QUESTIONNAIRE FOR OCCUPIERS OF AMALGAMATOR HOLDINGS IN SAMPLE

Hello, I'm sorry to trouble you but I was wondering if you could help me. I'm from the University of Edinburgh and I am making a study of the amalgamation of farms. Could you spare fifteen minutes or so to tell me a little about this farm?

1. How long have you been on this farm?

2. Has this farm taken over any other farms in the last ten years? (Probe to see if this means that the farmer did not occupy the land previously and does occupy it now).

3. How many farms have you taken over?

4. Could you tell me the names of these farms?

5. Were you on this farm at the time they were taken over?

   (Concentration now on specific amalgamation in the sample)

6. Approximately how far is it from this farm to the one you took over? (actual farm name used from Question 4).

7. Does _____ farm march with your original farm? (This ignores roads as barriers to contiguity).

8. Did you have any kind of business contact with _____ farm (apart from normal good neighbourliness) before you took it over? I am thinking of things like a partnership or exchanging crops or stock, sharing machinery or labour or buying in supplies together.

9. Was the previous occupier of the farm you took over a relative of yours, either directly or by marriage?

10. Is it very likely that a member of your family or a near relative will take over this farm when you retire?

11. After you had taken over _____ farm, could you tell me who owned it and who owned your original farm?

12. Who owned them before the amalgamation? Were you related to the owner?

13. Has the amalgamation let you alter any of your enterprises or has it let you start any new ones? (Probe to see if change is due to amalgamation).

14. Have you concentrated any particular crops or livestock on the extra land?
(If "Yes", note change)
(If "No", probe by asking if he keeps the same balance of crops and stock on the extra land as on the original farm).

15. Has the amalgamation let you change the ages at which you buy or sell your livestock? (Probe to see if the change is due to the amalgamation).

16. Now that you have had the extra land for a few years, what have been the principal benefits from having it?

17. Could you tell me roughly what proportion of your income comes from outside your farming? I am thinking of any other business interests or investments.

18. Was this proportion about the same when you took over _____ farm?

19. In the period before you took over _____ farm, were you looking for extra land?

20. Did you put in bids for specific farms or tenancies?

21. (IF "YES" TO EITHER QUS. 19 OR 20)

What size of farm and type of land were you looking for?

22. How far away would another farm have to be from this one before you would consider it too distant to run as one unit with this one?

23. Were you able to influence when _____ farm fell vacant?

24. Do you know why the farmer at _____ farm vacated the land when he did?

25. This is a rather difficult question, but could I suggest a hypothetical situation? Suppose that a nearby farm became vacant at just the same time you felt it might be financially beneficial to invest in your present acreage to intensify it in some way. Could you tell me what sort of things you would weigh up in your mind so as to choose between taking extra land or investing in your present acreage?

Probe: Which would tend to be the riskier investment?
Which would bring the greater return on investment?
Which would bring the faster return on investment?
Which would need more borrowing?
Which would make the farm more difficult to manage?

26. When you took over _____ farm, did you take over any of the livestock on it?

27. Roughly what proportion did you take over?

28. How old were you when you took over _____ farm?

29. IF INTERVIEWEE IS A FARM MANAGER, ASK:

    How old were you when _____ farm was taken over?

APPENDIX 5.4

THE REPRESENTATIVENESS OF THE SAMPLE WITH RESPECT TO THE OTHER AMALGAMATIONS IN THE SAMPLED COUNTIES DURING THE STUDY PERIOD

Criterion for comparison		Test	Result/ Significance
Acreage	- amalgamators before amalgamation	KS	n.s.
	- amalgamated holdings	KS	n.s.
	- cross-tabulation of amalgamator and amalgamated holdings	R_s	.0005
Smd size	- amalgamators' estimated size before amalgamation	KS	n.s.
	- amalgamated holdings	KS	n.s.
	- cross-tabulation of amalgamator and amalgamated holdings	R_s	.025
Farm type	- amalgamators after amalgamation	χ^2	n.s.
	- amalgamated holdings	χ^2	n.s.
	- cross-tabulation of amalgamator and amalgamated holdings	R_s	.0005
Proportion of amalgamations within one parish or across a parish boundary		χ^2	n.s.
Date of the amalgamation (date of change in occupier)		R_s	.0005
		χ^2	n.s.
Frequency of amalgamators taking over 1, 2 or more holdings at one census		χ^2	.001

n.s. = not significant at .05 level

APPENDIX 5.5

THE REPRESENTATIVENESS OF THE SAMPLE WITH RESPECT TO ALL OTHER AMALGAMATIONS IN SCOTLAND DURING THE STUDY PERIOD

Criterion for comparison		Test	Result/ Significance
Acreage	- amalgamators before amalgamation	KS	n.s.
	- amalgamated holdings	KS	n.s.
	- cross-tabulation of amalgamator and amalgamated holdings	R_s χ^2	.05 n.s
Smd size	- amalgamators' estimated size before amalgamation	KS	.05
	- amalgamated holdings	KS	n.s.
	- cross tabulation of amalgamator and amalgamated holdings	R_s	.01
Farm type	- amalgamators after amalgamation	χ^2	.001
	- amalgamated holdings	χ^2	n.s.
	- cross-tabulation of amalgamator and amalgamated holdings	R_s	.005
Proportion of amalgamations within one parish or across a parish boundary		χ^2	.05
Date of amalgamation		χ^2	n.s.
Frequency of amalgamators taking over 1, 2 or more holdings at one census		χ^2	.001

n.s. = not significant at .05 level

APPENDIX 6.1

THE FINANCIAL RESOURCES OF HOLDINGS

Definition of financial resources

The definition of "financial resources" used here is dictated by the available information. It is a modification of the DAFS definition of "net farm income". Net farm income is basically the value of the farm's net output (when allowance is made for changes in the valuation of stock) minus total costs (excluding seed and feed). It aims to measure the money left to a farmer after he has paid his normal costs of running the farm. Net farm income approaches the idea of retained financial resources which would seem to be the measure of greatest relevance to this study of amalgamations. It also has the advantage of being available for the seven non-intensive types of farming and, within each type, for small (275-599 smd), medium (600-1199 smd) and large farms (over 1200 smd). The information comes from the Farm Accounts Scheme (FAS) which is run by the three Colleges of Agriculture for the DAFS and the results are published annually in Scottish Agricultural Economics. Information was also available on the variation in net farm income by acreage but this was not used since it applied only to England and Wales in the 1950s. (Natural Resources (Technical) Committee 1961 Fig. 8 p 22 and p 24).

Net farm income has, however, some disadvantages as a measure of a farm's retained financial resources. The owner-occupied holdings in the Farm Accounts Scheme are charged an imputed (that is, imaginary) rent based on their acreage and type of farm. The purpose of this is

to achieve a comparability of results irrespective of tenure. Consequently, the net farm income of owner-occupied holdings is understated by the amount of rent imputed to them. Data on the mean imputed rent were obtained from the DAFS for each type and size group of farm and were added back on to the net farm income. This procedure is rather crude since what is added back is a mean figure for imputed rent based on all the holdings, of whatever tenure, in that size/type class. It is not a mean figure for the owner-occupied holdings alone, since this is not available, and so the smaller the proportion of owner-occupied holdings in a size/type class, the more the resulting mean will underestimate the true retained income of the owner-occupiers.

A second difficulty (from the point of view of this research) in the published data on net farm income arises again from a desire to maintain a comparability of results for farmers in different situations. It is assumed that all investment is made from the farmers' own capital resources and that the farmers do not borrow any money. To the extent that this is false (that is, to the extent that farmers do borrow), their net farm income will be an overestimate of their retained profits by the amount of interest they have to pay back to their creditors. Data on the mean interest paid per annum per holding in each size/type group were obtained from the DAFS and were added back to the net farm income data. These means again refer to all the holdings, so this procedure will produce an over-estimate of true retained income for farmers who do borrow heavily. It must also be noted that the interest relates only to the capital borrowed for current trading. Interest paid by owner-occupiers on their borrowings for land and

buildings (the provision of landlords' capital) is excluded from these figures so as to maintain comparability of results irrespective of tenure.

A third difficulty is that the net farm income data include the net amount of change in the valuation of the farm's stock during the year. This element of valuation change includes both the change in the value of the stock and the change in the numbers of stock. The former change is adventitious, it costs nothing to obtain, it does not affect the farm's cash flow for that year and so it should be removed from the net farm incomes. However, the money invested in changed numbers of stock should be included. Unfortunately, it is not possible to split the valuation change into its two components on a national basis and so the data will be used both with all valuation changes included and with all valuation changes excluded. In practice, the difference in the results is fairly minor.

So far, an amended version of net farm income suitable for the present study has been defined and it can be measured. However, the amount of non-farm income accruing to different types and sizes of farm is not included in the net farm income data and yet such income could be used for the purchase of land as easily as profits from the production of crops and livestock. Non-farm income is not recorded by the Farm Accounts Scheme nor is it measured nationally in any other work known to the author. Several authors have given data on the number of part-time and other holdings whose occupiers have other employment (Ashton and Cracknell 1961 pp 483-485 and 499, Agriculture EDC 1973 p 11, Wagstaff 1970 p 282 and Dunn 1975 p 374). In most cases, however, it is non-farm earned income which is measured,

unearned income (from investments, for example) not being considered. An exception is work by Davies, Dunford and Morris (1971 p 106) which allows one to compare farm and non-farm sources of income for a small sample of farmers in S.W. England who co-operated in the Farm Management Survey between 1949/50 and 1958/59 and between 1958/59 and 1967/68. They define farm income as also including sales of land and equipment while non-farm income includes capital grants, investment income, gifts and the net increase in current liabilities and in medium and long term loans. Even with such a broad definition of non-farm income, the non-farm component only rose from $14\frac{1}{2}$ per cent to 19 per cent of total disposable income in the total sample. The sample is fairly small and some farms (particularly those under 250 smd) had a higher proportion but the fact that, overall, less than 20 per cent of total disposable funds came from off the farm suggests that any errors in regarding retained financial resources as modified net farm income should not be too serious.

The measurement of financial resources as they vary by size of farm

Now that the concept of financial resources has been defined, it is necessary to demonstrate whether or not it varies as the size of farm in standard man-days increases. The information to do this is contained in the results of the Farm Accounts Scheme (FAS) which are published annually. This raises the difficult point of showing that the farms which participate in the FAS are typical of the generality of farms in Scotland. Since there are no national standards of farm income against which to compare the FAS data, a direct test of representativeness is not possible.

The Farm Accounts Scheme has expanded inevitably in a rather ad hoc fashion. It is a sample of farmers who are willing and able to participate and so it is in no way a random or systematic sample. It may be argued that it is an ageing sample of farmers who have taken part in it for many years. This might suggest these farmers are older and so less up-to-date and efficient than the rest of farming (Harrison 1967 pp 28-29). Conversely, it could be argued that this fairly stable sample includes farmers who are of above average skills and initiative and probably of above average financial performance by virtue simply of their being willing and able to participate in the Scheme. This is probably the more plausible direction of any bias there may be.

The principal evidence for regarding the financial performance of the Scheme's farms as representative of farms generally comes from comparing the aggregate farming net income for Scottish agriculture with a similar figure for the FAS farms raised to the national level. These are almost independent calculations and the results are usually within ten per cent of each other, with the FAS figure being usually the lower. This suggests that the FAS farms do not have a markedly different net farm income structure from all farms although there is the possibility that the aggregate total conceals large compensating errors within the size classes. However, a similar comparison led Robson (1973 p 14) to conclude that the FAS data were reasonably representative of Scottish farming. These income estimates are for the United Kingdom and are published annually in the Annual Review White Paper, the Scottish figures no longer being published. A direct comparison of the two estimates of farm income is difficult

because the FAS data exclude intensive and part-time farms, because stock valuation is treated differently in the two calculations and finally because the raising procedure is open to discussion.

The second reason for believing that the Farm Accounts Scheme's sample is fairly representative of farming in Scotland comes from a study made by Britton and Hill (1975 pp 36-37) of the English and Welsh equivalent of the Farm Accounts Scheme, the Farm Management Survey (FMS). They calculated the intensity of cultivation (standard man-days per acre) for the farms in the Farm Management Survey and compared this with the intensity of cultivation on all farms in England and Wales in June 1970. Although these data are not strictly independent, the comparison seems valid and the results, given in Table 1 for six size groups of farms, show that with respect to the intensity of cultivation, the FMS sample is representative to a large extent of all English and Welsh farms.

Table 1 Intensity of cultivation (standard man-days per acre)

Size group	FMS sample (1970-71)	All holdings (June 1970)
275- 599 smd	4.95	5.18
600-1199 smd	5.18	5.36
1200-1799 smd	5.40	5.44
1800-2399 smd	5.56	5.42
2400-4199 smd	5.78	5.80
Over 4200 smd	6.94	7.88
Weighted average (all farms)	5.54	5.66

N.B. 1. All horticultural and part-time holdings under 275 smd are excluded.

2. The FMS data for 275-599 smd holdings are based on holdings between 300 and 599 smd.

A comparable study for the Farm Accounts Scheme and Scottish farming has been carried out by the author and the results are given in Table 2.

Table 2 Intensity of cultivation (standard man-days per acre)

Type of farm	FAS sample 1968/9	All holdings (June 1968)
Hill sheep	0.26	0.22
Upland	0.70	0.98
Rearing with arable	2.90	3.01
Rearing with intensive livestock	6.47	5.37
Arable, rearing and feeding	4.99	3.62
Cropping	5.01	4.71
Dairying	6.25	4.94
All farms	1.19	1.08

FAS data refer to holdings over 275 smd (Scott. Agric. Econ. 20 1970 pp 332-8).

All holdings data refer to holdings over 250 smd DAFS (1970) Table 41).

In this case, the farms are tabulated by farm type rather than by size in standard man-days as in the English and Welsh comparison, but again, the FAS sample seems to be representative of farming generally with respect to the intensity of cultivation.

When one divides farms into three size classes and then into seven full time non-intensive farm types, and when one compares the percentages of total farms and of the sample's farms in each size/type group, one finds that the intensity of coverage varies within the FAS (Table 3). The FAS sample over-represents hill sheep farms by a factor of two, but this has been defended on the grounds that this sensitive sector of the industry requires greater accuracy in its financial coverage. The small arable, rearing and feeding type

is rather under-represented. There is a general tendency for small farms to be under-represented and for large farms to be over-represented. This is similar to findings in England and Wales when size was measured by acreage (Natural Resources (Technical) Committee 1961 p 16, Fig. 4). Since the figures which will be used in this study are means, this pattern of varying intensity of coverage should not introduce any systematic inaccuracy into the data although sampling errors remain.

Table 3 Intensity of sampling by Farm Accounts Scheme 1969/70 to 1970/71

Table 3a Percentage of total holdings by type and smd size class

a) FAS sample 1969/70 to 1970/71

Type	S	M	L	All
100	4.6	7.3	3.3	15.2
200	8.3	7.1	2.9	18.3
300	5.2	5.2	3.3	13.7
400	0.8	1.0	0.4	2.1
500	1.9	1.2	0.8	3.9
600	2.1	5.0	7.9	15.0
700	4.8	12.7	14.3	31.8
All	27.7	39.5	32.8	100.0

S = 275-599 smd
M = 600-1199 smd
L = >1200 smd
All = > 275 smd

Table 3b Percentage of total holdings by type and smd size class

b) Scotland June 1970

Type	S	M	L	All
100	3.2	2.5	1.3	7.0
200	10.8	7.3	3.2	21.3
300	9.2	5.2	2.2	16.5
400	1.4	0.9	0.5	2.8
500	3.5	2.2	0.9	6.6
600	4.9	6.3	7.5	18.7
700	4.7	12.2	10.2	27.1
All	37.7	36.5	25.8	100.0

Table 3c Ratio of (a) to (b)

Type	S	M	L	All
100	1.44	2.92	2.54	2.17
200	0.77	0.97	0.91	0.86
300	0.57	1.00	1.50	0.83
400	0.57	1.25	0.57	0.88
500	0.54	0.57	0.89	0.59
600	0.43	0.79	1.05	0.80
700	1.02	1.04	1.40	1.17
All	0.73	1.08	1.27	-

KEY

>1 = more intensive coverage by FAS

<1 = less intensive coverage by FAS

NOTE: The farm type code numbers are given in Appendix 3.2

The means are, however, subject to other sources of difficulty. No information is available about the incomes of individual farms, but it can be shown that all the means do not refer to the same distribution of incomes. A survey of farm incomes on holdings participating in the Farm Management Survey in 1954-55 (Natural Resources (Technical) Committee 1961 p 25) showed that the distributions varied from symmetrical to very positively skewed with several being bimodal. With such a variety likely in their underlying distributions the means are comparable only in a very broad sense.

Also, it has to be noted that the income from a farm varies greatly depending on the weather, the incidence of diseases and the state of markets. To overcome these annual variations, the mean incomes were added together for the period 1965-66 to 1970-71. The years before 1965-66 cannot be used since the data were published in a different form and the years after 1970-71 would not be relevant to amalgamating during the study period. Aggregation for five years should reduce greatly the effect of unusual years. However, aggregation

will have less effect on the variation of income between farms. The range of incomes earned in any one year, even by farms in the same type and size group is very considerable. The Agriculture Economic Development Committee noted in a sample of 133 farms in Great Britain that the mean net farm income per £10 of tenant's capital for high, medium and low productivity farms was £0.30 $\pm$ £0.36, £0.24 $\pm$ £0.16 and £0.15 $\pm$ £0.68 respectively with the range within two standard deviations being given after each mean. This great variability in net farm income per £10 tenant's capital, even when the farms are grouped by productivity, is found in other studies of farm income. It appears that this variability is made more intractable because the sample of farms, whose performance is published each year in Scottish Agricultural Economics, is not a constant one. It varies in size from 519 farms to 579 farms and only in 1965/66 and 1966/67 is it the same sample. Since the sample varies, it is difficult to compare results through time and since the means refer to distributions of different shapes and to samples of different sizes in each size/type group, comparison between means in any year is difficult. Aggregation of results over five years is only a palliative to this lack of comparability and to the variability of farming income from year to year. It must be assumed that the sample is representative, although such evidence as there is suggests that the assumption is valid. The calculation of sampling errors for the mean incomes is not possible. The data on farmers' financial resources are not ideal but they have to be accepted and seem quite adequate for the fairly limited demands being made of them in this chapter.

APPENDIX 8.1

ATTITUDES TO AMALGAMATION BY REGION

The full questions asked are given in Appendix 5.3

The regions are shown in Figure 5.2

Is amalgamation riskier than intensification?

	Yes	No	Don't know
Aberdeenshire	9	36	10
The East	-	24	10
The South West	1	8	9

Does amalgamation give a faster return on your investment than intensification?

	Yes	No	Don't know
Aberdeenshire	7	7	41
The East	7	3	24
The South West	4	-	14

Does amalgamation give a greater return on your investment than intensification?

	Yes	No	Don't know
Aberdeenshire	23	20	12
The East	12	5	17
The South West	6	-	12

Does amalgamation need more borrowing than intensification?

	Yes	No	Don't know
Aberdeenshire	23	17	15
The East	12	5	17
The South West	5	3	10

Does amalgamation make the farm easier to run than intensification?

	Yes	No	Don't know
Aberdeenshire	16	7	32
The East	15	4	15
The South West	3	3	12

APPENDIX 9.1

SUMMARY OF THE RELATIONSHIP BETWEEN (A) THE RANGE OF ACTUAL AMALGAMATIONS AND AMALGAMATORS' HORIZONS FOR CONSIDERING FUTURE AMALGAMATIONS AND (B) 21 TEST VARIABLES

In each case the χ^2 test, with the appropriate correction for continuity, was used on two independent samples - either long range and short range amalgamations or amalgamators with wide or narrow horizons for future amalgamations. These groups were achieved by dividing the population on the basis of the respective mean distances. Each group was sub-divided by the appropriate number of divisions made to the 21 variables. The χ^2 test measured the degree of dependence of the range or horizons for amalgamations on this test variable (farmer's age, holding size, etc.). A significant relationship is defined as that degree of dependence (as measured by χ^2) which would, on repeated trials, occur less than one time in ten with fully independent data ($\alpha = .10$). The significance level is set as liberally as this due to the fairly small size of some of the frequencies which means that a change in the classification of a single farm in the contingency table could alter the X^2 test statistic noticeably. It is felt that the greater risk of a Type 1 error is less serious than the correspondingly lesser risk of ignoring a significant relationship (a Type 2 error).

The table shows α where less than .10 (two-tailed test)

	Range of amalgamating	Horizons for amalgamating
Date of amalgamation	-	.02
Acreage of amalgamator before expansion	.05	.10
Smd size of amalgamator before expansion	.05	.05
Acreage of amalgamated holding	-	.05
Smd size of amalgamated holding	.10	.10
Age of occupier or manager of amalgamator holding	.10	-
Age of occupier (excluding managers) of amalgamator holding	-	-
Amalgamator employs a farm manager	.01	.05
Period as occupier (not manager) of amalgamator holding	-	-
Proportion of income from off the amalgamator holding	nearly .10	nearly .10
Tenure of amalgamator holding	.05	nearly .10

	Range of amalgamating	Horizons for amalgamating
Occupier of amalgamator holding had an heir	-	-
Occupiers of holdings were related	-	-
Occupiers of holdings had previous business contact	-	-
Amalgamator controlled the timing of the amalgamation	*	*
Amalgamator was looking for extra land before the amalgamation	-	-
Amalgamator had bid for other holdings before the amalgamation	-	-
Amalgamator was looking for a specific type of land	*	*
Amalgamator was looking for a specific acreage (range)	*	*
Farm type of the amalgamator holding after expansion	-	-
Number of amalgamated holdings claimed taken over during the study period	-	-

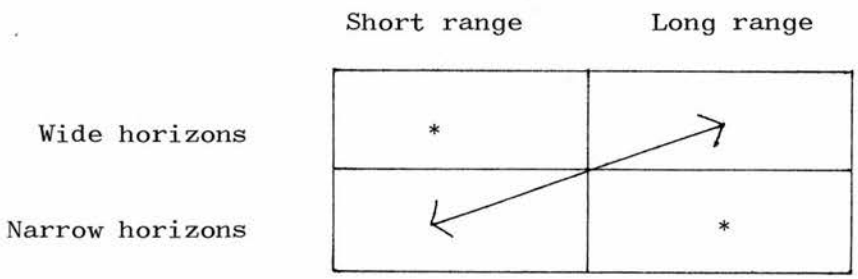
\- No significant difference

* The lack of dependence was determined by visual inspection since the frequencies were too low to allow X^2 to be calculated in these cases.

APPENDIX 9.2

SUMMARY OF COMPARISONS BETWEEN LONG RANGE, WIDE HORIZON AMALGAMATORS AND SHORT RANGE, NARROW HORIZON AMALGAMATORS

In each case the χ^2 test, with a correction for continuity where appropriate, was used to compare the frequencies of amalgamators in the long range, wide horizon group with the amalgamators in the short range, narrow horizon group. These two groups constitute 77 out of 107 members of the sample (72 per cent). It was suspected that there were considerable differences between these two groups which were being masked by aggregating these groups with the groups of long range, narrow horizon amalgamators and the short range, wide horizon occupiers. The comparison is being made between the groups



joined by the arrow in the above diagram and the groups marked by the asterisks are being omitted. It is, therefore, a comparison between what could be the extremes of the amalgamation process - between those who are consistently acting within a restricted radius of their holdings and those who are consistently operating within a much wider radius.

For the purpose of the χ^2 test, the two groups were sub-divided on one of several criteria and for each, the χ^2 statistic was calculated. The critical level of significance was set at $\alpha = .10$ and the reasons for this quite low level are set out in Appendix 9.1. To preserve consistency with earlier work (Appendix 9.1), two-tailed tests were used.

The criterion by which the groups to be compared were sub-divided	Significance level (where $\alpha \leq .10$)
Amalgamator employs a manager	.001
Number of amalgamated holdings claimed taken over during the study period	.05
Acreage of amalgamated holding	.01
Smd size of amalgamated holding	.001
Proportion of income from off the amalgamator holding	nearly .10
Occupiers of holdings had previous business contact	-
Occupiers of holdings were related	-
Amalgamator controlled the timing of the amalgamation	*
Tenure of amalgamator holding	.01
Amalgamator was looking for a specific acreage (range)	ø
Amalgamator was looking for a specific type of land	-
Amalgamator was looking for extra land before the amalgamation	-
Amalgamator had bid for other holdings before the amalgamation	-
Occupier of amalgamator holding had an heir	-
Farm type of the amalgamator holding after expansion	*
Period as occupier (not manager) of amalgamator holding	.05
Acreage of amalgamator holding before expansion	.05
Date of amalgamation	.02
Age of occupier or manager of amalgamator holding	-
Age of occupier (excluding managers) of amalgamator holding	-
Smd size of amalgamator before expansion	.01

* Frequencies too low to allow formal testing of hypothesis of independence. By visual inspection, there is no difference between the groups of long range, wide horizon farmers and the short range, narrow horizon farmers.

\- No significant difference

ø Frequencies too low to allow formal testing of hypothesis of independence. By visual inspection, the long range, wide horizon group specify an acreage to be taken over less often.

APPENDIX 9.3

THE DISTINCTIVENESS OF AMALGAMATORS AND OF SPATIALLY ADVENTUROUS AMALGAMATORS

Criterion	Criterion distinguishes amalgamators from other farmers (Appendix 3.3)	Criterion distinguishes spatially adventurous amalgamators from other amalgamators (Appendix 9.2)
Acreage of amalgamator holdings	Yes	Yes
Smd size of amalgamator holdings	Yes	Yes
Acreage of amalgamated holdings	Yes	Yes
Smd size of amalgamated holdings	Yes	Yes
Farm type of amalgamator holdings	Yes	No
Farm type of amalgamated holdings	Yes	n.a.
Age of amalgamators	Yes	No
Tenure of amalgamators	Yes	Yes
Employment of farm managers	Yes	Yes
Location	Yes	n.a.
*Non-farm income	n.a.	Yes (see footnote)
Period as occupiers of amalgamator holdings	n.a.	Yes
More holdings amalgamated	n.a.	Yes
Acreage (range) to be gained specified	n.a.	Yes

n.a. = the relevant comparison was either impossible by definition or was impracticable

* A strict comparison is not possible but Table 8.5 suggests that amalgamators do have non-farm sources of income more frequently than non-amalgamators when comparisons are made within size classes. The spatially adventurous amalgamators are distinguished from the others by having non-farm income less frequently, although this just fails to reach the .10 level of significance.

APPENDIX 9.4

A COMPARISON OF THE CHARACTERISTICS OF INNOVATORS, AMALGAMATORS AND SPATIALLY ADVENTUROUS AMALGAMATORS

Characteristic of innovators	Characteristic shared by: amalgamators	spatially adventurous amalgamators
Youthfulness	*	*
Greater financial resources	* A	**
Larger scale of operation	*	**
More specialised operations	-	* B
Better education	* C	**
Higher status	* D	**
=Greater sociability	-	-
More interaction with other innovators	-	-
Experience of non-local environments	-	-
=Tendency to being opinion leader	-	-
Rationality	-	-
Tendency to take risks	No	No
Favourable attitude to change	*	** F
Tenure (owner-occupation)	*	**
Seeks out professional advice	* E	**
Uses more non-local, impersonal information	-	-

= whether this characteristic applies to British innovators is less certain

An asterisk indicates that the characteristic is shared by amalgamators and innovators. A double asterisk indicates that the spatially amalgamators exhibit the characteristic in an even more extreme form than do amalgamators.

JONES, G.E. The adoption and diffusion of agricultural practices, World Agric. Econ. and Rural Soc. Abstracts 9 (3) (1967) 1-34

JONES, G.E. Agricultural innovation and farmer decision making, Part 2 pp 29-56 of Agriculture D203 III The Open University Press (1972) Bletchley

ROGERS, E.M. Diffusion of Innovations. Free Press (1962) New York

Together, these provide a thorough review of the socio-economic correlates of innovativeness which have been found repeatedly in the United Kingdom and the United States.

Notes: A As shown elsewhere, amalgamators, and particularly the spatially adventurous ones, are large scale occupiers and large scale occupiers have higher incomes and so greater financial resources than other occupiers. (For a detailed discussion of this, see Chapter 6). Amalgamators also tend to have non-farm sources of income more frequently than the rest of their size group (see Table 8.5) which will increase their financial resources.

B Based on the lower proportion of spatially adventurous amalgamators who have a non-farm source of income which would make them less speicalised in farming. No comparisons of specialisation by farm enterprise can be made.

C Based on the greater proportions of holdings run by managers who are better educated on the whole and on the relative youthfulness of the groups, the young tending to be better educated than the more elderly.

D Status in farming tends to be related to size of holding and to tenure. Both groups are well endowed with large owner-occupied holdings and estates. No measurements of status were made during the field work, however, and the comparison remains conjectural to a degree.

E Based on the greater willingness of the occupiers in both groups to employ professional farm managers.

F Based on the greater propensity of spatially adventurous amalgamators to have taken over several holdings, not just one holding, during the study period (see Appendix 9.3).

APPENDIX 9.5

SALES OF EQUIPPED FARMS IN SCOTLAND, 1963-1972

Table 1 Land remaining in agriculture

	Sales with vacant possession		Sales without vacant possession		All sales	
	No. of transactions	Price/acre(£)	No. of transactions	Price/acre(£)	No. of transactions	Price/acre(£)
1963	456	61	93	28	549	52
1964	471	69	165	44	636	62
1965	389	74	75	28	464	62
1966	355	85	78	38	433	76
1967	349	88	85	69	434	84
1968	406	73	71	68	477	72
1969	385	82	58	78	443	82
1970	390	97	46	67	436	93
1971	366	90	60	71	426	87
1972	331	145	79	85	410	128

Data refer to equipped holdings over 20 acres in total acreage which remained in agriculture after sale.
Prices are per total acre. See also Figures 9.3 and 9.4
Source: Mackenzie (1974) p 302.

Table 2 Land remaining in or sold out of agriculture - Average price (£) per total acre

	Land remaining in agriculture (equipped farms)	Land sold out of agriculture for urban uses	afforestation
1963	52	382	7
1964	62	327	4
1965	62	1009	9
1966	76	528	8
1967	84	751	8
1968	72	432	12
1969	82	573	19
1970	93	1074	15
1971	87	573	21
1972	125	1021	23

Table 2 (continued)

Data refer to holdings over 20 acres in total acreage
Urban uses are roads, housing and industrial development. See also Figures 9.3 and 9.4
Source: Mackenzie (1974) p 307

APPENDIX 10.1

THE SOCIO-ECONOMIC DISTINCTIVENESS OF THOSE WHO EXPRESSED A PREFERENCE FOR THE ACREAGE TO BE GAINED BY AMALGAMATION

A comparison was made of the socio-economic characteristics of two groups of amalgamators, namely, those who had expressed no preference for the acreage to be gained by amalgamation and those who had expressed such a preference. There are eight criteria for comparison listed in the left-hand column. The central column lists the test used to test probable differences between the two groups. The tests include the z test from the binomial distribution where this is valid (Yamane 1973 p730-733) and the χ^2 test (two-tailed) for two or k independent samples with a correction for continuity where necessary. The level of significance was set at 0.05 (n.s. = not statistically significant) and, had a one-tailed test been used with χ^2, no further significant relationships would have emerged.

Characteristic	Test	Result/ Significance
Acreage of amalgamator before amalgamation	χ^2	.01
Years as occupier of amalgamator holding	χ^2	.05
Presence of heir for amalgamator	χ^2	n.s.
Tenure of amalgamator holding	χ^2	.02
Presence of non-farm income for amalgamator	χ^2	n.s.
Amalgamator's horizons for future amalgamations	χ^2	n.s.
Age of amalgamator (not manager) at the amalgamation	z	n.s.
Presence of a farm manager on the amalgamator holding	χ^2	n.s.

APPENDIX 11.1

CHANGES IN LAND USE CONSEQUENT UPON AMALGAMATION

Three kinds of changes in the way land is used were hypothesised.

a) The instigation of new enterprises by the amalgamator.

b) The concentration of certain enterprises or functions on the amalgamated holding.

c) The alteration of the length of time for which livestock were kept on the amalgamator holding.

The amount of change in each of the three groups was measured (qv Tables 11.1 to 11.4) and this appendix records tests carried out to determine whether particular changes were unusually prevalent among particular sub-sets of the sample. It was hypothesised that the amount of change might be related to the amalgamator holding's acreage or its type, or to the acreage taken over or the number of holdings taken over. Tests were also carried out to discover if change was related to the contiguity of the holdings amalgamating or to the distance between the amalgamating holdings (their range) or to the number of years the amalgamator had been the occupier of the amalgamator holding. Because of the size of the sample (107 usually), the variables were divided in a binary manner - change or no change, small or large amalgamator holding. The dividing points for the seven test variables are given below.

Amalgamator holding's acreage	- $<$ 125 acres, $>$ 125 acres
Amalgamated holding's acreage	- $<$ 50 acres, $>$ 50 acres
Amalgamator holding's type - the 12 types of the DAFS classification of 1968	
Period as occupier of amalgamator holding (excludes farm managers)	- $<$ 20 years, $>$ 20 years
Number of holdings amalgamated during study period	- 1, more than 1
Range of amalgamation	- $<$ 1.5 miles, $>$ 1.5 miles
Holdingscontiguous	- Contiguous, discontiguous

The tests used were the χ^2 test (one-tailed) with a continuity correction where df = 1 and/or the z test (one-tailed) to test the significance of the difference between two percentages based on a binomial distribution. The level of significance was set at $\alpha = 0.10$ and a relationship was defined as significant if either test indicated that the probability of the observed difference occurring by chance was less than 0.10. If both tests were valid, the result of the test with the lower probability of a Type 1 error was taken as definitive.

The results are presented below, a dash indicating an insignificant relationship and the values in the matrix being the probabilities of a Type 1 error.

Test variable	New enterprises	Concentration on amalgamated holding	Livestock age change
Acreage - amalgamator holding	-	-	.05
Acreage - amalgamated holding	.10	-	.10
Type - amalgamator holding	ø	.01 (χ^2 two-tailed test)	-
Period as occupier of amalgamator	-	-	-
Number of amalgamations	-	.01	.05
Range of amalgamations	-	.005	-
Holdings contiguous		.10	

All relationships are positive except for the relationship between concentration and contiguity which is negative

ø Frequencies very low. By visual inspection, no marked difference in the uptake of new enterprises between farms of different types

BIBLIOGRAPHY

ADAMS, R.L.A. 1973 Uncertainty in nature, cognitive dissonance and the perceptual distortion of environmental information: weather forecasts and New England beach trips. Econ. Geog. 49 287-297.

AGRICULTURAL ADJUSTMENT UNIT 1968 Farm size adjustment. Bulletin No. 6, University of Newcastle-upon-Tyne.

AGRICULTURE ECONOMIC DEVELOPMENT COMMITTEE 1973 Farm productivity. HMSO London.

ALEXANDER, D.J. Unpublished work in Northern Ireland, quoted in Agricultural Adjustment Unit (1968) p 51.

ANDERSON, K.E. 1974 An agricultural classification of England and Wales. Research Discussion Paper No. 1, Department of Geography, University of Edinburgh.

ASHTON, J. and B.E. CRACKNELL 1961 Agricultural holdings and farm business structure in England and Wales. Jnl. Agric. Econ. 14 472-500.

BEILBY, O.J. 1974 Beef cow numbers in Scotland. Scott. Agric. Econ. 24 277-283

BIRD, J.H. 1975 Methodological implications for geography from the philosophy of K.R. Popper Scott. Geogr. Mag. 91 (3) 153-163.

BOSANQUET, C.I.C. 1968 Investment in agriculture. Jnl. Agric. Econ. 19 (1) 3-17.

BOWDEN, L.W. 1965 Diffusion of the decision to irrigate. Department of Geography, University of Chicago, Res. Paper 97, Chicago.

BOXLEY, R.F. 1971 Farm size and the distribution of farm numbers. Agric. Econ. Res. 23 (4) 87-94.

BRAYBROOKE, D. and C.E. LINDBLOM 1963 A strategy of decision. Free Press, New York.

BRITTON, D.K. and B. HILL 1975 Size and efficiency in farming. Saxon House, Farnborough.

BUNGE, M. 1964 Phenomenological theories. In M. BUNGE (editor) The critical approach to science and philosophy. Free Press of Glencoe.

BURTON, I. and R. KATES 1963 The perception of natural hazards in resource managment. Nat. Res. Jnl. 3 412-441.

CHISHOLM, M. 1968 Rural settlement and land use. (2nd edition) Hutchinson, London.

CHOYNOWSKI, M. 1959 Maps based on probabilities. Jnl. Amer. Stat. Assoc. 54 385-388.

CHRISTALLER, W. 1933 Die zentralen orte in Suddeutschland. Translated by C.W. Baskin as Central places in Southern Germany. Prentice-Hall (1966), Englewood Cliffs, N.J.

CLARK, C. 1969 The value of agricultural land. Jnl. Agric. Econ. 20 1-19.

CLARK, G. 1972 Geographical aspects of beef production in East Lothian and northern Berwickshire. Unpubl. M.A. dissertation, University of Edinburgh.

CLARK, G. (editor) 1973 Norway Expedition 1972 - final report. Occasional Paper No. 9 (First Series), Department of Geography, University of Edinburgh.

COCHRAN, W.G. 1954 Some methods for strengthening the common χ^2 tests. Biometrics 10 417-451.

CORMACK, R.M. 1971 A review of classification. Jnl. Roy. Stat. Soc. Ser.A, 134 (3) 321-367.

CRAWFORD, A.G.S. 1972 Economic and social aspects of farm amalgamations in Northern Ireland - a study of two contrasting electoral divisions. Unpubl. M.Ag. thesis, The Queen's University, Belfast.

DACEY, M.F. 1969 Similarities in the areal distribution of houses in Japan and Puerto Rico. Area 3 35-37.

DAVIES, G.D.D., W.J. DUNFORD and S.T. MORRIS 1971 Aspects of farm financial structure. Report No. 185, Agricultural Economics Unit, University of Exeter.

DAW, M.E. 1973 Factors affecting productivity at the farm level. (Second stage report) NEDO, London.

DEPARTMENT OF AGRICULTURE FOR SCOTLAND 1952 Types of farming in Scotland. HMSO, Edinburgh.

DEPARTMENT OF AGRICULTURE AND FISHERIES FOR SCOTLAND 1970 Agricultural statistics - Scotland 1968. HMSO, Edinburgh.

DEPARTMENT OF AGRICULTURE AND FISHERIES FOR SCOTLAND 1972 Agricultural statistics - Scotland 1971. HMSO, Edinburgh.

DEPARTMENT OF AGRICULTURE AND FISHERIES FOR SCOTLAND 1974 Agricultural statistics - Scotland 1972. HMSO, Edinburgh.

DEPARTMENT OF AGRICULTURE AND FISHERIES FOR SCOTLAND 1975 Agriculture in Scotland - report for 1974. Cmnd 5998. HMSO, Edinburgh.

DUNFORD, W.J. 1961 Uncertainty and the farmer. Report No. 126, Department of Economics (Agricultural Economics), University of Bristol.

DUNN, J.M. 1969 Some features of small full-time and large part-time farms in Scotland. Scott. Agric. Econ. 19 205-220.

DUNN, J.M. 1975 Some aspects of the structure of Scottish farming. Scott. Agric. Econ. 25 373-375.

EUROPEAN COMMUNITIES (Secondary Legislation) 1972 Directive 72/159/EEC of 17 April 1972 Directive 72/160/EEC of 17 April 1972 HMSO, London.

EVERITT, B. 1974 Cluster analysis. SSRC/Heinemann, London.

1965 Farm amalgamation 1950-1964. F.R. No. 159, Department of Agricultural Economics, University of Nottingham.

FULLER, A. 1976 Farm enlargement programme in Ontario since 1966. Paper to IBG conference 1976.

GALE, S. 1973 Explanation theory and models of migration. Econ. Geog. 49 257-274.

GASSON, R. 1973 Goals and values of farmers. Jnl. Agric. Econ. 24 521-537.

GUELKE, L. 1975 On rethinking historical geography. Area 7 (2) 135-138.

HANSON, N.R. 1969 Logical positivism and the interpretation of scientific theories. In P. Achinstein and S.F. Barker (editors) The legacy of logical positivism. The Johns Hopkins Press, Baltimore.

HARLE, J.T. 1974 Further towards a more dynamic approach to farm planning - a technically based model of the farm firm. Jnl. Agric. Econ. 25 153-163.

HARRISON, A. 1967 Farming change in Buckinghamshire. Misc. Study No. 43, Department of Agricultural Economics, University of Reading.

HARRISON, A. 1972 The financial structure of farm businesses. Misc. Study No. 53, Department of Agricultural Economics and Management, University of Reading.

HÄGERSTRAND, T. 1952 The propagation of innovation waves. Lund Studies in Geography, Series B No. 4.

HÄGERSTRAND, T. 1953/1967 Innovationsförloppet ur korologisk synpunkt. Lund. Translated as Innovation diffusion as a spatial process by A. Pred and G. Haag, University of Chicago Press, Chicago.

HELMFRID, S. 1968 Die Wandlung der Agrarstruktur in Schweden 1944-1966 in Regionaler sicht. Geog. Annaler 50 B 32-47.

HEMPEL, C.G. and P. OPPENHEIM 1948 Studies in the logic of explanation. Phil. of Sci. 15 135-175.

HENDERSON, H.J.R. and B.W. ILBERY 1974 Factors affecting the structure of agriculture in the Amman and upper Tawe valleys. Swansea Geographer 12 60-66.

HENDRY, G.F. and O.J. BEILBY 1957 The small farm in Scottish agriculture. Scott. Agric. Econ. 8 28-41.

HERZBERG, F., B. MAUSNER, R.O. PETERSON and D. CAPWELL 1957 Job attitudes: review of research and opinion. Psychological Service of Pittsburg, Pittsburg.

HESSE, M.B. 1969 Positivism and the logic of scientific theories. In P.Achinstein and S.F. Barker (editors) The legacy of logical positivism. The Johns Hopkins Press, Baltimore.

HILL, B. 1974 Resources in agriculture - capital. In A. Edwards and A. Rogers (editors) Agricultural resources. Faber and Faber, London.

HINE, R.C. 1973 Structural policies and British agriculture. Jnl. Agric. Econ. 24 (2) 321-329.

HINE, R.C. and A.M. HOUSTON 1973 Government and structural change in agriculture. (Final report). The Universities of Nottingham and Exeter.

HOTELLING, H. 1929 Stability in competition. Econ. Jnl. 39 41-57.

JARDINE, C.J., N. JARDINE and R. SIBSON 1967 The structure and construction of taxonomic hierarchies. Math.Biosci. 1 173-179.

JONES, G.E. 1960 The differential characteristics of early and late adopters of farming innovations. School of Agriculture Report, Department of Agricultural Economics, University of Nottingham.

JONES, G.E. 1962 A Bulk milk handling. Farm Report No. 146, Department of Agricultural Economics, University of Nottingham.

JONES, G.E. 1962 B The diffusion of agricultural innovations. Jnl. Agric. Econ. 15 387-409 (with discussion).

JONES, G.E. 1967 The adoption and diffusion of agricultural practices. World Agric. Econ. and Rural Soc. Abstracts 9 (3) 1-34.

JONES, G.E. 1972 Agricultural innovation and farmer decision making. In Agriculture. D203 III Part 2 29-56. The Open University Press, Bletchley.

KENDALL, M.G. and A. STUART 1967 The advanced theory of statistics (Vol. 2) Griffin, London.

KERLINGER, F.N. 1970 Foundations of behavioural research. Holt, Reinhart and Winston, London, quoting R. Braithwaite, Scientific explanation. CUP (1955) Cambridge 14.

KNEALE, W. 1967 Scientific revolutions for ever? Brit. Jnl. Phil. Sci. 19 27-42.

KRENZ, R.D. 1964 Projection of farm numbers for North Dakota with Markov chains. Agric. Econ. Res. 16 (3) USDA 77-83.

KRUSKAL, J.B. 1964 Nonmetric multidimensional scaling; a numerical method. Psychometrika 29 115-129.

KUHN, T.S. 1970 The structure of scientific revolutions. The University of Chicago Press, London.

LINDLEY, D.V. and J.C.P. MILLER 1970 Cambridge Elementary Statistical Tables. CUP, Cambridge.

LONGWORTH, J.W. and W.J. McLELAND 1972 Economies of size in wheat production. Rev. Mktg. and Agric. Econ. 40 (2) 53-66.

LÖSCH, A. 1940 Die raumliche ordnung der wirtschaft. Translated by W.H. Woglom as The economics of location. Yale University Press, (1954) New Haven, Conn.

LYON, A. 1967 Causality. Brit.Jnl.Phil.Sci. 18, 1-20.

McGLASHAN, N.D. 1972 European male stomach cancer in South Africa: a cartographic appraisal. In N.D. McGlashan (editor) Medical Geography. Methuen (1972) London 187-195.

McINTOSH, F. 1969 A survey of workers leaving Scottish farms. Scott.Agric.Econ. 19 191-197.

MACKENZIE, A.M. 1974 Agricultural land prices - Scotland. Scott.Agric.Econ. 24 298-308.

MACLENNAN, D. 1973 A re-examination and reconsideration of the neighbourhood effect in the diffusion of innovations at the micro-scale. Geog.Jnl. 139 (3) 583-585.

MADDEN, J.P. 1967 Economies of size in farming: theory, analytical procedures and a review of selected studies. Economic Research Service, USDA Economic Report No. 107, US Department of Agriculture, Washington, D.C.

MANSFIELD, E. 1961 Technical change and the rate of imitation. Econometrica 29 (4) 741-766.

MAUNDER, A.H. 1966 Some consequences of farm amalgamation. Westminster Bank Review (November) 57-63.

METCALF, D. 1969 The economics of agriculture. Penguin, Harmondsworth.

MIDDLETON, R.L. 1972 ERCC amendments to CLUSTAN 1A. PLS No. 9, Edinburgh Regional Computing Centre, Edinburgh.

MINISTRY OF AGRICULTURE, FISHERIES AND FOOD, DEPARTMENT OF AGRICULTURE AND FISHERIES FOR SCOTLAND and MINISTRY OF AGRICULTURE, NORTHERN IRELAND 1970 The changing structure of agriculture. HMSO, London.

MORRISON, D.G. 1967 Measurement problems in cluster analysis. Management Science 13 775-780.

MOSER, C.A. and G. KALTON 1971 Survey methods in social investigation. Heinemann, London.

NALSON, J.S. 1968 Mobility of farm families. Manchester University Press, Manchester.

NATURAL RESOURCES (TECHNICAL) COMMITTEE 1961 Scale of enterprise in farming. (The Zuckerman Report). Office of the Minister for Science. HMSO, London.

OLSSON, G. 1970 Explanation, prediction and meaning variance: an assessment of distance interaction models. Econ.Geog. 46 223-233.

OPPENHEIM, A.N. 1966 Questionnaire design and attitude measurement. Heinemann, London.

ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT 1964 Low incomes in agriculture. Agricultural Policy Report, Paris.

ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT 1974 Agricultural policy in the United Kingdom. Quoting J.A. Beaumont. The cost of processing and distributing food in the U.K. Economic Trends No. 217 (1971).

ORLOCI, L. 1967 An agglomerative method for classification of plant communities. Jnl.Ecol. 55 193-206.

PARRY, M.L. 1976 The abandonment of upland settlement in Southern Scotland. Scott. Geog. Mag.92 (1) 50-60.

POPPER, K.R. 1965 Conjectures and refutations. Routledge and Kegan Paul, London.

POWER, A.P. and S.A. HARRIS 1971 An application of Markov chains to farm type structural data in England and Wales. Jnl. Agric. Econ. 22 163-177.

RAEBURN, J.R. 1958 Economies of scale in farming. Jnl. Agric. Econ. 13 (1) 72-79.

RAEBURN, J.R. 1972 The economics of upland farming. In J. Ashton and W.H. Long (editors) The remoter rural areas of Britain. Oliver and Boyd, Edinburgh.

RETTIE, W.J. 1975 Scotland's farm occupiers. Scott.Agric. Econ. 25 387-393.

ROBINSON, J. 1964 Economic philosophy. Penguin, Hamondsworth.

ROBSON, N. 1973 The problems of small scale farms. Unpubl. Ph.D. thesis, University of Aberdeen.

ROGERS, E.M. 1962 Diffusion of innovations. Free Press, New York.

ROGERS, S.J. 1968 The elements of agricultural adjustment. Agricultural Adjustment Unit, University of Newcastle-upon-Tyne.

ROSENBERG, M. 1957 Occupations and values. Free Press of Glencoe, New York.

ROSENBERG, M. 1968 The logic of survey analysis. Basic Books, New York.

ROSKAM, E. and J. LINGOES 1969/1971 GKLR MINISSA 1

RUSSELL, T.P. 1970 The size structure of Scottish agriculture. Scott. Agric. Econ. 20 299-325.

SCOTTISH AGRICULTURAL ECONOMICS 1968-1972 — Vols. 18-22. The financial results of Scottish farming 1966/67 to 1970/71. HMSO, Edinburgh.

SCOTTISH AGRICULTURAL ECONOMICS 1968-1973 — Vols. 18-23. The financial results of Scottish farming 1966/67 to 1971/72. HMSO, Edinburgh.

SCOTTISH AGRICULTURAL ECONOMICS 1970 — Vol. 20. The financial results of Scottish farming 1968/69. HMSO, Edinburgh.

SELECT COMMITTEE ON SCOTTISH AFFAIRS 1971-1972 — Land resource use in Scotland. House of Commons Papers 511 (iii and v) HMSO, Edinburgh.

SIMON, H.A. 1959 — Theories of decision-making in economics and behavioural science. Amer.Econ.Rev. 49 (3) 253-283.

SIMPSON, I.G. 1968 — Changes in the structure of Yorkshire farming. Farm Report No. 177, School of Agricultural Science (Economics Division), University of Leeds.

SOKAL, R.R. and P.H.A. SNEATH 1963 — Principles of numerical taxonomy. W.H. Freeman, London.

STUART, A. 1962 — Basic ideas of scientific sampling. Griffin, London.

TAYLOR, P.J. 1969 — The location variable in taxonomy. Geog. Analysis 1 181-195.

TAYLOR, P.J. 1975 — Distance decay in spatial interactions. CATMOG 2, Geo Abstracts, Norwich.

THE CROFTERS COMMISSION 1973 — Annual Report 1972. HMSO, Edinburgh.

1965 — The development of agriculture. Cmnd 2738, HMSO, London.

" THUNEN, J.H. von 1826 — Der isolierte staat in Beziehung auf Landwirtschaft und Nationalökonomie. Rostock. Edited in translation by P. Hall as Von Thunen's isolated state. Pergamon (1966) New York and London.

TURNOCK, D. 1975 Small farms in North Scotland: an exploration in historical geography. Scott.Geogr.Mag. 91 (3) 164-181.

TVERSKY, A. 1974 Assessing uncertainty. Jnl. Roy.Stat.Soc. Ser.B 36 (2) 148-159.

URI, P. (Rapporteur) 1970 A future for European agriculture. Atlantic Paper 4, The Atlantic Institute, Paris.

URQUHART, G.A. 1963 The economics of the amalgamation of agricultural holdings with special reference to the parishes of Glass and Cairnie in Western Aberdeenshire. Unpubl. M.Sc. thesis, University of Aberdeen.

URQUHART, G.A. 1965 The amalgamation of agricultural holdings: a study of two parishes in Western Aberdeenshire. Jnl.Agric. Econ. 16 (3) 405-412.

VLIET, E. van der 1972 The nature of farming on south-west Gower; a study of some factors influencing farmers' choice of enterprise. Unpubl. M.Sc. (Econ.) thesis, University of Wales, Swansea.

VOLLMAR, G.J. and G.A. HELMERS and E.J. RETZLAFF 1968 Wheat production costs and economics of enterprise size in growing wheat in the Nebraska Panhandle. Nebraska Agric. Exp. Stn. SB500.

WAGSTAFF, H.R. 1970 Scotland's farm occupiers. Scott.Agric.Econ. 20 277-285.

WHITBY, H. 1970 Some developments in Scottish farming since the war. Jnl.Agric.Econ. 21 1-17.

WILLIAMS, W.T. and G.N. LANCE 1965 Logic of computer-based intrinsic classifications. Nature 207 159-161.

WISHART, D. 1969/1972 CLUSTAN 1A. PLS No. 8, Edinburgh Regional Computing Centre, Edinburgh and St. Andrews.

WHITBY, M.C. et.al. 1974 Rural resource development. Methuen, London.

YAMANE, T. 1973 Statistics - an introductory analysis. Harper and Row, New York.

YATES, F. 1960 Sampling methods for censuses and surveys. Griffin, London.

ZIPF, G.K. 1949 Human behavior and the principle of least effort. Addison-Wesley, Cambridge, Mass.