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Milk - Cost of production

UNIVERSITY OF OXFORD

WITHDRAWN

A History of the National Investigation into the Economics of Milk Production

1934-1951

PHYLLIS MANNING

THE AGRICULTURAL ECONOMICS RESEARCH INSTITUTE

1960

Price 12s. 6d.

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Foreword

In 1934 a scheme was introduced for the investigation of the cost of milk production in England and Wales. This is a history of the scheme from 1934 to 1951. During these eighteen years the methods of costing were improved, their use was extended and fuller and more reliable data were collected, but there was no real change in principle. In 1952, however, the collection of national returns was suspended for three years and local research into specific dairy problems took its place. The history ends with this development.

The general history and organization of the scheme are described in Chapter I; in Chapters II and III the technical details of sampling and methods of costing are given. In Chapter IV the uses to which the data have been put, and the critical foundations of the development since 1952, are discussed.

The study was completed in 1955. Since then the Scheme of May 1955 (applying to 1955-6 and 1956-7) has been published, and in consequence it has been possible to convert references to it from assumption to fact, but no other changes have been made in the substance of the text.[1] A summary of its provisions is given in Appendix V.

The material used has included papers and minutes of the Conference of Provincial Agricultural Economists and of the Milk Investigation Committee, and information from the Ministry of Agriculture, Fisheries and Food, from the Statistical Division of the Milk Marketing Board and from some of the University Agricultural Economics Departments.

I am grateful to my colleagues at Oxford and elsewhere for information and advice. In particular I would like to thank Mr. C. Pringle of the staff of the Milk Marketing Board who has always given generous and disinterested help to anyone working in this field.

PHYLLIS MANNING.

[1] Though the text was virtually completed in 1955, the final checking of the manuscript which is essential for a paper containing so much detail was delayed at various stages by illness. (Editor—Institute publications.)

Preface

The collection, on a national basis, of figures of costs of milk production, described in this booklet, came to an end after 1951, though after an interval somewhat similar work has been resumed. But the period 1934-51, here covered, may be regarded as the end of an epoch in agricultural economics.

Farm costing first began at about the time of the foundation of the Oxford Agricultural Economics Research Institute, in 1913. In those days the idea was to cost each farm product separately, using methods based on those designed for industry (though most industries now are much more sophisticated in their methods of costing than they were then). The object was to ascertain "the" cost of production of each product. Differences between costs on different farms, of course, would appear; but it was expected that these would be minor, and that the results could reasonably be averaged together to give valid conclusions. It is only in comparatively recent times that agricultural economists have begun to pay as much, or more, attention to the differences as to the averages of cost; to distinguish marginal from average costs and returns; and to understand that we shall make little progress in analysing the effects of a number of different variables, highly correlated among themselves, by just preparing tables in which the effects of each variable are shown separately. The real significance for costs and profits of the different variables (expenditure on food, size of herd, etc.) can only be shown by proper multiple regression analysis (and even then we must be on the look-out for non-linear relations).

Old ideas about the 'costing' of farm products prevailed with little challenge until the 1930's. In Australia to this day the labour of many excellent agricultural economists is wasted, and public and farming opinion confused, by operations which purport to ascertain the average cost of production for certain farm products, and then to use this figure as a basis for Government fixation of prices. No doubt there are many other countries in which this happens too.

Milk was the first product in this country to which these methods were applied on a large scale with semi-official (Milk Marketing Board) or official backing. Dr. Manning's account of the scheme, of its defects and perplexities, of the strenuous attempts to remedy them, makes an interesting piece of recent history. A considerable number of agricultural economists are still working on quite closely related problems. Only a few of them now will have had direct experience of the events which Dr. Manning describes, and therefore would do very well to study the record.

While recording a number of improvements, Dr. Manning has not claimed that all the problems had been solved by 1951, and points out some remaining defects. In the returns of costs entries have to be made,

for instance, for the rental values of the grassland, buildings, and land used for growing fodder crops. When the actual rents of nearly all farms were below economic rents, the use of actual rent figures made costs too low, but at any rate distorted them fairly uniformly. Now, when some farms on modern leases are paying three times the rent of old leases, these discrepancies will become much worse. It is also extremely difficult to ascertain a meaningful figure of cost of farm-grown feedingstuffs—how much of the general overheads of the farm should they have to carry? Again, to devise a proper system of recording the net cost (after selling old cattle) of herd replacements is an extremely intricate matter; and raises intractable theoretical problems.

Finally the problem of farm buildings and their costs has been allowed to go by default. An allowance of 15s. per cow per year was usually made, with a maximum of £2 for improved buildings. Considering that many modern farmers have incurred a capital cost of well over £200 per cow for new buildings, this allowance appears to be far too low.

It is because the difficulties of the work are so clearly and frankly shown that this booklet should make valuable reading for all those concerned with the problem.

COLIN CLARK.

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I.

GENERAL HISTORY AND DESCRIPTION

(1)

Studies in agricultural costing of a preliminary kind were first made in this country in 1913. The system was expanded both in England and Wales and in Scotland during the first world war in order to provide a basis on which to organise satisfactory remuneration for farmers in the food production campaign, and although this scheme collapsed it was replaced by another of a less narrow scope and purpose. By 1926 cost studies were in progress at nearly all the centres of the newly created provincial economic advisory service.[1] These were studies of individual farms and usually covered their whole economy. Dairy farms were included, but when the Milk Marketing Board was set up in 1933 it was realized that co-ordinated information about the economics of milk production would be needed, on a national basis, if the dairy industry was to become the healthy industry that the Board intended it to be.

At the invitation of the Board, and after much preliminary work by the Provincial Agricultural Economists in committee and in their own areas, a 'Scheme for the Investigation of Production Costs and the Economics of Milk Production', generally known as the Milk Costs Investigation Scheme, was introduced for England and Wales in 1934. It took its place immediately as a useful and successful source of information which has become embedded in the central structure of both costing and research, and it has continued in some form until the present time.

It had been running for five years when the outbreak of the war gave it fresh importance, and it continued under a series of short term grants without any real change in technique until 1945. It was then renewed for a further ten year period, but was subject to review at the end of four years and in 1952 national costings were interrupted for three of the remaining five years of the current Scheme in order that the grant might be used for specialized local studies of the industry.

During the first period it was financed by a grant from the Milk Marketing Board of £5,000 per annum. The Ministry of Agriculture did not make a special grant towards it but contributory work was done under its general grant at all the centres. When the Scheme was reconstituted in 1945 the grant was raised to £20,000, and was made

[1] The first Advisory Economists were appointed in 1923 and a scheme was completed in 1924 under which they were appointed to all provincial advisory centres. By 1926 the service was in full running order. Originally there were eleven advisory centres at agricultural colleges, or agricultural departments of the universities, but they were reduced to ten in 1945 when the territory of the 'West Midlands' province at Harper Adams Agricultural College was redistributed among other centres. In 1945 all the centres were attached directly to universities, although they continued to be financed by direct grant from the Ministry of Agriculture and Fisheries. The economists are now known as the Provincial Agricultural Economists and the service as the Provincial Agricultural Economics Service, and these are the terms used here.

jointly by the Milk Marketing Board and by the Ministry of Agriculture, to whom it was now as useful as it was to the Board. Part of this sum, £8,000, was to be used for the conduct of supplementary investigations at the provincial centres. Expenses increased rapidly, but it was not until after the end of the period under review, in 1954, that the Board raised its grant from £10,000 to £12,500 and the finances were reorganized.

The Scheme is under the general control of the Conference of Provincial Agricultural Economists, on which the Agricultural Economics Research Institute of Oxford University is represented, and which is under the chairmanship of the head of the Ministry of Agriculture's Economics Division. The detailed work has always been delegated to a Milk Committee, drawn mainly from the Conference, but during the war it did not meet and responsibility lay entirely with the Conference itself and with its General Standing Sub-Committee. After the reorganization of the Scheme a new Milk Investigation Committee was set up consisting of four members of the Conference and one member co-opted by them, and representatives of the Ministry, the Board and the Oxford Institute. It has greater responsibility than the earlier one had and advises the Conference on the design of the Scheme, controlling the year-to-year changes in it and the publication of the national reports. In relation to the supplementary research projects its function is to act as a source of advice, and as an intermediary between the provinces and the Conference in connection with their research plans and the administration of the grant.[1] The actual responsibility for the scope of these supplementary investigations and for carrying them out rests with the individual Economists, however,[2] and in this way a certain degree of decentralization has been introduced.

All the sponsors shared in the responsibility for the work. The comprehensive costs of a year's work in milk production are obtained by the Economists for a sample of farms in each province. These are made up into summaries, the 'primary returns', and are sent to the Ministry where they are checked and forwarded to the Board. Copies are also sent to the Oxford Institute. The results are calculated in the statistical division of the Board,[3] which has always borne the brunt of this work, although in earlier years it had some assistance from Oxford.

For the first ten years the Oxford Institute was responsible for the annual national reports which were based on this material, but in 1945 the work of preparing them passed to the Ministry. They are now written by the secretary of the Committee (a member of the Ministry staff) and under its general guidance and, after approval by

[1] Since 1955 it has consisted of 4 members of the Conference, the three other representatives, and a secretary provided by the Ministry.

[2] Subect to the approval of their Universities.

[3] The Board also makes routine basic calculations for its own purposes.

the Conference, are issued under the triple authority of the Ministry, the Board and the Conference.

The Oxford Institute played a considerable part in the early stages of the Scheme. Some of the preliminary study before its formulation was done under the guidance of the Deputy Director, Mr. A. Bridges, as well as the critical work of the first year. It still has the right to use the primaries for research and teaching, and it undertakes other work by invitation.

Each province made winter, summer and yearly reports for its own area. Until after 1945 there were too few resources for them to do more, but from then onwards occasional studies began to appear based on the milk records or on information which could be obtained in the course of the required milk work. The formal report itself, which might be given a slant towards local problems, often included material which was not sent up under the Scheme and might be based on a wider selection of farms than that qualifying for the sample.

The significant point about the division of work is that, although the Government and the Milk Marketing Board may use the data for policy purposes and the National Farmers' Union has access to them, the most critical part of the work, the collection of the facts, is done under a guarantee of academic disinterestedness. This is very important. The Economists have always guarded the Scheme against the possibility of any form of partisan approach, and the confidence and anonymity of the farmers have always been respected. It is important also that the role of the Milk Marketing Board should be understood. Although it is the producers' body, and provided the initiative and the original financial backing for the Scheme, its technical integrity has been unqualified. It naturally influenced the original approach in some ways but in none that would have seriously conflicted with a choice made on technical grounds alone.

The Scheme set out to examine the costs of a representative sample of farms, in a series of price situations, in order to discover the trends in these costs, their interrelationship, and their relationship with some of the simpler aspects of management in milk production. If any of these basic terms are forgotten it is liable to be misjudged and to be thought disappointing. The study is essentially a study of change, although a stable picture may be built up from it in the end.

The general purpose as set out in the Scheme of 1935 was 'to obtain and disseminate financial and other economic data of general importance concerning the milk industry in England and Wales'. It has been re-formulated and defined in greater detail since then but it has always been understood that it should provide a basis for local advisory work among dairy farmers, for guidance in price and production policies, and for research into the economics of milk production.[1]

[1] 'The Scheme is intended to produce information for various purposes: firstly to provide an adequate basis for the continuation and, if possible, expansion of local investigation and advisory work amongst dairy farmers and for research work into the economics of milk production, and secondly to provide information which will assist the Government and representatives of producers in formulating price and production policies.' Scheme 1947.

The emphasis may shift between the three, and has done so roughly in the sequence given. There was no doubt that at first the Conference considered the greatest use of the costs to be in management problems. After the outbreak of war this function was a little obscured. The costing was allowed to continue because it was expected to prove useful in the organization of food production; gradually it became an instrument of official price-fixing and by 1945 was used almost exclusively for that purpose. Its wider possibilities were so submerged by then that the newly appointed Milk Committee thought it neccessary to change the title to the 'National Investigation into the Economics of Milk Production' in order to underline them, and the trend continued in this direction until research has now become the main object. A wide programme of this kind is favoured by the Board as well as by the provinces.

There have been three stages in the investigation. The first Scheme established a strict enterprise costing.[1] Costs were allocated as precisely as possible and the dairy herd itself was closely defined. The costs of rearing calves and feeding heifers, and the costs of growing fodder, were excluded on practical grounds, a conventional costing device being substituted, and there was little background detail on the primary return even of a kind strictly pertinent to the actual cost movements.

A certain amount of criticism of technique accumulated during the war, and in 1945 a new Scheme was discussed which, when it was issued in 1947,[2] made important changes. The field of costs was expanded to include the costing of home-grown foods, but it was intended that there should be not only improvements in method but also a general widening of the scope of the enquiry. Little active change in principle resulted at this stage, but the recommendations paved the way for the changes which were made some years later. The national basis remained—it was still a national enterprise costing —but the right of the provinces to attempt less stereotyped work and to undertake basic research was financially recognised.[3] This was followed, when the Scheme was reviewed after four years as required,[4] by a reduction in the size of sample and amount of routine work but the provision did not become really effective until 1952, when the Scheme entered upon its third stage and, the Board being satisfied that cost relationships were sufficiently well established to enable costs to be estimated for the time being, the national costings were suspended for three years in order that local research might take their place.

[1] The costs of a dairy farm as an entity were dealt with later under the Farm Management Survey Scheme. This Scheme was introduced in 1936. The sample is one of some 2,500 farms of all types, dairy, arable, and mixed, and the data cover the workings of the whole farm.

[2] Applying to the accounting year of 1946-7.

[3] The possibility that there might be a wish to do work of this kind was recognised in theory from the beginning.

[4] Revised Scheme issued in 1951, applying to the accounting year of 1950-1.

This makes a decisive break in the running of the Scheme. The price-fixing function had only receded temporarily and national costings were to be resumed in October, 1955, but not in quite the same form. The whole of the dairy herd is covered, including 'followers', and the enterprise cost achieves the completion that was impossible in 1934 at the same time that, in certain circumstances, it approaches the costing of the whole farm. The interval has enabled new ideas to gain acceptance, and the cost tends to be discussed in different terms altogether. It is unlikely that the Scheme will be wholly occupied with the annual series again. Experience has established the need for a combination of central and local research and, moreover, the whole tendency of critical attention is to turn away from generalisation on the basis of the simple average towards marginal analysis, input-output relationships in resource use, and the closer measurement of efficiency generally.

The end of the phase has been taken as a suitable point at which to end this history of the Scheme. The description which follows is the period before 1952, therefore, but unless otherwise stated the principles and methods are those which still obtain.[1]

(2)

The sample is chosen to provide a basis for the examination of the typical costs of production, and to represent the dairy industry as a whole.

Certain general principles were observed. In the first place the costs are those of the producer considered in isolation from marketing.[2] This principle was established at the outset but the broad distinction was a little obscured at first. Three groups were distinguished in analysis—those of the wholesale producers of ordinary and accredited milk, the producers of quality milk selling either by wholesale or retail and, although in small numbers, the producer retailers in their capacity as producers. That is, the analysis included the producers of ordinary milk classified according to their method of milk disposal, and the producers of graded milk, and it was not until 1946 that the position was clarified by the exclusion of the producer retailer. Marketing costs have never been included, however.

The treatment is obviously correct for an enterprise cost, but production cannot be completely divorced from marketing as a general economic problem. The merits of the division have varied over the period. During the war, for instance, the question of winter milk became entirely one of production divorced from market problems and quite unlike that which usually faces the industry. Of more

[1] The Scheme of 1955 is described in Appendix V. As is stated in the Foreword this study was completed in 1955 and comments on the current situation in subsequent pages refer effectively to that date.

[2] The selection of the sample is not directly related to the gallonage produced under the different circumstances, but at the beginning the bulk of the supply came from the wholesale producer who was principally represented.

importance in the long run is the fact that during the term of the Scheme marketing conditions have been simplified and the whole trend is towards standardization in distribution. The producer retailer has already been affected and his omission from the sample become of less consequence. The rationalising of milk rounds and simplification of services during the war reduced his importance, the complexities of handling on the farm which accompany quality of production also tax his resources as a small producer, and compulsory heat treatment of milk other than T.T., within specified areas, affects him still further.

The representation of the dairy industry implies a correct disposition of the sample between types of farming, that is, broadly, between the extensive and intensive systems of production which follow from the natural conditions of grass and arable country or the proximity of towns. Administratively it means that the provinces shall be fairly represented, and this was the point which received most attention. The first requirement was secured in some measure at the same time, since provincial representation, geographical representation and representation of types of farming are closely linked in English dairying, and no other means of achieving a broadly correct representation of type were, in fact, employed. (Knowledge of the universe is defective in any case.) They are not synomynous, however, and there would be a margin for error even if the provincial samples were always made up of characteristic farms.

Originally the sample was to be divided equally between the provinces. The rule was not strictly followed and the Milk Committee of 1945 suggested at its first meeting that sampling should be varied from province to province according to the importance of dairying there. This principle would have ensured the statistical accuracy of the sample as a whole, but it disregarded the needs of local advisory work and a proviso was added, which was the effective part of the recommendation in practice, that each centre should obtain a sample of sufficient size to be useful in carrying out its advisory work. The double function has not been entirely successful. The samples chosen do not necessarily reproduce faithfully the characteristics of the provinces and the true regional variations in costs. This is partly because of the conditions of sampling which gave false importance in some areas to quality milk production during the middle period or, later, by excluding the producer retailer from the national returns, helped to make impossible the representation of whole areas typical of a province, such as the small farming area of East Lancashire.[1] Their place will be taken for this purpose by the local studies which have been developing since the provincial idea became important in 1951; these will probably give proper weight to the geographical emphasis.

In the national reports the provincial results are further confused.

[1] The terms of the Scheme, which excluded butter and cheese manufacturers, limited the representation of the southwestern groups in the first place.

For a long time regional differences in costs were shown in great detail and a summary table is still given. The 'regions', however, although they have similar names, are not those of the advisory provinces but of the M.M.B. This was the administrative arrangement most suitable for the original purpose of the Scheme, but it does not correspond exactly with the distribution of the provincial regions. This is important where there have been differences in provincial practice, as the effects would not be confined to any one of the eleven regions. The dismemberment and regrouping may also mean that the M.M.B. region is even less homogeneous in character than the provincial one.[1]

The original provision was that returns should be made for approximately 600 farms, representing about 0·5 per cent., of the herds in England and Wales. The numbers had risen to 700 by 1938-9 but in 1950 the sample was officially reduced to one of 500 herds (about 0·3 per cent., of the total).[2] Statistically it has been a very small sample for the variety of types of organization and the number of production factors to be examined. This is widely recognized. Elaborate stratification or sub-sorting is impossible, the use of frequency distributions of costs is prejudiced, and more weight has to be given to the average than to the range. The limitation is sometimes exaggerated but basically it was this flaw that led to a fissure in the Scheme in the end.

Apart from the weakness of its size the chief defect of the sample has been its inclination towards the larger herd. This is a well-known bias in agricultural surveys which depend on voluntary co-operation. A full range of herd-size has been represented from the smallest, of under 10 cows, to those of 60 or more, and herds of over 200 cows are recorded, but until 1944-5 the average worked out as 32 or 33 in comparison with 16 in England and Wales as a whole. A bias of this kind has a double effect, as not only does it distort representativeness but in a small sample the effect of one or two very large units of management can be seriously disturbing since the costs used are those per cow and per gallon, not costs per farm. It was partially corrected, however, and by 1946 the average had dropped to 24 cows.

There are other differences from the national herd in the make-up of the sample. There are more producers of category milk, the proportion of pedigree herds is different, and there is more winter production than in the country as a whole. These are evident biasses but it is also thought that the level of efficiency within the group is above the average. Certainly the yield is higher, although this is not a complete criterion and follows in part from the other biasses, but studies of efficiency factors made by the Board support the belief.

All farmers in the Scheme were to be producers of liquid milk. All were to be dairy specialists, which meant, roughly speaking, that more than 60 per cent. of their total receipts were to come from milk.

[1] The geographical composition of the M.M.B. regions and the corresponding provincial jurisdiction is shown in Appendix I.

[2] The sample for the new edition of the returns in 1955-6 will also be of this size but not all of these herds will be used for the standard costings.

(If receipts such as those from culled cows were included the percentage might be higher.) Over the years this requirement has been relaxed. The ploughing-up orders during the war which altered the economy of the farms of the existing co-operators, and the entry of new milk producers in response to price encouragement, strengthened the natural tendency, while latterly size of herd has taken precedence as a qualification when recruits are needed. On most of the farms, however, milk is still the chief interest.[1]

The majority of the farmers selected were to be wholesale producers, who were defined as producers selling 88 per cent. of their milk, or later two-thirds, on a wholesale contract.[2] The remainder were to be producer retailers or producers of quality milk, and their numbers have been governed largely by expediency.[3] The producer retailer group was difficult to handle for technical reasons. It was thought that in his dual role the producer retailer introduced practices which were extrinsic to milk production proper but affected the costs. The group was always small and little use has ever been made of it except for advisory purposes. It was dropped from the sample altogether in 1950. The producer retailer is still a part of the economic picture, however, although a diminishing one, and since his national representation came to an end his costs have been made the subject of special studies in those provinces where he is still important.

The representation of the producer retailer in the capacity of a producer only would have been, in fact, a little misleading in estimating his function in the industry, since the side of the business in which compensatory economies might occur, and by which his economic contribution could be judged, is not shown. His case illustrates the difficulties of enterprise costing and sectional treatment and could be used as an argument for whole farm sampling.

The second group on the other hand is now very important. Quality milk production has gone under a number of names and been the guarantee of a variety of conditions. When the Scheme came into existence the only quality producer financially recognized by the Board was the Grade 'A' producer, who was known later as the 'accredited producer' (i.e. the producer of accredited milk). He has always been classified in the Scheme with the wholesale producer of ordinary milk, making up a major part of the group which is in consequence of a higher standard than it appears to be.

[1] Milk was the main single source of income on 91 per cent of the farms in the first year of the Scheme, and the proportion was similar when the test was repeated in 1949-50.

[2] A certain number of returns were made in the early years of the Scheme for producers of ordinary milk who sold less than 88 per cent by wholesale but who did not qualify for inclusion in the retailer group. They were grouped as an 'intermediate' class for a time, but later were omitted altogether and are now exceptional. Otherwise there has been little waste of the returns, obviously faulty records or records which did not completely cover a year's working being rare.

[3] The ruling under the first Scheme was that the proportion of producer retailers to wholesalers should be in the ratio of 1 to 9, as in the national herd, and that graded producers should not be included at all except as a makeweight.

In 1934-5 there were returns from 18 producers of other kinds of quality milk who were formed into a separate ' graded group '. These were the Certified and the Grade ' A ' T.T. producers, who were the producers of milk from cows which had passed the tuberculin test. They were not included under the provisions of the Milk Marketing Scheme until 1937, when they were amalgamated under the name of ' T.T. producers ' and awarded a price premium. The main differences between this type of production and the accredited are less in the regulations applying to milk than in those applying to stock and buildings.

Other acknowledged quality producers are the owners of Attested herds, and of Accredited and Attested,[1] or T.T. and Attested,[1] herds, all of whom were represented in due course in the graded group of the sample. Herds which are Attested only are subject to the same tuberculin test as T.T. herds, but unlike them are not subject to clinical examination as well, and owners are under no statutory obligation to cull animals suffering from disease other than tuberculosis. The standards of housing and cleanliness of milk are the same as those for herds producing ordinary milk and in 1946-7 they were transferred to the ordinary wholesale group on the grounds of kinship in running costs, and the ' graded ' then became unequivocally the ' T.T. ' group. This was the hierarchy of producers during the period covered. It has now undergone a further change. The accredited category disappeared after September 1954, and from October 1957 all T.T. milk must come from T.T. Attested herds.[2]

The farmers in the sample responded quickly to these opportunities, new co-operators were drawn increasingly from among quality producers, and by 1948-9 the graded group formed 50 per cent. of the whole. By official standards, therefore, and from the point of view of its purity and safety, the general quality of the milk produced on these farms is high. The actual composition of the milk is another matter. Unlike countries which specialise in manufacture, milk is not bought on a simple butterfat content percentage,[3] and fat content plays no part in the records of the Scheme.

The choice of class structure was a realistic one and fitted the main stream of commercial production. Reservations could be made. The representation of T.T. producers, and possibly the provision that the farmers should be dairy specialists, were out of touch for a time with

[1] i.e. the owners of Attested herds selling, respectively, accredited milk or T.T. milk. The term ' Attested ' refers to the herds, the terms ' T.T.' and ' Accredited ' refer to the milk.

[2] The first Tuberculosis (Attested herds) Scheme was introduced in 1935. A revised Attested Herds Scheme came into operation in October 1950, and at the same time a start was made towards the establishment of the eradication areas originally authorized under the Agriculture Act of 1937. The aim is the total eradication of tuberculosis by the compulsory establishment, not only of herds, but of areas which shall be free from the disease. Up to this point, participation in the Schemes has been voluntary.

[3] It receives recognition in the prices system by the premium for milk from Channel Island and South Devon herds.

contemporary conditions in the industry. On the other hand any anomaly in the representation of the producer retailer righted itself. These were misfits of timing. The exclusion of the farmhouse cheese and butter manufacturer might become similarly important in the future on a broader view of the industry and its economic situation.[1]

Technically the Scheme has run very steadily for 18 years. It had the advantage of having behind it the experience gained by the individual Economists in earlier work and, incidentally, of a nucleus of farmers at each centre who were in consequence accustomed to demands of this kind. Moreover it was superimposed on joint work already in progress—a Milk Production Survey to investigate management problems. It was only formulated after long preparation: the preliminary work was very thorough, the method being discussed in committee for more than a year beforehand and the field work tried out experimentally at the centres. It had in consequence an initial technical stability which the later, more complex Farm Management Survey Scheme was to lack. This stability was prolonged by the war, which made change difficult.

The original Scheme was not superseded until the accounting year of 1946-7, although a few modifications were made. Under the Scheme of 1947, however, there were extensive reforms. Important changes were made in the methods of costing home-grown foods and herd replacement, and more physical detail was added to the returns. The sample was modified also. The break is important for the costs affected, but the Scheme itself was rather expanded than broken in continuity. The year 1946-7 was the most disrupted in the series as it was in some ways transitional, the more difficult new methods being impossible to perfect or even to launch immediately. When the Scheme was reissued for 1950-1 there were again slight revisions of technique, but the main change was a reduction in the size of sample.

The costs are strictly those of the milk enterprise, and end at the farm-gate, where the milk is usually collected.[2] Interest on tenants' capital and payment for management are not included as expenses. All running costs are covered, those shared by other farm enterprises being taken in proportion to their use in the dairy.[3] Rent is included in so far as it is a component of other costs. Receipts were not published before 1946-7 although they were usually recorded and held at the provincial offices, and the Oxford Institute made use of them for special Profit and Loss Statements which were circulated to the Economists in the early days of the Scheme.

[1] The distribution of the sample between the types is shown in Appendix 2.

[2] The equity of ending the costs here in every case was contested in 1948 and a pilot survey was made of the costs of transport from the farm-gate to the picking-up point, where this was a short distance away, to discover what difference their inclusion would make. It was finally decided to enter any such costs separately on the primary return so that they might be included when prices were discussed with the farmers at the centres, but they do not form part of the costs proper.

[3] The method of basing overheads on a labour allocation is the one used in the Scheme.

The accounting year runs from October 1st to September 30th, and until 1947-8 the primary returns were made up and sent in separately for the half-yearly periods as well as for the year. These ran from the beginning of October to the end of March and from the beginning of April to the end of September, in accordance with the wishes of the Board, to correspond with the periods of winter and summer prices. They did not coincide as precisely with winter and summer practices and costs, however, and the arbitrary division met with a good deal of criticism from the Economists. They were finally abandoned except for a much reduced winter record, and details of winter and summer production were entered on the yearly primary instead. The costings year itself has met with criticism because it is not completely in accordance with farm practice. Nor does it coincide with the financial accounts year, but this disadvantage was outweighed by other practical conveniences.

The data are taken from accounts kept by the farmer who sends in a record for every week; supplementary detail is obtained by the Economist. Substantially, this is the 'financial accounts' method of investigation with systematic recording. The very small herd might be treated by the 'survey' method, and crop costing introduced a large survey element later. The comparative merits of the two methods are sometimes debated but both appear to have been satisfactory here.

The farmer's record is very complete. It covers all his current working expenses, receipts and production, and gives a good deal of additional information, such as the number of hours spent on dairy work, which can be used for later calculations in the Economist's office of the proportion of general expenses to be charged, etc. The chief exceptions are the original valuations, and physical information about the farm and stock, all of which are obtained by the Economist. The amount of this supplementation is increasing but the main extension of the Economist's work has been in the costing since 1947 of the fodder crops. Before this, the only crop costed was grazing. It is done partly at the farm, with the farmer's assistance, and has sometimes meant that instead of two visits a year three or four have to be made. The Economist's office work has also grown with the use of more elaborate methods of calculation. It has always been substantial, and the provincial staff, in reality, may have to do even more than is formally required of them. In one province it was found that latterly about a third of its farmers were not filling in the weekly forms. Nevertheless, the very active part which the farmer has played throughout is remarkable and the fact that he has had indirect practical rewards should not detract from its recognition. So far from co-operation breaking down, as many as half the farmers concerned in some provinces asked to be allowed to continue to send in their returns when annual costings were suspended in 1952.

For a long time the Scheme was deficient in the descriptive physical data which sometimes provide an explanation of the changes in costs. The full acreage of the farm, with its distribution by pasture and arable

use, and the capital in dairy and other stock and equipment, have always been shown, but such vital information as the type and state of the buildings and the breed of cows, was lacking under the first version of the Scheme. An attempt to compensate for this was made in 1942-3 when the centres sent in 'Supplementary Returns' covering this kind of information, but they were not made for all farms and no published use was made of them.

Since the accounting year of 1946-7 much of the missing information has been collected. This includes a record of breeds and a note on milk recorded herds, which give an improved basis for the analysis of yield. In addition, facts which had previously remained in the provincial office are now entered on the primary return. The quantitative data were greatly strengthened in this way by the inclusion of hours of labour, and the release of the figures of receipts changed the possibilities of analysis. In spite of this, still more quantitative data of a kind that can be intimately related to costs and management are needed. It is a further defect for close analysis that direct information about the quality of input is hard to obtain and use.

The treatment of the data follows formalised lines. Four main groups of costs are taken into account in reckoning the annual cost of production:—foods, labour (including farmers' manual labour), herd replacement and miscellaneous expenses. These are combined into a total, the 'gross farm cost', from which credits for calves and manurial residues are deducted to leave a 'net farm cost', which is the main cost used in general work. All are clearly annual or current costs except herd replacement[1] and part of the miscellaneous charge, and the net farm cost corresponds, with reservations, to a running cost. It is so described, for convenience, throughout this history.

As an average cost figure is the central figure in the Scheme, the way in which it is obtained should be explained in more detail. On the individual farm the net farm cost per cow or per gallon is the result of totalling the amount spent and dividing it either by the total number of cows[2] or the total number of gallons. The sample average is obtained in the same way—total costs for the sample are divided by the total number of cows and the gallonage produced. That is, the sample average is not that of the cost on a series of farms for a series of farmers but the average cost of the million or so gallons of milk produced in the sample and the average amount that has been spent per cow in obtaining this production under the various systems of management represented. The idea of the farm as such is lost at this point; it is only a numerical unit in enterprise costing. Similarly, on the farm itself the average cost is a herd average: the 'cost per cow' is simply an arithmetic conception, not the sort of measurement made by recording societies, and this is a handicap when a close observation of inputs is required.

[1] The inclusion of this charge in the annual costs has a rather unbalancing influence since it has a definite cycle which varies between the regions.

[2] i.e. the total of the average number of cows kept during the year on each farm.

It will be appreciated that the cost figure calculated for the Scheme is not the full cost of production, but as a measure of comparison and of range its value is not greatly prejudiced by the omission of interest charges and a part of the rent, provided that there is a proper stratification so that the large farmers and the quality producers, who use a greater proportion of capital, can be analysed separately if necessary. The omissions are important, however, when the margin between costs and receipts is measured. This margin could not be used before 1946-7 as receipts were not published, and the investigation was purely one of costs—that is, of inputs measured against each other in cash terms, and against output expressed only in terms of quantity.

The basis of the calculations has been annual. It was originally intended that period studies should be made of the costs over groups of years, but the war intervened and only one summary report was written. Except for a few individual studies the reports have taken the form of annual 'interim' statements. This is a pity, for apart from the intrinsic value of a period study in the measurement of trend such an analysis is a justification of historical costing, and one of the criticisms of this and similar schemes is that the information it gives is always out of date. (The delay is protracted by the use of the information for the Price Review as the national figures cannot be released until this is over). The lack of identity of sample is a handicap for some of the purposes of costing. Identity from year to year is fairly high, but it becomes precarious over a period, and the progress that has been made technically under the Government's policy of encouraging a better quality of milk and dairy stock has meant a further loss of strictly comparable farms. (This is the sort of difficulty that attends any continuous costing scheme and that it should be part of its function to measure.) The number of farmers effectively maintaining consecutive records for the whole period was 35, and only 13 of these ran through without a change of grade. The few studies of identical farms that have been made therefore cover only short runs of years.

In the annual statements the framework of the analysis remained almost unchanged until the report of 1947-9. The measures used have been costs (or quantities) per gallon and per cow. There was no measurement during the period of output per acre or per £100 capital for which the data have been less appropriate. The main costs have usually been given for each type of producer separately; frequency distributions of total costs per gallon, and more detailed analyses were based until 1947-8 on the returns of the wholesale group only but are now made for the full sample. The examination of the overruling conditions of production which fundamentally affect the costs—roughly the methods of management—has always taken the form of an analysis by level of yield, by size of herd and by quality of production. A division according to method of milking, by hand or machine, also ranked at one time as a major classification.

In his report 'Milk Production : a study of variations in costs,

1934-5 to 1938-9 ', A. Bridges made use of the data for a more thorough and less narrowly statistical analysis which carried explanation as far as it could be taken at that stage. It was not until after the war that the addition of new material released the analysis from such a rigid stereotype and made other tests possible. The annual reports took full advantage of this and again have probably carried the analysis as far as it was possible to do on the revised basis. Individual costs are examined in more detail than before and in a more relevant context. Herd replacement, for instance, is amplified by a section on the rate of turnover which was made possible by the details of disposal which had been added to the primary. In management analysis there was a rather more selective examination of the pertinent costs, and frequency distributions have been used more often. Studies of labour use have been made since hours of labour were published.

The inclusion of receipts was particularly important. A three-dimensional analysis of all management factors was adopted at once, and the discovery of profitability is now openly an objective.

A number of reports have come from the provinces in the past few years. Some are the results of the recent official research programmes but earlier ones were written on such subjects as seasonality or the age structure of the herd. The M.M.B. has always carried out auxiliary analyses. Most of them are based on the material of the Scheme, often newly introduced data of immediate interest to the Board such as those of breed, or recorded herds, or the transport and delivery charges. A few have broken new ground although they have been carried out by orthodox method. These include studies of efficiency in various guises, such as the series of case studies of low cost producers from the 1946-7 sample, and the later studies of grassland management. The Board has been one of the first and most persistent protagonists for efficiency investigations. Another important study (but drawing on other sources as well) was that of the chemical composition of milk, and a useful contribution to technique was made in a comparison of the results of the old and new methods of costing home-grown foods.

The same classification groups for analysis and similar intervals in the scales of measurement have been used throughout. A few very minor changes were made—a change of convenience from a daily to a yearly basis of measuring yield, a change of method in the measurement of the comparative costs of seasonal and level production along a graduated scale of seasonality instead of in two rigidly defined groups, and a change to meet changing circumstances when the interval of measurement of net farm costs was widened from 1d. to 2d. in 1947-8.

The form of the scales is governed by the fact that it is the average that is measured and by a belief that the results of the sample form no grounds for supposing that the general dispersion and structure have shifted. (The groups at either end of the scale are rather more loosely built up, with the idea of an economic minimum in mind, or of a large herd or yield.) This might possibly be questioned. It is a

little time since the grouping in relation to the average was tested by the M.M.B., although distribution by size of herd has been under scrutiny for the general purposes of sampling. Also, the few examples given in the later national reports suggest that it might be profitable to find out more about the composition of the costs of the farms within the sub-groups. This examination would be essential if the data were to be used to attempt to discover anything about the growing points, the points at which changes in size, etc., become decisively effective in costs. Using the average only, and accepting the sample as a representative one, it could still be asked if an interval of ten cows, etc., is the most flexible class grouping for cost display. Something might be gained by questioning the broader statistical assumptions altogether —the notion of a large herd or a large yield in this country—and by re-scaling if necessary in accordance with new implications. But this is perhaps taking it towards the discovery of the ideal, which is not the object of the Scheme.

The general accuracy of the results depends upon the intrinsic reliability of the costing techniques, the automatic internal check that is present in some of them, and the standard of the actual recording. The fact that this is an enterprise costing means that it is precise and that the destination of any expenditure is properly traced but it also means that an element of calculation is introduced in the shared costs and particularly in the overhead charges, and it is here and in the herd replacement charge, which was a part conventional, part calculated cost, that the chief inaccuracies and discrepancies between the centres are believed to arise.[1]

The accuracy of the methods and the validity of the costs themselves are discussed in detail in Chapter III. Some are almost entirely verifiable, either because of the method of accounting or because they are conventional; a rough estimate could be made of the proportions of each that are automatically accurate or rigid. Briefly, the costing is fairly closely executed, the scale of reliability running down from purchased foods and labour to herd replacement and miscellaneous costs, both of which leave something to interpretation although there is a counteracting conventional element in the miscellaneous cost. The level of accuracy has varied a little over the period. In some ways the war years had advantages. Even in the case of home-grown feeding stuffs, which were at first not directly costed but entered at the corresponding rates for purchased feeds, the very rigid controls of the immediate past could have been a stronger insurance of accuracy than the direct costing today. (This is only true if all transactions were, in fact, recorded.) Otherwise, it would be difficult to say whether the method in use before or after the change gave the more scope for error. A weakness of the new system, shared by the miscellaneous cost, is that it contains an estimate for the overheads which are believed

[1] The whole farm costing of the Farm Management Survey is sometimes thought to be more accurate because of its freedom from this problem of the allotment of overheads.

to be the most dubious of all items. During 1947-8 when the method was 'running in', the cost was at its least reliable. The years 1946-7 and 1947-8 were weak for the herd replacement charge for the same reason. The reliability of this cost has also varied: at the beginning the method was not identical in all provinces, and in the last few years it has involved difficult calculations.

In appraising the intrinsic value of the methods, it has to be remembered that the Scheme was drawn up before the war. In the event, the weaker costs, those for which arbitrary methods of assessment had been accepted temporarily, met conditions for which they were ill-designed. The war with its sudden, uneven changes in price levels put an unforeseen strain on the basic validity of the costing of home-grown foods, and of herd replacement with its capital element, for which there was no immediate remedy.

The reliability of the recording is partly governed by the use of accounts. In practice this is not quite complete. Some round figure treatment is inevitable, and no recorder would completely endorse his farmers' accuracy even if he would their good faith. Every province has its own difficulties, and minor discrepancies in practice occur. All alike have experienced a general problem of shortage of skilled staff and during the war a lack of trained recorders was a real handicap.

Underlying faults or bias are suspected from time to time. There was some disquiet recently, when it was discovered that margins of profit for the producer in the Milk Scheme differ from those of the dairy farmer in the Farm Management Scheme by more than it is legitimate to expect. No doubt natural discrepancies in the field of costs account partly for this. Nevertheless, it is a warning that there is room for scrutiny and that the national average is not entirely irreproachable.

II.

THE SAMPLE

The main changes in sampling have taken place after very thorough research. But there have been other reforms and involuntary changes, some of which, such as those affecting the producer of graded milk, have been rationalised later.

A lenient use of the term 'random' has almost come to be taken for granted in connection with agricultural economic enquiries where persistent work for the farmer is entailed.[1] The Milk Scheme sample has something of the nature of a random sample, within certain defined limits which have become more constricting as the Scheme has progressed and bias has become apparent. 'Purposive' might, however, better convey its nature to those accustomed to strict sampling procedure. Stratification before sampling, by size of herd, has been carried out since 1943. Stratification by provincial location and by type of

[1] The situation is not accepted complacently and experiments have been made, but it has not been found possible as yet to obtain a true random sample for the Farm Management Survey or the Milk Scheme.

producer has also been attempted but less successfully and is not governed by purely statistical considerations.

It is chosen for the examination of typical costs and is roughly representative of the national herd. The interpretation of 'representative' varies a little from time to time, however, as different problems attract attention in turn. At first it meant the wholesale producer of ordinary or accredited milk, as he provided the bulk of the output, and the later inclusion of the graded producer in comparable strength, although partly a matter of expediency, was only an extension of the same principle. Later, ideas became more complex and provincial representation, for instance, was given increasing attention. This has proved difficult to combine with scientific sampling, neither the size of the regional group sample nor its structure by size of herd and class of producer being amenable to strict statistical discipline if a satisfactory local section is to be obtained, and in the end the principle of 'fair shares' formally ousted that of equal sampling fractions.[1]

This is in line with the general policy. It has been the cardinal principle of later years that it is less important that the composition of the sample should be in proportion to that of the national herd than that an adequate number of farms of each type group should be secured for self-contained analysis, the theory being that any deviations from the proportions in the universe can be redressed later by weighting. In 1950, when adjustments to the graded sample were suggested, the idea was taken further to the point of anticipating changes in the universe and accepting a marked temporary lack of balance in the sample in order to preserve its identity later on. Such a treatment has its dangers. It depends on a certain simplicity in the relation of cause and effect, and the actual weighting system may be affected by deficiencies in national data. In fact national weighting was not applied at all during the period because the information did not exist.[2]

The accuracy of the sample has been very much bound up with its structure in relation to size of herd. The inclination towards the larger unit is a notorious weakness of all farming investigations of this kind —the large farmer is usually readier to co-operate and the costing is easier and more economical—but it is probably simpler to offset the effects in a limited survey such as this than in a survey of the whole farm. This was the main bias of the sample and estimates of the probable limits of error have always taken it into account.

The first test of accuracy was made in 1945, on the basis of the figures for the year 1943-4. It was then estimated that, omitting herds of under 6 cows, the sampling error for the current sample of 352 wholesale producers was about 0·3d. per gallon on an average net

[1] This was in 1945 when an administrative redistribution of territory made it necessary to adjust the total numbers between provinces.

[2] This is a drawback that would apply, of course, at whatever point in the investigation a comparison with the national herd was made: good national statistics are essential for the complete success of any sampling scheme. An incidental defect of the treatment is that the average is liable to misinterpretation by the general reader.

farm cost of about 17¾d. It was also estimated that this could be reduced to just under 0·25d. if in addition to changing the limits of the smallest size-of-herd group from 'under 10 cows' to '7 to 9 cows' the numbers in it were increased from 14 to 74 herds, i.e. to 21 per cent. of the whole. This correction was held to be sufficient; an increase of 150 herds, after such an adjustment, would have reduced the sampling error by a further 0·04d. per gallon only. The accuracy of the other two groups, those of the graded producer and the producer retailer, was thought at that time to be less important as their numbers in the total population and the weights given to them in the final calculation were low, but it was suggested that there should be a redistribution of each between the provinces. This was something of a compromise between the theoretical and the practical, like all other adjustments to the provincial samples. The recommendations were carried out gradually,[1] the total number of herds, 650, remaining more or less the same as before.

The next series of tests were made in 1950, when the need for reducing work or suspending the annual returns was first discussed. The statistical implications of the various proposals were investigated in detail. The sampling error for the 679 herds in the 1948-9 sample (those of the T.T. producer as well as the ordinary wholesaler) was calculated to be 0·2d. ± 0·4d., on a net farm cost of about 21½d. That is, the error was less than before. Tests were made of the effects of reducing numbers, and of adjusting size-of-herd structure, both for the sample as a whole and for the individual provincial groups, but once again it was conceded that redistribution along perfect theoretical lines was impracticable in the latter case. There had to be a compromise solution by which the over-all size structure would be reformed but freedom left for adaptation between provincial groups. Nor was any attempt made to discriminate by type; the herds in the T.T. group are the larger.

It was the regional representation which stood in the way not only of reform, but of a drastic reduction of numbers. If provincial analyses had not been needed it was thought that the costing of 100 herds, redistributed by herd size and entailing a sampling error of 0·54d. per gallon, would be sufficient. But the minimum sample for any province, if it is to have local value, is one of at least 40 herds, and the total sample suggested was, therefore, one of 400 herds, with a sampling error, after redistribution of size, of 0·27d. per gallon. The actual recommendation made by the Committee a month later was for a similarly distributed sample of 500 herds. But an increase, instead of a reduction, in the number of large herds was conceded to some provinces.

[1] The reserve of a minimum of 7 cows in the smallest herds was changed to one of 5 and later was dropped altogether. It is difficult to maintain the representation of the small farmer as the active and younger members of the group move out of it. The representativeness of the sample is prejudiced in a number of ways by the small farms.

These reassurances of accuracy only apply to year by year comparisons of a simple, financial kind. However proper for this purpose, 100 farms would have made altogether too slender a basis on which to draw conclusions about anything other than a few major tendencies. As it stands the sample is too small for analyses which depend on complex cross-tabulations. Discussions up to this point had, indeed, rather neglected the use of the Scheme for research, and had concentrated on the immediate needs of a national average cost for pricing purposes.

Nothing further was done in 1950 but the 500 herd sample was taken as the basis for discussions when they were resumed for the Scheme of 1955. The Ministry undertook to make new tests of size and sampling error which would have the advantage of being able to use improved national figures of size-of-herd structure. A radical change was proposed, however. This was, that the full costings should be carried out on 350 farms only,[1] and special investigations into production costs on the remainder, although the data from these might be used to reinforce the ordinary costings. This would meet the criticism that was suggested above—that the tests had been too much related to the price-fixing function—but it was the smaller sample that was to be used for intricate work.

Rather more should be said about representation by type of producer and its implications for provincial representation, either of which has been less subject to control than distribution of the sample by size of herd.

The graded producer was of little importance at the time of the original debates and any principle of representation had to be worked out later. Hardly established in 1934, he was the exceptional producer for a number of years and even in 1939-40 only accounted for about a quarter of the sample. The co-operating farmers have tended to be among the more progressive, however, and by the accounting year of 1943-4 his representation in the sample was held to have outstripped his importance outside it, and haphazard inclusion began to give way to some sort of principle. At that time (1945) the graded sample was still looked on as a supplementary one, but a recommendation was made that it might be increased to 200 herds, the greatest number that it was thought the Economists would be likely to demand. Under the 1947 Scheme, however, any deficiency in the producer retailers' quota of 100 farms was to be compensated from among the graded producers and, as the number of the producer retailers dwindled, this became tantamount to permission to raise the graded sample to one of almost 300 farms.

Later, in 1950, it was confirmed that the graded and ordinary wholesale samples should be approximately equal and the definite ruling was embodied in the Scheme with provision for constant review. It was not justified by the weight of the graded producer in the

[1] The sampling error (as estimated in 1954) would be rather more than ½d.-1¼d. per gallon.

universe, of which he formed only 21·9 per cent. in June 1951, but the type of production had become so important that it qualified on the principle of having ample representation for independent analysis. Some of the centres were urging that an even higher proportion, such as, in fact, the sample was beginning to show, should be formally recognised. A variety of reasons were advanced, including the practical one that it was easier to get the co-operation of this type of farmer and, as a corollary, that as a number change grade each year, replacements of the ungraded—and least willing—producers must be found in any case. (A transitional period involves non-identity not only in the developing group but also in the established one.)

As between provinces it was estimated when the equal-proportion ruling was confirmed that only one, the South Eastern, would be technically able to justify it by 1951, and in the north and midlands, except in the Northern province proper, producers of tuberculin-tested milk would still only account for 15 per cent. of the total. Nevertheless, in 1950-1 they made up 40-50 per cent. of the samples in such provinces as the East Midlands, North Eastern and North Western which were the areas where quality production was least well established.

The bias introduced by over-representation of the graded producer is that of a higher yield[1] and higher returns. But the total costs in the graded and ordinary wholesale groups have been so similar lately that they are now amalgamated for the detailed analysis work, although a few separate calculations are maintained as the similarity cannot be assumed to be permanent.

The producer retailer, in the meantime, had lost his position altogether. In 1934-5 there were 72 producer retailers accounting for about 11 per cent. of the sample. This was in accordance with the principle that they should be represented in the same proportion as in the national herd, and was the largest number returned. An increase to 100 herds was suggested in 1945—the only time an increase was ever recommended—but the expansion did not take place, and by the accounting year of 1946-7 the number had fallen to 26. The returns were disregarded from then onwards in the national calculations. In 1950-1, under the revised Scheme, they were excluded altogether. The decision following the suggestion in 1945 of an increased sample had been, however, that the Economists in those provinces in which the producer retailer was important might obtain a sample for their own purposes, but that it must be a proper one of at least 20 herds and only to be taken if a minimum national sample of 60 was returned. Rather naturally this plan proved to be unworkable and in 1946 it was agreed that in the absence of a sufficiently large national sample the

[1] It was estimated in 1951-2 that if T.T. herds formed 30 per cent of the herds in a province, they would produce about 45 per cent of the total milk. It is in connection with this class that the importance of the sampling being in relation to the producer instead of to production is evident if there is anything haphazard about representation.

provinces might be asked to consider the costing as a research project. This was an open recognition that it was provincial needs and not statistical criteria that should apply, and the experiments might be considered the first of the locally controlled enquiries that are now part of the official system. The changes did not affect the main factor calculations and were important only from the point of view of regional representation.

This is an outline of the main sampling regulations. There is the important question of how, not only of how far, they have been implemented. That is to say, how long did it take to carry out a recommendation, particularly one of a reduction in sample which might easily upset basic rules if made too quickly; what were the effects on identity, as a whole and between the types; what involuntary changes,[1] and unexpected secondary changes occurred; and was there, as feared, any difficulty in finding a sufficient number of the very small herds to sample? Memoranda from the centres on such practical questions would make a useful addition to their current set of statistical enquiries.

There are subsidiary sampling questions. What, for instance, is the bias in relation to specific problems? Or how essential are identical farms and period costs? Some of the newer studies may require different approaches and new safeguards. In the main Scheme the introduction of the costing of home-grown foods brought fresh difficulties. Some of these appeared to be the result of a divided aim. If the crop costs were to be used as separate enterprise costs outside the Scheme dairy specialist farms alone obviously did not provide a proper range of conditions of production, and this objection was stronger still if the Ministry's interest in cash crops was to be covered. For instance, oats are an important dual purpose crop. Conversely, if the costing could not be carried out completely for the whole sample, and a provincial average was used for the farms on which crops remained uncosted, this average might cover too many types to be entirely applicable to the sample. This objection could apply even to an average taken from the sample itself as the drift away from the specialist dairy farm has been sufficient to develop a certain range. If, however, it was confined to its proper purpose of replacing by a realistic measure the feeding value system of recording home-grown foods, and if it could be carried out in full on all the farms of the sample, the objections disappeared.

It was the narrower purpose that was finally accepted, although in fact the costs are used in other contexts, but the full application to the whole sample proved to be impracticable and the problem of the average for use in raising the costs has remained as an integral one. It was agreed that cropping investigations should be carried out on a proportion, probably half, of the farms in the sample, giving weight to those where milk was of the first importance, and on the other farms

[1] These may be inseparable from healthy growth within the industry, e.g. a change in grade of production or size of farm among existing co-operators.

the average costs obtained in this way were to be applied after being adjusted for the variations in yield on each farm. That is, costs per acre rather than costs per unit of fodder crops were generalized, these being more constant from farm to farm than the latter. The ruling was subsequently revised, and transposed in practice for much of the period to half the costs on all the farms. A full costing of all crops on all farms was never carried out.

In contrast to the rest, this part of the costing is made entirely by the survey method. It is carried out in the year preceding the milk accounting year, except in the case of grazing, and forms a self-contained piece of work.

III.

METHODS OF COSTING

In this section the composition of each group of costs is described in detail and, as far as possible, in such a way that their value in the complete structure of costs can be judged. For instance, how far are they accounting costs and how far 'pure' costs, representing simple primary factors of rent, labour, etc.; what is their intrinsic validity and can their accuracy be verified; in what proportions are they the result of direct costing, or so stabilized and conventional that response to changing conditions and the inter-farm range are both obscured?

The changes in costing methods that have taken place during the period[1] and their effects on the construction of the total cost are also described. The changes from year to year in the actual amounts of the costs are not part of the enquiry.

Foods

The cost of foods is the most important cost in the structure and the change in the method of obtaining it that was made half-way through the period is the most far-reaching and ambitious change in technique that took place.

The group covers three classes of foods, purchased foods, home-grown foods and grazing. These are costed separately. Purchased foods normally cover the concentrates; they may be imported but this is not necessarily implied in the word 'purchased'. Home-grown foods are foods grown on the farm for which the return is being made, and cover the bulky foods, the roots, green fodder and hay, and cereals and pulses.

The records of purchased foods are easy to handle and this cost is probably the most reliable of any. They are charged at purchase

[1] A description of the changes made after the period is given in Appendix V, and it is indicated in the text where they have occurred. Except for herd replacement, however, the methods are still substantially as described in this section. Some minor improvements have been made which meet criticisms suggested in the text. These are also made clear in the Appendix.

price as delivered to the farm, including the cost of transport as far as the dairy store. The farmer records the quantity and price of each kind issued during the week, but occasionally he may send in the bills to the provincial centre which enters a figure after deducting an appropriate amount for other dairy stock.

Until 1946-7 home-grown foods were costed by convention, being entered according to their feeding values on the farm in terms of purchased foods (the 'feeding value method'). The direct costing of crops was too big an undertaking to be carried out under the Scheme in the early years and it was thought safe to assume that fodder would not be grown if its cost exceeded that of alternative feedingstuffs. Values for each month, based on the unit rates of starch equivalent and protein equivalent calculated for four main foods,[1] were given in the Journal of the Ministry of Agriculture. As in the case of purchased foods, the rates included some expenses of conveyance. The Economists could modify the calculation by allowing for a district variation if they wished.

The method was on the point of revision when the war broke out. The Ministry had accepted the recommendations of a Departmental Committee on the Farm Values of Home-grown Feedingstuffs but modifications were necessary before they could be introduced in war-time. The recommended method had involved the calculation of unit values of non-protein starch equivalent (N.P.S.E.) and digestible protein equivalent (D.P.E.) by least squares from a long list of purchased feedingstuffs. This list was reduced to 14, and as weighting according to quantity was impossible in the circumstances, and the various allowances, such as that for transport costs, difficult to make, it was agreed that the prices should be the actual costs to the farmers shown in returns made by the Economists. They applied at first to a six-month period but in December 1942 it was decided that one set of values should be used throughout the year. It had been recommended also that an allowance should be made for manurial residues, but this was dropped for the time being. This series started in 1939-40:[2] it was not quite continuous with the old, if only because it was based on N.P.S.E. and D.P.E.

The whole system became unsuitable, however, as the war continued. Home-grown foods formed a much more important part of the cost of milk production and the method, which under free conditions of trade might have been a fairly reasonable one,[3] was difficult to justify. In the first two years purchased food prices rose appreciably more than did farm costs, and the costs of home-grown foods were inflated above their real level. Later, with a ceiling on the price of concentrates, it

[1] Maize and imported barley were taken as representative of starchy foods, and decorticated groundnut cake and decorticated cotton cake as representative of protein foods.

[2] Also from 1939, supplementary information on the use and costs of feedingstuffs under war conditions was given in the Monthly Returns (see p. 57).

[3] Even then the possibility of substitution between types of feedingstuffs was exaggerated.

appeared that the opposite situation would arise. Also, the inherent defect of using a conventional figure and neglecting the real individual variations in yields and costs became more important as the growing of fodder crops increased among farmers who were unpractised in it. A complete change was out of the question, but in 1942 a 'cost index method' of valuing hay and straw was introduced as a preliminary measure. This was half-way to full costing. The average feeding values for the three years preceding the war were accepted as giving an approximately correct idea of the costs of production in those years and were taken as a base which was adjusted for subsequent changes in the unit price of the component production factors. The costs of these factors were raised in the proportion which they formed of the whole.

During the war the Economists had begun to cost certain crops as part of a general enterprise costs programme. Some were on dairy farms and when the new Scheme was planned in 1945 it was decided, after some hesitation, that full fodder crop costings might be introduced at last. The sample basis of the new system was described on pp. 29 and 30. It was some time before it was stabilized and in effect there were three systems. For the accounting year of 1946-7 charges for the main foods were based on cost of production data obtained from the general enterprise costings programme, brought up to date for changes in unit cost of factors and adjusted to national yields. The costs of minor items of feed continued to be determined by the 'feeding value' method until 1950-1. For the accounting year of 1947-8 the original intention had been that all crops should be costed on half the farms in the sample, but this was waived and it was left to the discretion of the Economist to spread the costing if he wished, although it was hoped that it would be made for all major crops on some farms. By 1949-50 this had settled down more or less as a system of costing half the fodder crops on each farm. For the remaining crops the yield was obtained and the provincial average cost applied. (The yields, particularly those of roots and green fodder, were not always easy to obtain.) It was unsatisfactory, however, not to have more farms fully costed and the provinces were uneven in their attempts to adapt a programme that was admittedly too heavy. In order to reduce the work and make it more systematic it was laid down in the Scheme of 1951 that complete costs should be collected from every farm in each year, but for a cycle of crops only, not for every crop. The sequence was to be one of cereals, pulses and their silage in 1950-1, roots, green fodder and their silage in 1951-2, and hay and the establishment of leys in 1952-3. In the event it was only put into effect for the crop year of 1950-1.[1] Under the Scheme of 1955, which was in preparation before the end of the period, the sample is smaller and it is considered practicable to cost all fodder crops on all farms.[2]

[1] For the milk costing year of 1950-1 the number of crops costed was 1442 for 563 farms (excluding grazing and leys); for 1951-2 it was 982 for 518 farms.

[2] Practicable from the financial point of view also; the costing has been expensive and a great measure of success is necessary to justify it.

These sampling regulations did not apply to grazing, which was to be costed, as it always had been, for all farms in the sample.

Such complete revisions of method mean that the series of average costs is discontinuous. Tests have been made of the effects which the changes have had on the calculations and the conclusion appears to be that they have progressively reduced the average charge. The cost index gave a lower figure than the feeding value method and the full cost of production a lower one than that of the cost index. The effect on inter-farm comparisons is equally important. The main object of introducing the system was to ensure a proper range, and for this cost the distributions are held to be of immediate importance. From tests made by the Board during the first year it was evident that there was a wide diversity in cost from farm to farm within a province, depending mainly on the yield. (In later reports a wide variation was to be seen in the costs and yields between the M.M.B. regions, but some of the cost differences may be attributable to differences in provincial method.) At the same time, in the form that it took before 1951, the system introduced a mixture of direct and average costs which inevitably spoilt the true inter-farm variation it was meant to establish.

Crop costing, in fact, brings new elements into the interpretation of the milk costs. With its introduction the factor of accident counts for more. Previously, a fodder crop failure on the farms of the sample would only affect the amount fed, but now it affects both quantity and cost per unit, and that the influence of failure can be very strong is shown in the distributions of costs given by the Board.[1]

Separate cost schedules are used for cereals and pulse crops, roots and green fodder, hay, grazing, and the establishment of leys. The costs cover rent and the improvement of land, seeds, fertilizers and lime, repairs and depreciation of machinery, hedging, fencing and drainage, all manual labour, including contract labour, the hire of machinery and implements, and a share of the overheads and general farm expenses. Rent is apportioned between crops according to their importance and the length of their growing season; the cost of an improvement is allocated to the land where it is made. Fertilizers and lime are entered net of subsidy, and fertilizers are adjusted for residual values brought, and carried forward;[2] the charge for lime is spread over an appropriate number of years.

The labour, horse, and tractor hours spent in each operation are shown and costed. Manual labour is charged at over-all average hourly rates on the farm taking into account the allowances for overtime, etc., and men, women and youths are distinguished. Horse and tractor labour are entered at hourly rates recommended by the Milk

[1] The costs of failed crops are added to those of the following crops if they are the same kind, otherwise they are spread over the costs of the remaining fodder crops.

[2] It is sometimes difficult to find out the composition of the fertilizers in order to calculate the residues.

Committee. There is a suggestion that labour hours and charges became rather more standardized than was intended, which would introduce a minor uncertainty into the cost. Further, the cost of general overheads (which is based in the first place on a labour ratio) is charged against the various crops and the miscellaneous item in the proportion of their labour costs, and the provinces use broad and variously standardized ratios for the calculation.

The timing of the costing, the crop costing year, has sometimes proved awkward in relation to the completion of the cropping programme and the carry-over. Even in the case of grazing, which should be contemporary with the milk accounting year, there may be discrepancies of date in connection with winter grazing. There are other awkward technical details such as the difficulty of determining whether the crop will be ultimately a fodder or a cash crop, or of estimating crop yields, or the value of straw where it is not used as a food. (Costs of grain crops are apportioned between grain and straw in accordance with utilization values.)

Grazing has always been dealt with separately and pasture costs obtained directly for each farm. The component costs were worked out by the Economist and the farmer and the total apportioned between the dairy and other stock on grass according to the number of cow-equivalent weeks of grazing spent by each.[1] The schedule was adapted to correspond with those for the other crops when they were introduced later, the chief changes being in the greater detail for labour, the entry of the hours spent on the different operations, and the addition of a share of the overheads. A share was added of the costs of establishing leys, and of hay and grass silage. Aftermath grazing of fields cut for hay or silage is usually taken as one-third of the cost of the meadows (excluding hay making).

The grazing cost is prejudiced more than other crop costs by the need for apportionment as not only must the grazing of the dairy cows be distinguished from that of other stock on the same pasture—the scale of livestock equivalents being taken usually from the Farm Management Survey—but there is the question of the relative weight to be attached to winter and summer grazing. This is left to the discretion of the Economist because of the regional differences in the feeding value of grass.

It is an inherent defect of the grazing cost that it is impossible to allow for differences in the food value of the pasture, and this is particularly unfortunate as the improvement of grassland was a key factor in successful production during the war and is still one of the progressive features of the industry. Pasture acreage declined in the period but its management became more important. More elaborate studies of grassland, including its feeding value, have been made by the Board, however, and a number of outside studies exist. The questions of composition and the measurement of quality are important

[1] Cows are considered to be at grass when they are grazing for two hours or more daily.

for all home-grown foods. Independent calculations of S.E. and P.E. content are made for these and purchased foods but they are at conventional rates and only apply to foods in bulk. (Measurement of volume is difficult for home-grown foods, except as an average figure, and impossible for grazing.) There are no other standards that can be used under the Scheme in relation to such important questions of the economy of feeding practice as the relative economic values of grass and other foods when nutrition as well as cost is taken into account, or the animal's requirements at different levels of milk output and the possibilities of over-feeding. The cost is only a broad test of feeding practice and efficiency. It is this fundamental weakness that American analyses have begun to compensate recently in studies of marginal rates of substitution in feeds, and feeding studies of a less narrowly analytical kind are among the more popular of those undertaken by the provinces in their independent research.

Questions of feeding practice are irrelevant here, but the changes of balance that took place as a result of the war have a direct bearing since the influence of the different types of costing varied with them. Purchased foods formed more than half the total food cost before the war, and from 28 per cent. to 32 per cent. of the gross farm cost. Home-grown foods were as low as 30 per cent. before the war (17 per cent. to 20 per cent. of the gross farm cost) but rose to 59 per cent. in 1943-4 (33 per cent. of the gross farm cost), and were still 54 per cent. in 1946-7. In 1951-2, purchased foods were again about half, and home-grown foods about 38 per cent., of the total food cost. (These are the figures per gallon for the wholesale group.) From this it may be inferred that in normal times half the cost is completely reliable, and that between 1940 and 1947 much of the real inter-farm variation was effaced in a proportion of the cost varying, with an artificial system of prices, between one half and two-thirds. The subsidizing of prices prevents this from being a consumption relationship for the period.

Labour

The labour cost, as planned, was an exact one but changes in the economy of the dairy farm over the period have given opportunities for inaccuracy in its use. In particular, it is a narrower cost than may be supposed. All labour employed in milk production is costed but the amount entered on the primary and in the published reports—the 'labour cost' proper—refers only to direct work in the cowshed and dairy, and does not include labour employed on the land in the production of fodder crops for the herd.

The wages that are entered for the paid worker cover overtime and insurances, and 'unpaid' family labour is assessed at corresponding rates. The latter is an unrealistic cost if used out of a strictly accounting context. A charge for the farmer's manual work is included but no managerial costs are covered. The total number of hours worked on the farm and those spent on dairy work by each man are entered on the farmer's weekly returns and the Economist's records, and the

total wage is apportioned accordingly. In the case of the cowman the dairy work probably accounts for his whole time but this is not necessarily true for the other workers and it is unlikely that labour cost will coincide with the total wages bill even on a highly specialized dairy farm.

Before the war, the only labour costed for milk production outside the dairy routine was that employed on the pasture, which was part of the cost of grazing. No other labour on the land in connection with the herd was charged, as home-grown foods were entered at feeding value. This was of small account at first. When farmers began to grow more fodder, however, an increasing amount of labour escaped costing altogether and 'labour cost' began to lose its identity with labour use. As wages rose this became an important practical issue and was one of the reasons for the introduction of the costing of home-grown foods. Labour, on the basis of hours worked, was a component of this new cropping cost, but was not added to the original 'labour cost' item. There is no break in the continuity of the cost item during the period, therefore, but it is now less representative than it was of the proportion of labour spent on processes integral to the whole dairy enterprise on any farm. (In recent years it has only represented two-thirds of it.) That is to say, the 'labour cost' in the annual reports no longer represents a labour factor cost. This is the widest breach between 'category' and 'factor' costs in the Scheme. It is recognized in national price-fixing; a 'primary' cost is built up for this purpose which includes not only the 'labour cost' proper but the labour that is employed in growing fodder crops and that covered by the miscellaneous item.[1]

The introduction of a national minimum wage rate in 1940 was important from the point of view of regional costs in general, but the effect on regional variation in the Scheme was negligible. This suggests that little use was made of either unskilled or underpaid labour.

There are other limitations to the use of the cost. It is planned and defined very closely for the purpose of showing the actual cost changes in relation to gallonage. But the values behind the changes are not evident. The primary return does not show the number, age, sex or grade of worker[2] and it was not until 1946-7 that the number of hours worked was given. It would be difficult, therefore, to make a real calculation of man equivalents from the records available for national analysis, or to distinguish changes in quantity or quality of labour.[3] This is not true of local studies as the wages and usually the names of the individual workers are given on the farmers' records.

[1] An estimate of the overhead labour was included in the overheads cost for 1947.

[2] These details are given for cropping on the crop cost summaries.

[3] As an example, in 1951 in one province the hours of labour bought by £1 of wages ranged on 50 farms from 6·2 to 11·6. This difference could be equally well explained by overtime or competitive wage rates, or by differences in quality or in age and sex of worker.

The number of hours worked have always been entered also. Presumably some of this material could be released if it was required.

The addition of hours of labour was one of the major reforms made to the primary return. It is a total figure that is given, without detail. Labour time spent on cropping is given separately on each crop cost summary, and is shown for each operation.

There is another important aspect of the cost estimate. It is generally held to be dependable because the apportionment of dairy to total labour on any one farm is a matter of routine. (As between farms there is, naturally, a very wide range.) The time taken up by the different processes does not admit of much variation, changes in feeding, apart from the major change of adopting a milking machine, being the most likely to have a disturbing effect. This may be less true in the immediate future as job analysis and time and motion studies gain popularity and new routines are adopted—although the stability would be greater eventually—or as buildings and their layout are improved and it is possible that fallacy exists already. There may be justification for saying that the basis of the cost has become standardized and conservative, and that small labour economies are not fully measured. In terms of working time, 'hours' do not measure the rate of performance of any set of jobs (except in cropping and there only roughly) so much as the disposition of a total available labour force. The indivisibility of labour and the way it confuses the appreciation of the total labour economy is a commonplace. It is possible to say that labour is expensive in the single enterprise, but not that it is unprofitably used on the whole farm. From this point of view, the more the farm is specialized to milk production, the more useful the cost.

These considerations must affect its value as a correlation factor in management studies. Its relation to and effect on the combination of inputs that results in increased yield would repay more searching treatment than they have received so far.[1]

Herd Replacement

This is one of the most difficult charges to plan, and to fit afterwards into an annual calculation of costs, combining as it does a capital charge with current expenditure.

The basic formula generally covers the differences between the valuations at the beginning and end of the year, and between the purchases and sales of stock. The difficulties rise from the part of the charge concerned with the valuation, and with this in relation to the varying rates of intake of stock which are intrinsic to different

[1] Studies at Cambridge have given illuminating detail of this kind, e.g. 'Labour Organization in Milk Production', Farm Economics Branch, Report No. 32, 1949. See also, from the East Midlands centre: 'Labour in Relation to Economic Efficiency on Dairy Farms', by Nalson, John S. The provincial centres are the obvious agents for much of the analysis.

systems of herd management and which affect the physical and economic value of the cow at the time of sale.[1]

Within the Scheme the problem has been dealt with by reducing the influence of the original valuation and at the same time making methodical allowance for radical changes in the size and quality of the herd. It is the only time that the valuation appears in the costs formula but its usefulness as a description of capital investment is affected by the treatment it receives here. There is, of course, no question of an interest charge being included and gross differences, as between farms, in the quality of the original stock are supposed to be shown in the yield. Pedigree cows are not valued as such, but at commercial values for non-pedigree cattle of a similar standard of yield, although in practice the valuation is sometimes advanced a little.[2]

The development of the charge, which has been constantly reviewed, has been as follows.

Until 1946-7 it consisted of the difference between the value of the opening valuation, the cows and heifers purchased or the home-bred heifers transferred into the herd during the year on the one hand, and that of the closing valuation and the dairy stock sold on the other. Homebred stock were transferred in at 'farm values'. It was intended that this should mean at cost of production, but even by 1951 it had not been found possible to obtain such costs, and estimated market values were used instead. This was important in some areas, and before the end of the period the spread of attestation had made it a factor of greater account generally.

In the early years there was an important discrepancy in practice. The original valuation is made by the Economist in consultation with the farmer, and it was discovered that some Economists were valuing herds at market price, and revaluing them for the closing valuation at the prices paid for stock purchased during the year or according to the official yearly index of prices of dairy cows. In 1936-7 the stock had been written up in this way in several areas. On some farms, therefore, the valuation of the whole herd fluctuated annually at local market values with the effect, as it was a time of rising prices, of reducing the charge or even converting it to a credit. Other Economists kept the original stock remaining in the herd at the end of the year unchanged, i.e. at 'standard values'. The closing valuation was the opening valuation adjusted for sales and purchases, with newly purchased stock entered at the price paid for it. In this way depreciation on any animal was postponed until it left the herd, and in any one year the charge amounted to the depreciation on the animals sold.[3] Over a period, however, a gradual adjustment of capital values did

[1] A cow appreciates in value between its first and third calving unless there is disease, and depreciates after the third or fourth. She may be sold, while still appreciating in value, to another dairy herd, or sold fat at a loss.

[2] It was suggested in 1945 that where pedigree cattle were bought for milk production only their heavier depreciation might be legitimately charged against milk costs but no rule was made.

[3] It has usually been known as the 'depreciation on cows sold' method.

occur, as the values of the old and new stock in the closing valuation were averaged for the opening one of the following year, but farms were affected unevenly according to their system of herd management. Under an intensive system the turnover was rapid, but elsewhere depreciation might be deferred for as long as four years, and a comparison of current capital values at any one time between farms could be misleading. This latter practice was finally endorsed and made general for the accounting year of 1938-9.

Standard values are unsuitable in times of fluctuating prices, however, and after the beginning of the war the time lag in depreciation was important. In most areas the downward trend in the charge that had been taking place since 1938-9 still persisted in 1940-1 in spite of the increased cost of replacement, and it was reasonable to suppose that it was because of this deferment.

During 1941 and 1942 the subject was thoroughly discussed by the Conference and a series of papers were written which, together with those produced during the later debates of 1945, make a valuable dossier on method. In 1941 the main suggestions were:—

(*a*) that the valuation should be excluded altogether and the charge reduced to the difference between the total purchases and the total sales of the year. Herd stability was to be assumed but if a real change in size occurred, the additional purchases or sales might be debited or credited to capital instead of being entered in current transactions. This eliminated the effect of prices on the valuation, and the effect of the valuation itself on the calculation, and turned the charge into one of net yearly transactions.

(*b*) that the valuation should be retained and the whole herd depreciated each year by anticipating sales according to the average length of herd life in the district. A yearly depreciation would be calculated by applying to the actual costs of entry an average value of the ratio of selling price to cost of entry over the preceding 3 or 4 years, and an average herd life. In this way the valuation and charge would be adjusted to continuous price change but something of a convention substituted for the direct annual charge. By its evenness it would keep more closely in pace with physical depreciation.

(*c*) that the valuation should be kept steady, and a true replacement cost obtained by adding the difference between the price of newly purchased stock and the original value of the same number of animals in the opening valuation to the difference between the amount realized for stock sold and their value in the opening valuation. Replacements were to be entered in the closing valuation, and in the opening valuation of the following year, at the average price of the cows in the original valuation, although the possibility of making some arrangement for adjusting these constant standard values was not excluded. This gave

a more logical current cost and a uniform type of valuation change.

All had disadvantages and it was not until 1946, after renewed debate, that the method was revised in such a way as to combine a strict replacement charge with the system of continuous valuations which is needed if period changes are to be observed. The only ruling made in 1942 was that a detailed statement of the herd transactions should accompany the primary return in the forthcoming year[1] in order to supplement standard values. These were reinforced by the Monthly Returns during the war.

Under the Scheme of 1947, which applied to the accounting year of 1946-7, no change was to be made in the valuation unless there was a significant change in the size or quality of the herd. Where the herd was stable the charge was to be treated simply as a replacement charge, as in the third proposal above, the valuation remaining unchanged. Where there was a change in composition the old basic formula, with an active valuation, was used, but the method of entering new stock into the valuation was changed.[2] If the herd was enlarged the total value was increased by the depreciated cost, not by the full cost, of the additional animals, the new stock being written down by approximately one-third of the difference[3] between the purchase price and the average price received for the stock sold. Following a subsequent reduction in number the total value of the herd was written down on a 'last in, first out' principle, the closing valuation being reduced by an amount equal to the number sold multiplied by the average value of the animals in the group or groups last added or, if there was a quality change as well, of the animals added of a similar type.

In this way, although the problem was not solved, the effect on the valuation was made more orderly as well as the charge itself and, at least in theory, methodical allowance was made for farmers upgrading their herd or increasing its size. This has been particularly appropriate at a time when changes in general conditions and new regulations for quality production are leading to reorganization and the upgrading of stock, although on some farms a transfer to T.T. production means selling the whole herd and making a fresh start.

This method continued in use for the rest of the period. It was a more difficult one for the office staffs to handle, and the conversion was not completed until well into the accounting year of 1947-8. There has been a good deal of freedom and variation in the use of the

[1] This was not, in fact, the only year for which they were received.

[2] Replicas of the formulae are given in Appendix IV.

[3] This was a working convention to meet the difficulty that when there is a greater number of cows in the closing valuation than in the opening one the cost of herd replacement per cow and per gallon is understated, since replacement cost by this method is calculated on the basis of the number of cows in the opening valuation while the per cow and per gallon costs are calculated on the basis of the average number of cows and total milk production throughout the year.

formula, the allowances for change in quality having been particularly difficult to apply.[1]

Another improvement which it was hoped it would be possible to make eventually was in the valuing of home-bred heifers but, although the current method of using market values was unsatisfactory, with its continual danger of divergence from true costs, a change to direct costing was still impracticable and it was thought that the problem, which was a subsidiary one in relation to the charge, must be set aside until the whole field of costing could be extended.[2]

The constitution of the charge has meant that it was particularly liable to be upset by the unexpected changes in prices which occurred after 1939. Its evolution in relation to price levels, as both a short-term and a period charge, may be summarized as follows. By the method which was first used the annual charge was merely the depreciation on the animals sold, with a slow period adjustment in the valuation—which was an integral part of the calculation—to changes in price level. It tended to understate annual depreciation in times of rising prices, and to overstate it when they were falling. In some areas, at first, the valuation was tied as closely to the price level as were the current transactions. After 1946 the idea of an ordinary depreciation almost disappeared: the annual charge became the current cost of replacement and this, although immediately related to ruling prices, was apparently less vulnerable to fluctuations in their level. The valuation ceased to reflect changes in cost altogether unless there had been a real change in the composition of the herd; where this occurred the valuation also was brought into relation with prices, but not in quite the same way as before. It had not been expected that the whole formula would be employed very often, but in fact there has been a change in the composition of many herds since the ruling was made.

On the face of it the rate and size of charge should have been appreciably affected by these changes. Between the pre-war period and the early years of the war one would expect to find a break in continuity in its size in some areas: in 1947 the change would affect all areas equally unless expansion in size of business, or change in quality, has been easier in one part of the country than another. The tendency should be towards a more even annual distribution of the charge.

It would be difficult to say whether any major variation in treatment still exists: there are too many legitimate reasons for dissimilarity in the cost.

The weight in the sample of some of the factors affecting the charge is different from the weight which they have in the national herd.

[1] A qualifying change is not always easy to recognize, particularly in a period of unstable prices. Sometimes a yield test is used (as in the North Eastern province) but time is needed to corroborate it.

[2] The temporary use of an index of farm costs based on expenditure data from the Farm Management Survey was suggested in a Ministry paper in 1941, but the suggestion was not adopted. Costing studies were started before the end of the period in two or three centres.

For instance, the numbers of the T.T. producer, who has a lower cost per gallon than the rest because of the condition of his stock and a less frequent turnover once the herd is established, increased more rapidly within the sample than outside it. But the average herd life of the cow does not appear to be longer than for the country as a whole in either the T.T. or the non-T.T. group if they are considered separately.[1] A high rate of turnover does not necessarily result in a high charge when it is part of a management system however. (In effect an element of dealing is introduced in this case, but it is one that is pertinent to milk production.) In general, as a result of the various influences, the herd replacement charge in the full sample is probably lower than the cost for the country as a whole.

The charge came into the foreground again in the discussions on the resumption of the investigation in 1955. Under the new Scheme the unit for costing is the full dairy herd, including the home-reared replacements, and this brought the whole charge under scrutiny once more. The revision occurs, as it happens, at a time when, for one reason or another, habits of rearing appear to be changing.

Miscellaneous Expenses

The group of miscellaneous expenses is made up of small items which together only amounted to a little over 1d. per gallon on average in 1934-5, and to about 4d. at their highest point in 1951-2. This was roughly 11 per cent. and 15 per cent. of the gross farm cost however.

It covers a rent charge for cowshed and dairy buildings; a depreciation and repairs charge for dairy equipment; milking machine expenses; bull upkeep and service fees; veterinary fees, medicines and disinfectants; consumable dairy stores; general dairy costs and a share of the general farm expenses.

The charge for dairy buildings and cowsheds is arrived at by the Economist in consultation with the farmer. Originally, in the absence of special circumstances, a general charge of 10s. a stall was made: this could be increased to £1 a stall for 'improved buildings'. In 1947 the maximum was raised to £2 in recognition of rising costs, a usual rate being 15s. a stall. 'Improved buildings' are buildings that conform to up-to-date standards (with concrete floors, a supply of water, etc.). At some centres a little is added for later improvements as they are carried out. It was not intended that any interest charge should be entered as such; this would appear indirectly as an increased rent charge after a major improvement.

The depreciation charge for dairy equipment applies to dairy equipment and the other farm equipment especially used for the cows, including that used for preparing foods, but excluding cultivating and harvesting machinery. (Milking machine depreciation is not entered here, but in milking machine expenses.) It was calculated on the basis

[1] Any measurement of the national rate of herd turnover as distinct from the national rate of slaughterings is complicated and imprecise.

of the Inland Revenue scales of depreciation for income tax.[1] In 1946 rather more flexibility was allowed at the discretion of the Committee, which was to keep the rates under review, and this was increased for the Economists in 1950 when adjustments were made to bring the practice into line with that of the Farm Management Survey.[2]

Bull upkeep consists of depreciation, taking into account the expected service life, the buying-in and disposal prices, and feeds and labour charged to the bulls in the same way as to the dairy herd. Any breeding fees received are deducted from the cost. This rather difficult item was the only one to receive serious critical discussion before 1951.

General dairy costs cover Dairy Association subscriptions, milk recording society fees, insurance of cows, and fees for milk tests and weights and measures. A share of general farm expenses[3] is charged in the proportion of the cost of dairy labour to the total labour cost—since 1946-7 the total direct labour cost—of the farm. These two are the largest of the six sub-groups and are those into which the doubtful items find their way.

In 1946-7 the group was expanded to include artificial insemination and overhead labour, and in 1947-8 to include miscellaneous horse and tractor labour on work connected with the dairy other than the delivery of milk. There have been no other changes in content. The methods of calculation also remained unchanged except for the adjustment of standard rates and slight alterations to bull depreciation,[4] but there has been a clarification of detail where experience showed minor variations in provincial interpretation.

As might be expected, it is this group of costs which gives the most room for differences in practice. Almost all items allow for discretion and this occasionally becomes misinterpretation, as in the entry of large interest charges for 'improved buildings'. The cost of power is also troublesome to assess. (It has been suggested that, for this reason, milking machine expenses are more accurate if the machine is run on petrol.) The grouping of the costs may be faulty too; bull depreciation has been occasionally included in herd replacement costs, and the depreciation of the milking machine is sometimes misplaced. Most of these adjustments are tiresome rather than serious, but it is suspected that it is in the calculation of overheads in this cost (and in cropping), that the greatest danger of inaccuracy exists. The total farm expenses are themselves estimates, and the calculation of the labour in proportion to which they are to be charged is also arbitrary. At the same time

[1] Excluding the initial allowance after it was introduced under the Income Tax Act of 1945.

[2] The broad principle is that the figures should reflect the known conditions of physical deterioration and likely degree of obsolescence as closely as possible, and the method of depreciation from diminished value was preferred to that from original cost.

[3] This covers office expenses, management expenses (i.e. paper, subscriptions, etc.), bailiff's wages (manual labour only), travelling and market expenses (cars, subsistence) and other overheads ' (including overhead labour since 1946-7).

[4] Further changes in these two items were made in 1955. Otherwise the miscellaneous cost remains as described.

the falsification can be only slight in proportion to the gross farm cost.

For detailed analytical work the items might be grouped differently. In 1934-5, in ordinary wholesale milk production, 17 per cent. of the miscellaneous cost—the charge for cowsheds and dairy buildings—was conventional and relatively rigid. This is the only really formal part of the entire gross farm cost. In later years it formed a smaller proportion and by 1949-50 was only 8 per cent. on all farms. This might be looked on as a capital charge (although strictly it is rent) and if that for 'dairy equipment, repairs and depreciation' is added, the capital element formed 25 per cent. and 15 per cent. of the miscellaneous cost in 1934-5 and 1949-50. Milking machine expenses had risen from an insignificant figure to 9 per cent. of the total, and bull upkeep was about 18 per cent. in both years. The first might be grouped with labour costs and the second with herd replacement, and little more than half the cost, 55 per cent. in 1934-5, or in later years 58 per cent., would be left as a true miscellaneous cost. This would include the general farm expenses.

The quantities involved in all these sub-groups are trifling, and it is a cost that has little connection with yield, but the miscellaneous group in any costing system is beginning to attract attention, and a more exact idea of its composition is useful.

Although parts of it are conventional, the distribution of the cost is fairly wide. There are undoubtedly genuine differences in individual expenditure. Between producers of T.T. and ordinary milk some dissimilarity in the charges for buildings, bull fees, or veterinary fees and medicines is natural, and even between herds of a similar type the upkeep of a bull might outweigh service or A.I. fees, and the use of the milking machine made a difference of 0·4d. per gallon in 1950-1. But discrepancies of treatment may be equally responsible for the range in expenditure, and a proper examination of the cost, such as that which was proposed by the North Eastern province some time ago, would be a useful piece of fundamental analysis.

Credits

Credits are given for two by-products of the milk production process, for calves born and for manure produced by the herd. Calves are credited at their market price less the cost of marketing if they are sold immediately; if they are retained for rearing they are credited at their estimated value on the farm at 7 days old (4 days in 1934).

Credit for manurial residues of foods has proved to be a disproportionately troublesome item for its size. Before the 1947 Scheme it was obtained by calculating the residual values of purchased foods, home-grown corn and meal and hay fed to the dairy herd according to their N, P_2O_5 and K_2O content valued at unit prices related loosely to current prices of fertilizers. The rates were taken from the tables of Voelcker and Hall, but were reduced by 50 per cent. because of possible loss of chemical content before application. The resulting amount was entered as a general credit item, without reference to

particular use, and was not deducted from the appropriate foods cost. In 1946 the whole question of residual values was investigated by the Scott Watson Committee. The principle of valuing remained the same but the new figures in the tables given in the report of the Committee,[1] which were then adopted, are reduced at discretion in the individual provinces in accordance with the conditions of storage. Alternatively a standard rate recommended by the Milk Committee may be used.[2]

The credits have never amounted to more than 1·38d. per gallon, the level they reached in 1951-2 in the wholesale group.

Capital and Rent

An introductory statement of capital investment per cow, in the form of valuations, and of rent per acre, has been given at the beginning of every report until recently, but neither capital nor rent enter completely into the running costs. The points at which they do so have been covered already in the discussion of the individual costs.

Less direct use is made of capital than of rent and it is held to be a rather unreliable item. It is not a complete statement of farming capital and its treatment is unsystematic. Interest charges are definitely excluded but charges for depreciation and, with considerable irregularity, for improvements or upkeep are allowed. Practically no official allowance has been made for revaluation of the original investments following rising costs or changes in money values.

The statement of the valuation made in the reports covers capital in stock, and capital in machinery at depreciated original cost. Total investment, in these terms, was made the subject of a special analysis of the sample data for 1949-50, but suggestions that the material should be reinforced were rejected because of the work involved. Descriptive physical details of the farm were added in 1946-7 and the strengthening of the data on breeds—and the incidental information about disease in the stock disposals section—had a direct bearing on the interpretation of the costs, although they were of little statistical value. But the whole question of the effect which capital investment, in quality of stock and in machinery, can have on the running costs is passed over except for the very general implication of the division between T.T. and non-T.T. herds. The main interest of the figures as they stand is in their illustration of the differences in investment in these two groups.

The stock valuation is made in two parts, that of cows and that of other dairy stock. The latter was entered only for background interest during the period and did not reappear, but the valuation of the milking herd is linked with the accounts through the herd replacement

[1] 'The Residual Manurial Values of Fertilizers and the Manurial Values of Feedingstuffs.' Under the 1955 Scheme the rates calculated annually by the Scottish Standing Committee are substituted for those of the Scott Watson Committee.

[2] The Scheme of 1947 originally provided that only the farmyard manure used for cash crops should be valued; that used on fodder crops should be omitted from both credit and costs. But the onesidedness of the treatment, as well as the intricacy of the calculation as it then stood, roused considerable criticism and the ruling was abandoned.

charge. The original valuation is made at market value but subsequent changes in its level have been largely dependent on the method of charging herd depreciation. The valuation might, in fact, be said to have been almost a by-product of the herd replacement charge after a certain number of years, and its adjustment in this way to changing values has been awkward and incomplete. After 1947 there was less infiltration, the valuation reflecting only changes brought about by the improvement of quality or the building up of herds.[1]

There is little important machinery used in dairying except the milking machine. Even in the T.T. group it was only 9 per cent. of the total valuation per cow in 1949-50, and 8 per cent. in the non-T.T. group. The milking machine is considered so important, however, that its possession provided a sub-classification for the main analysis until recently.[2] The purchase cost is not entered, but depreciation is allowed. Purchases of small items are recorded with the depreciation charge for dairy machinery and equipment in the miscellaneous group.

Buildings might have been included in capital equipment but the allowance made under miscellaneous expenses (p. 42) is properly one for rent. The primaries do not show whether the farmer is an owner-occupier or a tenant so that the finer points of distinction between capital and rent could not be made in any case. As it is conventional it would not have reflected in its capacity of rent any rise in land values which could have occurred during the period. But in 1947 the allowance was raised and this was a definite concession to changing money values.

The average rent per acre is given at the beginning of all reports: this is the rent for the whole farm, including buildings, irrespective of the proportion of the land used for dairy stock. Its value lies in the general indication it gives of the quality of the land occupied. A proportion of the rent of the farm reappears in the running costs, however, but before home-grown foods were costed it entered only into grazing costs, and into the miscellaneous costs through the charge for buildings. Now, on those farms where the land is used for cropping, the rent may be almost completely covered. At the beginning few farmers grew their own fodder and the under-representation of the charge occurred chiefly in the years between the beginning of the war and 1947-8.

Land has been neglected as a factor: studies of production per acre have been undertaken only recently, and on a local basis, but there is no real barrier to them.[3]

[1] The two are brought into a closer, if rather different, relationship again through the major change in costing made in the 1955 Scheme.

[2] This has fulfilled its purpose, as the use of the machine has become general, and the comparison has been narrowed to that of its effects on yield and labour costs, with which it is properly associated.

[3] Under the new Scheme, greater detail of land use has to be given, with the development of this branch of the study in mind.

The Structure of Costs

The structure resulting from these costs may be very briefly described.

The two important general measures of the trend of costs are the horizontal or inter-farm range, and the cost structure or position of the individual costs in the total. More use might be made of the first. (A wide range of costs of production is a traditional characteristic of agriculture.) No comprehensive tests have been made of the distributions of individual costs and their range over the years and in comparison with each other.[1] Distributions of net farm costs have been given regularly and, as might be expected, their dispersion spread as conditions changed with the war, especially at the upper end of the scale. In a period comparison of five pre-war and five war years for 63 identical farms,[2] however, it was found that averaging the costs over three years or more brought about a contraction in the range. This was true of the pre-war period as well as of the later, abnormal one.

For the purpose of price-fixing it is the vertical structure that is used, but it is not made up of the costs as they are grouped in the Scheme (the 'secondary' costs) but from the 'primary' costs, that is from their prime constituents of labour, rent, etc., for a single yield group, corresponding to the average yield for the country, of all farms sampled in England and Wales, Scotland and Northern Ireland. There have been temporary changes in the vertical structure, but as some costs were stablized and it was not a 'free' structure between 1939-40 and 1949-50, corrections for subsidy and rationing would be necessary before a real appraisal could be made. The dropping of the conventional valuation of home-grown foods is also relevant. Of equal importance in judging change is the stability of type representation in the sample: a correction should be made for management. If the cost structure has changed, is it because a rise in prices has altered the intrinsic relationship through the cost or quantity used, or is it because there has been a change in the farming type structure of the sample? This is more important in the case of the secondary structure, as the primary structure is to some extent safeguarded by its stratification by yield.

The primary structure has altered very little from year to year since it was finally established late in the war, except for the displacement caused by the removal of the feedingstuffs subsidy. Since this occurred, purchased foods have risen in the structure by some 5 to 6 points. The corresponding reduction appears to have been in labour and rent. The comparable secondary cost structure for England and Wales, for wholesale farms only but for the total sample of these, can be taken for the full period. It shows a change during the war years in all three major costs, but the interesting thing is that since the removal of the subsidy it is tending to revert to its earlier composition in foods and

[1] Some were made for an identical sample of wholesale farms in 1938-9, 1943-4 and 1946-7. 'Some Changes in the Distribution of Milk Costs', *Farm Economist*, Vol. VI, No. 9, 1951.

[2] Agricultural Economics Research Institute, Oxford (unpublished).

labour. This would seem to imply that a similar type of management structure obtains. The principal displacement has been in the herd replacement charge. The changes are shown in the table below:

STRUCTURE OF SECONDARY COSTS: INDIVIDUAL ITEMS OF COST PER GALLON AS PERCENTAGE OF TOTAL (WHOLESALE GROUP)

	Foods	*Labour*	*Herd replacement*	*Miscellaneous*	*Gross farm cost*
			per cent.		
1934-5	58	21	10	11	100
1935-6	55	22	11	12	100
1936-7	58	22	8	12	100
1937-8	61	19	9	11	100
1938-9	58	21	9	12	100
1939-40	63	21	4	12	100
1940-1	65	20	4	11	100
1941-2	60	23	5	12	100
1942-3	57	24	7	12	100
1943-4	56	24	8	12	100
1944-5	54	25	8	13	100
1945-6	54	25	8	13	100
1946-7	52	27	8	13	100
1947-8	51	28	8	13	100
1948-9	52	27	7	14	100
1949-50	57	24	6	13	100
1950-1	58	23	6	13	100
1951-2	58	24	5	13	100

IV.

THE APPROPRIATENESS OF THE SCHEME IN USE

(1)

The Scheme has been put to three uses, management and advisory work, straightforward costing in relation to policy making, and fundamental research into the economics of the industry. It has had a similar degree of success in all three functions, although the second has received the longest official encouragement owing to the war.

Its usefulness for farm management and advisory work has probably been the least direct. The farmer is more concerned with individual than with average results, and even averages for all or a selection of the sample farms in his area, which most centres send him with a statement of the costs of his own farm,[1] may not be of directly constructive interest to him since no area is entirely homogeneous. Nevertheless they are suggestive, and his belief in the value of the Scheme was proved when he continued to send in his returns during the years when national costing was suspended. To the Economist the data collected, which have always been ampler than those published, make a quarry of local information that is valuable as a basis for general

[1] Oxford also issued national summaries of the 1938-9 and 1939-40 costs for distribution to farmers (Oxford 1940 and 1942).

advice and for the building of efficiency standards,[1] even if the actual problems that crop up in day-to-day work are not always directly referable to it.

One of the greatest weaknesses of the Scheme from the practical angle is the impossibility of measuring exactly from it the results of small changes in the individual economy—the 'more or less' that is the ground of marginal analysis. It does give a hint of the probabilities—of the results, for instance, of increasing the size of a farmer's herd—but for really exact planning it is likely to be superseded, as the activities of the centres expand, by the newer and more expensive methods of farm budgeting, etc. Its other weakness, its lack of relation to the whole farm, which the farmer himself dislikes, is inherent in an enterprise cost. The Farm Management Survey has a great advantage here and is probably the more popular and useful source for advisory work.

It would be out of place to discuss in any detail the application of the Scheme to advisory work. Difficulties are more likely to be threshed out at the provincial offices than to be brought immediately to the Conference—the aims do not conflict with those in the wider field—but a stimulus was given to such discussion by the research carried out by American economists when they spent some months at the British advisory centres a few years ago. The formal meetings of more junior members of the provincial departments which now take place occasionally, will help to expose weaknesses of method and harmonise provincial practice. A broader idea of this function of the Scheme has been developing recently. Cambridge, for example, is making suggestions in the field, and a number of the provincial research projects are concerned first of all with these problems.[2]

The uses of the Scheme in policy and research may conveniently be discussed together. For both purposes the outbreak of the war made a difference, and the discussion falls naturally into two periods, that from 1934-5 to 1938-9 and that from 1939-40 to 1951-52. In the first period fundamental research is more important; in the second, except towards the end, conventional costing for price-fixing.

(2)

The Pre-war Period

The period before the war was the normal one. The Scheme was not used for expediency or warped by over-insistence on one purpose. The Government made little use of it and in so far as it was a basis for price negotiations it was for those of an ordinary (but state supported)

[1] C. H. Blagburn of the Agricultural Economics Department of Reading University some years ago initiated studies of the measurement of business efficiency from this type of material (using either the average or the upper part of the range) for his work as a liaison officer between the National Agricultural Advisory Service and the Provincial Agricultural Economics Service.

[2] See S. R. Wragg's paper to the Agricultural Economics Society in July 1954. 'Progress and Prospects in Farm Management Liaison Work' for a thorough discussion of such advisory problems.

monopoly. This makes the period the basic one, in which it should be possible to distinguish the true factors in the economy, but it was cut short by the war at the end of five years and test conditions were upset. There is a certain risk, therefore, in accepting conclusions drawn from the pre-war Scheme as hard and fast and as the foundation of further lines of analysis or of plans for the development of production. Moreover, its historical position puts it in danger of being read as the ideal instead of the representative. There were also, unfortunately, fewer data for this period than for the later one, particularly of an explanatory kind, and the absence of figures of receipts from the primary returns affected its value as a standard in measuring the reasonableness of economic changes during the war.

The report of A. Bridges, mentioned earlier, is the best reference for the period. It sums up the results of the five years' working and examines the relationships and principles that may be inferred.

There are two relationships that might be expected to show some permanence, that between yield and costs, and that between size of herd and costs. The effects of the other major variables of management —of seasonality, quality of production, or the use of the milking machine—are rather more dependent on current resource prices, or on the date of their introduction into the industry and the experience gained in their use.

The conclusions that can be drawn with any certainty prove to be much the same as those that would be produced by a diagnosis based on general knowledge and unsupported by figures. A consistent relationship between yield and cost per cow was evident. Food, labour, and total costs all rose with yield, the rise in net farm cost being most marked before the highest yield. Herd replacement, which might be high or low in relation to a high yield, according to replacement policy and quality of stock, rose less consistently. The difference in output was sufficient, however, to offset the extra costs and make them economically worth while. Net farm costs per gallon declined steadily with rising yield until the last advance to a yield of over 2·50 gallons per cow per day was made. This is a measure of the average cost of maintaining a high-yielding herd, not of the amount spent on any individual high-yielding cow.

The effect of size of herd on costs was indeterminate. Net farm costs per gallon were high for the smallest herds and low for the largest, but no particular relationship obtained over the rest of the scale; the one consistent factor was the higher yield in the smaller herds. A link with labour was fairly well established, however. Its cost per cow declined with size, and although the trend in cost per gallon was less consistent the groups of herds of under 40 cows had costs above, and those of over 40 cows had costs below, the sample average in nearly all years.

Later analysis, which may be summarized here for convenience, did

not seriously shake these conclusions.[1] The same sort of relationship was maintained between yields and the total and individual costs, and a high yield was still worth attempting. Between size of herd and cost the relationship was uncertain again, although between 1947-8 and 1950-1 net farm costs per cow declined as size increased and, after 1947-8, the smaller herds having lost their advantage in yield, net farm costs per gallon declined also. The labour/cost relationship held good and was stronger than before in the case of cost per gallon.[2] The inconclusiveness is encouraging to those who believe in the usefulness of the small herd, and perhaps to those critics of general agricultural policy who think that one of the most serious of contemporary problems is how to obtain working economies without increasing production. Lack of a hard relationship is not altogether surprising when the intricacy of the economy in connection with size is remembered. Even the differences that exist are not always explained simply. The efficiency of the very small herd may be arbitrary; it is often on a family farm operating under rigid conditions of land and labour. On the other hand in larger herds, where there is some flexibility of working, labour cost may be low because that is the particular economy the herd has been organized to obtain, not because it is an automatic economy of scale.[3]

The explanation of the sequence of the costs belongs broadly in fact, to the province of farm management. Bridges discussed cause and effect along these lines and in later reports a similar if less exhaustive commentary has been made. In these it was possible also to examine the sequence of some of the individual costs, and cross-association of relevant factors, in a way that could not be done in the first period.

Of other comparisons of policies of management that might be made, that between ordinary and quality milk production, which was a comparison between an established process and one that had been recently introduced and that was without settled characteristics, had already begun to change before the end of the period. At the beginning, T.T. production was much the more expensive in spite of a higher yield; later the gap in running costs was narrowed. But the costs of conversion are known to be heavy, and if interest charges had been included there would still have been a wide difference. The T.T. group was made up at first of larger farms, with more milking machines and general equipment, and this is still true on balance. Seasonal and level

[1] The earlier analysis was made for the wholesale group and some of the figures were averages for the five years. The later one was made on an annual basis, and after 1946-7 for wholesale and T.T. herds combined. An important technical point in the case of size of herd is that the sample was then more evenly distributed between the size groups.

[2] Labour cost in the case of size of herd is connected directly with the use of the milking machine. This had increased in all groups, however, including that of the smallest herds.

[3] It would be interesting to have provincial studies of large herds to find if any had been reorganized to secure economy in a particular basic cost, such as labour or bulk feed.

production were not closely analysed in the annual reports; it was not until 1947-8 that a comparison was made of the full yearly costs of production on a graduated scale of seasonality, running from a winter production of 36 per cent. to one of 60 per cent. and over. Before the war it was the costs of the summer and winter months that were compared and these could not be separated easily. Moreover, a high level of winter production affects costs over the whole year. Bridges made the distinction between seasonal and level producing areas a basic stratification in his report, the criterion of seasonal production being, for each area taken as a whole, a summer output of 20 per cent. more than that of the winter, but this was naturally very broad[1] and the real value of the comparison was that it discriminated the general conditions of organization.

These readings of the scales 'in the flat' appear to show that there are certain associations of cost and levels of yield or size for the farms of the sample which have been sufficiently persistent to be accepted as genuine relationships, in spite of statistical shortcomings. Their establishment is important, both for the theory of the industry and for policy,[2] in determining the effect of price changes on the costs themselves and their repercussion in the whole organization, and to this extent the period did give a lead. But this is as far as it is legitimate to go. It would be superficial to consider them as anything except partially descriptive of the problems involved and their value depends on the use made of them. It is a different matter also to read them as measures of maximum efficiency or of the cost of improvement. In the case of yield a natural clarification of the costs occurs in passing from the lower to the higher yielding groups, as the cost of the maintenance ration as well as that of the overheads becomes relatively less important, and this gives an opportunity to measure the additional running cost of obtaining a really high yield.[3] There is nothing comparable in the case of size of herd. A good deal depends on the scale chosen and the intervals might be varied. Where the group averages were broken down in the later national reports the distribution of costs within each class was seen to be quite wide. This is particularly important if a real attempt to measure change is to be made; many of the changes must occur within the class intervals chosen and so escape observation altogether. But the difficulty of finding more suitable ones is evident from reports of the M.M.B. in which there have been latterly two sets of tables for yield, size, and seasonality, the intervals

[1] It was the sort of broad type-of-farming area grouping that was by-passed in sampling.

[2] The possibility of establishing a clear differential for size of herd in such a cost as labour is obviously important in any price policy based on compensation for increases in costs.

The relative economy of the two relationships, of costs and size and costs and yield, would be important for policy if it could be traced, since an increase in size of herd does not necessarily ensure a corresponding increase in output, and a greater intensity of production within a rather inelastic size unit is often a more practical response to higher prices than an increase in herd would be.

[3] i.e. ignoring breed and capital expenditure.

for the introductory tables being about half those in the tables of detailed analysis. Here the finer sorting does not always make a significant difference, although it occasionally locates more exactly the areas that are responsible for group averages being high or low. A. H. Maunder in a later study of hours of labour,[1] made use of analysis of variance to measure change as between herd sizes, but this type of analysis is still insecure on the present data.

It is difficult to see that anything more could have been done during this period. The elaboration of method, the cross-reference to individual costs and the singling out of those that are relevant have only been possible since there were more data, particularly of a quantitative kind, and this was a development that did not take place until after the war.

The Period from 1939-40 to 1951-2

During the second period, that from the beginning of the war until 1952, the Scheme was brought into practical and official use. The data were examined as the background for price-fixing and for solving a wide range of unusual problems on a national scale, and local and management interests took a second place. The effectiveness of the Scheme in these years has to be judged, therefore, not only as a continuation of the earlier series, but in relation to a new set of requirements, some of which could not have been foreseen when the Scheme was started.

The conditions under which milk was produced were, of course, abnormal and there were drastic changes in economy, but although the period was very different from the first it would not be quite true to say that it was one of instability for the farmer. Control was as important as scarcity and the government action that was taken to iron out irregularities caused by emergency conditions sometimes introduced more uniformity than was customary.

Nevertheless the dairy industry, at least at the beginning of the period, had to adjust its economy to an expanding and assured market on the one hand, and to shortages and uncertainties in the supply of raw materials on the other. The first set of conditions was a complete reversal of those under which the Scheme was started. The effects of the second, the conditions of supply, were complex and are not easily traced. Ordinarily there is little fundamental change in either methods or resources in the dairy industry. Technical innovations and the introduction of new processes are infrequent, but this particular period saw a great expansion in the use of milking machines and in the production of quality milk. This would probably have occurred in any case, but the pace of introduction of other new processes was undoubtedly speeded up by the war, the use of silage being an outstanding example. Techniques were introduced which were new altogether to many of the farmers, such as the growing of fodder to compensate for the loss of feedingstuffs from overseas, or new in the extent of their applica-

[1] 'Labour in Milk Production II.' *Farm Economist*, Vol. VII, No. 3, 1952.

tion, as in the feeding of roots and green fodder. In resources, the loss of concentrates was the most serious abnormality, although difficulties in obtaining livestock also upset the intensive-producing areas and affected herd replacement costs. In other ways it might be said that the abnormal period, after the first year or so, was steadier than the normal.

The controlling factor of the period for the Scheme is that it was subordinated to government use. This affected the object and emphasis of costing. The policy of encouraging a plentiful supply of milk had to be implemented first by smoothing out the tangle created in supply conditions, and secondly by fixing prices which would not only recoup the dairy farmer and maintain him in production but induce him to produce more. The first was accomplished by rationing and other means that are irrelevant here. The second, in so far as it was the concern of the Ministry of Agriculture, was the point at which the Scheme was introduced officially. Changes in cost are only one determinant of policy, however, and the Milk Scheme is only one source for their discovery.

Costs in relation to prices were originally a domestic matter concerning the dairy industry as a whole, and particularly the relationship of producers and distributors. They are now always thought of in connection with the Annual Price Review. This is the final and permanent form of the machinery which was set up early in the war. The principles of price-fixing have varied but the technical means of determining costs, at least in the case of milk, have remained much the same throughout.

There are three stages in the technical part of the Review: the assessment of aggregate net farming income, the assessment of its variation for different types and sizes of farm and the calculation of the changes in the cost of production of individual commodities. The data of the Milk Investigation Scheme are used at the third stage, to which it makes a solid technical contribution as a properly sampled and verified set of facts. (At the second stage, the factor used is not the profit from milk production but the income from ' dairy farming ', that is, from the whole dairy farm.)

The application is not a literal one. For this last stage of preparation for a Review the cost structure of each of the more important farm products is analysed to discover the relative importance of the main items in the total running costs of production. The general changes that have occurred in these costs since the preceding year are then measured and the structure adapted and brought up to date accordingly. That is, in the case of milk the Milk Investigation Scheme provides the weighting, the weights being in terms of cost. The change in unit cost is then worked out from the general data. For the Price Review ' costing ' is therefore more a matter of relative than of absolute values.

The data are not used for the structure exactly as they stand. The various groups of costs are broken down into their elements and rearranged as ' primary costs ', or basic factor costs, expressed as per-

centages of the total running cost. For instance, the labour used in growing fodder crops is taken from the cost of home-grown foods and, together with that derived from the herd replacement charge and from the miscellaneous costs groups, is added to the direct dairy labour to obtain 'primary labour cost'. This is closer to the concept of 'input' than the ordinary classification.[1] The primary costs extracted are: labour, machinery services, depreciation and repairs of equipment, rent, fertilizers, seeds, purchased foods, fuel and oil, and sundry costs. Herd replacement, the cost with an element of time-lag, is not a primary cost. It is assumed that the cost structure of dairy herd replacements is the same as that for milk and it is divided between the primary costs accordingly. Rent is that of the buildings (from the miscellaneous charge), of pasture land (from grazing), and of tillage used for fodder. Further, the structure to which the general unit price changes in cost over the year are applied is not that of all farms in the sample but of the group of farms with the yield closest to the national average yield for that year.

The time sequence is a slow one. The structure or weighting is that of the costings year ending in the September a year and a half before the Review; it is brought up to date by applying the known changes in factor costs that have taken place since the costing period.

The English Scheme is not the only source drawn upon and the figures include those collected similarly for Scotland[2] and Northern Ireland, the combined costs being weighted according to the total production of milk in the three countries.

The chief weakness of the sample, in this as in its other uses, is that it is very small when it has to be subsorted.[3] The sorting made, by yield, may give a total of only about a hundred farms. Any others have to be disregarded, but the adoption of a single yield group, which neutralizes an awkward factor, can be held to be something of a short cut to the rest—to some degree of uniformity in type of management systems, that is in such aspects as intensity of feeding. The statistical effects of the size-of-herd structure of the group are partially controlled in the selection of the sample. Cross-classification by scale is probably less important in any case than it would have been in industry.

In some ways the composition of the sample was favourable for war-time use. The original regional bias gave a preponderance to the North-western area, and this was appropriate later as it was the area where the effect of shortages of purchased feedingstuffs was felt the most. (The South-eastern region also had a large quota but it is an

[1] The breakdown into factor costs is important theoretically and if released in a useful form, that is, one in which the costs for England and Wales were shown separately, would give an improved opening for academic work. (As the purchased foods are not broken down, the factor input is not complete for the industry, although it is correct for its purpose and for the farm.)

[2] Costings were started in Scotland in 1934 but lapsed in 1937; a parallel scheme to the English one was set up in 1945. In Northern Ireland the administrative procedure is rather different.

[3] This was discussed in W. Mackenzie's: 'Principles of economy in milk production in England and Wales', Oxford 1952 (mimeo).

arable area.) The annual addition to the Scheme of new co-operators was also an asset during the war, when they probably included a number of recruits fresh to milk production, or to specialized milk production, altogether. The inclusion of these men would have been unusual in the ordinary way in a model costing scheme, but as the milk policy was meant to attract new producers, they enhanced the value of the sample temporarily and ensured that it was a living and contemporary one.

The use of the arithmetic means as the typical financial measure has been criticized, but the data are not adapted for marginal analysis and could not be used for that purpose even during the war when production had to be stimulated beyond the limits of the ordinary economy.[1] Frequency distributions are not ignored, although the number of variables makes their use difficult.

In spite of the reservations the data are sound, as far as they go, for the purpose of description and suggestion in price-fixing. By ideal standards they are almost necessarily defective. The validity of a set of costs as a basis for any kind of price guarantee—assuming the general principle to be accepted—and as a measure of its consequences, depends on its showing all the relevant facts, and those which provide the means of judging two things in particular. It is essential to be able to isolate efficiency, and to identify circumstances in which it may be frustrated. If more is spent per cow in a certain direction, is there a corresponding increase in output per cow? Successful measurement requires exact input-output data in the first place, but controlling factors are very complex. The personal efficiency of the farmer is an evasive thing to pin down in data which have to conform to a national pattern of enquiry even if they are improved, and the whole industry is operating within a general frame, the soundness of which it would be difficult to examine at all points by the Scheme, or by any simple test. The yield factor does not make the problem easier. This is the 'rogue' factor in agricultural costing. It is not even the same as output, and the value of a high yield per cow has not yet been determined. When no resources need husbanding, it is an obvious national objective, but in the diversified circumstances of the dairying industry it is not necessarily the best one for the individual farmer.

This weakness in the national analysis can be offset to some extent by local work, either in fresh case studies or in selective enquiries following any indication in the national data of a key problem. The M.M.B. did good supplementary work of the latter kind in their enquiry into low-cost production, and have also used the sample figures to enquire into special problems of efficiency, such as grassland management. Other short, buttressing analyses of the data have been

[1] Some of the issues in relation to the type of means are shown in an article in the *Economic Record* by Sheila Rowley in which she discussed in connection with samples of unit costs for the farming industry and farm prices the financial differences that might result from using the weighted arithmetic mean, the unweighted arithmetic mean, or the geometric mean. 'Averaging unit costs'. *The Economic Record*, May 1953. Vol. XXIX, No. 56.

made by individual research workers and statistical approaches have been made recently through studies of variance.

On the other hand, although in fact not used for the purpose, the data give an opportunity to trace, however broadly and inadequately, the consequences of a national production policy. The motives for price fixing are mixed. The aim may be to provide recoupment in order that production shall be maintained at the existing level, or to give a stimulant to further production. Recoupment is in direct relation to cost, and both the need for it in the case of any particular cost and its results are fairly easily seen. Otherwise the price differential is not meant to fit costs exactly and stimulus may be very indirect.

The success of a price policy in encouraging, or directing, production is measured in the national figures of milk output, but the Scheme gives an idea of the way in which it may have been achieved. This would be clear in a history of production on the identical farms of the sample, but even as they stand the costs illustrate the relevance of the stimuli and the milk production and price relationship. For instance, the analyses have shown that the differences between the costs of production of quality and ordinary milk are declining and occur rather in the initial stage of setting-up and in capital maintenance so that, in effect, the bonus is not a flat rate compensation for additional running costs but an award whose size is dependent on the amount of the margin between the returns from the higher yield of the quality milk and the greater expense of the overheads and the interest on capital outlay. (This is a form of speculation which in the event has been a very safe one.) Similarly, the differential price for winter milk is needed to cover the extra strain on the general economy and the dislocation of summer production at least as much as to cover the special winter expenses which are usually thought to be decisive.

There were contemporary problems the solution of which depended on wider knowledge than the Scheme could give. Although, for instance, it was competent to show where the danger points lay in supply, the material was insufficient to serve as a real basis for a policy of resource control. The analysis had always been, and still is, mainly a cost analysis, but it was during this period that the need for more details of quantity, and for the better use of those which already existed, became urgent. Although foods were fairly well covered and stock changes were reflected uncertainly in the herd replacement charge, it was decided early that such data were inadequate for the purposes for which they were now needed and that they must be supplemented systematically. This was done by the introduction of special Monthly Returns of small identical (linked year) samples of 15 to 20 farms from each province, in which more detail of the resources, and the distribution of their use over the year was released.[1]

[1] The returns covered details of size of herd, calvings, purchases and sales of dairy stock, milk receipts, quantities and values of purchased foods, quantities of home-grown foods and costs of labour.

It was purely a war-time measure and was not incorporated in the Scheme; the last returns were received in September 1946. A little later it was arranged that the Supplementary Returns of descriptive material should be made, showing details of buildings, breeds of cows, health of stock and general stock policy for the year of 1942-3. These soundings gave an idea of what was happening to the two most affected resources and provided a regional clue to the possibilities of development.

Something of the success or failure of control and the attempt to equalize conditions might have been read from frequency distributions of the costs. There is an indication from those that have been made that the range and irregularities of the individual costs were not smoothed as much as might have been supposed, and that the use of resources in short supply became more variable between farms in spite of the curb. But distributions of these data are hard to handle and no official calculations for an identical sample of farms over any length of time have been made.

The preoccupation with official interests during the war left a permanent mark on the general use and technique of the costing. As well as bringing into prominence needs which were satisfied later by alterations to the Scheme, the period was responsible for certain involuntary changes in direction and data. In direction, for example, interest was concentrated on the short term, and on short-term comparisons of a provisional kind, and the idea of measuring costs over a period was lost sight of until recently. Further, with the farmer aware that all the milk that he could produce would find a waiting market, it was cost per gallon to which most attention was given. Costs per cow were neglected and this, especially in the absence of conclusive evidence on the relationship of yield and cost, may be quite contrary to long-term national interest.

Other changes were technical and affected the data. The key to official use is the costs structure. After the outbreak of war this became artificial, except in its current context, through the unequal stabilizing of costs by rationing and subsidy. At the same time, the continuous use of the structure in the Price Review as a means of estimating the effects of changes in cost on expenditure tended to make the bias self-perpetuating. No estimate has ever been made of the degree of artificiality, or of what a structure comparable with the earlier series—the natural structure corrected for price—would have been. The greatest deflection was in the cost of feedingstuffs. It is impossible to measure the effect of rationing on the average quantities used in the sample and only a very imprecise correction can be made for the sudsidy, but its partial removal in 1949-50 raised the foods cost as a percentage of gross farm cost by 5 points in the secondary costs

structure, and they had by then declined considerably from the position they had occupied in the structure during the war.[1]

A point that may be made here is that the base from which the changes in structure are measured should not be taken too much for granted. Historical data of average costs over two or three years before the war were studied for early price-fixing, to obtain the original set of relationships, and discussed and recast later for the Price Review, but it was difficult work and the result was not wholly satisfactory. Nor should it be confused with 'the best'. Although it might be descriptively sound, there is no guarantee of what may be called, in an economic sense, the ethical validity of the original premises, and judgment is made more difficult by the absence of published figures of receipts for the early years. Lancashire, with a milk and feed system which might be criticised for extravagant use of feedingstuffs, has lately examined its pre-war costs and profits level from this point of view.

These are obvious points, but the milk economy is closely knit and policy decisions are likely to have secondary effects which it would be unreasonable to expect a review to take into account. The cost structure in any year is a summary not only of the simple effect on single factors of changes in their price in the previous year, but of a chain of reactions throughout the whole production process. A decision to raise wages may drive more farmers to use the milking machine, and alter the labour percentage in the next cost structure. This is the sort of change which it is the function of the Scheme to measure. There may be automatic technical reactions in the sample as well. An outstanding example is that in increasing the attraction of winter milk production, the stratification of the sample by seasonality is constantly being changed. Such shifts in the material are of basic importance to the design of the Scheme, and affect its contributions towards the solution of long-term economic problems.

The change in seasonality is one of the more important of the changes in the production setting of the costs during the period. The movement away from intensive farming which was forced on some farmers by the withdrawal of resources, and the contrary pressure for more intensiveness after the campaign for winter milk had started, broke the continuity of the earlier period. Other management factors

[1] It was very roughly estimated for 1946-7 that, assuming that the quantities of the various foods used were in the same proportion to each other in the sample as in the total supply upon which subsidies were paid, the average cost of all foods would have increased from 11·24d. to 14·32d. per gallon, if the rate of subsidy on the appropriate imported and home-grown feedingstuffs (total for the U.K.) had been added to the average amount spent on homegrown and purchased concentrates used on the sample farms. In the secondary structure the food cost would have formed 66 per cent, instead of 52 per cent, of the total. (This was a very rough calculation and was intended only as an illustration of the possibilities, see p. 47, footnote 1.)

were less affected. The use of the milking machine[1] and the production of quality milk were more widespread but the differential costs of both were greatly reduced as they became general and this made the change of less statistical importance. There was little direct interference with the size of herd.

The manipulation of the costs of the resources, however, had indirect reactions on the management factors which could disturb their long-term analysis. For instance, if the cost of labour is essentially a function of size of herd, the fact that it was free to rise more than foods makes the actual measurement of its place in the economy of different size groups incorrect for the comparison. In fact, as seen, the apparent relationship of size and cost was reasonably similar in the normal and abnormal periods and this was also true of the relationship of yield and cost, although yield was particularly vulnerable to the disorganisation of the war.[2] What this means, and how far such a broad comparison is valid is another matter.

As between the other alternatives in management system, the later comparison of T.T. and ordinary milk production showed that the position had changed entirely; there was now little difference in the running costs and ordinary milk production was the more expensive. The variations of costs with seasonality of production were properly measured only in this period, but the result was still to emphasise the importance of the general organization of the farm—the technical questions of calving dates and the level of milk yields—and the link with the regions. The last, of course, was very plain. Otherwise, on the basis of running costs, the choice of system, as in the case of quality of production, seems to be moving towards a point of indifference. Food costs increased with winter production but depended on local geographical factors, labour was irregular, and although net farm costs rose up to a certain point, there was little difference in the later years. In making either of these comparisons it is impossible to distinguish the effects of interference during the war. The results of sheer familiarity in what had been a new form of production, and the tendency of the more progressive farmer to transfer to it, would obscure them in the first case, and in the second the appropriate controls over feedingstuffs were too complex for their outcome on costs to be traced.

[1] Since 1947-8 the proportion of herds in the sample which were milked by machine has varied from 50·0 per cent, to 78·9 per cent for herds of 10 to 20 cows (3·5 per cent in 1934-5 and 10·9 per cent in 1939-40) and has reached 43·4 per cent even in the group of herds of less than 10 cows. But in the size group of 50 to 60 cows it rose from 40 per cent in 1934-5 to 100 per cent after 1946-7.

[2] Some effects of producing under emergency conditions were visible in food and labour costs, which showed a much sharper rise per cow for the final groups of high yields after 1940-1. The costs of foods per gallon maintained a smooth gradient, however, with slight inconsistency at the 824 gallons level, in spite of their reduced and uneven quality, and the controls of rationing and prices. The decline in yield which followed the change in feedingstuffs, complicated as it was by a selective rationing system based on milk yield and herd size, must have had a strong effect on many figures of costs per gallon but one which it would be difficult to trace.

Even with the inclusion of quantity data these have remained very simple analyses. More elaborate techniques might be used to attempt to break down the costs complex by a mathematical examination of the effect of isolated factors under statistical control, but the present material and size of sample give only a doubtful basis for them. For the elementary purpose of showing whether a rise in the price of a factor of production is followed by a rise in cost, or by adjustment to another resource,[1] they are satisfactory enough. But unless actual relationships are proved, the full reaction in the cost structure to a rise in prices during the year is not properly understood.

These are the definite relationships that it is appropriate for a costing scheme to measure. Problems of a broader or more theoretical kind can be approached but, naturally, the Scheme will fit them less satisfactorily. They might, for instance, be discussed in relation to the standard comparisons of the long term and short term, or as internal and external problems. Taking the first, it is to the solution of the short-term problem that the design of the Scheme is best suited even in ordinary times, in spite of an incidental costing of innovations.[2] The cost of disease, for instance, was not shown at all until recently, and information about breeds has been neglected although this is a part of the dairy economy in which there has been active change. Fundamentally the costs are the short-term, flexible costs which farmers can quickly adjust. The problems themselves, however, have been considered as mainly short-term problems until now. Unspectacular changes are constantly taking place, but conversion of buildings and of stock have only recently become of urgent practical importance. The milk industry is one that can accommodate itself to change very quickly, as it did during the winter milk campaign, although in any one year it is the use of milk for manufacturing which balances the industry.

Considering problems under the second heading—the internal or external—the industry is evidently in some ways independent of the outside economy. It produces for the home market and is largely sheltered, but it was its fringe of exposure to foreign competition in manufactured products that helped to prompt the setting-up of the M.M.B. This problem, which exists because there is an over-supply of summer milk brought about by the level nature of demand for liquid milk and the seasonal nature of supply, is both an internal one of production and an external one of the market. During the war it disappeared; the industry was completely protected from competition in the form to which it had been accustomed although, in the accelerated imports of dried milk, it was introduced to another kind

[1] Forecasting output from these data alone is a different matter; an enterprise cost can only give a one-sided view of the probable response to price even when the costs are completely firm and real.

[2] Processes which are still in the pioneer stage and dependent on close study of the management factor are obviously matters for individual work. (e.g. the series of studies by R. N. Dixey, as sole or joint author, in grass drying, T.T. milk production and bail milking, Oxford 1933-1942.)

in the liquid market where it had not been vulnerable before. Immunity was temporary, however, and the problem is still to be solved. The relevant costs can be directly measured through the Scheme; the improvement in the data on seasonality and their presentation[1] means that there is now a better foundation for discussion when the problem really comes to the front again. It is a very far-reaching problem, however, that requires research in a much broader field for its proper solution.

The experience of the Scheme is equally useful in judging the chief handicap in relation to production itself that rises from outside the industry, which is its dependence on imported feedingstuffs. Here the experience gained during the war is direct and the problems in connection with it have been displayed and clarified by the data.

The problem of scale of production is thought to be one of the more difficult of those internal to the industry. In the form of size of herd there is plenty of material relevant to this which might be used—including material that gives some idea of what promise there is of increasing scale of output without increasing the herd—but it should be freshly analysed and more clearly presented. If the problem is broken up it is simpler to handle, although some of its components —the use of labour in the small herd, for instance, which is really a question of its use on the whole farm—lie outside the scope of the main Scheme in its present form. A difficulty that immediately faces the industry, that of providing the capital needed to renovate buildings in compliance with quality milk regulations, could also be taken as one of scale, but again it has not been a concern of the Scheme.

The question of the limits which the size of farm itself—the acreage —imposes on efficiency is implicit in such factors as the feeding costs, but has not yet been directly touched upon in the national work. It is, however, being put forward.

Some of the purely historical facts and conclusions are of more than temporary interest. The war allowed a comparison of alternative practices to be made and gave a range of experience in conditions of production that would not have been obtained normally. The costs show where and how losses in resources can be compensated and illustrate the extremes to which the supply of resources may fall and costs may rise. These should represent the limits of range and they are very useful limits to have defined. (In 1946, in addition, as great a loss as the industry is likely to experience through bad weather might have been measured if there had been direct costing of all home-grown foods.) Another advantage was the demonstration that was given of the speed at which the economy can be changed. The ultimate effect of mobility, however, and broad questions of the smoothing of irregularities, changes in types of farming, and type of farming areas, or the levelling out of seasonality, are judged better from national figures.

[1] Supporting local studies have been made also.

There is still the question of the problems that the future developments of the industry are likely to bring, assuming that no great change in technology takes place and that the threat of competition is not intensified. Will there be a policy of cheap milk or quality milk, level production or seasonal (with greater reliance on the improved grassland), increased production or contraction to fit a declining market, and is there likely to be a scarcity of any particular resource? Some changes—the tightening of quality requirements, for instance—are already in train, and in connection with most of them there is practical guidance to be extracted from what has happened before, even though the economic relationships which have been observed are based on the prices of the period. There is reasonable evidence of the cost of the winter bias, the cost of improving quality instead of quantity of production,[1] the cost of a high yield, or the amount saved on the national herd in labour costs if machine-milking becomes universal. In resource use there seems to be a tendency, if there are no abnormal external pressures, towards longer life, e.g. the extended grazing system or earlier calving, and semi-technical changes are partially covered.

On the really wide questions, however, of what the dairying pattern should become—whether, for instance, it should incline to specialist dairy farming or to milk production on the general farm, or what the relationship of cattle and milk interests should be—there is less help to be gained from the standard design.[2]

The recently introduced local research programmes give an opportunity for a new approach to new problems but the central need for costing, whether in the terms of the old formulae or those of the modern techniques, is to be able to establish and measure the mutual changes in relationship more exactly. How far is it possible to associate definitely and closely any one set of costs with another, and are the standard intervals of measurement the most effective for the purpose? Even if detailed relationships cannot be derived for the country as a whole, can any idea be obtained of the level at which a change in one cost brings about significant changes in the others related to it?

(3)

The Scheme is now in a transitional stage. It has come a long way from the first, sharply formulated, rules and uses, and much of the criticism to which it has been subjected rises because it has been stretched too far and used in a different context and for wider purposes than its designers intended.

[1] i.e. moving from one category of milk to another. Concentration on T.T. costing, however, might lead eventually to a change in balance of the make-up of the primary return, towards an expansion of the capital section. It may be remarked that, unless the size of herd is reduced, a change in quality will probably entail one of quantity also since yields have so far been higher in the T.T. herds.

[2] The more extended Scheme of 1955, under which rearing costs are included, will make the second of these long-term economic problems accessible to analysis. The breeds data, even in the imprecise form given since 1946-7 are a necessity for this as for narrower cost studies.

Many of the original principles are being abandoned. Thus the first principle, that the costing should be that of the single enterprise, is having to meet the idea that it should cover the whole farm, and the calculation of a national average cost by sampling the whole, diversified industry is giving way to the examination of local and geographical problems. The construction of an historical series is still needed, but the idea of analysis has expanded, owing partly to the recognition of American techniques, and increasing importance is attached to a sophisticated statistical approach. Interest in marginal costs now competes successfully with interest in the average; the study of the average itself tends to include that of the modal, input-output studies are asked for as a basis for judging efficiency in the use of resources and the concept of the model farm is attracting attention. If these ideas are to be covered it is obvious there must be some change in method.

Occasionally, indeed, there has been a tendency to jettison the whole idea of milk costing proper. When marketing, consumption, and distribution studies are advocated it means that other fields are being entered altogether, some of which are already occupied. But it should not be overlooked that the most important technical developments in the future, such as those in processed milk or freezing, may lie outside the production process and make necessary an expansion of the whole field of reference.

The more moderate suggestion is sometimes made that the whole dairy farm should be costed, on the grounds that this would be simpler and would illustrate opportunity cost.[1] Its general justification depends on the extent to which specialist dairy farming is the normal form of milk production and this is not known. Technically it does not offer a full solution, as the subtraction of minor enterprises when the specific milk costs are required increases the need for estimating and, unless the costs are allocated in this way, such an investigation would merely duplicate the Farm Management Survey in which dairy farms are represented. The existence of this Scheme appears to be forgotten sometimes in milk cost discussions.

Another development has been in the role of the provincial centres. They are becoming more important as not only is there a tendency, for both scientific reasons and reasons of policy, for the actual research work to be undertaken there, but advisory work is beginning to rely on budgeting and other methods to which a national survey gives little help except of a corroborative kind. Case studies are becoming important again also. But although the division of work is one that should be made on functional grounds an additional reason for it has undoubtedly been the anxiety of the centres to engage in research.

Critical discussions have taken place along two lines: how to reform the classical Scheme and extend the range of information along the old lines, and secondly, but first in order of popularity, how to accommodate the new techniques.

[1] The direct costing of the fodder crops and, from 1955, of herd replacements obviously admit elements that bring this nearer since, although both fodder and replacements are for use in the dairy herd, there is the question of the surplus.

The reform of the Scheme might be attempted by improving the sample or the data, or even by improving their use.

Technically the sample has been constantly improved and the chief trouble now comes from the temporary suspension of the national returns and the reduction in their number after the interval which mean, even if no other changes are made, that there will be a break in continuity and that some research work must be done on a narrower basis. (This in itself prejudices the national approach to research in the future.) It might still be asked, in less mathematical terms, how far it has remained representative, and whether it needs re-drawing merely to keep pace with changing conditions. The fact that the co-operating farmers were specialist dairy farmers fitted the contemporary organization of market and production, but if more milk is now produced by the general farmer a revision to include him in the sample might be merely a restatement, and not a change, of principle. It would be one that would lead naturally to the treatment of joint products and of milk in relation to other enterprises. On the other hand the omission of the producer retailer is becoming less important from the point of view of representativeness, although his problems are increasing and therefore in greater need of study.[1] In relation to organization and type of production, the sample has automatically adjusted itself to changing seasonality, and the change in quality of production was anticipated and even over-estimated for a time. Finally, the size-of-herd structure of the sample was manipulated to fit the national structure in 1945 and it is only lately that it has been possible to measure change in the universe exactly again.[2]

Much of the criticism of the Scheme as a design for an enterprise costing is really a criticism of material. In fact the data have been strengthened already, but they may be overtaken by new needs. Future developments may accentuate the seriousness of some of the deficiencies of long standing. Of the more complete, that of information about capital will probably be felt the most, as capital overhaul becomes unavoidable. It is a forward-looking item which becomes important when big changes in scale or type of output are contemplated, or as new processes are established, and this appears to be the beginning of a period of comprehensive development. It can no longer be taken for granted that rent will remain inactive over a period and this factor is also becoming important therefore, although any swing of the market towards the wholesaler reduces the importance of rent, as it

[1] At the beginning of the war the producer retailers, of whom there were some 40,000, still accounted for 29 per cent of all registered producers; a further 17·5 per cent held both wholesale and retail contracts. By 1950 the number of producer retailers proper had dwindled to little more than 10,000 and by 1955 to 3,523, or about 2·5 per cent of all producers. To these might be added 27,500 producers holding both types of contract in 1950 and 18,728 in 1955. The decline was apparent even within those regions of the Board in which the traditional producer retailing areas are to be found.

[2] Between 1942 and 1955, in fact, the size of herd structure has altered. There has been a trend towards larger herds, which is particularly clear in an increase of the 50 cows and over group, and in a reduction of the group of under 12 cows. (Census of dairy herds in England and Wales published by the M.M.B. in 1956.)

is the producer retailer who tends to take up the high-priced urban land. In so far as the charge is formal it will be a matter of keeping the conventional rates adopted for buildings, etc., under constant review.

The fundamental change will be from a cost analysis on the basis of values to one accompanied by a full quantity analysis on the basis of physical data. This will be to move towards the measurement of a truer efficiency than costs efficiency. The reinforcement of physical data is almost essential if the new techniques are to be adopted, even if it could never be sufficient to enable a full marginal analysis to be made on a national scale. At present bulk quantities of foods are given, and hours of labour, and these amount to primary factors when properly extracted and combined. Individual inputs per cow are still unobtainable, however, and so is the quality of input. The absence of quality information is a fault that runs through all studies alike.[1] At the same time all the existing data have not yet been used on the national scale. There is a small reserve that may be tapped, such as the Supplementary Returns or the descriptive data at the centres which might be made accessible without infringing local rights. Again, many of the farms reappear in the Farm Management Survey.

The late introduction of much of the material—physical data, receipts, and direct fodder costs—breaks the series for long-term analysis. As an historical series, the full range is not absolutely comparable although it is not seriously distorted for values. Statistically it is broken in 1946 and again in 1951. This gives a short run for the construction of a time series for period costs and variance studies, and brings a danger of accidental change carrying too much weight. It also prevents the use of an earlier starting point than 1946-7 for the new type of analyses, whether on a basis of quantity or value. The series of returns starting in 1955-6, again, will be discontinuous with the old.

The new methods are being developed at the provincial centres in the independent studies which have been undertaken since national costings were suspended.[2] The ways in which the provinces have been using their three years of freedom are a commentary on the Scheme and should be mentioned for that reason although they belong to a later period than this history.

There are certain studies to which only a local approach is correct. It is obviously the right procedure for obtaining whole farm data for dairy and interlocking enterprises, and it is the best way of breaking

[1] Quality of output receives only very broad treatment under the Scheme and is a possible subject for development. No attempt is made to measure variations in cost caused by variations in the compositional quality of milk, or the costs of improving it; the costing of milk 'by quality' means the costing of milk by category. (A very indirect reference is contained in the fact that milk recorded herds, including those recording for butterfat testing, and Channel Island and South Devon herds, are distinguished on the primary returns.) The Board, however, made an independent investigation into the chemical (solids-not-fat) composition of milk in 1948, in the course of which it used some of the farms of the Scheme.

[2] Since this review was written in 1955 numbers of these studies have been published (Editor).

into the closer input-output relationships. Budgeting develops the case study which is a natural prerogative of the provinces, and time and motion studies also have their place here. Some of the factors in efficiency, such as grassland management which was the determining factor in costs and yields during the war, are dependent on specialised treatment, whether of the new or orthodox kind. The provinces have the option of doing this type of study, which supplements the national analysis where it is invalid, or they may take up studies that are peculiarly appropriate to the locality. Some of these are of a kind that will allow the same problem to be studied under conditions in different type areas and combine to give a correct regional picture of the whole country. In this way, the studies which have been undertaken of the small farmer and of the marginal farm in various guises—the small grass farmer in the North Eastern province, the intensive farmer in the North Western—should illustrate the problem of small producers and producer retailers with similar markets but not necessarily with similar production conditions, and the studies of the costs of rearing herd replacements, made at the request of the Conference, have been developed along the lines of local practice and problems. The opportunity for this kind of work varies; the North Western province, for instance, occupies a frontier position between agriculture and industry and is a natural laboratory area for many problems. In their own field the studies furnish an opportunity to reform the substructure of the whole enquiry; regional representation has always been poor and this will make it more genuine.

Among the studies proposed for the period of independent research some took up a mathematical approach with the use of period costs, or broke new ground with budgeting or linear programming, or dealt in various forms with the economics of feeding and substitution between feedingstuffs.[1] The projects covered problems of joint supply and the relation of milk production to the whole farm, marginal production—problems of competitive enterprises as well as production on marginal farms—output in relation to the land, and narrower but neglected questions such as capital requirements or the longevity of cows, and there were various forms of labour study. An interest was taken in marketing also. A few aimed at the improvement of the sample or would incidentally further it. Such are the investigation by the North Eastern province into the reasons for the discrepancies between the results obtained from farmers in the Scheme and from those keeping full farm accounts for the Farm Management Survey, and the classifications of dairy farms in the area and discovery of modal types carried out elsewhere.

Some suggestions were ambitious and difficult to carry out in full. In a few cases the absence of national definitions and preliminary controls was a complication. It is difficult to apply a study of joint products, for instance, when farming types are still not satisfactorily

[1] The last tend to be field appraisals of American theories, but with the herd instead of the cow as the unit.

classified, and some definition of their own universe has been the first charge of several provinces. Also, a local study must be absolutely accurate as there is no compensating average, but one of its advantages is that it is bound, of its nature, to be practical in attack and in the application of results. Perhaps the main weakness, so far, has been the insufficiently early co-ordination of the projects; the dovetailing of local problems has been accidental, or has come later. In the British dairy industry local problems are not isolated ones, but the conditions under which they are repeated are always slightly different and it would be dangerous to expand a single local solution into a national one.

Whatever else they may contribute to the main analysis, however, the provinces have a unique function in interpolating special knowledge. They have always had a fund of other material, including the key figure of receipts for their own farms, as well as their practical experience to draw on, and their realistic knowledge of the make-up of the national costs is obviously very great. As a source of criticism and commentary they are invaluable, and perhaps ultimately the revolution will turn back on itself and local work stimulate the development of national research.

All these new developments are valuable, both intrinsically and in breaking the stereotype caused by the standstill of the war, and they reduce the danger of overstraining the present material to provide an explanation where a description only was intended. At the same time it would be unwise to abandon the staple Scheme. It is true that some of the reasons for its inception have been fulfilled. The Milk Marketing Board was satisfied in 1950 that it could forecast the trend of costs for two or three years on the basis of what was already known, although some of its long-term problems in relation to supply and the market were not solved. Again, a structure having been obtained it is possible that the Ministry could abandon fairly easily the collection of further data, since apart from the changes in development in the industry which are already planned they have no reason to suppose that straightforward costs will now change greatly in relationship to each other except as they themselves dictate. At the same time the possibility does exist that new conditions may set up a need for a new set of desirable basic data. Nor is the original basis sufficiently tested, since all judgments of the kind of costing that will be necessary in future depend on the correctness of the analysis hitherto made, particularly that of the management factors. For the purpose of research, which is now very important, it is reasonable to suppose that national costs for a new stable period are needed to cross-check the trends and relationships discovered in the first.

There is scope for the freer use of old material and for new breakdowns of costs. The Cambridge annual reports and some of the *ad hoc* studies in other provinces, which are essentially based on the old data, have shown this. Nor have the provinces a monopoly of the newer methods: production function and variance studies, at least, are better done on the wide basis.

Margins between running expenses and receipts have been incorporated in the national reports for some time but more attention might be given to them for basic period analysis, and also to output data on the individual farm. Interfarm variation is important, and there is insufficient measurement of the range of the different individual costs. Also, although it has been necessary to the use of the Scheme so far that it should show representative costs rather than ideal, and an average of some kind is indispensable, there is no reason why the extremes of the scale should not be studied regularly for other than advisory work. More attention should be given to costs per cow and the study of land use could be expanded. The latter has so far taken the form of local studies of production per acre, but under the new Scheme the acreage used by the dairy herd is identified, and national study will be easier. This provision and that for costing herd replacements open up a new field of study—and one of contemporary importance—in problems of acreage and stocking.

Period costs, neglected so far, can be explored either simply or by statistical analysis. The need for them is less urgent than in a mixed system of farming where cropping, with its rotations, is a large part of the activities, or in a costing where long-term expenditure is systematically entered, but the experiments that have been made show that treatment of identical farms on the lines of averaging expenses for groups of years would give a different picture of costs and this, on the lowest basis, could be important for price-fixing. The cycle chosen could be related to the working cycle, or to price movements, or to both. The satisfactory isolation of accident, or the ' random ' element,[1] would be an important part of the analysis. This approach may well become the most useful of all in the analysis of past costs.

A minor point which might be considered in any development of the Scheme is that of its alignment with other national schemes to make international comparisons easier. Differences in the purpose and conditions of production make it unlikely that they will be perfect—the awkwardness of a measurement of yield by gallonage here and butter fat elsewhere is not likely to be smoothed out, for instance, as it reflects a difference in outlook—but there is common ground. Also, it was a pioneer scheme and countries which have been able to profit by English experience may have made improvements that can be referred back.

The improvement of definitions and data in agriculture and of national statistics generally will help investigation schemes of this type. Incidentally, it may be pointed out that once the idea of a representative sample is left behind it is always possible to substitute different sources altogether. For a factor analysis independent of cost, for instance, yield might well be approached through the milk recording schemes. More use could be made of this external work and the Milk Marketing Board in particular must obviously draw widely on it for the solution of its problems.

[1] e.g. ' The Importance of Variance in the Interpretation of Averages (with special reference to Farm Records) ' Rasmussen, K. (paper given to the Agricultural Economics Society in December 1953).

There are difficulties in the way of every method, and even with new material and provincial help some problems may remain insoluble. Trouble begins as soon as simplicity of problem and approach is left behind. The main strain of weakness is the impossibility of linking either production or efficiency exactly with cost factors, and the most troublesome single factor is still that of yield.

It is possible that a new line of attack will develop which will owe little to any of these approaches, all of which have some element of the orthodox in them. In the meantime there is room for both the national and local approach to costing—in fact they are indispensable to each other. A considerable field is still left to national analysis. It must be urged, however, that it should only be used within its limits and these are, that it is designed for the construction of an average, that basically it measures a set of relationships, in a series of price situations, that the 'total' cost which is measured is arbitrary and incomplete, and finally, that it has been a descriptive rather than an explanatory study.

APPENDIX I

THE PROVINCIAL COMPOSITION OF THE MILK MARKETING SCHEME REGIONS

Number of Region	*Name of region**	*Counties in region: classified by 'provinces' of Provincial Agricultural Economics Service***	*Headquarters of Provincial Agricultural Economists*
1	Northern	Northumberland (*b*), Durham (*b*), Cumberland (*a*), Westmorland (*a*) (Northern province), Yorks. E. Riding (*b*), Yorks. N. Riding (*b*) (North Eastern province)	*Northern* University of Durham (King's College, Newcastle upon Tyne)
2	North-western	Cheshire (*a*), Lancashire (*b*) (North Western province), Stafford (*a*) (West Midlands province until 1945; afterwards North Western province) Derby (*b*) (East Midlands province), Yorks. W. Riding (*b*) (North Eastern province)	*North Eastern* University of Leeds (Leeds) *North Western* University of Manchester (Manchester)
3	Eastern	Cambridge (*b*), E. Suffolk (*b*), Isle of Ely (*b*), Norfolk (*b*), Huntingdon, Soke of Peterborough, parts of Holland, W. Suffolk (*b*), (Eastern province), Parts of Kesteven, parts of Lindsay (*b*) (East Midlands province)	*East Midlands* University of Nottingham (School of Agriculture, Sutton Bonington)
4	East Midland	Bedford (Eastern province), Leicester (*b*), Nottingham (*b*), Rutland (*b*) (East Midlands province), Warwick (*b*) (West Midlands province until 1945; afterwards Southern province), Northampton (*b*) (Southern province)	*South Western* University of Bristol ('Bristol II'; operating from Newton Abbot (Until 1945 this was attached to Seale-Hayne Agricultural College, Newton Abbot, not to Bristol University)
5	West Midland	Gloucester (*b*), Hereford, Worcester (*b*) (Western province), Shropshire (*a*) (West Midlands province until 1945; afterwards North Western province), Monmouth (*a*) (Wales)	*Western* University of Bristol ('Bristol I'; operating from Bristol)
6	North Wales	Anglesey, Caernarvon, Denbigh (*a*), Flint (*a*), Merioneth, Montgomery (Wales),	*Southern* University of Reading (Reading)
7	South Wales	Brecknock, Cardigan (*a*), Carmarthen (*a*), Glamorgan (*a*), Pembroke (*a*), Radnor (Wales)	*Eastern* University of Cambridge (Cambridge)
8	Southern	Berks. (*b*), Bucks. (*b*), Oxford (*b*), Hampshire (*b*), Isle of Wight (Southern province)	*South Eastern* University of London (Wye College, Ashford)
9	Mid-western	Somerset (*a*), Wilts. (*b*) (Western province), Dorset (*a*), (Southern province until 1945; afterwards South Western province	*Wales* University College of Wales (Aberystwyth) and until 1945,
10	Far-western	Cornwall (*a*), Devon (*a*) (South Western province)	*West Midlands* Harper Adams Agricultural College, Newport, Salop.
11	South-eastern	[London], Essex (*b*), Hertford (*b*) (Eastern province), Kent (*b*), Surrey (*b*), E. Sussex (*b*), W. Sussex (*b*), (South Eastern province), Middlesex (Southern province)	

* Basis for tabulation of results.
** Basis for collection of material.
(*a*) Counties classified as seasonal producing area groups in the period 1934-5 to 1938-9 by A. Bridges on the basis of a summer production (total area gallonage) 20% or more higher than that of the winter.
(*b*) Counties classified as level producing area groups in the period 1934-5 to 1938-9 by A Bridges.

APPENDIX II

TABLE 1. THE COMPOSITION OF THE SAMPLE: TYPE OF PRODUCER

Year October—September	Total number of herds recorded[1]	Number of			Number of herds identical with those of previous year[3] in		Number of accredited producers in wholesale group	Number of herds of 60 cows and over in wholesale and graded groups
		Wholesale producers (as tabulated)[2]	Graded producers	Producer retailers	Wholesale and graded groups (including interchanges between the two)[3]	Producer retailer group		
1934-5	628	490	18	72			205	48
1935-6	597	437	(2) 35	63	367	41	279	47
1936-7	617	437	(2) 64	53	349	42	304	57
1937-8	594	409	(5) 81	50	375	37	393	52
1938-9	595	382	(30) 123	47	375	36	280	47
1939-40	568	360	(41) 139	48	400	35	274	51
1940-1	579	372	(32) 128	50	403	35	244	44
1941-2	558	352	(48) 131	49	412	40	247	42
1942-3	599	382	(39) 138	39	401	36	261	55
1943-4	613	375	(44) 147	52	418	28	246[4]	49
1944-5	610	354	(39) 175	49	430	36	201	40
1945-6	547	301	(16) 184	41	401	31	184	37
1946-7	684	381 (19)	273	[26]	376	10	176	41
1947-8	693	370 (33)	289	[31]	519	15	156	33
1948-9	699	332 (31)	347	[18]	524	13	139	38
1949-50	682	275 (34)	385	[15]	535	11	111	34
1950-1	572	199 (31)	364	[5]	482	1	70	34
1951-2	522	153 (26)	368	[1]	451	—	54	41

[1] Herds for which an incomplete set of primaries (winter, summer or year) were sent in, or which were recorded for less than 51 weeks, are omitted from the total. Records left unused for any other reason are included.

[2] Until 1946-7 producers of milk from Attested, and Attested and Accredited, herds were included in the graded group. From 1946-7 onwards they were placed in the wholesale. They have been entered here in the total figures for the groups in which they currently appeared, but their numbers are shown in brackets.

[3] Effective identity on the basis of the tabulations.

[4] 234 only were tabulated as accredited.

[ ] Not tabulated.

APPENDIX II

TABLE 2. THE COMPOSITION OF THE SAMPLE: PROVINCIAL REPRESENTATION

Year	Province										
	Northern	*North Eastern*	*North Western*	*East Midlands*	*West Midlands*	*South Western*	*Western*	*Southern*	*Eastern*	*South Eastern*	*Wales*
	*Number of herds**										
1934-5	34	63	52	56	73	56	68	60	50	50	66
1935-6	40	58	44	55	59	64	58	56	55	50	58
1936-7	46	53	42	57	58	79	58	58	55	51	60
1937-8	55	55	41	55	54	68	59	58	55	36	58
1938-9	52	54	42	63	61	61	59	52	55	41	56
1939-40	46	50	45	59	55	56	51	53	55	36	67
1940-1	61	49	42	55	62	56	59	44	55	39	57
1941-2	56	35	42	55	62	51	59	45	55	42	56
1942-3	50	48	42	67	61	55	62	50	50	55	59
1943-4	51	46	44	72	60	63	64	50	57	55	51
1944-5	54	48	42	87	46	62	58	50	52	58	53
1945-6	51	45	71	74		62	48	40	55	51	50
1946-7	54	60	85	77		77	78	67	52	47	87
1947-8	55	62	97	74		79	79	60	55	45	87
1948-9	52	71	91	74		86	79	60	53	46	87
1949-50	49	65	90	58		86	83	58	61	45	87
1950-1	47	55	85	55		66	74	45	44	41	60
1951-2	44	50	64	49		59	67	45	42	42	60

* Omitting only those returns which were made for an incomplete year.

APPENDIX II

TABLE 3. THE COMPOSITION OF THE SAMPLE: REGIONAL REPRESENTATION

Year	Region										
	Northern	*North-western*	*Eastern*	*East Midlands*	*West Midlands*	*North Wales*	*South Wales*	*Southern*	*Mid-western*	*Far-western*	*South-eastern*
	*Number of herds**										
1934-5	62	130	33	62	62	28	28	37	54	56	76
1935-6	69	110	31	57	52	19	31	33	40	64	81
1936-7	75	101	35	58	49	23	32	38	46	79	81
1937-8	91	96	33	51	44	24	30	42	47	68	68
1938-9	86	100	43	57	46	23	29	36	46	61	68
1939-40	77	101	39	52	42	28	31	34	45	56	63
1940-1	89	99	38	52	55	28	26	30	40	56	66
1941-2	77	93	35	56	49	29	25	27	45	51	71
1942-3	80	98	27	70	47	31	26	33	48	55	84
1943-4	77	103	39	66	46	28	21	35	48	63	87
1944-5	78	102	36	71	42	26	25	36	46	62	86
1945-6	73	94	39	55	35	24	24	30	39	57	77
1946-7	73	130	37	53	58	35	46	54	63	63	72
1947-8	80	134	37	48	60	37	42	52	69	63	71
1948-9	89	129	39	46	51	30	52	51	74	67	71
1949-50	86	123	44	37	51	29	53	49	75	66	69
1950-1	79	111	29	31	47	21	36	39	65	51	63
1951-2	71	91	24	29	39	17	41	38	62	45	65

* Omitting only those returns which were made for an incomplete year.

APPENDIX III

CALENDAR OF CHANGES IN SCHEME AND METHODS OF COSTING

Date of decision	*Accounting year to which first applied*	*Nature of change*
Schemes and General		
Schemes		
Discussed 1934-5 Issued 1935	1935-6	First Scheme and set of instructions issued (A codification of instructions devised for 1934-5). Accounting started in November 1934 for most producers (i.e. an eleven month year).
1939	Starting May 1940	Monthly Returns introduced for samples of identical farms in each province. These were to show details and costs of herd management, and the distribution over the year of the types and quantities of foods used and their costs. (Not incorporated in Scheme.)
1942	1942-3	Supplementary Returns, of physical data, made for one year.
Main principles discussed and approved between July 1945 and June 1946; Scheme issued in June 1947.	1946-7	Second Scheme and set of instructions issued. Changes in costing (mainly to foods and herd replacement) are shown below. Physical detail, figures of receipts and hours of labour added to primary return.
	September 1946	Monthly Returns discontinued.
1948	1947-8	Some revision of 1947 instructions.
1950 Issued 1951	1950-1	Revised Scheme and set of instructions issued.
1952	1952-3	Principle of periodic costings approved; annual costings suspended for 3 years in favour of provincial research.
Discussed 1952-5 Issued May 1955	1955-6	Third Scheme and set of instructions issued.
Sampling		
1945; incorporated in Scheme of 1947	1944-5 (size of herd) 1946-7 (other changes)	Changes in sampling recommended. Sample numbers to be redistributed between provinces, and size-of-herd structure of sample modified. Numbers of graded producers to be increased. Sample to be one of 650 herds, 350 being wholesale producers of ordinary milk, 200 of graded, and 100 producer retailers. In Scheme of 1947 latter part of provision took final form as 'at least' 200 graded producers, and producer retailers at personal discretion of Economists provided that a provincial sample of 20, and a national sample of between 60 and 100 records were obtained. A failure in producer retailer returns was to be made up from among graded producers so that the total of these might be 300.

CALENDAR OF CHANGES IN SCHEME AND METHODS OF COSTING—*continued*

Date of decision	*Accounting year to which first applied*	*Nature of change*
Sampling		
1950; incorporated in Scheme of 1951	1950-1 1951-2 (first year of full operation for major changes)	Sample to be reduced to one of 500 herds as quickly as possible, with adjustments to size-of-herd structure. Producer retailers excluded from main Scheme. Graded producers to make up approximately half the sample (already the practice owing to deficiency in producer retailer representation). This proportion was to be maintained in each province but the ruling was subject to review.
1951		Recorded that there would be no official objection to some latitude in graded representation.
Individual Costs		
Foods		
1939	1939-40	Composition of index of feeding values of purchased foods, on basis of which all home-grown foods except grazing were costed (feeding value method) was slightly altered. Also it was to be given for periods of six months instead of every month. The method of using it was unchanged.
1940	1940-1	Government announced that prices of feedingstuffs should be stabilized at their existing level irrespective of costs.
(Accepted Nov. 1940) February 1941	1940-1	Scheme for rationing purchased feedingstuffs came into operation.
1942	1942-3	Feeding values index to be given yearly instead of half-yearly, and used for the whole 12 months.
1942	1942-3	First real break in method of food costing. A 'cost index method' of valuing hay and straw introduced, which was a method based on modified cost of production instead of feeding value.
Principle agreed 1945, method agreed 1946; incorporated in Scheme of 1947		Full costing on the farm of all major home-grown foods (hitherto carried out for grazing only) to be substituted for feeding value method. Only gradually applied and with a reduced range. Feeding value method retained for minor foods.
	(for accounting year) 1946-7	A 'bridge' year. Cost of production data obtained for the main foods from the general enterprise costings programme.
	(for accounting year) 1947-8	Costing of home-grown foods fully launched; roughly half the fodder crops were costed on each farm.

CALENDAR OF CHANGES IN SCHEME AND METHODS OF COSTING—*continued*

Date of decision	*Accounting year to which first applied*	*Nature of change*
Inaividual Costs		
Foods		
March 1949 (for April)	1949-50	Partial withdrawal of imported feedingstuffs subsidy.
March 1950 („ „)	1950-1	Remaining half of feedingstuffs subsidy removed except for certain small farmers.
1950	1950-1	An estimate of the costs of production of minor foods, for which feeding value method had been retained, to be made annually by the Ministry for voluntary use by provinces.
March 1951	1951-2	Feedingstuffs concession for small farmers withdrawn.
1950	(for accounting year) 1951-2	Costing of a cycle of crops, on every farm, to be substituted for earlier arrangement (crops in 1950-1, for the 1951-2 accounting year, were to be cereals, pulses and their silage).
Labour		
June 30 1940		Introduction of national minimum wage rate.
1946 (for 1947 Scheme)	1946-7	Hours worked added to primary return.
„ („ „ „)	1946-7	Overhead labour added to miscellaneous charge.
„ („ „ „)	1947-8	Costs and hours of labour included in newly introduced fodder crop costs.
Herd Replacement		
1939	1938-9	Method of using fixed values in the valuation—that is, of keeping the original stock in at the original price instead of at current market values—endorsed and made general, having the effect of deferring depreciation on aminals remaining in the herd. ('Depreciation on cows sold' method).
1945 (passed with rest of 1947 Scheme in 1946)	1946-7	'Depreciation on cows sold' method changed. The new method, which was nearer to a true replacement charge, insulated the valuation from the yearly charge unless there had been a significant change in the quality and size of herd, that is, in the capital structure. The existing formula was elaborated for use in the latter case.
	1947-8	First fully effective year of new formula.
1946 (final decision) for 1947 Scheme	1946-7	Statement of dairy herd valuation and hard transactions made on the primary returns, with a section showing numbers of cows disposed of, and reasons for disposal.
1948	1947-8	Values to be given, as well as reasons for disposals.

CALENDAR OF CHANGES IN SCHEME AND METHODS OF COSTING—*continued*

Date of decision	*Accounting year to which first applied*	*Nature of change*
Miscellaneous		
1946 (for 1947 Scheme)	1946-7	Miscellaneous charge expanded to include artificial insemination.
" " " "	1946-7	Slight modifications to charge for depreciation of machinery and equipment. Rates ranging between 6% and 30% recommended by the Milk Investigation Committee for 1946-7. These were to be reviewed by the Committee from time to time.
" " "	1946-7	Maximum allowance per cow stall, that can be made without explanation, raised from £1 to £2.
" " " "	1946-7	Overhead labour included among general farm expenses in the charge for overheads.
1948 (later incorporated in 1951 Scheme)	1947-8	Miscellaneous horse and tractor labour on work connected with the dairy included in miscellaneous charge.
1950 (for 1951 Scheme)	1950-1	Depreciation rates made more flexible at discretion of Economist and brought into line with F.M.S. practice.
Credits		
Calves		
For 1947 Scheme	1946-7	Calves credited to the herd at market value if sold within one week, instead of four days, of birth.
Manurial Residues of Feeding-stuffs		
1946 (for 1947 Scheme)	1946-7	Rates used in valuing manurial residues of feedingstuffs for credits revised in conformity with the findings of the Scott Watson Committee of 1946.
1947 (for 1947 Scheme)	1947-8	Originally, F.Y.M. was to be omitted from credits and costs except where used for cash crops, when the rate was to be recommended annually by the Milk Investigation Committee. This ruling was waived, however, and it was agreed in 1948 that all F.Y.M. should be valued and that a standard rate of 10s. per ton might be used instead of the rates of the Scott Watson Committee.
1948		
1951	1951-2	The standard rate of valuation which might be used for F.Y.M. raised to 15s. per ton.

CALENDAR OF CHANGES IN SCHEME AND METHODS OF COSTING—*continued*

Date of decision	*Accounting year to which first applied*	*Nature of change*
General		
The primary return		
1946 (for 1947 Scheme)	1946-7	Yearly primary return changed and enlarged to correspond with new Scheme.
1948	1947-8	Half-yearly primaries discontinued for summer, and reduced for winter, period. Two copies only of latter issued instead of three. Details of winter and summer costs entered on the yearly primary, which was again expanded. Delivery expenses, values in the disposal of cows section, monthly calving dates and monthly milk production were included. The form was also changed slightly for convenience of analysis.
1950	(1949-50) 1950-1	Winter record reduced to one of quantities only (foods, labour and milk produced); financial data omitted. Yearly primary modified, correspondingly, to show costs only for the full year. The ruling might be put into effect for the year 1949-50 on the old type of primary. Other, minor, alterations to the primary were the broader grouping of the miscellaneous expenses, and the omission of the labour of the farmer and his wife as a separate item.
Conventions of presentation, etc.		
	1944-5	Responsibility for national reports left Oxford.
	1945-6	Some reorganization of provinces and provincial jurisdiction. Counties of former West Midlands provincial centre distributed between Southern and North Western provinces.
	1946-7	Herds which are attested only to be transferred from the 'graded' to the 'ordinary wholesale' classification group, (i.e. ordinary wholesale producers are those selling ordinary milk or milk from accredited, attested, or accredited and attested herds).
	1946-7	Producer retailer dropped from calculations.
	1947-8	Wholesale and graded producer groups amalgamated for analysis tables in all national reports (formerly only wholesale group used for these).
	1947-8	Calculations adjusted to a 364 day year basis (some farmers having recorded a year of 371 days).
	1947-8	Comparison of costs of production in winter and summer superseded by the measurement of costs along a graduated scale of seasonality.
	1948-9	Recommendation to Economists to record a 365 day year.

APPENDIX IV

Herd replacement charge formulae

(*a*)

The 'depreciation on cows sold' method: Scheme 1935. (Used until 1946-7)

'For yearly returns and summaries the depreciation (or appreciation) will be the difference between (i) the total of (*a*) the valuation of dairy cows at the beginning of the year, (*b*) the cost of purchased cows and heifers and (*c*) the value of homebred heifers transferred in during the year, and (ii) the total of (*d*) the value of cows sold, died and transferred out during the year and (*e*) the value of dairy cows at the end of the year.' e.g.

	No.	*Per head*	*Value*	*No.*	*Value*
			£		£
Initial valuation ..	20	20	400	Sales 7 at	130
Add purchases ..	5	22	110	Deaths 1 at ..	1
Inward transfers ..	2	20	40	*Remaining Herd*	
				12 at ..	240
				7 at ..	150
				Depreciation ..	29
Total			550		550

Purchases and transfers are entered in the closing valuation at the end of the year at prices paid, and the *average* unit values of the closing valuation are used for the opening valuation of the following year.

(*b*)

Herd replacement costs method: Scheme 1951

'For the purposes of determining costs of herd replacement the following procedure should be used:—

(i) The number of animals in the herd at the date of initiation into the scheme is to be regarded as the basic number. The initial valuation of the herd should be made in consultation with the farmer or professional valuer. Pedigree herds, however, should be valued, both in regard to intake prices and subsequent valuations, at the commercial value for non-pedigree cattle capable of an equal level of performance.

(ii) When no change is made in the size of the herd, as between the opening and closing inventory, the total valuation of the herd should also remain unchanged unless replacements represent a substantial improvement in the quality of the herd (i.e. replacement animals should be entered in the valuation at the average unit value attached to the remainder of the herd). Purchases or transfers in will be offset by deaths, sales or transfers out.

(iii) On the occasion of each increase in the size of the herd from the number at the beginning of any year its total value should be increased by a sum which represents the value of these additions adjusted by an amount equal to one-third of the difference between their cost or intake value and the average market value of cows sold

or drafted from the herd. This depreciated or appreciated average value per head of the additional animals may be higher, lower or the same as that of the original basic herd or of the herd at the beginning of the particular year.

(iv) In the event of a substantial change in the quality of the herd, without any change in numbers, the closing valuation should reflect the value of the improvement or deterioration effected by the change in replacement policy.

(v) When a substantial change in quality is accompanied by an increase in numbers of cows in the herd, the method of adjusting the value of the additional animals outlined in (iii) above has to be amended to cover the "herd improvement or deterioration value" of the additions.

(vi) When a herd, which has previously been increased in size but not changed in quality, is reduced in number, the closing valuation should be reduced by an amount equal to the number reduced multiplied by the average value of animals in the group(s) most recently added. For example: if a herd increased by 7 cows in two years, 4 of them being entered in the first year at £30 per head and 3 in the second year at £35 per head, is reduced by 5 in the third year the closing valuation in that year will be reduced by £165 i.e. by $3 \times £35$ plus $2 \times £30$. This is an adaptation of the "last in first out" method in so far as the decrease in value consequent on the reduction of the herd is based on the average of the group(s) of additional animals recently added and not on the individual values of these.

(vii) When a herd which, in previous years, has been increased in size and changed in quality is reduced in number the closing valuation should be reduced by an amount equal to the number reduced multiplied by the average value of animals of the type being reduced in the groups of these recently added. The operation of the "last in first out" method applies here only in so far as it refers to animals of similar quality. When recent additions have all been of improved quality and subsequent reductions have been of the quality in the original herd the closing value will be reduced by the number of reductions multiplied by the average value in the original herd.'

APPENDIX V

Summary of the Scheme of May 1955

A new Scheme was issued in May, 1955. This confirms the dual approach of national costing and provincial research and the principle of dual authority, the Milk Investigation Committee being responsible for the design of the 'Costings Scheme' and the individual centres for their own research projects, subject to the Committee for advice only.

It differs in important ways from its predecessors. The sample is one of 500 herds belonging to either ordinary or T.T. wholesale milk producers, but only 350 of these are to be used for full national costings. The remaining 150 herds are intended as a basis for special provincial work and are to be costed according to the needs of the Economists. The information obtained for them is likely to be comprehensive but in any case must include certain basic facts which may be used to supplement the data of the standard sample. The residual sample does not have to conform to any distribution by size of herd and the requirements have been slightly relaxed for the standard sample.

The instructions in the Scheme apply to national costings on the 350 herds for the two years from 1st October 1955 to 30th September 1957 and the appropriate crop costing years. They can be summarised briefly as follows.

The most important change is that the unit of costing is now the dairy herd instead of the milking herd. With the inclusion of home-bred heifers in this way as well as of home-grown foods, which must now all be costed on all farms, the ambitions of 1934 for a self-sufficient costing have been realised. It involves revisions of method and a new period of trial and error. The herd replacement charge has been completely rebuilt and is governed by the stock account. (There are three of these, one referring to the young stock, one to the milking herd and one to the whole dairy herd.) In some ways it is a reversion to the simple method in use before 1947. Purchased cows are charged in at purchased price and carried on at that price until their disposal. (For the initial valuation the purchased cows in the existing milking herds are entered at the probable purchase price for that date.) Home-bred heifers are entered at cost. The complicated formula for entering sales and purchases is replaced by straightforward entries of the actual receipts and the costs of rearing or buying, but the trading balance of the young stock account—the amount by which the price obtained for *any* young dairy stock sold off the farm differs from the cost of its production—is also brought forward and enters into the charge on the primary return. The costs of rearing which are entered in the young stock account are the total costs apportioned evenly between the stock according to age, on the assumption that, in raising a heifer, the cost of a month's feed etc. will be the same at all ages above 3 months. For the first 3 months the cost is assumed to be higher. That is to say, they are standardized, herd average, costs and not individual costs. The closing valuation of young stock should offset the costs of the year's growth. (In order to deal with stock for the initial valuation it was assumed that costs in earlier years had been similar to the current costs.) The method also involves a breakdown of miscellaneous charges and overheads between the milking and rearing herds and increases this kind of arbitrary assessment within the total cost while increasing the autonomy of the total cost itself.

An attempt is made to make easier the estimating that already forms part of the Scheme, and to reduce its more specious elements. The calculation of the share of general farm expenses is simplified by substituting as a basis a flat rate of 5/- per £1 of direct manual labour[1] for the earlier dairy herd to total labour ratio, and a flat rate of 15/- per acre was introduced for the depreciation of the machinery, except for the larger items of tractors, etc., charged against home-grown crops. (Discretionary adjustments are allowed in each case.)

The standard rates in use were increased, the maximum rent charge for dairy buildings and cowsheds from £2 to £5 per cowstall and the optional rate for valuing farmyard manures from 15/- to £1 per ton. Other changes include the replacement of bull costs by a charge for service at the M.M.B. rates for artificial insemination. There are also minor changes in crop costing, such as that the manurial value of farmyard manure is to be divided over two years and include the cost of carting and spreading.

Contingent adjustments were made, the most interesting of which is that to the allowance for milk fed to livestock, which is now to be charged at market price instead of net cost of production. (Where the enterprise is costed as a unit no credits are charged for it.) This puts it out of alignment with other foods entered at cost but, with the entry of 'crops for sale', which may be made where it is known, it completes a basis for judging opportunity costs. More information about stock management is naturally included, e.g. the methods of wintering young stock, or the distribution of cows according to the number of completed lactations. The number of lactations in the case of stock which has been disposed of is also shown now.

There is a general impression of increased interest in data concerning capital and management generally, and a significant innovation which could lead to new uses of the land factor is the entry of the acreages devoted to the dairy herd and to the followers. For feed crops these are calculated from the quantities fed and the yields of crops. In the case of grassland, equivalent acreages which take into account the different uses to which the land is put are employed. The fact that special forms for this information must now accompany the primary returns shows the constant widening of interests within the more conventional of the two patterns of costing.

[1] Subsequently increased by the addition of a maximum of 15 per cent to the average hourly cost of labour per farm for crop costs as it was thought that insufficient account had been taken of overhead labour.