Appendices

Appendix 1

Source References

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Agricultural Statistics Report, 1927-1933
Agricultural Statistics Report, 1934-1956

Agricultural Statistics General Abstract, 1854-1886
Agricultural Statistics General Abstract, 1891-1895

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Agricultural Statistics Ireland, 1875-1879
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Agricultural Statistics Ireland, 1877-1878
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Agricultural Statistics Ireland, 1880-1884
Agricultural Statistics Ireland, 1885-1886
Agricultural Statistics Ireland, 1885-1889
Agricultural Statistics Ireland, 1887
Agricultural Statistics Ireland, 1888-1889
Agricultural Statistics Ireland, 1889-1890
Agricultural Statistics Ireland, 1890-1894
Agricultural Statistics Ireland, 1890
Agricultural Statistics Ireland, 1891
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Agricultural Statistics Ireland, 1893

Agricultural Statistics Ireland, 1895-1899
Agricultural Statistics Ireland, 1895
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Agricultural Statistics Ireland, 1897
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Agricultural Statistics Ireland, 1911
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Agricultural Statistics Ireland, 1915
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Agricultural Statistics Ireland, 1917
Agricultural Statistics Ireland, 1918
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Statistical Abstract of Ireland, 1952
Statistical Abstract of Ireland, 1953
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Statistical Abstract of Ireland, 1955
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Statistical Abstract of Ireland, 1957
Statistical Abstract of Ireland, 1958
Statistical Abstract of Ireland, 1959
Statistical Abstract of Ireland, 1960
Statistical Abstract of Ireland, 1961
Statistical Abstract of Ireland, 1962
Statistical Abstract of Ireland, 1963
Statistical Abstract of Ireland, 1964
Statistical Abstract of Ireland, 1965
Statistical Abstract of Ireland, 1966
Statistical Abstract of Ireland, 1967
Statistical Abstract of Ireland, 1968
Statistical Abstract of Ireland, 1969
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Statistical Abstract of Ireland, 1979

Census of Agriculture, June 1991, Detailed Results

Appendix 2

Agricultural Statistics, Ireland 1900 - General Instructions

I Enumeration Districts

1. The Townland Lists (Form E) of 1896, amended for last year, will assist the Superintendents to divide their Districts for the purposes of the present Enumeration; they are recommended to refer to the Ordnance Maps to see that the Townlands allotted to an Enumerator adjoin each other and that every Enumeration District is of convenient size. These Townland Lists corrected, where necessary, so as to show the arrangements for the present year, should be preserved for future reference.

2. Blank Forms - marked E - are supplied, in which Superintendents will enter the names of the Townlands allotted to each Enumerator. The Enumeration Districts ought, as far as practicable, to be co-extensive with Electoral Divisions. The Forms E so filled up, after being used by the Enumerators, should be sent back to this Office with the other Returns for the District.

3. The extent of Tillage and the distribution of Land in each Townland will be shown as in former years, on one set of Returns,- marked A;- and the number of Live Stock on another - marked B.

II Tillage and Distribution of Land Returns - Forms A, A1 and A3

4. Form A will contain the names of all persons occupying land within each townland – the acreage of their respective holdings (see note at foot of Form A), - the extent of land under each description of crop; in fallow, &c. - each area to be given in STATUTE (or English) ACRES. When turf bog, barren mountain, or waste land forms part of the holding, its extent should be entered in the proper column and also included in the total of the holding; and where tracts of land of any description are not occupied by a tenant farmer, or cultivated by the proprietor, their acreage should be ascertained by the Enumerator and added at foot of the Return, in the proper columns. The total of all the occupied and unoccupied portions should equal the area of the Townland as determined by the Ordnance Survey.

5. The area of the entire Townland, being first entered by the Enumerator at the head of Form A, affords a check upon the quantities stated by the various landholders and a means of testing the general accuracy of the answers. If upon adding up the acreage of the several holdings within each Townland, the total be found to differ from the area of the whole Townland, further inquiry should be made in order that the error may be corrected by the Enumerator.

6. In order to fill Form A correctly, the Enumerator will ascertain, first the total area of the holding, then the extent under each description of crop and finally, the quantity under Fallow, Woods, &c., observing particularly that the total of all the items (except those in the columns for separate additional statement relating to Orchards, Market Gardens and Nursery Gardens), should amount exactly to the total area of the holding. Each item of this information should be procured from the occupier of the land, his steward, or some other competent person who has an intimate knowledge of the particulars. When on the lands, the Enumerator will take the areas in whatever measure - Irish or Cunningham - may be in use in the locality and afterwards convert it into English or Statute Measure, in effecting which he will be guided by Form H.

7. Land intended for Turnips or other Green Crops, but which may not be sown at the time of the Inquiry, should be entered in the proper column, AS IF THE CROP WERE ALREADY IN THE GROUND - the Enumerator taking care to ascertain from the Occupier, or his Steward, or some other competent person, the EXACT extent to be cropped.

8. The Returns for Towns should be kept in separate files, showing the portions of the Town in each Townland; and the quantity of ground attached to each house as a garden plot must also be specified; but if such plots are very small it will be sufficient to state their number (as in pattern at pages 10-11) and total area. The extent of the crops grown in small gardens may be entered under the column headed "Other Green Crops", if the exact quantities under plots of "Cabbage", "Carrots and Parsnips", &c., cannot be determined.

9. The Enumerator will note that the Columns for some details additional to those required in former years, which were added to Form A in 1891, have been retained. Full instructions regarding these subjects are given on the Form.

10. The distribution of the area entered under Woods and Plantations on Form A and the estimated number of each description of tree will be entered on Form A3. The Enumerator will observe that the total of the areas under the several descriptions given in the latter Form must agree with the area for Woods and Plantations on Form A.

11. When obtaining information as to the extent of land under Potatoes, the Enumerator will ascertain the extent under each of the different kinds planted, and make an Abstract for each Townland on Form A1 supplied for that purpose.

12. In the case of an occupier of land resident within an Enumerator's District holding two or more farms, or having a farm which extends into two or more adjoining Townlands, a special Form A2 is furnished, on which the Enumerator will show the Townland where each farm (or portion of a farm) is situated. This information is necessary to compile a correct Return of the quantity of land in the occupation of each Landholder. One or more of these Forms A2, should be filled for each Enumeration District in accordance with the particular Instructions given on the Form. Should there be no such case in his District, the Enumerator will state so on Form A2.

III Returns of Live Stock, &c. - Form B

13. The first and second columns of this Form should contain, in the same order as the first and second columns of Form A, - the name of every Landholder and the extent of each holding. The other columns should show the number and description of Live Stock, &c., for each holding, as required by the headings of the columns. In order to insure accuracy, it is very desirable that the Enumerator should first obtain the total number of each description of Stock, and then ascertain the number at the various ages stated on Form B.

14. Grazing Stock (that is, Stock not belonging to the holder of the land on which they are feeding) must be considered as the stock of that land for the time being and should be entered as if belonging to the holder of such grazing land.

15. In the case of persons having Stock, but who are not Landholders, their names and the quantity of Stock in their possession will be entered on Form B, after the Landholders of the Townland and a line drawn across the "Area" column. The names of such Stockholders should not appear in the A Returns.

16. With regard to Towns, the names of Stockholders should be entered for each Street on one or more of the Forms as in the case of a Townland and the Stock belonging to each person distinctly stated.

17. Where farms extend into more than one Townland, the number of each description of Stock within each Townland, at the time of the inquiry, should be entered on the Form B for that Townland, the Enumerator taking care that none are enumerated twice. Cattle driven to Fairs and Markets on the day of the Enumerator's visit to the Farm should be entered as Stock belonging to the Holding from which they were driven.

18. Separate columns are given to distinguish the purposes for which Horses two years old and upwards are kept, whether for "amusement or recreation", for "traffic and manufactures" or for "agricultural purposes"; particular inquiry should therefore be made with a view to obtain this information. In many cases it will be found that the same horse is kept for recreation as well as for work and in every instance where the Enumerator is informed that any portion of the labour of the animal is given to productive employment, the horse is to be entered in the column headed "Agricultural purposes" or "Traffic and Manufactures" as the case may be. Carriage and Saddle Horses, kept for hire, should be returned in the column headed "Traffic and Manufactures". Military Horses should have the word "Army" written after them. In entering the Horse according to Age, strict regard should be had to the time of enumeration and the entries made in the several columns accordingly. For example, the number in the column headed "Under one year" should include all the animals under one year old at the time of enumeration and no others; and so on for the remaining columns.

19. In making up the files of Stock Returns (Form B), they should be arranged in exactly the same order as those of Tillage (Form A).

IV Abstracts of the A and B Returns of Enumeration Districts

20. As soon as an Enumerator has completed the Tillage and Stock Returns of the Townlands allotted to him, he will fill up with great care the Abstracts marked F1 and F2, observing the instructions at the foot of the A and B Forms and entering the Townlands in each Electoral Division on separate Forms. Very great trouble would be experienced if Townlands in different Electoral Divisions were entered on the same F Form; this irregularity should, therefore, be avoided. The E Returns should be used as a guide to the arrangement of the Townlands.

21. The Abstracts are to be placed in front of the files of Returns to which they belong.

V Rates of Produce - Form C

22. Form C, which will be forwarded in October together with instructions on the subject, will provide for a Return of the Average Rates of Produce of the various Crops grown in each Electoral Division.

VI Scutching Mills and Corn Mills - Form D

23. On Form D will be entered the number and description of Flax Mills and of Corn Mills. In those Enumeration Districts where there is not a Mill of either kind, a statement to that effect is to be written on one of the Forms D and the Form transmitted with the other Returns. If during the past year a Flax Mill has been converted to any other purpose, or the machinery has been taken down, or a Mill has fallen into ruin, or been burned, the circumstance should be clearly stated on the Form D.

VII Agricultural Labourers (Migratory) - Form M

24. Each Enumerator will carefully ascertain and enter on Form M the Names, &c., of all persons (Harvestmen) who, though usually resident in his enumeration district, are at the time of this inquiry assisting in Agricultural operations (a) elsewhere in Ireland, (b) in England or (c) in Scotland; also of those persons who are likely to be so employed during the season, the latter being marked with a cross thus X.

25. The Enumerator will carefully attend to the directions given on the Form, and fill it up in accordance with the "Pattern Return". Should there be no case of the above kind in his District, a Form M should be sent to this office marked "Nil".

26. Agricultural Labourers working outside the Enumeration District, who return daily to their homes within it, should not be included in these Returns.

VIII Forestry Operations

27. Form T provides for a Return of Forestry Operations in each Superintendent's District during the year ending 30th June, 1900. The information required (which is similar to that furnished for the preceding year) should be obtained from the Owners of Woods and Plantations or their representatives. No particulars are required regarding isolated trees; but trees cut down for thinning Plantations should be included; in such cases the column for Area will, of course, be left blank.

IX Insects Injurious to Crops

28. Referring to the "Special Report on Insects, Fungi and Weeds injurious to Farm Crops", copies of which have already been supplied to them, the Superintendents are requested to furnish observations as to any special injury to Crops from Insects or Fungi during the present season. Where the ravages have been extensive, specimens of the insects should if possible, be procured and forwarded to this Office.

X Bee-Keeping Statistics for 1899 - Form P

29. Form P for Apiculture Statistics has been prepared for the purpose of obtaining information as to the quantity of Honey and Wax produced and the number of Swarms at work in 1899. Should there be no Bee-keepers in his District, the Enumerator should send a Form P to this Office marked "Nil".

30. Should there be any cases where Bee-keepers have not hitherto noted the particulars as to which information on this subject is sought, the Enumerators will point out the desirability of their doing so in future, in order that the Statistics may be as complete as possible and therefore useful to Bee-keepers in general.

XI Silos and Ensilage - Form Q

31. Form Q is for the purpose of obtaining from each Enumerator a Return, for his District, of the names and addresses of persons making use of "SILOS" this year; and of those who this year have made or intend making ENSILAGE without SILOS.

XII Dairy Industries - Form U

32. Form U, which will be forwarded in October, provides for a return of particulars regarding "Dairy Industries". It is similar to that used for the purpose last year.

XIII Returns of Boars kept for Breeding Purposes - Form W

33. On Form W the Enumerator will enter the number of Boars kept for Breeding purposes in his District, showing the number of each of the principal breeds as provided for in the Form and distinguishing animals "Bred in Ireland" from those "Imported".

XIV Forwarding Returns to the Department of Agriculture and Technical Instruction

34. When the Returns for any DISTRICT have been completed, they are to be very carefully made up and forwarded to this Office by Rail or other public conveyance and not by post, unless the parcel be under 3lbs. in weight. The proper address is printed on the labels, one of which should be pasted on the parcel; the name of the District having been first written thereon.

35. An Invoice (Form I) of the contents should be placed in each parcel and a copy thereof forwarded by post at the same time.

36. Letters forwarded to this Office by Post, or Parcels transmitted per Rail should NOT BE PREPAID.

XV General Observations

37. It is very important that these inquiries should be commenced in each District on the same day. It is therefore recommended that Friday, the 1st of June, be adopted as the date for commencing the Enumeration, which should be continued diligently until completed. The Government is desirous of being informed of the results at an early period and - as errors arising from the transfer of Stock from one proprietor to another during the period of the inquiries may occur - expedition is most desirable.

38. Experience has shown that the Enumerators have had much difficulty in some cases, in ascertaining the extent of "Woods and Plantations"; their attention is, therefore, particularly directed to this subject, as being one which requires great care.

39. Errors have sometimes arisen in preparing fair copies of the Returns A and B and in making the Abstracts of them on the F1 and F2 Forms, by inserting in wrong columns the facts previously collected and by mistakes in the additions. As ordinary care would prevent such errors, the attention of the Enumerators is requested to this point; also to the instructions at foot of the A and B Forms.

40. In carrying the foregoing Instructions into effect, the Enumerators will observe the utmost civility; the information sought is to be asked for with courtesy and never with harsh language or threats. It is to be borne in mind, that almost all persons view inquiries of this character with suspicion in proportion to their want of knowledge of the results sought to be obtained; it is, however, considered that the publication of similar information which has now been collected for so many years, has done much to remove prejudices from the minds of all classes, so that it is confidently expected the Returns of this year will be obtained with facility and that the required particulars will on public grounds be faithfully given to the Enumerators by occupiers of land and also by proprietors of Live Stock, especially as the information collected will be published in General Abstracts only and no reference made to the property of individuals. In any case of refusal to supply the required information, a special report should forthwith be made by the Enumerator to the Superintendent, whose duty it will be to forward the report to the Secretary, Department of Agriculture and Technical Instruction, without any delay.

41. It is most important that in all cases, where possible, the Enumerator should ascertain the particulars from the occupier of the Farm, or from his Steward, or other intelligent person employed on the land.

42. The following stationery is supplied for the use of each Enumerator:

½ Quire Ruled Foolscap;
2 Sheets Blotting Paper;
1 Box of Pens; and
2 Pencils.

All applications for additional Forms, Portfolios, &c., should be made through the Superintendent of Enumeration for the District and not direct to this Office.

An allowance of 4d. will be made to the Head Constable or Sergeant in charge of each Police Station to supply ink for the use of the Enumerators.

HORACE PLUNKETT,
Vice-President of the Department of Agriculture and Technical Instruction.

We approve of the foregoing Instructions being addressed to those members of the Royal Irish Constabulary and the Dublin Metropolitan Police who may be engaged in collecting the Agricultural Statistics. They will use their best exertions to obtain early and accurate information for the Government.

District-Inspectors will therefore take care that the Districts of Enumerators are of convenient size; that the Instructions contained in Sec.37 (page 330) are strictly complied with; and that the required Returns are completed and forwarded to the Secretary, Department of Agriculture and Technical Instruction, 4, Upper Merrion Street, Dublin, as early as possible.

County Inspectors will afford every facility in their power to carry out the objects herein referred to.

Questions regarding the Accounts of the Royal Irish Constabulary Enumerators should be addressed to the Inspector-General.

A. Reed,
Inspector-General.

John J. Jones,
Chief Commissioner of Metropolitan Police.

Appendix 3

Census of Agriculture 1991 - Methodology Note

This note is an extract taken from the Census of Agriculture 1991 - Detailed Results published in May 1994.

Introduction

A Census of Agriculture was conducted in June 1991. This was the first full Census to be conducted since 1980. Censuses had previously been conducted at five-yearly intervals since 1960 and earlier still on an annual basis between 1847 and 1953 inclusive.

The 1991 Census was conducted using a completely new methodology. It was the culmination of a major EU-supported programme undertaken by the Central Statistics Office (CSO) to modernise the production of agricultural statistics in Ireland. This programme, which began in 1987, also involved the replacement of the traditional agricultural enumeration system with more cost-effective postal sample surveys and the computerisation of the processing and analysis of the returns. Notwithstanding the introduction of postal surveys, the Census itself was undertaken by 1,300 field staff who were retained by the CSO following the completion of the 1991 Census of Population. This was necessary because of the non-availability of a comprehensive and up-to-date register of farms on which to base a postal Census - indeed one of the principal objectives of the Census was to construct such a register for future statistical use.

The use of a new methodology inevitably means that some of the results obtained are not fully comparable with those obtained under the former system. This applies mainly to the coverage of the basic farm units and the related area used for agriculture. However the change in methodology does not give rise to significant discontinuities in the measurement of the main agricultural activities.

Coverage of the Census

The objective in the 1991 Census of Agriculture was to identify all operational farms in the country and to obtain details on the agricultural activities etc. undertaken on them. A farm was defined, in accordance with the definition adopted for the EU surveys on the structure of agricultural holdings, as:

a single unit, both technically and economically, which has a single management and which produces agricultural products

Agricultural production covers the growing of all crops (including horticultural crops) and the raising of all livestock (including those in intensive units). In line with the definition, a farm can consist of two or more separate pieces or parcels of land provided they are being worked together as a single unit i.e. using the same management, labour force and other means of production such as machinery. Two or more persons or concerns can be involved in the management of a farm provided that a single independent decision-making entity exists and that the partners involved share profits or losses as the case may be. Under the criteria described, a farm may consist entirely of owned land or entirely of rented land or a combination of both. In addition, a farm may consist only of buildings in the case of some of the highly intensive horticultural or livestock production units.

All farms where the agricultural area used was at least 1 hectare (2.47 acres) were covered in the Census. Farms with less than 1 hectare (ha) were also included if they were engaged in intensive production (e.g. pigs and poultry). The agricultural area used for farming (AAU), or area farmed, was defined as the combined area under crops, silage, hay, pasture and rough grazing land in use (including fallow and set aside land). Areas taken up by roads, tracks, water, bog, marsh, rocks, unused rough grazing land, building etc. were excluded. Commonage used by the farm was not included as part of the area farmed but livestock etc. held on such land were returned as belonging to the farm.

Differences between 1991 Census and previous censuses

The 1991 Census methodology was completely new and differed radically from that employed in the 1980 and earlier censuses. In the latter, an enumerator was assigned to a particular District Electoral Division (DED) for which the total map area was known and was required to account for all the agricultural land on holdings of 1/4 acre or more in the DED - other (i.e. non-agricultural) land being recorded as a residual. All agricultural activities in the DED were recorded as if they were undertaken by the registered owners (or 'holders') of the agricultural land - even if some or all of the land on individual holdings was let to others. An aggregate return was also included under agricultural area used for any commonage in use in the DED. As an aid to conducting the earlier enumerations, the total area of the DED together with a list of the names and addresses of agricultural landholders and the total size of their holdings (as recorded in the last enumeration) were made available to each enumerator. In essence, the enumerator's task under the old system, which continued until 1987 in the sample survey operation, was to update these particulars and to record the agricultural activities taking place in the DED in the process.

Another major difference was that the 1991 Census focused on the 'farm' as distinct from the 'holding'. It excluded commonage in use in determining area farmed and in terms of coverage, it excluded farms whose area farmed was less than 1 ha unless intensive agricultural production was undertaken on them.

The 1980 Census indicated that there were over 263,000 agricultural landholders with holdings of 1 acre (O.4 ha) or more and that the overall agricultural area used was 5.704 million ha. Because of the methodological differences these levels are not directly comparable with the 170,578 farms and associated area farmed of 4.442 million ha recorded in the 1991 Census.

For the purposes of the 1980 EU Farm Structures Survey, supplementary information was collected from a sample of about 35,600 of the 1980 Census holdings to estimate the number of farms (on a basis broadly consistent with that used in the 1991 Census) and the associated agricultural area used. From this information it was estimated that there were 223,500 farms in 1980 with an agricultural area used of 5.049 million ha. Three-quarters of the difference between the number of holdings and the estimated number of farms in 1980 was accounted for by holdings where all the land was let and the remainder consisted of farms under the EU size threshold of 1 ha. In the case of the agricultural area used, most of the difference was attributed to the exclusion of commonage from the coverage of farms but there was also an unaccounted "leakage" of approximately 250,000 ha because the recorded total area let by holdings exceeded the estimated total area taken by farms.

EU Farm Structures Sample Surveys were subsequently undertaken in 1983, 1985 and 1987. The estimated numbers of farms and the related areas used for agriculture, derived from the four surveys, are compared with the corresponding 1991 Census of Agriculture results in Table B.

Table B Numbers of farms and related agricultural area used (AAU) estimated from the Farm Structures Surveys 1980 to 1987 inclusive and returned in the 1991 Census of Agriculture

Survey	No. of Farms	Agricultural area used (AAU)
	(000)	(million ha)
1980 Survey	223.5	5.049
1983 Survey	221.1	5.037
1985 Survey	220.2	4.996
1987 Survey	217.0	4.915
1991 Census	170.6	4.442

This table would indicate that there are significant differences remaining between the survey estimates and the 1991 Census figures. However, when account is taken of the following factors the difference can be largely reconciled:

(1) There has been an increase of around 120,000 ha since 1980 in the area under woods and plantations and most of the increase has taken place in the latter part of the decade - most of this land would previously have been returned as agricultural land.

(2) Over 10 per cent of the farms covered in the 1987 survey, accounting for around 250,000 ha of the agricultural area used, had NO cash crops or livestock on them i.e. the land was simply returned as grass, pasture or rough grazing land. In 1991 less than 3 per cent of the farms, accounting for just 50,000 ha, were in this category.

(3) The more extensive screening procedures employed in the 1991 Census resulted in a large number of insignificant farms being excluded from the coverage (as evident from the almost halving of the number of farms of less than 5 ha, from 35,000 in 1987 to 19,000 in 1991) - in this regard the EU threshold of 1 ha is very low in an Irish farming context.

In summary therefore the number of farming units and the total agricultural area used recorded in the 1980 and 1991 Censuses cannot be directly compared. Closer agreement is obtained when the 1991 figures are compared with the results from the Farm Structures Surveys undertaken between 1980 and 1987. Even here, however, discontinuities still exist since it would appear that the rigorous screening procedures used in 1991 removed over 30,000 of the smaller or more marginal units which were included in the coverage of the structures surveys.

Despite the large reduction in the number of farming units in 1991, a detailed examination of the figures shows that the change in the methodology has had only a negligible effect on the recording of the level of agricultural activity in the State i.e. in terms of the numbers of livestock and of the areas under cash crops. Practically all the difference in the area used for agriculture is reflected therefore in the coverage of land used for grass, pasture and rough grazing.

Appendix 4

Sampling Methods applied to Irish Agricultural Statistics

By R. C. GEARY, Central Statistics Office

This paper is reproduced from the Journal of the Statistical and Social Inquiry Society of Ireland 1949.

For more than a century statistics of numbers of livestock and acreage under crops have been compiled annually for the country as a whole and for its constituent areas. The police acted as enumerators on all occasions except during the years 1919-1924, when estimates were made from returns received through the post from a large sample of farmers.

For many years preliminary estimates of agricultural statistics as on 1st June have been made from returns received in respect of the rural District Electoral Divisions in which Gárda Síochána barracks are situated. There are about 3,000 rural D.E.D.'s in all, and the sample extends to about a quarter of the totality. This sample has also been utilised for the purpose of estimating numbers of livestock on 1st January. The estimate of each statistic (number of cows, acreage under oats, etc.) is obtained by multiplying the ratio derived from the sample of identical D.E.D.'s in consecutive years by the result of the complete enumeration in the earlier year. Thus in the sample of 762 D.E.D.'s the number of milch cows was 329,866 in 1947 and 324,716 in 1948, giving a ratio of 0.984, which multiplied by 1,156,327, the actual number in the country in 1947, gave an estimate of 1,137,800 for 1st June, 1948, which compares with the actual figure of 1,133,663 from the complete enumeration. Up to 1933 estimates were made for each province separately, the provincial estimates being aggregated to give the total for the country. It was found that this method did not give more accurate results than did the ratio method applied as a simple aggregation of the sample D.E.D. figures, so the latter method was used in all years after 1933, with some saving in computation.

An investigation is at present proceeding in the Central Statistics Office with a view to determining the accuracy obtainable in estimating agricultural statistics from samples of various designs, having regard especially to the methods to be used to obtain the most accurate estimates. "Accuracy" is attained by using that sample design and method of estimation which, for a given size of sample or cost of inquiry, gives the estimate of the quantity required with the smallest sampling error. This paper gives the first results of this examination.

It is natural to start the investigation with a general comparison of the ratios obtained from the above mentioned sample and from the complete enumeration for all statistics over a period of years. Table 1 accordingly shows the percentage changes for the 20 consecutive years 1928-29 to 1947-48 inclusive, derived from the sample of about a quarter of the rural D.E.D.'s as compared with the percentages derived from the totality. The ratios are, of course, equal to $(1+\rho/100)$ where ρ is the percentage change. It will be observed at once that (a) the sample method yielded very accurate results in general, and (b) the results were considerably more accurate for some statistics than for others. Comparing, for the sample and the totality, the number of cases in which the sample yielded a ratio too large or too small, it is found that of the 381 independent comparisons (i.e., excluding summaries) in Table 1 there were 185 too large and 196 too small, revealing an absence of bias. As regards individual statistics where generally 20 comparisons are possible, in

no case does the deviation from the mean $(=n/2)$, where n is the number of comparisons, divided by the expected standard deviation $(=\frac{1}{2}\sqrt{n})$ exceed 2.

Throughout this memorandum, the quantity to be estimated is taken as the *ratio* of the statistic in 1948 to the 1947 value. Since the population value for 1947 is deemed known, the problem of estimation of the ratio is identical with the problem of estimating the aggregate value in 1948 and has the practical advantage of producing small variances and covariances.

The variance of the ratio is given approximately by

$$\frac{u^2}{u'^2}(v^2 + v'^2 - 2vv'\rho)\frac{(N-n)}{n(N-1)} \qquad (1)$$

where u and u' are the means, v and v' the coefficients of variation (i.e., the ratio of the standard deviation to the mean), in the later and earlier years respectively. These parameters are the appropriate values in the population which consists of all the D.E.D.'s or all the farms in the country, according as the D.E.D.'s or farms are the units of the sampling method. ρ is the coefficient of correlation between the measures in the two years, n and N the number in the sample and in the totality respectively. This formula shows how the accuracy depends on the magnitudes of v and v' and on the proportion which the sample bears to the totality as well as on ρ.

Table 1 Percentage Changes in Numbers of Livestock and in Acreage under Crops at1st June between consecutive years from 1928/29 to 1947/48 as derived from (1) a sample of about 750 districts and (2) from the Census.

Agricultural Statistics	1928-1929	1929-1930	1930-1931	1931-1932	1932-1933	1933-1934	1934-1935	1935-1936	1936-1937	1937-1938	1938-1939	1939-1940	1940-1941	1941-1942	1942-1943	1943-1944	1944-1945	1945-1946	1946-1947	1947-1948
Bulls																				
Sample	-	-	-	3.2	8.4	1.0	-	-2.8	-2.3	0.1	-0.2	4.9	5.8	-9.4	9.3	-1.3	0.3	-7.3	0.2	-2.9
Census	-7.9	5.5	-1.2	4.4	5.6	2.1	4.2	-3.0	-0.2	-0.4	-0.5	5.1	6.3	-9.6	9.2	-0.6	-0.3	-6.2	-0.7	-3.8
Milch Cows																				
Sample	-0.1	-0.5	-0.1	0.0	3.5	4.3	1.7	1.0	-2.8	-1.8	-1.5	-2.8	-1.2	-0.2	-0.3	1.2	0.1	-1.9	-3.3	-1.6
Census	-0.3	-0.2	-0.2	0.6	3.1	3.2	1.7	1.3	-3.3	-1.7	-1.7	-2.4	-1.3	-0.6	-0.4	1.3	0.4	-1.8	-3.7	-2.0
Heifers in Calf																				
Sample	-	-	-	-14.5	9.4	4.8	-	-11.9	-6.1	19.4	27.3	6.4	8.0	-1.9	5.5	5.5	-11.4	11.9	-19.1	50.4
Census	-5.2	8.9	-9.7	-13.5	3.2	7.7	-8.5	-8.7	-8.5	11.5	30.9	0.9	12.6	-1.6	10.0	4.1	-10.9	12.8	-22.6	53.6
Other Cattle																				
3 years & older																				
Sample	-	-	-	-4.9	8.1	0.5	-	-15.8	-16.4	10.2	-4.4	3.4	31.6	2.7	1.7	11.4	8.3	2.1	5.3	18.4
Census	0.3	-5.0	-1.1	-6.4	4.8	-1.1	-1.9	-18.6	-13.0	8.4	-1.7	2.2	33.2	-2.0	8.7	9.9	7.0	1.8	4.7	15.9
2-3 years old																				
Sample	-	-	-	-2.2	6.7	-7.1	-	-12.3	-8.3	9.0	2.9	3.4	17.3	-4.1	4.3	3.1	3.1	-0.2	-3.8	1.8
Census	3.5	-3.0	-5.1	-2.1	6.5	-6.6	1.7	-11.0	-6.6	9.2	1.6	3.6	14.6	-5.0	2.2	5.8	2.9	0.0	-4.4	0.4
1-2 years old																				
Sample	-0.3	-0.5	1.0	0.3	4.9	-3.0	-	-3.9	7.6	2.8	-2.2	1.1	0.5	-2.6	0.0	2.1	-1.5	-4.5	-4.0	-12.3
Census	-0.4	0.1	-2.2	0.5	3.9	-3.8	1.2	-2.6	6.1	3.5	-0.5	0.8	0.2	-2.4	0.4	1.6	-1.3	-5.0	-3.3	-12.4
<1 Year (incl. Calves)																				
Sample	0.3	-7.1	5.1	1.8	-0.1	-2.0	-11.5	14.0	0.4	3.1	0.8	-4.2	0.1	-0.5	1.2	1.6	-5.5	-2.2	-8.4	0.0
Census	0.2	-7.1	6.0	2.2	-1.4	-1.8	-10.2	13.1	-0.1	2.5	0.2	-3.6	-1.4	0.5	0.9	1.3	-5.5	-1.4	-8.7	0.2
Total Cattle																				
Sample	0.6	-2.5	0.1	-0.3	3.7	-0.8	-2.0	-0.4	-1.2	2.7	-0.1	-0.9	3.9	-1.4	1.1	3.1	-0.8	-1.7	-4.5	-0.3
Census	0.3	-2.4	-0.2	-0.1	2.8	-1.2	-1.6	-0.1	-1.5	2.6	0.0	-0.8	3.2	-1.6	1.3	2.6	-0.8	-1.5	-4.7	-0.7

Agricultural Statistics	1928-1929	1929-1930	1930-1931	1931-1932	1932-1933	1933-1934	1934-1935	1935-1936	1936-1937	1937-1938	1938-1939	1939-1940	1940-1941	1941-1942	1942-1943	1943-1944	1944-1945	1945-1946	1946-1947	1947-1948
Total Sheep																				
Sample	7.0	1.8	2.9	-3.2	-1.3	-11.3	2.3	1.0	-2.4	5.4	-5.1	-0.3	-3.6	-7.7	-5.1	3.1	-3.3	-4.2	-13.5	-2.9
Census	3.4	4.1	1.7	-3.2	-1.6	-13.9	3.8	0.7	-2.0	6.6	-4.7	0.7	-5.2	-7.4	-4.9	4.0	-3.1	-6.1	-13.6	-1.7
Boars Over Five Months Old																				
Sample	-	-	-	-1.5	-5.0	10.8	-	-4.8	-5.1	-2.0	4.4	-3.8	-16.9	-22.4	-13.0	-14.0	18.2	-8.0	11.1	-0.6
Census	-19.7	7.2	8.1	-9.5	-2.5	7.6	-0.1	-5.3	-3.7	-1.7	-1.5	2.6	-14.1	-21.8	-13.5	-7.9	1.0	4.6	0.9	-2.5
Sows																				
Sample	-17.3	15.6	10.0	-13.9	-11.6	5.9	13.3	-8.2	-9.5	3.9	-1.6	8.5	-30.4	-29.2	-16.9	-7.8	15.6	9.1	-8.8	8.3
Census	-16.7	16.0	12.2	-13.1	-10.1	5.4	10.7	-8.5	-9.3	2.2	-1.4	8.5	-32.3	-29.4	-16.2	.7.6	15.2	9.0	-10.5	9.4
Other Pigs 3 months & older																				
Sample	-	-	13.8	3.4	-24.8	3.5	-	-8.0	-5.6	6.1	-0.6	16.6	-27.3	-35.4	-5.1	-24.2	14.6	7.6	4.1	4.8
Census	-19.0	8.9	15.2	-3.8	-21.0	5.8	8.2	-3.8	-8.3	4.7	-2.5	15.3	-25.6	-33.9	-7.1	-23.6	15.0	9.5	0.8	2.5
<3 Months																				
Sample	-	-	19.3	-17.4	-14.7	0.4	-	-6.1	-5.5	0.8	-2.6	12.2	-23.0	-31.0	-25.4	-0.8	10.3	16.5	-8.5	-8.2
Census	-21.7	12.4	18.8	-13.8	-12.8	2.3	16.3	-8.3	-7.6	1.0	-3.5	11.3	-27.7	-31.0	-24.5	-1.0	8.6	16.0	-8.1	-4.2
Total Pigs																				
Sample	-20.8	10.5	16.0	-8.6	-18.7	2.2	14.3	-7.1	-6.0	3.3	-1.7	13.6	-25.6	-32.7	-15.9	-12.5	12.6	11.9	-3.3	-1.0
Census	-20.1	11.3	16.6	-9.7	-16.0	4.1	12.3	-6.5	-8.1	2.6	-2.9	12.7	-27.2	-32.1	-16.3	-12.3	11.9	12.5	-4.7	0.0
Total Poultry																				
Sample	2.2	1.8	-1.9	-0.6	2.2	-11.3	-2.5	2.8	-4.5	0.1	0.2	2.1	-14.7	1.5	-1.6	7.6	0.2	-0.6	-6.4	17.8
Census	1.7	3.7	-0.5	-1.1	-0.1	-11.2	-2.5	4.2	-4.0	0.7	-0.4	2.2	-12.9	-0.2	-1.5	7.2	-0.1	-0.2	-5.3	15.8

Agricultural Statistics	1928-1929	1929-1930	1930-1931	1931-1932	1932-1933	1933-1934	1934-1935	1935-1936	1936-1937	1937-1938	1938-1939	1939-1940	1940-1941	1941-1942	1942-1943	1943-1944	1944-1945	1945-1946	1946-1947	1947-1948
Wheat																				
Sample	-	-	-	-	142.1	76.9	73.7	55.8	-12.1	4.1	12.0	21.4	60.9	26.2	-11.8	25.9	3.7	-3.2	-9.7	-10.9
Census	-8.8	-6.4	-22.0	2.6	136.1	85.8	74.2	55.7	-13.5	4.6	10.8	19.6	51.7	24.1	-11.4	26.2	3.1	-3.0	-9.8	-10.6
Oats																				
Sample	3.7	-4.4	-2.4	0.1	2.8	-8.5	6.1	-9.4	2.4	-1.4	-6.4	26.0	14.4	12.7	6.9	1.5	-12.5	-0.7	-1.0	6.9
Census	2.7	-3.4	-3.3	1.5	0.4	-8.1	5.3	-9.0	2.6	-0.5	-5.9	26.9	14.9	12.2	6.7	1.0	-11.7	-0.4	-0.5	6.5
Barley																				
Sample	-10.3	-2.7	-0.9	-11.4	12.7	22.1	-5.1	-4.5	0.8	-12.2	-39.0	87.2	28.0	14.0	13.7	-19.1	0.3	-16.1	1.5	-19.5
Census	-8.9	-1.2	-0.4	-10.6	13.5	21.6	-2.9	-6.2	0.5	-9.8	-37.4	79.3	23.5	14.0	12.2	-19.8	1.6	-15.5	1.4	-17.9
Corn Crops																				
Sample	0.9	-3.9	-2.9	-1.2	9.1	0.9	12.4	2.5	-1.4	-1.6	-5.6	29.8	28.7	17.3	1.0	6.8	-5.2	-3.1	-4.1	-2.3
Census	0.3	-3.2	-3.5	-0.4	6.0	2.1	11.7	3.0	-2.1	-0.6	-5.7	29.3	26.0	16.5	1.1	6.2	-4.9	-3.1	-4.1	-2.2
Potatoes																				
Sample	-0.4	-4.3	0.3	0.7	1.4	-0.6	-1.3	-0.1	-2.4	-0.4	-3.6	15.5	19.3	-0.9	-4.8	2.2	-6.8	1.3	-2.4	0.3
Census	-0.3	-4.4	-0.2	0.4	-1.9	0.5	-2.1	-0.4	-2.2	0.0	-3.0	15.6	16.7	-0.6	-4.2	1.1	-5.9	0.8	-1.9	0.6
Turnips																				
Sample	0.4	-4.2	-0.4	-1.2	-2.3	-5.4	-5.3	-2.3	0.0	-5.0	-2.2	5.8	5.1	-8.1	-3.3	2.3	5.4	-0.1	4.2	-3.3
Census	-0.8	-4.9	1.8	-2.5	-4.2	-6.2	-4.7	-1.4	-0.6	-3.8	-1.2	6.8	4.0	-6.7	-2.5	0.9	5.6	-0.9	5.4	-3.6
Mangels																				
Sample	-1.3	-0.9	0.7	-3.5	2.4	3.1	1.6	0.9	2.0	-2.0	0.1	11.9	3.7	-13.4	-0.1	2.9	2.2	1.3	-3.8	-3.7
Census	-1.4	-3.5	4.3	-3.2	-1.4	3.6	1.5	1.4	1.1	-2.1	1.0	9.2	2.8	-12.9	0.0	0.9	3.8	0.5	-4.4	-2.2
Sugar Beet																				
Sample	-	-	-	-	-	-	-	5.7	2.2	21.4	-16.2	42.8	33.5	-30.1	50.4	-4.1	4.0	-7.5	-22.4	5.8
Census	-21.6	10.3	-65.2	173.1	10.2	202.3	25.7	7.3	0.2	-16.9	-18.6	51.0	24.6	-30.0	51.3	-1.5	3.3	-6.5	-22.1	7.9
Root and Green Crops																				
Sample	-0.5	-4.7	-1.1	0.3	0.3	3.6	-0.6	0.3	-0.8	-3.6	-4.3	15.3	14.8	-6.2	1.8	0.8	-1.8	0.0	-3.4	0.1
Census	-1.2	-5.0	-0.3	0.4	-2.3	3.7	-0.7	0.2	-1.2	-2.8	-3.8	15.2	13.3	-6.1	1.0	0.1	-1.1	-0.4	-3.1	0.0
Hay																				
Sample	-	-1.2	-1.0	0.9	1.2	-6.4	-1.7	-1.5	1.1	-2.9	1.2	2.8	-6.7	-2.0	-0.5	-1.4	1.5	0.5	3.2	1.3
Census	8.3	-1.6	0.8	-1.4	-1.6	-4.4	-3.0	-1.6	1.8	-2.4	1.2	3.1	-5.7	-2.2	-0.1	-3.0	2.7	-0.8	3.9	0.5

The range (or standard deviation) corresponding to any other sample size, say n', can be found from that shown in the tables (corresponding to sample size n) by multiplying by

$$\left\{\frac{(N-n')n}{n'(N-n)}\right\}^{\frac{1}{2}}$$

The range is invariably stated as corresponding to probability .05; the standard deviation may be deduced from the range by dividing by 3.92 (= 2x1.96).
From the above formula also it is possible to measure the relatively greater accuracy of the *ratio* method of estimation compared with the *simple sampling* method of estimation, which consists in multiplying the mean of the statistic from the 1948 sample by the total number *N*. It follows at once from (1) that, given the number *n* in the sample, the ratio method is more efficient than the simple sampling method so long as

(2) $$\rho > v'/2v$$

The sampling theory required for the application of the ratio method was worked out some years ago (Geary (1930))*. The basic theorem is as follows if $z = X/X'$ where X and X' are two variables normally distributed with means μ and μ' respectively, and if X' is unlikely to assume negative values, then

(3) $$u=(\mu' z-\mu)\Big/\left\{z^2\,\mathrm{var}X'-2z\,\mathrm{cov}(X,X')+\mathrm{var}X\right\}^{\frac{1}{2}}$$

is normally distributed with mean zero and variance unity. Given μ, μ' and the variances and covariances, the limits of the ratio *z* can be found corresponding to any desired normal probability level K (e.g. K =1.96 for probability .05) by setting

(4) $$\mu^2 = K^2$$

and finding therefrom the limits z_1 and z_2 of z by elementary algebra. There should be no difficulty in the applications contemplated in this memorandum with regard to the validity of the assumption of normality of the joint distribution of (X, X') since these represent the arithmetic means of different agricultural statistics derived from fairly large samples of districts or farms, and distribution of means tends to be close to normal even when the parent universes from which the samples are drawn are appreciably different from normal.

* Journal of the Royal Statistical Society, Vol. 93, p. 442.

The covariances (and variances) to be used in (3) are given by

$$covar(X, X') = \frac{(N-n)}{(N-1)n} covar(x, x') \tag{5}$$

where (x, x') are the measures of the statistic on individual districts or farms.

In this memorandum the accuracy obtainable from estimates of agricultural statistics derived from samples, using as sampling units (1) whole D.E.D.'s and (2) individual farms, is discussed. Four statistics are selected for special investigation-

(i) Number of milch cows;
(ii) Number of heifers in calf;
(iii) Number of pigs;
(iv) Acreage under barley.

This selection is well diversified from the sampling point of view: milch cows are the foundation of the agricultural economy and change little in number from year to year; the number of heifers in calf on the other hand varies very considerably and, as reference to Table 1 shows, yields relatively inaccurate estimates; the number of pigs varies considerably from year to year, but the sample estimates are generally satisfactory; and cultivation of barley is highly localised, being grown in quantity only in the south-east of the country. The investigation relates to the latest two years for which agricultural statistics are available, namely 1947 and 1948. To apply the theory summarised above, it was necessary to compute for each of the four selected statistics, and for district and farm units, the variances for each of the years and the covariances for the two years, on identical units. For this preliminary investigation, which it is proposed to extend if it yields promising results, it was regarded as adequate to estimate these functions from a random sample of 350 districts and 1,651 farms, the latter, however, containing a progressively higher proportion of farms with increasing size of farm, so that the numbers on which the estimates of the variances and covariances for larger farm sizes were based were not too small. The estimates of these statistical functions are accordingly subject to sampling errors of estimation which may well be the explanation of the fortunately few aberrations found in the results presented here. It must constantly be borne in mind that for both district and farm unit experiments the sample sizes vary considerably between provinces.

The principal basic data used in the calculations are given in the Appendix.

Sampling based on District Units

The main object of this section is to examine the behaviour of the ratio for 1947-48 for each province and for the country as a whole in the case of each of the statistics investigated. The abovementioned sample consisting of the D.E.D.'s in which police barracks are situated is not a random one and the number of districts in the sample and in the totality in each province are shown in Table 2.

Table 2 Number of Districts

Province (1)	Total (2)	Sample (3)	(3) as % of (2) (4)
Leinster	903	225	24.9
Munster	1,128	283	25.1
Connacht	646	168	26.0
Ulster (part of)	312	86	27.6
Ireland	2,989	762	25.5

The results are summarized in Table 3 for the four statistics for each province and for Ireland. Columns (2) and (3) of Table 3 show the true and sample value in the case of each of the indicated ratios. The remaining columns, as already explained, were obtained by estimating the appropriate variances and covariances from a separate *random* sample of 350 districts and from these finding the range, etc., appropriate to a sample of the size used.

Comparing columns (3), (4) and (5) it will be observed that in only one case out of 20 is the sample value of the ratio outside the .05 probability limits derived from formula (4) above, so that in this regard experience is in almost exact conformity with theory. As a more stringent test the 20 values of u were computed from formula (3) and the variance (from zero mean) of the twenty values was found to be 1.52 which is below the .05 probability of Fisher z-test for $(20, \infty)$ degrees of freedom so that the population variance of the sample was probably not significantly different from unity, as theory requires. The sample may be regarded as a normal sample, since the value of the test of normality a (Geary (1936))[2] is 0.8520, which is within the 10% probability points for sample size 20.

A further test of conformity of experience with theory had reference only to numbers of milch cows. This test involves the assumptions that (a) the 1947-48 coefficient of correlation $\rho(=.9920654)$ and coefficient of variation $v(=.0215773)$ remained constant at the 1947-48 level throughout the 21 years.

[2] Biometrika Vol, xxviii, pp.295-305

Table 3 True and Sample Values, Theoretical Sampling Limits and Range of Estimate, of Ratio for Four Statistics for 1947-1948.

Statistic And Area	Ratio		Theoretical Sampling Limits of 0.05 Probability		Correlation Between Measures on same Districts in 1947 and 1948	Range for 0.05 Probability	
	True	Sample	Lower	Upper		Actual	Approximate[1]
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Milch Cows:							
Leinster	0.974	0.975	0.960	0.986	0.9938	0.0256	0.0255
Munster	0.989	0.993	0.983	0.995	0.9938	0.0120	0.0120
Connacht	0.971	0.983	0.954	0.988	0.9686	0.0339	0.0338
Ulster (part)	0.966	0.963	0.953	0.979	0.9853	0.0257	0.0256
Ireland	0.980	0.984	0.975	0.985	0.9921	0.0106	0.0106
Heifers in Calf:							
Leinster	1.139	1.140	1.092	1.190	0.8636	0.0977	0.0971
Munster	2.324	2.174	2.118	2.580	0.7061	0.4618	0.4551
Connacht	1.277	1.312	1.160	1.416	0.8376	0.2559	0.2509
Ulster (part)	1.197	1.145	1.102	1.320	0.8598	0.2187	0.2139
Ireland	1.536	1.504	1.468	1.608	0.7324	0.1395	0.1390
Pigs							
Leinster	0.911	0.906	0.884	0.938	0.9280	0.0534	0.0533
Munster	1.122	1.089	1.089	1.155	0.9267	0.0660	0.0658
Connacht	0.948	0.952	0.913	0.987	0.9283	0.0740	0.0735
Ulster (part)	0.865	0.873	0.808	0.920	0.9741	0.1119	0.1080
Ireland	1	0.991	0.980	1.020	0.9256	0.0408	0.0408
Barley:							
Leinster	0.856	0.813[2]	0.826	0.894	0.9841	0.0574	0.0564
Munster	0.757	0.783	0.718	0.794	0.9615	0.0766	0.0758
Connacht	0.798	0.841	0.752	0.854	0.9558	0.1023	0.0991
Ulster (part)	1.073	1.150	0.956	1.202	0.9651	0.2459	0.2254
Ireland	0.821	0.805	0.798	0.842	0.9825	0.0443	0.0439

[1] Based on linear approximation to ratio.
[2] Outside 0.05 probability limits.

Making the transformation $z=z'\mu/u'$ we find

$$(6) \qquad u = v^{-1}\left\{1 + \frac{2(1-\rho)z'}{(1-z')^2}\right\}^{-1/2}$$

Twenty values of *u* can thus be computed. Of these all were found to be less than 2 except for 1931-32 and 1933-34, when the values were respectively -2.61 and +4.11. The latter value is impossibly large and, if correct, would invalidate the conclusion that the sample was "well-behaved" in regard to this particular statistic during the twenty years.

The aberration must be due to the non-applicability of the rather large assumptions stated above. It happened that between 1933 and 1934 a larger change occurred in the number of cows than in any other pair of consecutive years during the period and the changes were much diversified throughout the country. It must be borne in mind in regard to this application and throughout this memorandum that inferences are drawn generally from sample and not from population values. It would be possible to make a separate analysis for 1933-34, but the point does not seem to be of sufficient importance to justify further onerous calculations. Omitting the single value 4.11 the remaining 19 values yield an estimate of the variance of 1.256 which is not significantly different from unity for 19 degrees of freedom, while the *a* test of normality gives a value of 0.8373 which is not significantly different from the normal value.

We conclude that, although the 762 districts used at present for the preliminary estimation of agricultural statistics are not formally a random sample from the totality of 2,989 rural electoral districts - they are in fact districts in which police barracks are situated – they behave, as far as sampling theory by the ratio method is concerned, as if they were random.

The correlation coefficients given in column (6) of Table 3, derived from the separate *random* sample, are given because, from formula (2) above, it is evident that the superiority of the ratio method over the simple sampling method depends very largely on the magnitude of the correlation. From the magnitude of the correlations in all cases it is clear that, when sampling units are districts, the ratio method, given the number of districts sampled, is far superior to the method of simple sampling.

The figures in column (7) represent the differences between those in columns (4) and (5) (with an additional decimal place) and are derived from formulae (3) and (4). The figures given in column (8) are obtained from the approximate formula (1) which is derived from a linear approximation to the ratio. It will be noted that the figures are in excellent agreement, due to the fact that the samples are fairly large. This result, if it has been somewhat empirically established, is very useful because it offers a prospect of studentizing the ratios (i.e. using estimates for the variances) when the samples are fairly large, and thereby rendering more exact the estimation of limits of random sampling error.

As a curious fact it will be noted from columns (7) and (8) that the range of sampling error for the whole country is not invariably smaller than for the provinces, despite the smaller samples utilised in the latter case.

The principle of the ratio method is also involved when agricultural statistics are estimated from, say, the statistic per acre of agricultural land in the sample, the estimate in this case being density multiplied by the total area of agricultural land. The range for the estimate of the ratio for milch cows is given in column (3) of Table 4, derived from formulae (3) and (4).

Comparison of the figures in columns (2) and (3) shows that the estimate based on agricultural area is incomparably less efficient than the 1947-48 ratio method, due mainly to the fact that on identical districts correlation between numbers of cows in the two years is far greater than the correlation in 1948 between number of cows and agricultural area.

Comparison between columns (3) and (4) shows that the estimate based on agricultural area is not much more efficient than the simple sampling procedure which bases the estimate on the average number of cows per district sampled.

Table 4 Range of Estimate of Ratio (1948 to 1947) corresponding to .05 Probability for Number of Milch Cows, 1947-48 using Three Methods of Estimation. Approximately one-quarter Sample of Districts.

	Method of Estimation		
Province	Ratio 1947-48	Ratio of cows to Agricultural area 1948	Simple sampling 1948
(1)	(2)	(3)	(4)
Leinster	0.0256	0.1594	0.1919
Munster	0.012	0.0866	0.105
Connacht	0.0339	0.1381	0.135
Ulster (part of)	0.0257	0.1592	0.1497
Ireland	0.0106	0.0741	0.0812

Number of farms in the district sampled can also be used as a basis of estimate since number of farms is generally known in the aggregate. As an example, the range for the ratio for milch cows in Munster in 1948 was computed as 0.0844, not significantly different from the ratio derived using the agricultural area as a basis of estimate. The "estimates" shown in columns (3) and (4) have, of course, no practical value; they are given simply for their showing the contrasts in efficiency in this kind of work of different consistent methods of estimation.

Estimates of Ratio using Farms as Units

For these estimates the sample size for the country as a whole was deemed to be about 82,000, forming the same proportion of total farms in each province as do the districts shown in Table 2, with not less than 13,000 for any province or less than 7,000 for any size group of farms. Accordingly formula (1) was used for the estimation of the variance of the ratio, and, of course, the normality of the distribution of the ratio can be assumed. The variances and covariances in the case of the farm units were, as already explained, calculated from a *random* sample of 1,651 farms.

Table 5 Comparison of Standard Deviation of Sampling Error of estimate of Ratio (1948 to 1947) corresponding to .05 Probability for Three Methods of Estimation. Sample: one-quarter (approximately).

Province and Method of Estimation (1)	Milch Cows (2)	Heifers In Calf (3)	Pigs (4)	Barley (5)
Leinster				
A Ratio (district units)	0.00653	0.02492	0.01362	0.01464
B Ratio (farm units)	0.00650	0.02267	0.00973	0.01587
C Simple (farm units)	0.01206	0.01941	0.01042	0.01949
Munster				
A Ratio (district units)	0.00306	0.11781	0.01684	0.01954
B Ration (farm units)	0.00170	0.05677	0.01023	0.00875
C simple (farm units)	0.00514	0.04962	0.01358	0.00848
Connacht				
A Ratio (district units)	0.00865	0.06528	0.01888	0.02609
B Ratio (farm units)	0.00202	0.02891	0.00898	0.02244
C Simple (farm units	0.00337	0.02208	0.00856	0.02462
Ulster				
A Ratio (district units)	0.00656	0.05579	0.02854	0.06273
B Ratio (farm units)	0.00502	0.03521	0.02186	0.06822
C Simple (farm units	0.00605	0.02987	0.02536	0.08090
Ireland				
A Ratio (district units)	0.00270	0.03559	0.01041	0.01130
B Ratio (farm units)	0.00177	0.02042	0.00569	0.00970
C Simple (farm units	0.00398	0.01835	0.00715	0.01214

The values shown at A of Table 5 are found as the quotient by 3.92 of the values shown in column (7) of Table 2. Table 5 shows that, in general, methods B and C based on farms yield better estimates than does method A based on districts, but the rule is not invariable. While, as is obvious from the values of the correlations shown in Table 3 in conjunction with formula (2), the ratio method is incomparably more accurate than simple sampling when the sampling units are districts, this is not always the case when the units are farms; amongst the provinces there are six cases (out of sixteen) where the C value is lower than the B value. It should be emphasised that in each province the number of farms sampled is approximately the same for each of the three methods of estimation.

Most Efficient Sampling Pattern

If the statistics are given in M strata (geographical, type of husbandry, farm size, etc.) then the *simple sampling* estimate of the ratio z' will be given by

$$\mu' N z' = \sum_{i=1}^{M} N_i \bar{x}_i \tag{7}$$

Where N is the total number of farms, μ' the known population mean of the statistic in1947, N_i the number of farms in the ith stratum, x_i the mean of the statistic for the sample of n_i. It is well-known that, given the total number

$$n = \sum_i n_i$$

sampled, the values of n_i which minimise the variance of z are given by

$$n_i \propto N_i \sigma_i \tag{8}$$

where σ_i *is* the standard deviation of the statistic in the i th stratum, estimated, of course, as the square root of the estimated variance. Formulae (7) and (8) can readily be adapted to the *ratio* method by taking

$$\mu' N z'' = \sum_{i=1}^{M} N_i \mu_i' \bar{x}_i / \bar{x}_i' \tag{9}$$

where μ_i' and $\bar{x}_i'$ are the population and the sample mean of the sample n_i (identical in the two years) in the i th stratum. To apply the formula the linear approximation to $\bar{x}_i / \bar{x}_i'$ is taken in each stratum. In this case formula (8) again gives the minimum sampling variance with σ_i, replaced by μ_i' times the standard deviation of the ratio in the i th stratum.

Strictly speaking var z' or var z'' should be minimised subject to the cost of inquiry being constant. For this preliminary investigation it is therefore assumed that the cost of assessment of each farm is constant, whatever the farm size or situation. Formula (8) shows that the problem of the most efficient sampling pattern is closely related to that of discovering, in relation to the particular statistic to be estimated, the set of strata which yield the most heterogeneous standard deviations, for stratification has no advantage whatever over a random sample of the same total size unless the variances in the strata are different. The number of strata must of course be fairly

small, for if one could increase the number of strata indefinitely the heterogeneity would also be increased but so necessarily would the sample size.

The difficulty arises that each statistic has in general a different most efficient sampling pattern, as will presently appear in the case of the four investigated. It would be quite simple to find the sampling pattern which would ensure that the ratio for the weighted average of principal agricultural statistics has minimum variance, the predetermined weights being related perhaps to the contribution of each statistic to the agricultural income.

As Appendix Table C shows, stratification by size of farm introduces a satisfactory degree of variability into the variances. Needless to say, if sufficiently large samples were available for the estimation of variances and covariances on the lines of Table C, stratification should be carried much further, for instance to provinces and even counties, to farms sending milk to creameries and non-creamery farms, etc.

Table 6 contrasts the sampling pattern for minimum variance for four statistics whether based on the ratio method or on simple sampling. The figures shown in the second column are derived from column (6) of Appendix Table B. The Table shows clearly that in order to attain greater accuracy, it is generally necessary to sample a proportion of farms which increases with size of farm. As already pointed out, however, this result is true only because it is assumed that the cost of enumeration is the same per farm on large and small farms. It is interesting to note that for each statistic the percentage distribution for the ratio method and for simple sampling are very similar.

Table 6 Most Efficient Distribution of Sample for Estimation of Ratio (1948-1947) between Different Farm Sizes for Different Methods of Estimation and Statistics. Approximately one-quarter Sample of Farms.

Farm Size		Most efficient distribution of sample							
Acres	Actual	Milch Cows		Heifers In Calf		Pigs		Barley	
		Ratio Method	Simple Sampling	Ratio Method	Simple Sampling	Ratio Method	Simple Sampling	Ratio Method	Simple Sampling
1-15	27.9	12	9.3	22.9	24.9	14.4	11.2	3.1	5.3
15-30	27.4	21.6	16.8	14.2	11.3	24	27.6	19.2	19
30-50	19.6	20	19.9	12.6	12.5	21	19.7	14.2	14
50-100	16	16.4	25.9	20.3	18.1	21.2	23.7	25.7	33.8
Over 100	9.1	30	28	30.1	33.2	19.3	17.8	37.9	27.9
All Farms	100	100	100	100	100	100	100	100	100

Table 7 shows the gain in accuracy for each of the four statistics separately from using minimum variance sampling pattern as compared with random sampling. Except for pigs the gain is quite substantial since the error standard deviation is reduced by about 30-40%. If, however, one had to select a single sampling pattern based on size of farm strata, it is clear that in general the improvement in accuracy would be less than this.

Table 7 Comparison of Standard Deviation of Estimate of Ratio (1948 to 1947) for Most Efficient Distribution with Random Sampling Distribution. Approximately one-quarter Sample of Farms.

Statistic	Ratio Method		Ratio Method	
	Most Efficient	Random	Most Efficient	Random
(1)	(2)	(3)	(4)	(5)
Milch Cows	0.001254	0.001767	0.002339	0.003978
Heifers	0.015663	0.020415	0.013229	0.018348
Pigs	0.005119	0.005690	0.005982	0.007152
Barley	0.004918	0.009678	0.007465	0.012136

Summary

For this preliminary inquiry into the accuracy attainable from sampling methods applied to the estimation of agricultural statistics, the estimates obtained from a sample of about one-quarter, using district units and the year to year ratio method, are compared with the Agricultural Census results over a period of 20 years for all principal agricultural statistics (Table 1). After a brief discussion of the theory, the accuracy of estimates of four particular agricultural statistics for the year 1948 is examined, using simple sampling and the ratio method and using districts and farms as sampling units, for provinces as well as for the country as a whole. The sampling fraction was about one-quarter of the totality, whether of districts or of farms.

The following are the principal results:-

(i) the results for 20 years using districts as sampling units are consistent with theory showing that the districts, though not selected formally at random, behave as if they were when the ratio method is used;

(ii) using districts as sampling units the linear approximation to the ratio gives very accurate results from the viewpoint of probability inference, thus permitting the 'studentization' of the ratio method;

(iii) using districts as sampling units, the year to year ratio method is incomparably more accurate than simple sampling or than estimates based on sample estimates of density per acre of agricultural land or than estimates based on average number per farm;

(iv) ratio method estimates are more accurate using farms rather than districts as sampling units;

(v) using farms as sampling units, the ratio method is not invariably more accurate than simple sampling;

(vi) using farms as sampling units and stratifying by farm size, the most efficient sampling patterns yield estimates generally about 30-40% more accurate than random sampling for each statistic separately; if a single most efficient sampling pattern be devised on any basis, the improvement would obviously be much less than this; it is recognised, however, that further research will probably reveal much more efficient patterns when stratification is carried out by factors other than farm size.

Table A District Units:[3] Population Means and Estimated Variances and Covariances.

Statistic and Province	Population Mean		Estimate of		
	1947 (μ^1)	1948 (μ)	Variance 1947	Variance 1948	Covariance 1947/1948
Milch Cows:					
Leinster	285	277	51,983	58,182	54,657
Munster	513	508	68,590	71,325	69,507
Connacht	321	312	25,900	27,712	25,949
Ulster (part)	362	350	23,028	22,581	22,468
Ireland	387	379	62,632	65,706	63,641
Heifers in Calf:					
Leinster	42	48	941	1,030	891
Munster	23	54	1,003	2,182	1,208
Connacht	19	24	656	847	624
Ulster (part)	24	29	510	410	393
Ireland	28	43	888	1,528	853
Pigs:					
Leinster	148	135	8,889	8,691	8,156
Munster	167	187	14,202	21,002	16,055
Connacht	136	129	11,921	9,325	9,788
Ulster (part)	151	131	48,901	39,950	43,053
Ireland	153	153	16,133	17,975	15,762
Barley:					
Leinster	96	82	21,046	17,148	18,696
Munster	43	33	3,808	3,011	3,256
Connacht	16	12	607	334	434
Ulster (part)	3	3	38	45	40
Ireland	49	40	9,581	7,722	8,451

[3] Estimation based on random sample of 350 districts, of which 113 were in Leinster, 123 in Munster, 77 in Connacht and 37 in Ulster (part of).

Table B No. of Holdings over 1 acre in Ireland in 1948.

Class of Holding	Leinster	Munster	Connacht	Ulster (3 Cos.)	Ireland
(1)	(2)	(3)	(4)	(5)	(6)
1-15 acres	21,969	20,086	29,093	18,034	89,182
15 – 30 acres	17,194	17,859	37,378	15,158	87,589
30 – 50 acres	14,259	19,929	19,772	8,509	62,469
50 – 100 acres	14,305	23,221	8,365	5,172	51,063
100 acres and over	11,200	13,001	2,831	1,996	29,028
All Classes	78,927	94,096	97,439	48,869	319,331

Table C Farm units:[4] Estimates of Means, Variances and Covariances for each size of farm.

Statistic and Size of farm in acres	Estimate of:- Mean 1947	Mean 1948	Variance 1947	Variance 1948	Covariance 1947/'48
Milch Cows:					
1 – 15	1.4400	1.2196	1.2013	1.1290	0.8652
15 – 30	2.7479	2.6109	3.7489	3.7795	2.8390
30 – 50	4.0325	3.9812	9.2160	10.4776	8.3403
50 –100	6.6659	6.4345	25.6563	26.5903	24.5911
Over 100	9.7580	9.7148	94.2215	96.0331	79.5555
Heifers in Calf:					
1 –15	0.0335	0.1172	0.0434	1.0143	-0.0032
15 – 30	0.0726	0.1502	0.0993	0.2165	0.0046
30 – 50	0.1644	0.2953	0.2015	0.5199	0.0553
50 –100	0.3803	0.7150	0.8791	1.6268	0.2621
Over 100	1.1935	2.0347	6.8146	16.9350	3.2703
Total Pigs:					
1 –15	0.4766	0.4066	0.8629	1.3936	0.2302
15 – 30	1.2868	1.2077	8.2813	8.9115	5.9992
30 – 50	1.4450	1.6493	8.0496	8.8743	5.2309
50 –100	2.5034	2.6194	18.4756	19.3414	13.4846
Over 100	2.7174	3.2015	21.3967	33.5926	14.5528
Barley:					
1 –15	0.0750	0.0411	0.1749	0.0646	0.0955
15 – 30	0.1826	0.1802	0.6815	0.8572	0.5327
30 – 50	0.4183	0.3138	1.6806	0.9212	0.9004
50 –100	1.1250	0.8467	9.1978	7.9928	7.0888
Over 100	1.5968	1.3494	20.2897	16.7997	8.5402

[4] Estimates based on sample of 1,651 farms of which 224 were 1-15 acres, 373 were 15-30 acres, 256 were 30-50 acres, 432 were 50-100 acres, and 366 were over 100 acres.

Appendix 5

Two Centuries of Irish Agriculture, a Statistical Retrospect, 1672-1905.

BY D.A. CHART, ESQ., M.A., Public Record Office of Ireland.

[Read, March 20th, 1908.]

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In economic, as in political problems, a knowledge of the past is essential to the proper understanding of the present. At this time therefore, when so many Irishmen are hoping and striving for a general industrial revival, it may not be inappropriate to trace the fortunes of our oldest, most important, and perhaps, most successful industry - that connected with the land.

And here the tendency of history in general, and Irish history in particular, to repeat itself is the first thing to impress the inquirer. From the earliest times, Ireland has been, just as she is still, primarily a country of pasturage. Animals and animal products, cattle and sheep, wool, tallow, hides, butter, figure as prominently in the mediaeval records as they do in the most recent returns of the Department of Agriculture. The Celtic tribes were purely pastoral in their habits, even taking the cow as their standard of value. The English settlers of the Pale were also, for the most part graziers. Yet cereal crops were raised to an extent that varied, probably, according as the country was peaceful or the reverse. In times of disturbance no holder of land cared to give a hostage to fortune by sowing his land with corn, which could easily be burnt or destroyed by his enemies. Cattle, on the other hand, in the eyes of both English and Irish, had the advantage that they could, at time of need, be driven to some hiding-place or some defensible position, where they would be secure from capture. The bawn or fortified enclosure to which cattle were driven for safety at night or in war time, is a prominent feature in most of our ancient castles. In the thirteenth century, however, before the Bruce invasions threw everything into confusion, a considerable quantity of wheat must have been grown, for the English armies campaigning in Scotland, Wales and France were largely victualled by cargoes of corn from Ireland. The counties of Dublin, Kildare, Kilkenny and Carlow were the chief sources of this supply. The tribesmen, too, must, in later times, have taken to growing oats, for the Elizabethan writer, Campion, in 1571, mentions oatmeal (with shamrocks, watercresses, roots, butter, whey, milk and beef broth) in a list of the chief articles of diet among the natives. Still the evidence goes to show that the practice of tillage in Ireland was spasmodic and uncertain, while pasturage was steadily and consistently pursued.

In the seventeenth century we come to firmer ground for our conclusions than the casual entries in royal accounts or the obiter dicta of the careless chronicler on which we have hitherto had to rely. Official statistics of trade begin to be issued, and these, illustrated and elucidated, as such silent witnesses should always be, by the remarks of contemporary economic writers, provide sufficient data for our inferences. The best authority for the period is undoubtedly Sir William Petty, a man of great practical ability, deeply interested in problems of state. In 1672 he published his Political Anatomy of Ireland, in which he applies his methods of political arithmetic , in other words, statistics, to ascertain the state of that country. As an official of the Irish Government, for many years, he had had ample opportunity for observation and investigation. His Treatise of Ireland, written in 1687 adds further details.

Again, the picture is of a land devoted mainly to pasturage, but producing, nevertheless, a certain quantity of corn. The chief exports in 1685 were as follows:

Beef	75,000	Barrels (a barrel is 2½ cwt.)
Pork	2,500	barrels
Butter	134,000	barrels
Corn (of all kinds)	148,000	barrels
Bacon	2,080	flitches
Tallow	41,000	cwt.
Hides (Tanned)	86,000	cwt.
Hides (Salted)	93,000	cwt.
Lamb Skins	1,435,000	cwt.
Calf Skins	48,000	cwt.
Coney (Rabbit) Skins	1,665,000	cwt.
Goat Skins	278,000	cwt.
Linen Cloth	1,851	pieces
Linen Yarn	3,825	cwt.
Wool	123,000	stone
Frieze	629,000	yards
Drapery	4,900	pieces
Beer	4,600	barrels
Aquavitae	1,519	Gallons

These figures show what a country Ireland has always been for livestock. Almost every item deals with animals or their produce. The total production of grain must have been small, for, as will be shown, there was very little consumed at home, and not much was exported. Indeed, Petty estimates that only 500,000 acres were under tillage, while 7,000,000 were devoted to the support of great flocks and herds whose total numbers he estimates at 3,000,000 horned cattle and 3,000,000 sheep. The number, great as it is, is probably not exaggerated. The million and a half of lambs whose skins are mentioned, presuppose almost as many full-grown sheep to give them birth. At least 180,000 head of cattle must have been slaughtered in one year to supply so many hides and fill so many barrels of salt meat. Great numbers of milch cows were needed to provide such a quantity of butter after supplying the home demand for milk, then a chief article of diet. The grain export is the surplus after home consumption, which was probably less than of old, for by this time the people had taken eagerly to the potato. Petty asserts that for the ten months from August till May, potatoes and milk were the staple food everywhere, oatmeal being only used to fill up the intervals when the tuber was not available. The abundance of sheep and consequent cheapness of wool had led to a prosperous manufacture of the coarser grades of woollen fabrics. The export of frieze was so considerable, that it was destined to arouse the fatal jealousy of English manufacturers and to be smothered by hostile legislation. Under the head of bacon, linen, beer and whiskey, we find the small beginnings of four still flourishing Irish industries. As a whole, however, the country was self-supporting and self-sufficing. It made its own clothes, tanned its own leather, grew and prepared its own food. There were little or no imported luxuries, and the standard of living was low. The houses of the poor were miserable cabins, which could be run up in three or four days. Irish bacon and butter, produced amid such unwholesome surroundings, often took a taint, which diminished their value considerably. There was a certain rude plenty, no doubt, in favourable seasons, but, taken altogether, the condition of the people was deplorable. The tribal organisation had been swept away, and the race was not taking kindly to the new system of landlord and tenant.

Apparently during the next forty years there was little progress in Ireland. In 1729 Dobbs published his Essay on the Trade and Improvement of Ireland, and it cannot be said that either the statements made in his book or the official figures of the period indicate any very marked improvement. Wool, tallow and hides are stationary or retrogressing, butter has diminished, bacon and cheese are approaching extinction, woollen manufactures are much reduced; grain is hardly an eighth part of the figure quoted in 1685.

On the other hand, the dead meat trade is increasing by leaps and bounds. The average export of beef was 135,000 barrels, and of port 10,000 barrels. These figures are, in the one case, nearly double; in the other, four times the exports in Petty's time. The probable explanation of the increase is to be found in the need of the young American and West Indian colonies for salt provisions, pending the establishment of their own agriculture on a sound basis. Ireland was favourably situated for this trade. The navy, army, and merchant service of Great Britain was largely victualled from the South of Ireland ports.

Again, linen was a flourishing industry, and the country was now able to export 4,000,000 yards of linen cloth. It may, perhaps, be objected that export returns are not a true guide to the amount of produce raised in the kingdom, that, conceivably, much of the annual crop was consumed at home and never appeared in the export returns. The only answer to this is, that, for many years, export and import figures were the only ones which Governments troubled themselves to collect, and hence they are the only data for our conclusions. Wherever any particular form of agricultural produce is shown on the evidence of contemporary writers to have been an article of diet or daily use, and does not appear to have been much imported, it must be presumed that it was largely grown in Ireland, and must, therefore, be added to our lists of agricultural products based on the export returns. This is the case throughout our period, with potatoes and oatmeal, for instance, both staple foods of the people.

Dobbs, however, though an earnest and intelligent writer, is not a very good witness as to the conditions of farming, in which, indeed, he does not display a very great interest, save that, like all the economists of the day, he disliked the grazing system on account of the few hands it employed, and, on that account, desired to see it replaced by tillage. From many indications in his book, it is evident that the country was still in a bad way. A devastating war had been followed by a period of confiscation, change of ownership and emigration. Penal laws and commercial restrictions were in full force, and were producing their baneful and blighting effect on the life of the country.

A far better picture of eighteenth century agriculture is given by Arthur Young, who visited Ireland more than once between 1776 and 1779 and traversed the whole length and breadth of the country, observing and inquiring into the cultivation of each district he passed through, and noting down the results with all the conscientious industry of a Royal Commission. He was a man of lively intelligence and warm, human sympathies, an agriculturist of no small reputation, and therefore peculiarly fitted to conduct an unofficial survey of Ireland. During the fifty years between Dobbs and Young new influences had been at work. The native Parliament had grown in strength and had cast about it for means to encourage the industries and promote the prosperity of the people. Associations of private individuals, like the Dublin Society, pursued the same ends. The stranger found much to criticise, yet much to approve. There was a certain poverty of equipment everywhere, which prevented the attainment of the best results. Ploughs and harrows were often of primitive construction. Farm cars consisted of no more than two wheels, an axle, and a small platform of boards. Bullocks were used in place of horses. Corn was threshed on mud

floors, so that Irish grain could often be recognized by the clay adhering to it. Insanitary cabins served the purpose of dairies.

The system of land tenure was unsound and oppressive. Land was let out for limited periods; and, as a rule, several middlemen of a low social type intervened between the landlord and the occupying tenant. The holder of land on short lease racked the property during the last few years of his term, and made no improvements whatever, knowing they would profit him nothing. A service tenure by which the tenant was obliged to give so many days work yearly to his landlord was not unusual. Rents were forced up by competition, for, to the Irish peasant, the possession of land on which potatoes might be grown was the only sure guarantee of continued existence. There were practically no industries to turn to, except, perhaps, in the North, the linen manufacture. There was no system of poor relief. The landless man, having no means to raise food for himself and his family, must either starve by the wayside or drift into the precarious existence of the hired labourer.

The labourers were, indeed, miserably situated. Wages were nominally sixpence a day, but each man employed had to submit to two heavy annual deductions from his pay, firstly, for the rent of a little patch of ground let out to him for growing potatoes, secondly, for the grazing of a cow to provide the milk required to supplement that monotonous vegetable in the daily diet. These payments brought his wages down to some three pounds a year, which was often whittled down still further on various pretexts, so that Young declares that, as a rule, no money at all passed between the parties. Men living in a state like this are at the mercy of every accident. A bad yield of the potatoes or the death of the one solitary cow brought them face to face with starvation.

Yet, on the other hand, there were traces of improvement. The encouragement of tillage and corn-growing, which was a pious wish with Dobbs, had been carried into action, though at an enormous expense and on an uneconomical method, by the Irish Parliament. Bounties were given for corn raised in the interior of Ireland and brought to Dublin for sale. The scale of payment was most liberal - 6d. per ton per mile for wheat and barley, and 4d. per ton per mile for oats. For flour the premium was 1s. per ton per mile, so that in order to earn thehigher premium, country gentlemen were tempted to erect mills on their properties. In 1777 bounty was paid on some 40,000 tons of wheat and 15,000 tons of flour, and the cost to the Irish Government was £50,000 - about one-twentieth of the total annual revenue. Young thought the results attained were not value for the expenditure, and would rather have spent the money on the improvement of waste lands. Here, however, the Dublin Society had done some very useful work by giving premium and medals for the reclamation of bogs and mountains. Many of the great landowners, even without such a stimulus, had spent considerable sums in experimenting on the best methods of cultivating the waste. Altogether, in Young's opinion, the country was on the up grade, and had been so for some time past.

The increase of tillage had not materially injured the grazier. In fact Young states several reasons why Ireland must always be a pastoral rather than an agricultural country. The damp climate is favourable to the growth of grass, and adverse to cereals, especially to wheat. A field left fallow in Ireland would, he states, cover itself with a spontaneous natural crop of white clover and succulent grass, whereas in other countries the result would be a fearful array of weeds. Such a soil must always be specially suited to the rearing of cattle. However, he laments the general omission of turnips, which would provide food for the bullocks during the winter, when the grass did not grow. The result of this lack of winter provender was that the cattle, half starved as they were during half the year, could not pick up condition during the other half, and never attained the size or weight of beasts in other lands. The export figures of the produce of pasturage and pig-keeping will show clearly that tillage and grazing managed to co-exist very comfortably.

Average of Exports, 1771 - 1777

Beef	195,000	barrels
Pork	55,000	Flitches
Bacon	19,125	cwt.
Butter	267,000	cwt.
Hides	121,000	cwt.
Tallow	41,000	cwt.
Wool	1,415	stone
Worsted Yarn	99,000	stone

If these figures be compared with those of 1685, it will be seen that, in most of the commodities mentioned, with the conspicuous exception of wool, Irish production had considerably increased. Corn was now produced all over Ireland for the Dublin market. Even from County Cork, distant at least 120 miles, it was carried in carts to the capital, earning for the growers a bounty of 6d. per mile carried, in this case £3 to the ton. Export was encouraged by a bounty, and the home market was protected by a duty of 2s. per barrel on import, but, nevertheless, the corn exports were not large at this period. The figures are –

Wheat	5,000 quarters
Barley	5,500 quarters
Oats	33,000 quarters
Flour	35,000 cwt.

The growing taste for beer and spirits was fostering the growth of barley. But oats, then as now, was far and away the most important grain crop in Ireland. There were four fields of oats to one of any other cereal. It was grown chiefly for home consumption; oatmeal stirabout, especially in the North, alternated with boiled potatoes as the staple dish of the poor.

Thirty-three years after Young, in 1812, a year of great wars, another experienced agriculturist, Edward Wakefield, took a survey of the state of Ireland. Despite his careful accuracy, he is not so illuminative as Young. Like his predecessor, he was a humane man, but he failed to humanize his statistics, and his work accordingly savours a little too much of the blue book. However, from his laboriously collected facts and marshalled statistics satisfactory inferences may be drawn. The first of these is that the long war with the French Republic and Napoleon had given a distinct impetus to Irish agriculture. What with privateers and Berlin Decrees, the usual sources of supply were closed to England. Ireland had that great and increasing market all to herself, and profited accordingly. The two great canals, the Grand and the Royal, brought produce to Dublin in a cheap and convenient manner. Corn was grown in Ireland to an extent unequalled before. The total production can, of course, only be guessed at, but the export figures for 1811 give some idea of its magnitude.

Wheat	192,000 barrels
Barley	76,000 barrels
Oats	756,000 barrels
Flour	91,000 cwt.
Oatmeal	57,000 cwt.

A contemporary letter speaks of Kildare, Carlow, Kilkenny, Queen's Co., Tipperary, and Limerick as the granary of England. And, just as in Young's time, the extra growth of corn seems to have been achieved without inflicting marked injury on the pasturage system, for which the export figures for 1811 are as follows:-

Beef	95,000 barrels
Pork	110,000 barrels
Bacon	{ 310,000 flitches
	{ 16,000 hams
Butter	390,000 cwt.
Hides (untanned)	54,000
Bullocks	45,000
Sheep	21,000
Hogs	35,000

It will be noticed that the export of beef is down compared with the figures of 1770-1777, but this diminution is amply compensated by a larger production of butter and an enormously increased export of pork and bacon. The pig, once comparatively seldom mentioned in Irish records, had now become universal. Every cottier kept one, feeding it on potato refuse, and curing establishments sprang up at Limerick, Clonmel and Waterford. The salt meat trade was centred at Cork, a great victualling station, not only for merchantmen sailing to America, but also for the navy blockading French ports, and for the Wellington's troops in the Peninsula. The live cattle trade was just commencing to be of importance again. It had flourished in the seventeenth century, until checked in 1666 by a law against the import of Irish cattle into England. Slowness and difficulty of transit were also a great obstacle to its development. In the absence of railways, only districts within a day or two's march of the sea could send out bullocks and sheep, and again on arrival the beasts could not be driven far inland; sometimes, however, a trade could be done, as, for instance, between Meath and Lancashire, by way of Liverpool and Dublin. Dairy farms were on the increase, and, according to Wakefield, covered more land than the grazing farms. Butter commanded a good price, not less than £6 a cwt., though the old complaints are reiterated of deterioration caused by insanitary surroundings at the place of origin. Beer and spirits increased every year, and must have consumed great quantities of barley. The firm of Beamish and Crawford, in Cork, alone brewed 100,000 barrels yearly. 1,000,000 gallons of whiskey were sent to England in 1806, and probably much more than that amount consumed at home; for it was the palmy time of illicit distilling, and most of the whiskey never saw the face of a gauger, and, a priori, never got into an official return. The value of turnips to cattle-owners had, since Young's time, been recognised in Ireland, and a considerable crop was grown.

During the first half of the nineteenth century the state of things described by Wakefield continued. The war came to an end in 1815, but the Corn Laws, with their heavy duties on foreign cereals, gave the Irish corn-grower a great advantage in the English market. The exports of grain, flour, and meal increased, until in 1845 they stood as follows:-

Wheat and flour	779,000 quarters
Barley	93,000 quarters
Oats and Oatmeal	2,353,000 quarters

The returns of the period do not distinguish ground corn from unground, but, on a rough estimate, about two fifths of the total export was in the form of flour and meal, and it may be inferred that the old mills, whose ruins now sadden many an Irish glen and river valley, were still doing a prosperous business. Butter, bacon, porter, etc., were exported as before in undiminished quantities, but the trade in dead meat was fast being replaced by that in live cattle. The steamship and the railway train were now available to carry Irish cattle from Liverpool or Bristol to the inland cities of England. Great Britain was now covered with railroads, and Ireland was just beginning to follow suit, when the great catastrophe of the Famine broke unexpectedly on the land.

The causes of that disaster are not easy to trace, and indeed, in view of the terrible sufferings recorded, it seems a hateful thing to sit and philosophise over the whys and wherefores of such a national misfortune. However, it may be premised that the country was over-populated, considering its lack of industries. It was carrying three hundred souls to the square mile, nearly half as many again as the purely agricultural districts of England support at the present time, and, indeed, twice as many as Denmark, the model farming country of Europe. To maintain this teeming population the land was subdivided into a number of small holdings, each of which grew enough potatoes to feed a family, provided it was content to live on little else from year's end to year's end. Where an overcrowded people with a low standard of living is subsisting mainly on the produce of one particular crop, periodical famines are inevitable. The same causes lead to the same result, whether in India or Ireland. There had been sharp distress on several previous occasions, notably in 1822, but, with a less numerous population and, perhaps, a less complete reliance on the potato, the suffering had not been so great as it was destined to be in 1846 and 1847.

Another point to be noticed is that communications in Ireland were as yet undeveloped. At the beginning of 1846 there were only 65 miles of railway in the country. The Great Northern had only got as far as Drogheda; the Great Southern, though in course of construction, was not yet open for traffic, and its engineers had so far not penetrated south of Carlow. Hence it was not easy for one region to aid another. There are many indications that the famine, though severe, was, to some extent, local. The remote and backward districts, where the potato was the only crop - West Cork, Kerry, Galway, Mayo, Donegal - the identical Congested Districts that require special treatment even now, were the worst afflicted and the hardest to relieve. So recently as 1891 relief measures had to be provided for these very localities, though Ireland as a whole was not much distressed. The midlands, in 1846, grew a good crop of corn, but it passed out of the country by export along the usual channels, going, as commodities will, to the best neighbouring market. In the absence of compulsory State purchase there was nothing to detain the corn in Ireland. The starving peasant in Mayo could not buy corn, even if he would. Irish rural economy, whether of tenant or labourer, was not based on a money system. The one took his food directly out of the ground; the other received for his toil, not, as a rule, money, but a piece of ground, from which he, too, might produce his own food. Money wages or growing for a market were very unusual west of the Shannon. It was a peculiar subsistence, farming, in which failure of the chief crop meant starvation.

At all events the Famine, like the mediaeval Black Death, had a profound influence on the conditions of rural life. It gave rise to an enormous stream of emigration, overcoming at one bound the strong local attachments of the people. That stream has not yet ceased to flow, though the causes which originally produced it have now ceased to operate. Emigration is now a settled habit, and, as a nation, we are strongly wedded to our habits and averse to change. The small holder was hard hit by the Famine, and, either by death, emigration, or eviction, soon disappeared.

A change in popular diet was another outcome of this disastrous period. The treacherous potato fell from its position. The peasantry no longer trusted to it for its chief support. Gradually, as will be shown, other articles of food have crept into the Irish menu. This had had a most important and a most beneficial influence on social conditions.

Again, concurrently with the Famine, Ireland lost her privileges in the English corn market. One of the justifications alleged for the repeal of the Corn Laws in 1846 was that they hindered the despatch of cheap corn from America to relieve the scarcity. The Irish agriculturist found himself unable to contend with the produce of the prairies of America or the steppes of Russia, both better adapted by nature to the growing of cereals than his own country. Except oats, little or no corn is now grown in Ireland. Since the fatal year 1847 an annual record has been kept of the acreage under the different crops in Ireland and the amount of their produce. A comparison of the returns for 1851 and those for 1905 will illustrate the trend of modern Irish farming:-

	1851		1905	
	Acres	Produce Qrs.	Acres	Produce Qrs.
Wheat	504,000	1,493,000	37,860	182,000
Oats	2,189,000	10,771,000	1,066,000	6,211,000
Barley, Bere & Rye	355,000	1,758,000	164,000	887,000
Beans and Peas	49,000	160,000	1,724	8,910
Total Cereals	3,099,000	14,184,000	1,271,000	7,290,000
		Tons.		Tons.
Potatoes	868,000	4,442,000	616,000	3,423,000
Turnips	383,000	6,081,000	282,000	4,722,000
Other Green Crops	99,000	1,058,000	145,000	1,789,000
Total Green Crops	1,352,000	11,582,000	1,044,000	9,934,000
Flax	140,000	33,000	46,000	10,000
Meadow & Clover	1,246,000	2,518,000	2,294,000	5,322,000

It will be noticed that corn crops have uniformly gone down. Wheat has almost reached the vanishing point; oats and barley are down to one-half their former figures. Oats, however, though so diminished, are still a crop of some magnitude, amounting to about 1½ quarters, or 4½ cwt., per head of the population. Potatoes, turnips, and green crops generally are diminished about one-fourth. The average yield of potatoes is three quarters of a ton per head, and as the export is comparatively small, we may assume that each individual consumes about 1,500 lbs. per annum, or 4 lbs. per diem. The Irish peasant of the present day eats quite as many potatoes as his grandfather did in 1851, but, unlike his progenitor, is able to diversify his bill of fare with other cheap foods, mostly imported.

The only noteworthy increase during the period from 1851 to 1905 is in Meadow and Clover, which has nearly doubled itself. The figures are symbolical of the new tendency, or rather, perhaps, the old tendency reasserting itself. Ireland has become a country rearing animals on a scale never before equalled in her history. Here again the statistics of 1851 and 1905 may be compared.

	1851	1905
Cattle	2,967,000	4,645,000
Sheep	2,122,000	3,749,000
Pigs	1,084,000	1,164,000
Poultry	7,470,000	18,549,000

Cattle and sheep have nearly doubled themselves; pigs show an increase; poultry is nearly treble its former amount. The value of Ireland's live stock, as it stands, is £69,000,000. About one-fourth of the whole is disposed of annually by export to Great Britain, and brings in a return of about £12,000,000. But the profits of cattle-rearing do not end with the selling of live animals. Animal products, butter, bacon, eggs, hides, tallow, etc., earn large profits annually for the Irish producer. The export figures for the first three of these, taken from the returns of the Agricultural Department, show a very satisfactory result.

	Amount	Value
Eggs	6,098,000 great hundreds	£2,515,000
Bacon	617,000 cwt.	£1,790,000
Butter	685,000 cwt.	£3,357,000
Total value of export		£7,662,000

In these commodities Ireland occupies a strong position, and enjoys a good reputation in the British market. But there is room for improvement. Irish eggs and butter diminish in quantity in the winter and give the foreigner a chance during the cold season of recovering whatever ground he may have lost during the summer.

By a singular coincidence, the imports of bacon almost exactly equal the exports. The explanation is that the Munster farmer, who, through the medium of a local factory, produces Irish bacon, does not eat the home-cured article, but uses the proceeds of the sale of his pigs to purchase cheap American bacon for his household. This is an instance of how modern Ireland grows most of her produce for a distant market, and is content to subsist her own population largely on imported food. It has been remarked that Ireland now raises very little wheat. Not one field in sixty is now devoted to this crop. To make up for the deficiency she imports 7,000,000 cwts. of wheat and 5,000,000 cwts. of flour annually. Maize, very little known in Ireland before the Famine, is now imported to the amount of 10,000,000 cwts. The individual consumption per head of foreign wheat and flour is 3 cwts. per annum, very nearly a pound a day; and of maize, 2½ cwts., or about 10 ounces a day. These figures point to an increasing adoption of cereals in the daily diet, and the evidence of statistics is supported by observers of country life, who remark that tea, baker's bread, and, indeed, butcher's meat are now seen in houses where, fifty years ago, they were unheard of luxuries. The cattle bring Ireland money, and the money is used to improve the conditions of life at home. The standard of living is being raised. Economically, as well as in other respects, the old land struggles on, with painful steps and slow, to a better day.

What form that future will take no man can tell, and few will venture to prophesy. It is never safe to dogmatise or theorise too much about Irish affairs. Yet, if we may judge from the history of the past, the future should be bright. In spite of hindrances and disasters, of commercial restriction in one century and famines in another, there is a steady tendency towards improvement. Ireland today is vastly superior to the Ireland of Petty's day; though less densely populated, it is richer, happier, and healthier than the Ireland of 1851. Trade and agriculture show different forms from time to time, but the results, taken in the mass, are better from year to year. There is no need to despair of the republic. But in these days of world-wide competition, when France, Denmark, and Russia, Canada, the United States, Australia, New Zealand, and the Argentine, pour their products into our one great market, and even into Ireland itself; when huge liners and fast trains annihilate distance, and every resource of science is turned by our competitors to advantage in agriculture, there will be need of unceasing effort, both of hand and brain, in this country, if we are to improve, nay, if we are to do no more than maintain our position.

Appendix 6

The Extent of the Potato Crop in Ireland at the time of the Famine

By P.M. Austin Bourke

(Read before the Society on October 30th, 1959)

This paper is reproduced from the Journal of the Statistical and Social Inquiry Society of Ireland 1959-60.

Purpose of the Paper

Any attempt at a quantitative analysis of the failure of the potato in Ireland in 1845-6 requires a knowledge of the extent to which the crop was grown in those years.

The collection and publication of official returns of crop acreages and yields in Ireland did not begin until 1847. The figures for the extent of the potato crop in that year, after two seasons of blight had reduced the country to starvation, are quite unrepresentative of pre-Famine conditions.

The primary purpose of this paper is to present and analyse the results of a survey of the potato crop in Ireland in the years 1844-6, based on returns discovered in the Public Records Office, Dublin.

Part 1 - The Data

First Reference to Pre-1847 Returns of Acreage Under Potatoes

Occasional references, confused and at times inaccurate, are to be found to a survey of land under potatoes which predates the first official Irish crop returns of 1847.

In Thom's Almanac for 1847 (15, pp. 191-2) a table is published giving an "estimate of the quantity and value of the potato crop of Ireland in the year 1846, and of the loss caused by its failure". In the preamble to this table, it is stated to be "compiled from sources of official authenticity" and to be "founded on returns of the extent of land planted with potatoes in 1845 and 1846, some of which give the actual extent which appears to be 842,573 acres in parishes containing 5,627,476 inhabitants; and this proportion of potato land to population may be fairly taken for the whole country".

This guarded and oddly-worded paragraph, and part of the table which accompanies it, appear to be the basis on which all subsequent statements have been founded. Column 13 of the table referred to gives the total extent of land under potatoes in 1846, by provinces and for the entire country, and column 9 gives corresponding figures for the extent of potato land in conacre. No subsequent commentator appears to have noticed that the "acre" referred to in these figures is the Irish acre, although this is clear from the heading of Columns 5-8, which gives figures for the necessary crop "supposing one Irish acre to be capable of affording subsistence to five persons living during the year on potatoes exclusively". These estimates, specified as in Irish acres, are applied directly to the returns quoted in Column 9 and elsewhere as in "acres", thus confirming that the same unit is used throughout.

The relevant figures are quoted below, as they appear in the original table, and also, in brackets, converted into statute acres:

Table 1 Contemporary Estimate of the 1846 Potato Crop

	Area under potatoes		Area in conacre	
	Irish acres	**statute acres**	**Irish acres**	**statute acres**
Ulster	352,665	(571,317)	12,331	(19,976)
Munster	460,630	(746,221)	76,772	(124,371)
Leinster	217,854	(352,923)	24,756	(40,105)
Connaught	206,292	(334,193)	18,585	(30,107)
IRELAND	1,237,441	(2,004,654)	132,444	(214,559)

It should be noted that if, as the preamble implies, the *total* area under potatoes was calculated directly from the proportion of potato land to population in the survey sample, the final acreage for Ireland was arrived at, not on the basis of the 1841 Census return, but on a population figure of 8,265,000, possibly an estimate for 1846. The corresponding total figures based on the 1841 population 8,175,124 would be 1,224,000 Irish acres or 1,983,000 statute acres, i.e. a reduction of about 1%. Alternatively, it may have been that the appropriate proportion, based on the 1841 census returns, was applied to the *provincial* samples, and the figure for Ireland arrived at by simple addition. This seems the more likely, since population figures quoted for another purpose in the same table in the original publication are taken from the 1841 census.

Other References to Extent of Pre-1847 Potato Crop

O'Rourke (6, p.153) says: "The failure of 1845 did not prevent the people from planting potatoes very largely in 1846, in which year, according to one account, the quantity of land under potatoes in Ireland was 1,237,441 acres, the produce being valued at £15,947,919 sterling (Thom's Almanac, 1847), but according to another account it was very much larger, being as estimated by the Earl of Rosse, two million one hundred thousand acres, valued at £33,600,000. The great discrepancy between these two accounts arises from there being no authoritative official returns on the subject. The truth, no doubt, lies somewhere between them." In a footnote to the same page he adds that "the Rev. Theobald Mathew said, I do not know on what authority, that two millions of acres of potatoes were irrevocably lost, being worth to those who raised them £20 on acre. This estimate would have made the loss £40,000,000".

The difference in the estimates of the money value of the crop is unimportant; the potato was overwhelmingly a subsistence crop of which only a small part passed through the markets, and estimates of the financial value of the total produce are quite arbitrary. It is, however, remarkable that O'Rourke, writing as early as 1874, overlooked the fact that the discrepancy between the three versions of extent of land under potatoes was reduced to vanishing point if one recognised that the first was in Irish acres and the other two in statute acres.

Barrington (1, p.224) reproduces the original data from Thom's Almanac as included in Table 1 above, and obviously, though not explicitly, accepts them as being expressed in statute acres. Salaman (7, pp. 248 & 300) repeats the figures as given by O'Rourke and Barrington, but in the latter case specifically states the unit to have been statute acres. Later (p.321) he arbitrarily

resolves the difficulty found by O'Rourke by assigning the two estimates to different years; "The acreage under potatoes in 1846 was 1,237,441 acres. Prior to that date it has been held to have been in the neighbourhood of 2,000,000 acres. In 1847 it fell to little more than one-eighth of this amount, viz., 284,116 acres; this was but temporary, and due to the fact that there was little or no seed from the 1846 crop in the country. The 1847 crop was dependent on fresh seed from Scotland, much of which was imported by the Friends....In 1859 it reached its new maximum of 1,200,247 acres, a figure only a little below that of 1846 though it served a population that had decreased at least 25%".

The last statement is of course, quite misleading and leads to the false deduction that "the supremacy of the potato was scarcely shaken" for thirty years after the famine. The real reduction of acreage from 1846 to 1859 was about 40% (and, as we shall see later, the reduction from 1845 to 1859 was over 50%). In addition yields had fallen from a typical pre-Famine figure of over 6 tons per acre (3) to a level where 4 tons per acre was an unusually high national average, so that the potato production per head of the population in 1859 represented a fall to about 40% of the pre-Famine figures. In fact, the return after the Famine towards a potato-based economy never attained to anything like the level of the early 1840s.

An even greater misinterpretation of the upward trend of the potato crop from 1847 to 1859 is made by F. Dudley Stamp (9, p.38). "The peculiar suitability of the potatoes to the humid soil and atmospheric conditions of Ireland was by no means appreciated a century ago when oats, wheat and barley were the staples. It is not too much to say that the increased cultivation of potatoes rendered possible an increase of population and perhaps actually occasioned the overpopulation of rural districts prior to the terrible famines of the forties of the last century. The statistics given below show quite definitely the rise in acreage given to potatoes in those years". The figures which follow are the official returns of potato acreage commencing in 1847. A glance at Table 5 in the present paper will show that what Stamp assumed to be a belated recognition of the potato was, in fact, merely a partial recovery to a position which was only a pale shadow of its former domination.

Location of Details of 1844-6 Potato Acreage Returns

The discovery in the Public Records Office, Dublin, of summary forms of the pre-1847 returns of potato acreage clarifies much of the earlier confusion and provides material for a much more detailed analysis. These papers were filed away with the constabulary reports on potato blight (13) and do not appear to have previously received attention.

The documents show that the Inspector General of Police, by order dated May 20th, 1846, directed the constabulary to submit returns of the extent of land planted with potatoes, and the proportion thereof which was let in conacre, in each of the years 1844, 1845 and 1846. The papers which have been located consist, not of the original returns, but of two sets of printed forms on which have been entered in manuscript-

(a) *fair copies of the original returns, in the form in which they were presented.* These are available for each county in Leinster, Munster and Ulster; and in Connaught, for Counties Galway, Mayo and Roscommon.

The forms show that there was a certain ambiguity in the Inspector General's directions, possibly arising from the use of the word "proportion". Some of the enumerators submitted returns, not in acres, but as a fraction of the arable land in the district in question. Others gave the total under potatoes in acres but the "proportion in conacre" as a fraction; in some cases, the complexity of a fraction demonstrates that it represents a conversion from an enumeration originally made in acres.

(b) *final copies with totals of the returns.* These are available, county by county, for each of the provinces except Ulster. The individual entries on these forms are identical with (a), except that the fractions have been converted into numerical values, doubtless by the use of the 1841 figures for arable land. The totals are partial ones, since complete returns were available for no entire county (although full returns are included for a large number of baronies).

Although detailed returns for Ulster are missing from these final copies, the forms for Leinster included also a summary for all four provinces, and for Ireland as a whole.

In both these series of forms, the counties are sub-divided into baronies, and the latter into parishes (or parts of parishes falling within the barony boundaries). In the case of many parishes, sub-totals are given, which probably refer to townlands although these are not identified by name. There is thus an enormous amount of detailed information available in these forms, and it is a lucky chance that the missing forms in each series do not overlap, so that returns covering the whole of Ireland are available.

As an indication of the size of the samples available for each county, it may be mentioned that, out of a possible total of 214 returns for Tipperary, 182 were expressed in acres, 14 wholly or partially in fractions and 18 are missing. For Limerick, out of a maximum of 166, 107 were returned in acres, 20 include fractions and 39 are missing. As will be seen from Columns 1 and 2 of Tables 2, 3 and 4 , samples of the order of 80% or better are available for each county outside Ulster.

In addition to the crop returns, the constabulary were required to comment on the use to which land was being put consequent on the fall in acreage under potatoes which followed the partial failure due to blight in 1845, i.e. to state "the crops sown in 1846 in the land which would,

under ordinary circumstances, have been planted with potatoes". Returns under this heading are summarised in the remarks column of forms (a), and indicate that where the land in question was not allowed to lie fallow or to revert to waste or grass, it was sown mainly with oats.

It is clear that the purpose of the survey was to determine the probable food situation during the Winter of 1846-47, and, in particular, the effect of the reduced acreage under potatoes in 1846 compared with the immediately preceding years. Before the entire collection and calculation of the data had been completed, the disastrous blight attack of the first days of August 1846 virtually wiped out the crop and converted the question of its extent, for contemporary purposes, into an academic one. No doubt for this reason the computations were never completed, re-checked or published.

Incidentally, the reason for the peculiar wording of the statement in Thom's Directory for 1847, quoted in paragraph 2 above, becomes clear when the circumstances of the survey are known.

Reliability of the Returns

The main factors to be considered in a broad assessment of the reliability of the survey are the possibility of confusion as to units and the conscientiousness of the enumerators.

The risk of confusion between Irish, Cunningham and statute acres is a very real one. In the first half of the nineteenth century in Ireland, the use of the unqualified word "acre", other than by a Scottish or English agent or other person with similar connections, normally referred, outside parts of Ulster, to the Irish acre. The uncertainty thus introduced extends even to official statistics and forms a subtle trap for the unwary.

The tabulated returns in the Public Records Office are ambiguously classified as "acres"; only the evidence provided in Thom's Almanac for 1847 and the incidental support of contemporary calculations (3), shows that they are expressed in Irish acres. A few of the Ulster entries in forms (a) are specifically labelled as being in Cunningham acres; these have been converted before inclusion in the total. The inclusion of any uncorrected returns in statute or Cunningham acres in the 1844-6 survey would lead, of course, to an overestimation in the final returns. To the extent that this occurred, it may have been offset by the omission of inaccessible mountain and bog tracts under potatoes and, in the year 1846, of any plantings made after the survey in late May. (The crop was normally sown later than it is nowadays, and in 1846 some deferred planting in order to see if blight attacked the earlier crops.)

The returns were made by the Constabulary, who following their reorganisation in 1836 and the enlightened policy pursued by Drummond and his superiors, probably came closer to winning the confidence of the people, and even to gaining some measure of popularity, in the following ten years than at any other time, under British rule. Over the country as a whole, there was one policeman to an average of rather less than 4 square miles, so that the survey did not suffer from a scarcity of observers. The constabulary were in a particularly favourable position to report on the potato crop, for since September 1845, they had been making continuous surveys of the crop from the point of view of potato blight, and reporting frequently and at length to the Inspector General. The care and attention to detail in these reports (13) is impressive.

Presumably the retrospective data as to the 1845 and, particularly, the 1844 crops are less accurate than those for 1846. But the degree of error is unlikely to be large, for the police had direct personal knowledge of the 1845 sowing; further, because the primary purpose of the 1845 blight reports was to assess the probable food situation compared with previous years, several of

them made qualitative references to the upward trend from 1844 to 1845 which are consistent with the later numerical returns.

Probably the major factor favouring accuracy was that the enumerators knew the serious and immediate purpose for which the figures were intended, and had not yet lapsed into the inertia of routine returns. Certainly, the internal consistence of the figures and their agreement with other evidence suggest that they may be accepted with some confidence.

Calculation of County Acreages from the Partial Returns

In Tables 2, 3 and 4, the "districts" enumerated in Column 1 are the county totals of parishes and parts of parishes within the boundaries of baronies, i.e. the number of returns required to give a complete account of each county's acreage under potatoes. Column 2 shows the actual number of returns on record. The calculated total area under potatoes in Irish acres (Column 4) is obtained by increasing the partial total in the sample (Column 3) in the proportion of total of districts to actual returns (Column 1 divided by Column 2). By a similar operation, the conacre crop in Irish acres (Column 7) is derived from the partial totals given to Column 6. Columns 5 and 8 give the final figures for total acreage and the conacre as expressed in statute acres.

The figures of partial totals given in the Tables (Column 3 & 6) for Connaught, Munster, and all of Leinster except Co. Laois, are identical with those given in the Public Records Office papers, which have been checked for accuracy. In the case of Co. Laois, the returns for the barony of Maryborough West were omitted in error from the original totals; the corrected figures for partial acreage under potatoes in County Laois have accordingly been increased in 1844 by 1,580 Irish acres, in 1845 by 1,604 and in 1846 by 1,291. The corresponding increases in calculated total acreage in statute acres are, respectively, 2,835, 2,878 and 2,317. For the province of Ulster for which forms (a) only are available, it was necessary to ignore the returns given partially or wholly in fractions, and to work only from the smaller sample of completely numerical returns.

As a matter of interest, it may be mentioned that the entire partial sample for which returns are available, including the Ulster returns given as fractions and the Maryborough West figures amounted-

in 1844, to 1,959,181 statute acres

in 1845, to 2,065,246 statute acres

in 1846, to 1,639,088 statute acres

These are the totals for which concrete evidence is available *before* extrapolation to the entire population from a sample of the order of 80%.

The method adopted for extrapolation is conceded to be somewhat crude, for it ignores, *inter alia,* variations in the size of parishes and parts of parishes and, in particular, differences in the extent of arable land. I would no doubt be more satisfactory, using the detailed 1841 Census returns, to use a proportion based on population figures, although it is not easy to see how allowance should be made for the effect of large towns. In any case, such an approach would involve a considerable amount of work and require facilities not available to a private individual.

Table 2 Area under Potatoes in 1844

1844	Total of Districts	Number of Returns	Partial area under Potatoes (Irish acres)	Calculated total area Under Potatoes (Irish acres)	Calculated Total area Under Potatoes (Statute acres)	Partial Area Under Conacre (Irish acres)	Calculated Total area Under Conacre (Irish acres)	Calculated Total area Under Conacre (Statute acres)	Percentage Of potato Land held in conacre
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Connaught									
Galway	171	137	70,000	87,372	141,543	6,662	8,315	13,470	9.5%
Leitrim	24	22	15,050	16,418	26,597	1,453	1,585	2,568	9.7%
Mayo	79	72	77,955	85,534	138,565	5,653	6,203	10,049	7.3%
Roscommon	63	59	34,809	37,169	60,214	6,542	6,986	11,317	18.8%
Sligo	42	41	28,490	29,185	47,280	5,187	5,314	8,609	18.2%
Total	379	331	226,304	255,678	414,199	25,497	28,403	46,013	11.0%
Leinster									
Carlow	61	53	14,974	17,234	27,919	1,839	2,117	3,430	12.3%
Dublin	96	71	10,506	14,205	23,012	1,332	1,801	2,918	12.7%
Kildare	131	118	15,347	17,038	27,602	1,255	1,393	2,257	8.2%
Kilkenny	168	152	39,635	43,807	70,967	6,010	6,643	10,762	15.2%
Laois	72	65	26,858	29,750	48,195	3,507	3,885	6,294	13.1%
Longford	40	32	15,084	18,855	30,545	2,893	3,616	5,858	19.2%
Louth	69	65	16,868	17,906	29,008	4,758	5,051	8,183	28.2%
Meath	162	149	25,571	27,802	45,039	8,426	9,161	14,841	33.0%
Offaly	60	55	24,542	26,773	43,372	2,094	2,284	3,700	8.5%
Westmeath	69	64	18,681	20,140	32,627	3,945	4,253	6,890	21.1%
Wexford	155	139	42,569	47,469	76,900	2,897	3,230	5,233	6.8%
Wicklow	70	66	16,325	17,314	28,049	1,143	1,212	1,963	7.0%
Total	1,153	1,029	266,960	298,293	483,235	40,099	44,646	72,329	15.0%

1844	Total of Districts	Number of Returns	Partial area under Potatoes (Irish acres)	Calculated total area Under Potatoes (Irish acres)	Calculated Total area Under Potatoes (Statute acres)	Partial Area Under Conacre (Irish acres)	Calculated Total area Under Conacre (Irish acres)	Calculated Total area Under Conacre (Statute acres)	Percentage of potato Land held in conacre
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Munster									
Clare	81	76	37,641	40,117	64,990	6,179	6,586	10,669	16.4%
Cork	337	243	164,396	227,990	369,344	36,097	50,060	81,097	22.0%
Kerry	99	88	38,875	43,734	70,849	5,405	6,081	9,851	13.9%
Limerick	166	127	48,619	63,549	102,949	9,879	12,913	20,919	20.3%
Tipperary	214	196	87,853	95,921	155,392	13,945	15,226	24,666	15.9%
Waterford	91	74	45,538	55,999	90,718	8,940	10,994	17,810	19.6%
Total	988	804	422,922	527,310	854,242	80,445	101,860	165,012	19.0%
Ulster									
Antrim	96	42	21,523	49,195	79,696	122	279	452	0.6%
Armagh	46	7	4,364	28,678	46,458	447	2,937	4,758	10.2%
Cavan	48	24	19,467	38,934	63,073	2,496	4,992	8,087	12.8%
Derry	46	38	33,978	41,131	66,632	1,056	1,278	2,070	3.1%
Donegal	55	40	36,482	50,163	81,264	1,365	1,877	3,041	3.7%
Down	88	28	25,630	80,551	130,493	788	2,477	4,013	3.1%
Fermanagh	37	27	18,679	25,597	41,467	1,493	2,046	3,315	8.0%
Monaghan	27	18	18,338	27,507	44,561	2,350	3,525	5,711	12.8%
Tyrone	47	34	32,431	44,831	72,626	512	708	1,147	1.6%
Total	490	258	210,892	386,587	626,270	10,629	20,119	32,594	5.0%
IRELAND	3,010	2,422	1,127,078	1,467,868	2,377,946	156,670	195,028	315,948	14.0%

Table 3 Area under Potatoes in 1845

1845	Total of Districts	Number of Returns	Partial area under potatoes (Irish acres)	Calculated total area under potatoes (Irish acres)	Calculated Total area under potatoes (Statute acres)	Partial area under conacre (Irish acres)	Calculated total area under conacre (Irish acres)	Calculated total area under conacre (Statute acres)	Percentage o potato land held in conacre
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Connaught									
Galway	171	137	74,611	93,128	150,867	8,118	10,133	16,415	10.9%
Leitrim	24	22	15,402	16,802	27,219	1,457	1,589	2,574	9.5%
Mayo	79	72	81,393	89,306	144,676	6,475	7,105	11,510	8.0%
Roscommon	63	59	36,213	38,668	62,642	8,024	8,568	13,880	22.2%
Sligo	42	41	30,370	31,111	50,400	5,616	5,753	9,320	18.5%
Total	379	331	237,989	269,015	435,804	29,690	33,148	53,699	12.0%
Leinster									
Carlow	61	53	15,580	17,932	29,050	1,961	2,257	3,656	12.6%
Dublin	96	71	11,709	15,832	25,648	1,914	2,588	4,193	16.3%
Kildare	131	118	16,022	17,787	28,815	1,472	1,634	2,647	9.2%
Kilkenny	168	152	42,288	46,739	75,717	6,613	7,309	11,841	15.6%
Laois	72	65	28,062	31,084	50,356	3,746	4,149	6,721	13.3%
Longford	40	32	15,205	19,006	30,790	2,894	3,618	5,861	19.0%
Louth	69	65	18,197	19,317	31,294	5,183	5,502	8,913	28.5%
Meath	162	149	27,469	29,866	48,383	9,222	10,027	16,244	33.6%
Offaly	60	55	25,392	27,700	44,874	2,465	2,689	4,356	9.7%
Westmeath	69	64	19,666	21,202	34,347	4,262	4,595	7,444	21.7%
Wexford	155	139	44,444	49,560	80,287	3,116	3,475	5,630	7.0%
Wicklow	70	66	16,871	17,893	28,987	1,228	1,302	2,109	7.3%
Total	1,153	1,029	280,905	313,918	508,548	44,076	49,145	79,615	16.0%

1845	Total of Districts	Number of Returns	Partial area under potatoes (Irish acres)	Calculated total area under potatoes (Irish acres)	Calculated Total area under potatoes (Statute acres)	Partial area under conacre (Irish acres)	Calculated total area under conacre (Irish acres)	Calculated total area under conacre (Statute acres)	Percentage o potato land held in conacre
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Munster									
Clare	81	76	41,691	44,434	71,983	7,385	7,871	12,751	17.7%
Cork	337	243	175,387	243,232	394,036	39,162	54,311	87,984	22.3%
Kerry	99	88	42,078	47,338	76,688	5,796	6,521	10,564	18.8%
Limerick	166	127	51,097	66,788	108,197	10,682	13,962	22,618	20.9%
Tipperary	214	196	93,297	101,865	165,021	15,529	16,955	27,467	16.6%
Waterford	91	74	44,859	55,164	89,366	9,810	12,064	19,544	21.9%
Total	988	804	448,409	558,821	905,291	88,364	111,684	180,928	20.0%
Ulster									
Antrim	96	42	23,377	53,433	86,561	127	290	470	0.5%
Armagh	46	7	4,468	29,361	47,565	499	3,279	5,312	11.2%
Cavan	48	24	20,429	40,858	66,190	2,617	5,234	8,479	12.8%
Derry	46	38	35,373	42,820	69,368	1,056	1,278	2,070	3.0%
Donegal	55	40	38,846	53,413	86,529	1,379	1,896	3,072	3.6%
Down	88	28	27,773	87,287	141,405	839	2,637	4,272	3.0%
Fermanagh	37	27	20,183	27,658	44,806	1,815	2,487	4,029	9.0%
Monaghan	27	18	19,894	29,841	48,342	2,409	3,614	5,855	12.1%
Tyrone	47	34	33,673	46,548	75,408	465	643	1,042	1.4%
Total	490	258	224,016	411,219	666,174	11,206	21,358	34,601	5.0%
IRELAND	3,010	2,422	1,191,319	1,552,973	2,515,817	173,336	215,335	348,843	14.0%

Table 4 Area under Potatoes in 1846

1846	Total of Districts	Number of Returns	Partial area under potatoes (Irish acres)	Calculated total area under potatoes (Irish acres)	Calculated Total area under potatoes (Statute acres)	Partial area under conacre (Irish acres)	Calculated total area under conacre (Irish acres)	Calculated total area under conacre (Statute acres)	Percentage o potato land held in conacre
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Connaught									
Galway	171	137	55,015	68,668	111,242	3,927	4,902	7,941	7.1%
Leitrim	24	22	12,562	13,704	22,200	1,003	1,094	1,772	8.0%
Mayo	79	72	69,141	75,863	122,898	3,219	3,532	5,722	4.7%
Roscommon	63	59	29,350	31,340	50,771	5,307	5,667	9,181	18.1%
Sligo	42	41	24,683	25,285	40,962	3,770	3,862	6,256	15.3%
Total	379	331	190,751	214,860	348,073	17,226	19,057	30,872	9.0%
Leinster									
Carlow	61	53	13,591	15,642	25,340	1,468	1,690	2,738	10.8%
Dublin	96	71	7,919	10,707	17,345	422	571	925	5.3%
Kildare	131	118	13,267	14,729	23,861	905	1,005	1,628	6.8%
Kilkenny	168	152	28,899	31,941	51,744	3,323	3,673	5,950	11.5%
Laois	72	65	20,633	22,855	37,025	2,096	2,322	3,762	10.2%
Longford	40	32	12,942	16,178	26,208	2,127	2,659	4,308	16.4%
Louth	69	65	12,670	13,450	21,789	3,227	3,426	5,550	25.5%
Meath	162	149	17,827	19,382	31,399	4,768	5,184	8,398	26.7%
Offaly	60	55	20,713	22,596	36,606	1,022	1,115	1,806	4.9%
Westmeath	69	64	14,876	16,038	25,982	2,182	2,352	3,810	14.7%
Wexford	155	139	38,236	42,637	69,072	2,038	2,273	3,682	5.3%
Wicklow	70	66	14,861	15,762	25,534	919	975	1,580	6.2%
Total	1,153	1,029	216,434	241,917	391,905	24,497	27,245	44,137	11.0%

1846	Total of Districts	Number of Returns	Partial area under potatoes (Irish acres)	Calculated total area under potatoes (Irish acres)	Calculated Total area under potatoes (Statute acres)	Partial area under conacre (Irish acres)	Calculated total area under conacre (Irish acres)	Calculated total area under conacre (Statute acres)	Percentage o potato land held in conacre
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Munster									
Clare	81	76	29,622	31,571	51,145	2,676	2,852	4,620	9.0%
Cork	337	243	142,994	198,309	321,261	28,912	40,096	64,956	20.2%
Kerry	99	88	37,837	42,567	68,959	4,814	5,416	8,774	12.7%
Limerick	166	127	40,431	52,847	85,612	6,298	8,232	13,336	15.6%
Tipperary	214	195	63,322	69,492	112,577	8,722	9,572	15,507	13.8%
Waterford	91	74	36,742	45,183	73,196	7,062	8,684	14,068	19.2%
Total	988	803	350,948	439,969	712,750	58,484	74,852	121,261	17.0%
Ulster									
Antrim	96	42	18,030	41,211	66,762	126	288	467	0.7%
Armagh	46	7	3,829	25,162	40,762	261	1,715	2,778	6.8%
Cavan	48	24	15,862	31,724	51,393	1,056	2,112	3,421	6.7%
Derry	46	38	29,015	35,123	56,899	508	615	996	1.8%
Donegal	55	40	36,480	50,160	81,259	1,260	1,733	2,807	3.5%
Down	88	28	20,387	64,073	103,798	374	1,175	1,904	1.8%
Fermanagh	37	27	16,890	23,146	37,497	648	888	1,439	3.8%
Monaghan	27	18	14,689	22,034	35,695	1,334	2,001	3,242	9.1%
Tyrone	47	34	32,274	44,614	72,275	478	661	1,071	1.5%
Total	490	258	187,456	337,247	546,340	6,045	11,188	18,125	3.0%
IRELAND	3,010	2,421	945,589	1,233,993	1,999,068	106,252	132,342	214,395	11.0%

It would, I think, be useful if the Central Statistics Office were in a position to acquire the crop records at present in the Public Records Office, and to edit, calculate and publish them for general use; the detailed parish information would be of value to local historians, especially as a supplement to any earlier figures in Tithe Books or elsewhere.

Meanwhile, it will be noted that, outside of County Armagh, the size of the observation sample is so large as to preclude any gross errors, even with the method adopted for extrapolation. The figure found for total Irish acreage in 1846 (1,999,000 acres) is in remarkable agreement with the contemporary estimate (2,005,000) calculated on a population basis (Table 1). For the pre-blight sowings, the two totals of 2,378,000 (1844) and 2,516,000 (1845) are consistent with Dowdall's estimate of two and a half million acres (3), based on population and consumption.

Comparison of the provincial totals for 1846 in Tables 4 and 1 shows rather larger differences, but this does not necessarily reflect on the accuracy of the present calculations. Examining the earlier figures, it is difficult to accept without further evidence that the 10% missing reports for Leinster would have contributed to more than about 1% of the total Leinster acreage, while less than 20% missing reports in Munster added over 31%.

As regards the percentage of land in conacre, the figures are, of course, unaffected by the proportion in which the two corresponding *county* returns are increased; and, indeed, the figures given in Column 9 of Table 4 for each of four provinces and for Ireland agree with those calculated from Table 1.

Part II – Comment

Total Area Under Potatoes

The calculated figures of total acreage under potatoes for the years 1844-6, combined with official returns for selected subsequent years, are presented in the second column of Table 5.

Table 5 Extent of Potato Crop in Ireland in Selected Years

Year	Acreage statute acres 000	Yield tons per acre	Estimated Produce 000 tons
1844	2,378	(6.25)	(14,862)
1845	2,516	(4.0)	(10,063)
1846	1,999	(1.5)	(2,999)
1847	284	7.2	2,046
1848	810	3.8	3,077
1849	719	5.6	4,024
1855	982	6.4	6,287
1856	1,105	4.0	4,419
1859	1,200	3.6	4,321
1872	992	1.8	1,785
1879	843	1.3	1,095
1897	677	2.2	1,490
1951	466	8.5	3,963

1. The 1848 figures are based on extrapolation from incomplete returns.

2. The yields given for the years 1844-6 are personal estimates; that for 1846, in particular, is highly speculative.

3. Although the late nineteenth century generally was a period of poor potato yields, those of the three years 1872, 1879 and 1897 were particularly low, and should not be taken as representative. During this period mean yields of 3 to 4 tons per acre were the rule.

The 6% rise in acreage from 1844 to 1845 was one of the reasons for official optimism regarding the food situation in the early Autumn of 1845, and, without doubt, it helped a little to mitigate the partial failure of the crop which came to light in September of that year. The 1845 figure, large as it was, may not represent the maximum extent of potatoes ever planted in Ireland. Comparison of the acreage under potatoes in certain Co. Tipperary parishes in 1845 (13) with that in 1834 (8) shows a reduction from the earlier year. Other indirect evidence suggests that the potato crop in Ireland reached its maximum extent between 1830 and 1835, and that it contracted in the following decade in face of expanding pasture. Thus the increase from 1844 to 1845 may be interpreted as a desperate reaction from a gradual fall which had brought the crop to a critically low level in 1844.

The total of two and one half million acres under potatoes in 1845 much exceeds the amount of land ploughed for all crops in the whole of Ireland today. Made up primarily of inferior varieties, bred to exhaustion point for yield, it represented a vast congested potato slum, wide open to epidemic plant disease.

Under the impact of the first blight attack in 1845, the extent of the crop in the following year fell sharply by over 20%. Even had disease spared the potato in 1846, the reduction in land under the crop would have led to distress little below that of the previous winter. Hence the decision to hold a constabulary census of potato sowing in May, 1846.

In actual fact, blight struck in 1846 even earlier and more severely than before, and ushered in the Famine proper. Few had seed to plant in 1847, and those who had, feared that it would immediately be torn from the ground by the starving people. Jonathan Pim, writing in April 1847, estimated that "from one-tenth to one-third of the usual planting" had been carried out, according to the locality (16, p.276). The official returns confirmed that the sowing had been exceptionally small, and quoted as an example the union of Castlebar with only 803 acres of potatoes, "where under ordinary circumstances there would not have been less than 6,000 acres of potatoes". (14, part 1. p.v.)

The figures show that the 1847 acreage was, in fact, almost exactly one-seventh of that in the preceding year, and less than one-eighth of that in the immediate pre-Famine years, 1844-5. The abnormal figure of 284,116 acres is easily the minimum value for potatoes in the official series of crop returns, and very possibly represents the lowest area under the crop in Ireland during the last two hundred years or more.

Although blight was noticeable here and there in the 1847 crop, the season did not favour its development and the yield was good. The immediate effect was the enormous increase in the 1848 sowing, which was not achieved without great sacrifice. A Quaker report from Roscarberry in late April of 1848 is typical - "An extraordinary effort is being made in these two parishes to plant the potato. I know of a great many instances of the poor people fasting for eight and forty hours, trying to save the little remnant of their potatoes for seed." (16, p. 456.)

The result was almost a tripling of the area under potatoes between 1847 and 1848. Although blight struck again in that year, leading to a temporary fall in acreage in 1849, the extent of the crop continued its general upward trend at a slower pace to the plateau of over a million acres which lasted from 1856 to 1871. The post-Famine maximum of 1,200,347 acres was reached in 1859. After that the crop extent went into a slow but steady decline which was continued, apart from partial wartime recoveries to the present day.

Yields and Total Production of Potatoes

Thoughtful observers viewed with mixed feelings the recovery of the potato crop immediately after 1847. "I do not know" wrote Jacob Harvey from New York to the Society of Friends Committee in Dublin a few days before his death in April 1848 (16, p. 327) "whether to rejoice or not at the improved prospect of the potato crop; if they should prove as prolific as formerly, what is to prevent the labourers and small farmers from falling back upon them as their only food? This is the great danger to my mind and I confess I am anxious as to the result".

The rise in acreage, considered by itself, was however to prove no true guide to the come-back of the potato, for, after the first few years, it was accompanied by a marked fall in yield per acre. The maximum produce in any post-Famine season (about six and a quarter million tons) fell short of half the pre-Famine requirements, and this record production occurred only in an exceptional year (1855), when high acreage and high yield happened to coincide). Over the following sixteen years (1856-71), when the potato covered over a million acres, the total crop averaged three and a half million tons per year, i.e. a quarter of pre-Famine production and roughly the same amount as is nowadays obtained from less than half the acreage. From 1870 to the turn of the century, potato production reached its lowest level on the average, with a minimum of just over one million tons in the disastrous season of 1879.

As an example of how unreliable a criterion acreages alone can be, it is interesting to note that the total potato crop in the year 1847, when its extent was far below that of any other season, was, because of a good yield in excess of that in no fewer than eight later years (1861, 1872, 1877, 1879, 1890, 1894, 1897 and 1900).

It is an indication of the extent to which the importance of the potato in the diet of the people had fallen, that the failure of the crop in 1879, coming immediately after the poor crops of 1877-8 and comparable in degree to that of 1846, should have caused so little starvation, although distress was widespread and severe.

It would be interesting to evaluate the position of the potato as human food at various stages in post-Famine Ireland, in comparison with its earlier dominance. For this purpose it would be necessary to have, in addition to potato production and population figures, some information on changes in the relative use of the vegetable for human and animal food. Dowdall's calculations (3) show that before the Famine roughly twice the quantity of potatoes were eaten by people as by livestock, after allowance had been made for seed, wastage and exports. Nowadays the proportion is almost exactly reversed. It is possible that the proportion of the potato crop which was eaten as human food increased at first after the Famine. Turnips, virtually neglected previously, were grown in 1847 as emergency human food and later continued on a high level (3 to 400,000 acres) as fodder for livestock. The importation of maize and other animal feeding material also relieved pressure on the declining potato production in the nineteenth century.

If the population of Ireland in 1901 ate potatoes at the present day average rate, they would have consumed roughly one million tons per annum. When allowance is made for seed, waste and even limited animal consumption, there are many years about this time (e.g. 1894, 1897, 1900, 1903, 1904, 1906, 1907) when it is extremely doubtful that the production of potatoes could have met such a demand. Thus the implication in a small-scale Guinness investigation (5) that the consumption of potatoes as human food in Dublin at the turn of the century was below the present level may well be true.

A similar rough analysis applied to the 1856-71 period, during which the total annual crop averaged three and a half million tons, suggests that human consumption, on the average, can scarcely have reached twice the present day level.

An English observer who had been familiar with pre-Famine Ireland wrote of conditions in 1869 (10, p. 10): - "A great improvement has taken place in the labourers' diet; those in regular employment, especially in the towns, being large consumers of wheaten bread, an article of diet which, a quarter of a century ago, was completely out of the reach of any working man. Even the ordinary farm labourers are not limited, as formerly, to the potato; Indian meal being largely used

by them, especially when potatoes are dear, or when they begin to lose their goodness, in the later months of Spring."

All of which tends to indicate that, ignoring regional variations, the use of the potato as human food in Ireland dropped abruptly at the time of the Famine to about one third of its previous per caput value, then fell more slowly to a minimum value about 1900, and may have risen somewhat in later years.

Distribution of the Crop by Counties in 1845

The distribution of the 1845 potato crop by counties is illustrated in Maps 1 and 5. Map 1 shows the number of acres under potatoes per thousand acres under crops and pasture, using the 1851 Census figures for the latter. Map 5 gives the number of persons (1841 Census) per hundred acres of potatoes in each county. The ten counties of highest potato density are shaded in each case.

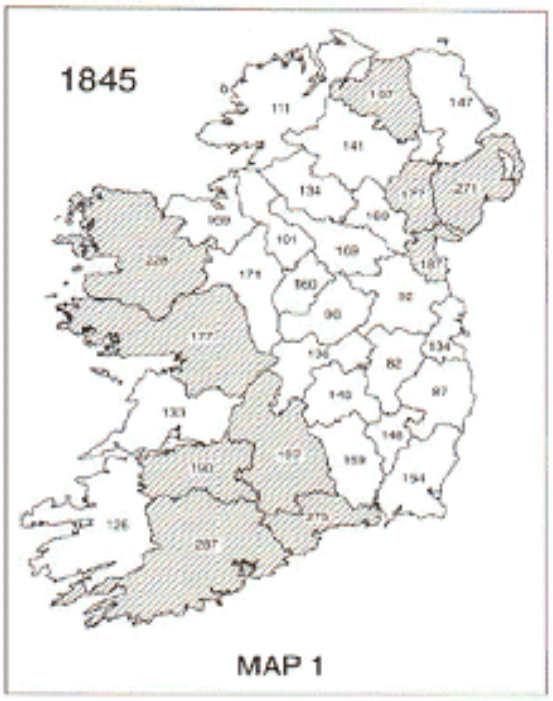
The feature in both diagrams, particularly in Map 5, is the southern wedge of high potato density, stretching mainly to the northwest from a maximum in Cork-Waterford. No doubt there are historical reasons for this specialisation, since growth of the crop from early times in the Youghal district has been established, irrespective of the truth or otherwise of the Raleigh tradition (2, p. 290). It is worthy of remark that the acreage under potatoes in Co. Cork alone in 1845 (394,036) exceeded the crop in the whole 32 counties in 1957 (366,450).

There was also an early seventeenth century nucleus of the crop in Co. Down (2, p. 290), which may have originated the region of high density in the Northeast. Map 1 suggests the possibility of a third focus in Mayo-Galway, perhaps of Spanish origin.

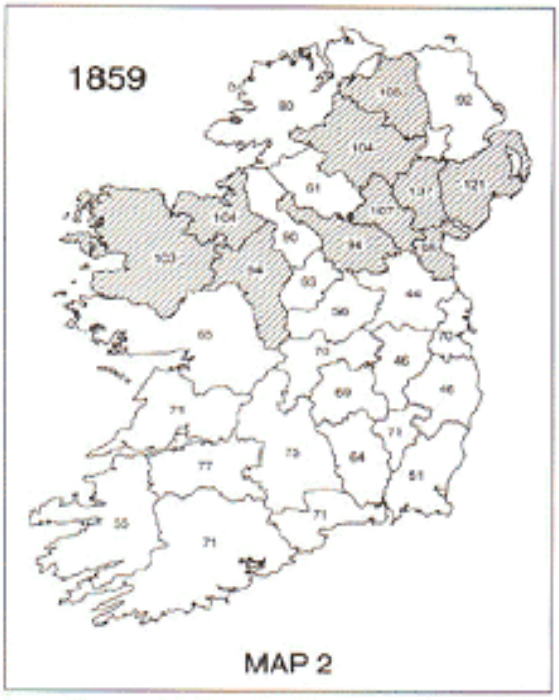
Potatoes, in pre-Famine days, were exported from both North and South, mainly to Scotland and England, respectively. There was also a considerable internal trade of potatoes, mainly to Dublin where (Map 5) there were 1,453 people per hundred acres of potatoes in that county, as against the national average of 325. Townsend (11. pp. 230-232) gives an interesting account of this trade, as plied from Cork to Dublin:-

"The mode of sending potatoes to Dublin is thus managed. Two, three, or more farmers jointly freight a vessel, and, if their own stock of potatoes be insufficient, collect from their neighbours enough to make up the loading. One of the party, or some person in whom they confide, goes as supercargo, sells the potatoes, and on his return divides the profits among the several contributors, being allowed a certain commission for his trouble. It is supposed, and, I believe not without cause, that the supercargo does not always make fair returns. As there is no check upon his accounts, their only security is his honesty, which, it may be easily conceived, is not always proof against so tempting an opportunity of enriching himself at the expense of his employers. Trusts of more importance, though in the hands of his betters, are not always managed more faithfully.

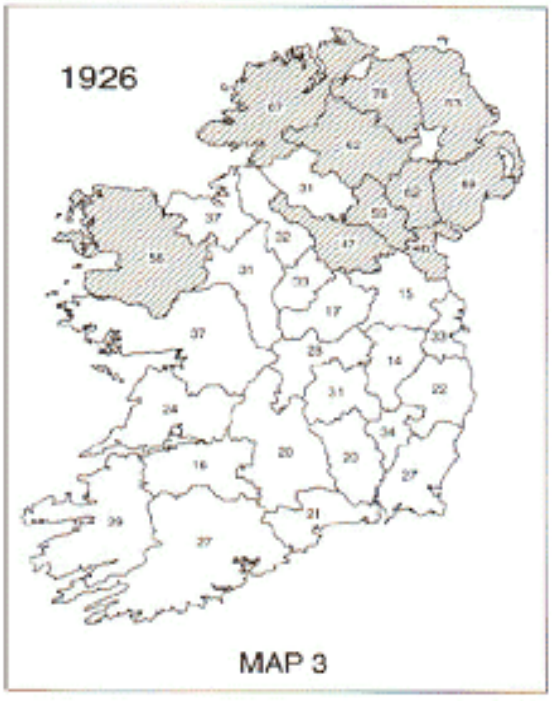
POTATOES PER 1000 ACRES OF CROPS AND PASTURE



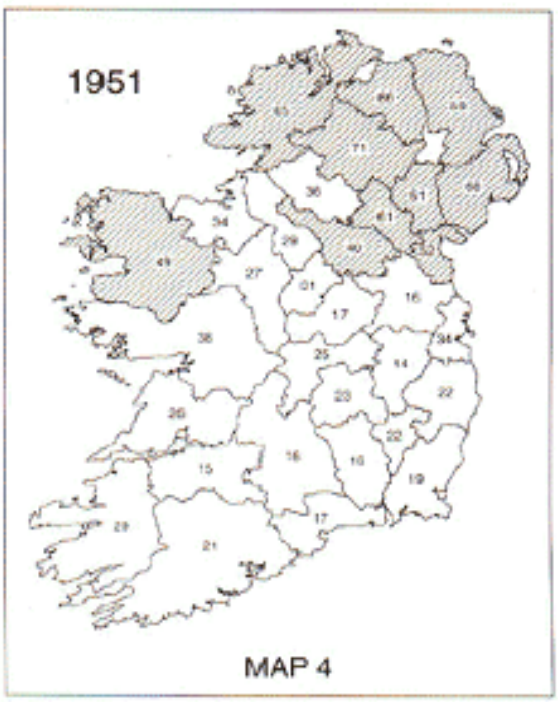
MAP 1



MAP 2



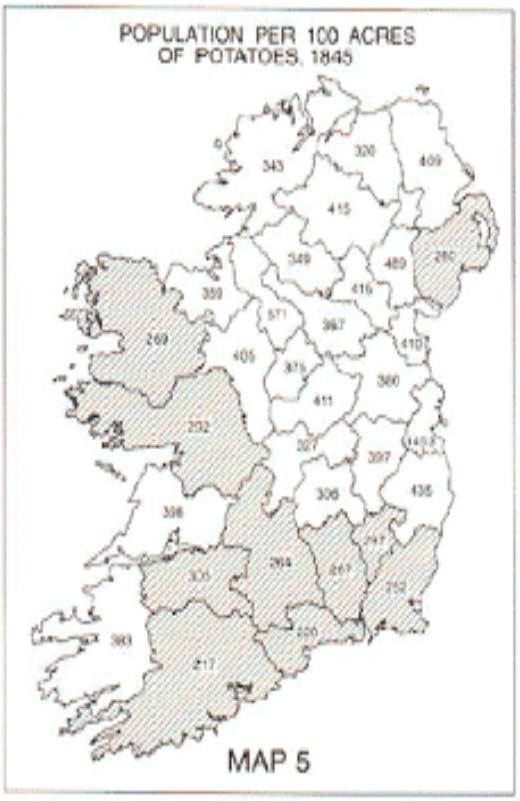
MAP 3



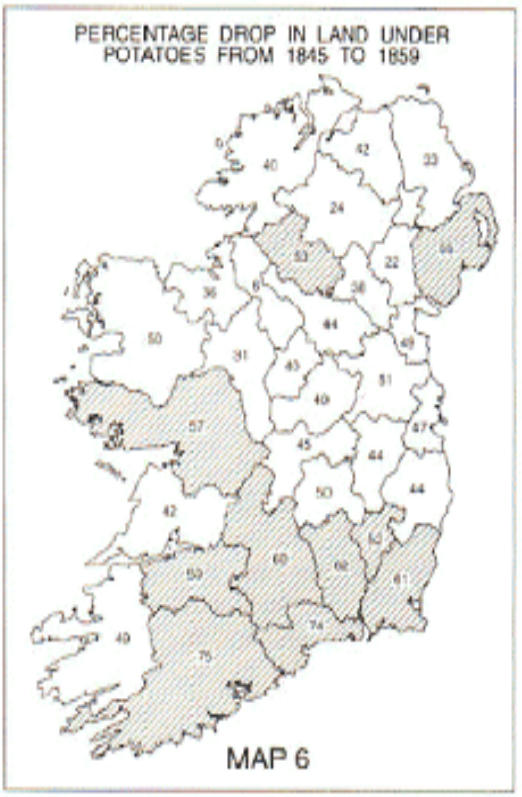
MAP 4

Sometimes a rich farmer hires a vessel on his own account, and either superintends the sale himself, or deputes one of his sons. The freight varies according to circumstances, generally from thirty to forty guineas for a sloop of fifty or sixty tons. Larger vessels are procured on cheaper terms, but the delay, that frequently attends the sale of a large cargo, seems to render the smaller conveyance more eligible. The master's profit in these voyages is so considerable, that farmers are never at a loss to procure a vessel. The demand for the commodity in Dublin is however, very fluctuating and uncertain. As the supply, in consequence of the variable weather in this climate, must necessarily be irregular, the market frequently experiences the extremes of want and abundance. The profits of the farmer, therefore, are always precarious. Sometimes he is fortunate enough to return with full pockets, and sometimes he has been known to desert the vessel, and leave the cargo to pay the freight. This uncertainty, however, is not found to destroy his hopes or diminish his ardour. It is a sort of lottery, in which, like other adventurers, each man hopes to be the favourite of fortune, and never calculates the chances against his success. Four shillings per hundred weight, in Dublin, afford a fair profit; his good or bad fortune depends upon their exceeding or falling short of this standard".

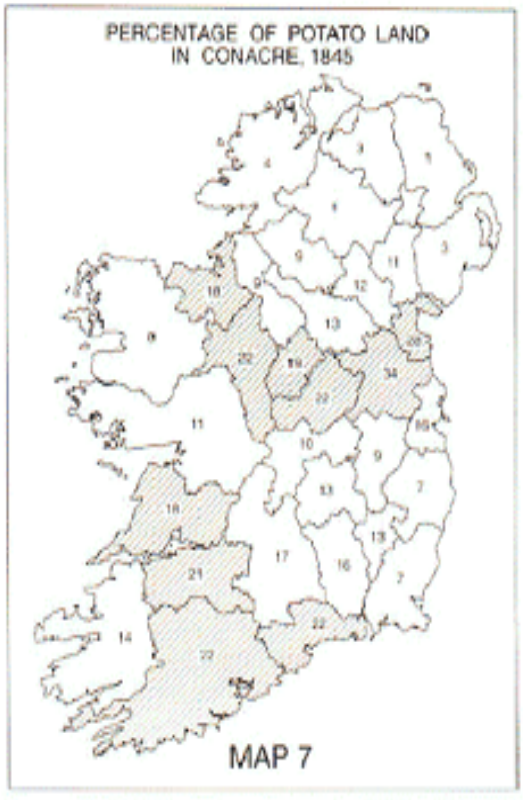
One puzzling feature of the 1845 county distribution (Maps 1 and 5) is the low density of the potato crop in Co. Leitrim, which is about two-thirds only of that in neighbouring counties. It seems unlikely that the figures are at fault since almost complete returns are available. It is difficult to suggest an explanation, for contemporary works rarely discuss Leitrim and never at any length; then, as now, it appears to have been the forgotten county. It may be significant that in pre-Famine and even Famine days, it does not seem to have acquired its modern reputation as one of Ireland's poorest counties. It may be relevant, too, that in 1841 it shared with Kerry the distinction of having the highest density of cattle, ahead of Meath and, for instance, more than 25% above Westmeath. In the subsequent century it lost much of its pre-eminence in cattle raising, for three counties - Wicklow, Donegal and Leitrim - show the lowest increase in cattle population amongst the 32 counties over the period 1841 to 1951. Whether the Famine marked for Leitrim a deterioration of economic status even more pronounced than elsewhere is an interesting point; certainly, unless the figures are erroneous, the county came much closer in 1859 to its pre-Famine potato acreage than did any other (Map 6).



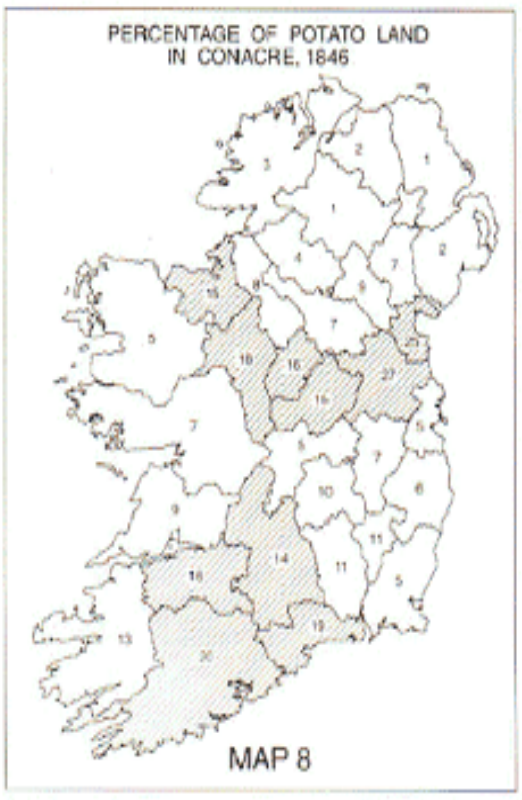
MAP 5



MAP 6



MAP 7



MAP 8

Subsequent Changes in the Distribution of the Crop

Maps 1 to 4 permit a quick review of the changing density of the potato crop over the period 1845-1951. Map 6 shows the percentage drop in acreage for each county in the period from 1845 to its post-Famine maximum in 1859.

The feature in the first period (Map 1 to 2, and Map 6) is the speed with which Cork and Waterford, ignoring tradition, abandoned the potato, never to return to it again on an intensive scale. This example was followed, to a somewhat lesser degree, by most of the South. Apart from Leitrim, the least falls in acreage occurred in Armagh and Tyrone - a sign of things to come. The crop in Down fell by over half, as did that of Fermanagh, but even with the residue, Down remained one of the counties of highest density in 1859.

The Northward retreat of the potato continued between 1859 and 1926, with falls in density of crop everywhere but much lesser decreases in the North than in the South. Sligo and Roscommon had dropped from the leading potato producers in 1926, and been replaced by Donegal and Antrim. It will be observed that Donegal emerged comparatively late as a potato specialising county.

An intensification of this Northward trend took place between 1926 and 1951, for, although a slow drop continued over most of the country outside Ulster, a sharp *rise* in potato density took place in Derry and Tyrone, and even Fermanagh, last outpost against the potato in the province, showed a similar trend.

The following list of counties of densest potato crop in each of the four years underlines the general trend:-

1845	1 Cork	2 Waterford	3 Down	4 Mayo	5 Derry, Tipperary
1859	1 Armagh	2 Down	3 Monaghan	4 Derry	5 Tyrone, Sligo
1926	1 Derry	2 Down	2 Donegal	4 Antrim	5 Tyrone, Armagh
1951	1 Derry	2 Down	3 Down	4 Donegal	5 Monaghan

One aftermath of the famine has been that the centre of gravity of potato growing (and of pig rearing) has moved from one end of the country to the other, to come ot rest solidly in the North.

Distribution of Conacre in 1845-6

Much evidence on conacre, mainly qualitative, was tendered before the Devon Commission. The following were among the conclusions drawn:-

“The practice of letting land in con-acre appears to be much more prevalent in Munster and Connaught than in Leinster and Ulster. In the latter province it seems that con-acre is little known except as potato-land, or land let under a con-acre contract for a single crop of potatoes; but in the southern and western counties con-acre seems to be frequently taken for the purpose of raising crops of oats, hay and flax, as well as potatoes, though the latter was always the crop for which con-acre was chiefly sought”. (4, p. 519.)

The distribution of potato land in conacre in 1845-6, as illustrated in Maps 7 and 8, shows considerable differences from the picture drawn by the report of the Devon Commission and generally accepted by subsequent commentators. The highest percentages occurred neither in Munster nor Connaught, but in the Leinster counties of Meath and Louth. Outside of Counties Roscommon and Sligo, the percentage of potato land in conacre in Connaught was below the national average.

It is outside the scope of the present paper to discuss the reasons for the distribution of conacre; the data and maps have been included since they represent, it is believed, the first published numerical analysis of this important aspect of the pre-Famine agricultural economy.

Acknowledgements

Thanks are due to the administrators of the Scientific Activities Fund of the Royal Meteorological Society (London) for a grant towards an investigation on weather and potato blight in Ireland in 1845-7, to which the present paper is incidental.

The help of Mrs. R. Keenan in checking calculations is gratefully acknowledged.

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Appendix 7

Some Perplexities in regard to the Agricultural Statistics of Ireland.

By Professor C.H. Oldham, Vice-President.

[Read Friday, 9th May, 1924.]

This paper is reproduced from the Journal of the Statistical and Social Inquiry Society of Ireland October, 1925.

Seventy-seven years ago the first paper ever read to this Society was "On the Connection between Statistics and Political Economy" by Mr. James Anthony Lawson, LLB. It has been my task, in the Chair of the National Economics of Ireland, to aid students to investigate the application of economic science to the special case of Ireland. The use of statistics to reduce the actual facts of Irish life to measured statements is, I think, the best method of approach to the subject for Irish students. I may be allowed to repeat here the words which used a year ago on this very point in the *Manchester Guardian Commercial,* dated May 10, 1923:-

> *"Each race has the defects of its own qualities. The Celt had no use for statistics hitherto. He as naturally dislikes being asked for a measured statement of anything as he would resent being choked. His richly emotional nature craves for emphasis, for vehement utterances; his imaginative mind loves to believe that facts can be shaped by a strong will as clay in the potter's hand; and his intellect, much exercised about literature or verbal debate but quite untaught in science, has never understood Lord Bacon's great dictum, "Nature to be commanded must be obeyed". The Irish Celt has been accustomed to live in a world of his own mind, where facts were really impertinent. But to-day the Vita Nuova of self-government has brought new mental valuations. To reduce the facts of Irish life to measured statements is the practical need of the moment. The statesman must begin by being statistician.*
>
> *"The current notions about Ireland seldom stand the test of measurement. The country is a veritable terra incognito to those who dwell there, and Irish facts are not what they are commonly thought and said to be. No doubt many important facts could not become known except after a careful use of statistics. And Government experts are to-day busily engaged upon that sort of research. But the true cause of the general mental blindness is the inveterate Irish habit of squinting whenever the facts seem disappointing. Imaginative people, who happen also to be untrained in science, have a childish notion that we can select our facts as we like them. But rejected facts remain, even if we are unwilling to see them. It is the rejected facts of Irish life that will control our future in Ireland. "In every work of genius", said Emerson, "we recognise our own rejected thoughts: they come back to us with a certain alienated majesty". When Irish Ministers bring before Dáil Éireann their practical measures for the reconstruction of Irish life, let us hope that Irish people will be ready to recognise their own rejected facts, which will come back also with a certain alienated majesty, for in many cases they will be the dominating factors in the problem in hand. These unknown facts of Irish life are the submerged rocks through which Irish Ministers have to steer the ship of the Irish Free State."*

Certainly, if we leave aside political issues for the moment and consider economic problems only, then the capacity of a people for self-government can be pretty well measured by their capacity to handle statistical evidence as to the economic position of their country. In Ireland this capacity hardly exists among our responsible public representatives, and is very rare among our irresponsible private citizens. The condition of our public statistics at the present moment is probably worse in the Free State of Ireland than in any civilised country in Europe. We have no Census of Production since 1908; no Census of Population, Housing and Occupations since 1911; no detailed report on Agricultural Statistics since 1921; no statistics of External Trade for any year later than 1921. Whenever our government departments do issue any statistical material, the method of its publication is unbusinesslike and is such as prevents accessibility. The Railway Statistics, published in connection with our new Railway Bill, is sold to the public at the stiff price of thirty shillings; the annual Finance Accounts and the Estimates cost ten shillings; the Imports and Exports, which cost eight shillings in 1922, came down to three shillings in 1923. Our Stationery Office issues these publications without any "Official Number" to identify each; and without any annual Index Volume, which would (1) enable a student to ascertain what statistical material exists, and would (2) enable libraries to bind the loose sheets into well-ordered volumes, so as to preserve the records in an accessible form. The Irish Government is costly; it maintains a very numerous staff of Civil Servants: why should the public statistics of Ireland be in a condition so discreditable? One remembers John Milton's description in *Lycidas* of "our corrupted Clergy then in their height":-

Blind mouths! that scarce themselves know how to hold
A sheep-hook, or have learnt aught else the least
That to the faithful herdman's art belongs!
What recks it them? What need they? They are sped;
* * * * *
The hungry sheep look up, and are not fed.

I do not myself think that the fault lies with the Civil Servants: they have given proof in the past that they "know how to hold a sheep-hook," for under the old Dublin Castle government Irish economic statistics were, as a rule, well done. I do not know where the fault lies. But the fact remains that our Irish public statistics have fallen into a disgraceful state of confusion - the hungry sheep may "look up" the records, and search for figures, but they are certainly not fed!

But swoln with wind, and the rank mist they draw,
Rot inwardly, and foul contagion spread.

That Ireland formerly had an admirable body of public statistics was due mainly to Sir Thomas A. Larcom, R.E., who carried out the Ordnance Survey of Ireland, 1826-42. His Census of Ireland, 1841, created "a new era in Irish statistics." He assumed the conduct of the Board of Works in Ireland during "the most dangerous and doubtful crisis" of the Great Famine, 1846-7, when "he remained like a sailor tied to the helm in a dark night and on a stormy sea." (Lord Cardwell's letter of 1868). He was a principal founder of the Dublin Statistical Society in 1847. He created the Agricultural Statistics of Ireland in 1847, as part of his duties at the Board of Works, and then brought them out annually, with remarkable completeness, until he saw that they were put upon a permanent footing while he was Under Secretary at Dublin Castle, 1853-69. No other man has ever given so many fruitful services to Ireland in the varied fields of topography and place-names, of historical antiquities, of economic statistics, and of administrative reforms. Yet no mention of his service is to be found in Dr. George O'Brien's excellent and elaborate work upon "The Economic History of Ireland from the Union to the Famine"!

In the case of statistics to follow changes in agriculture Ireland had the start of Great Britain by twenty years. British returns, giving only the acreage's under crops and the census of live stock, begin in 1867 (Parl. Papers, 1867, vol. 71): they were brought out for the Privy Council by Mr. Albany W. Fonblanque, the journalist. But statistics that give the produce of crops (yields per acre) were not obtainable for Great Britain until 1884 (Parl. Papers, 1884-5, vol. 84). It is a remarkable achievement that the agricultural statistics for Ireland, issued by Captain Larcom, R.E., in 1847 (Parl. Papers, 1847-8, vol. 57), were complete from the start, and were the model, both in form and in methods of collection, for these returns in all subsequent years down to 1906, when certain innovations were made by Mr. W.G.S. Adams. Two local circumstances combined, with the ability of the man himself, to explain Larcom's success, both with his Population Census in 1841 and his Agricultural Statistics in 1847: (a) Ordnance Survey Maps were now available, so that the Irish Boundaries were precisely known for the first time; (b) the Irish Constabulary (a centrally controlled force dating from 1836) supplied a corps of enumerators with ideal qualifications for the task. In his 1847 report (explaining by what methods the agricultural statistics had been compiled) Larcom wrote testifying to "their entire and zealous devotion to this novel duty.... to the admirable discipline and organisation of that body it is due that the most general and extensive inquiry can be conducted in Ireland with as much precision and exactness as a model operation on the most limited scale." It was a popular gibe with the politicians in those troubled times that Ireland's real government was "Larcom and the Police." We must acknowledge it gave us admirable statistics without which we to-day could not discern the social and economic changes in Ireland consequent to the Great Famine, 1846-7.

For 1851 and 1852 the agricultural statistics were bought out by the Commissioners appointed to take the Irish Census of 1851; but it formed a separate publication (Parl. Papers, 1852-3, vol. 93). Dr. Grimshaw initiated a custom by which Census Years (1841, 1851, etc.) are used, as stepping stones down the stream of time, when following the changes of agriculture in Ireland. For brevity's sake the later practice is to compare merely the figures of 1851 with those of the year under discussion. Since nobody goes back earlier than 1851, it has now been forgotten that 1851 does not represent the position of our agriculture at the time of the Great Famine. It is a surprise to learn that tillage in Ireland was increasing after 1847, so that 1851 was a "peak" year, viz.:-

Tillage Acerage in Ireland (Larcom)

	1847	1849	1850	1851
Corn Crops	3,313,579	3,174,424	3,149,556	3,099,401
Green Crops	727,738	1,167,693	1,317,572	1,352,315
Flax	58,312	60,314	91,040	140,536
Meadow Hay	1,138,946	1,141,371	1,200,124	1,246,408
Total Crops	5,238,575	5,548,748	5,738,292	5,858,951

N.B.- 1848 figures exist, but omit three "disturbed" counties (Tipperary, Waterford and Dublin) for that year.

Comparing 1847 with 1851 in detail, we find that Total Crops increased by 620,376 acres, in which the Hay Crop accounted for only 107,462 acres. Corn crops had decreased by 214,174 acres, yet Wheat alone showed the larger drop of 239,623 acres (viz., from 743,871 to 504,248 acres), being the only crop that was then shrinking. Potatoes had revived from 284,116 to 868,501

acres, and Flax had grown from 58,312 to 140,536 acres. The recognition of these facts would involve a revision of a good deal that has been written about Ireland at this crisis in our economic history.

The old Department of Agriculture and Technical Instruction by the publications of its Statistical and Intelligence Branch had rendered very great services to the scientific study of Irish economics. It is now replaced by the new Ministry of Agriculture of the Free State. And I find myself again quoting from *Lycidas*-

> *But O the heavy change, now thou art gone,*
> *Now thou art gone, and never must return!*

The change has been disastrous as regards Irish Agricultural Statistics. It is not the fault of the new Ministry of Agriculture, but the result of the disturbed state of this country since1918, which accompanied the transition to the new order and of the "partition" in the government of Ireland, which is the most deplorable feature of that new order. The last detailed report on the Agricultural Statistics of Ireland deals with the statistics for the year1917; and it was issued in the middle of 1921 by Mr. John Hooper, the very competent statistician of the old Department. He had to contend with a sea of troubles, like what often follows upon an earthquake; and one can only admire the spirit and ability with which he faced his difficulties and managed to carry on as far as was possible. I quote his own words, which do him infinite credit-

> *"The delay in restarting the publication of this series of Reports is regretted, but was unavoidable. During and since the War the Department's statistical staff, depleted in the first instance by enlistment and afterwards by transfer to other Departments, had to meet a largely increased demand for statistical information. Moreover, since 1917 the collection of statistics in Ireland has been becoming increasingly difficult; new machinery had to be devised for collection of agricultural statistics in 1918; this had to be changed in 1919 and again in 1920 to meet the changing circumstances. Still all the more important figures of immediate interest were issued fairly promptly each year in preliminary summaries, but the publication of the less urgent particulars had to be delayed."*

This Report (Cmd. 1316, of 1921) has an uncommon importance, because it contains the explanations regarding two novel happenings in the history of Irish agriculture, viz.:- (1) The effect on tillage in Ireland of the measures taken by Government to increase home-grown food supplies during the War Time (I may refer to my own paper of Feb. 2, 1923, in the "Journal" of this Society, dated October, 1923.) (2) The new methods for collection of statistics, devised suddenly when the services as enumerators of the old Royal Irish Constabulary were found to be no longer available after 1918. I want to say here something about this second event. From 1847 down to 1918, inclusive, these statistics were collected, on the Larcom lines, by police enumerators who visited each holding. From 1919 down to to-day the figures are compiled in the Office from "sample returns," obtained through the post from certain farmers who have complied with the Office invitation (perhaps 30 per cent. of the farmers may have made such returns). For a fuller description of the new methods now in use students may be referred to the Official Paper, Cmd. 1317 of 1921, which is the "General Abstract" for years 1916-1920. On the other hand, Cmd. 112 of 1919 ("Detailed Report" for year 1916) and Cmd. 113 of 1919 ("General Abstract" for the years 1916-7-8) make no reference to any change, because the R.I.C. enumerators were still doing the work in June, 1918. That date marks the transition.

Now, for nearly all persons who may want to use our agricultural statistics at all, what they want is a figure; and if they can get a figure (e.g., out of Thom's Directory or Purdon's Almanack) they are satisfied, and feel themselves to be based on the actual facts. Their case is that of Peter Bell and the primroses in Wordsworth's poem:-

A primrose by a river's brim,
A yellow primrose was to him,
And it was nothing more.

When Mr. John Hooper writes that "the more important figures of immediate interest were issued fairly promptly each year in preliminary summaries," he has these people in his mind: the people who only want a figure of some sort provided it be "official", and who might "kick up a row" if the figures were not there, or not there in time. But there are a few other people - I hope they include all my own students! - who are more critical, because they want to interpret the economic significance of the figures. These people know the difference between a "cooked figure" and an "ascertained statistic", viz., the interpretation of the former has to do with the mind of the person who "cooked" the figure, whereas the interpretation of the latter has to do with the economic significance of the fact which the statistic has measured. Every scientific statistician will know that a fundamental change in the method of collection will alter the comparability of the figures, and will need new canons of judgement when the significance of the bare figures requires an interpretation. The Irish agricultural statistics obtained on the Larcom plan were "enumerated" figures obtained by actual visits to the farm holdings; those published since 1918 are "estimated" figures compiled in the Office by generalising from sample returns that were obtained through the post. Both may rank as ascertained statistics, and neither can be branded as "cooked" figures, since both are honestly based upon evidence. But there is a difference, and the difference must affect both the comparability and the interpretation of the statistics.

I hope I have made it clear that no blame attaches to Mr. John Hooper in this matter; that, on the contrary, he deserves infinite credit for continuing to bring out the Irish agricultural statistics in spite of difficulties which would have daunted and overwhelmed any official less brave and competent than he has proved himself to be. I would like to lift my hat to him every time I mention his name! But I am anxious to blame somebody for the form in which our agricultural statistics are at present "made public" by our new Ministry of Agriculture. Single loose sheets are printed from time to time containing the figures required for publications like Purdon and Thom and similar works of reference. There is no explanatory comment to show how the figures were compiled and to assist people in interpreting the changes which the figures reveal either in Crop Acreages or Live Stock Numbers. For scientific purposes these sheets of figures are nearly worthless. They are also far from complete. But the worst features about them are that (although Official Publications) they are not on sale to the public; they carry no Official Number by which they can be bound up in ordered volumes by Public Libraries and so can be preserved in a form suitable for reference; and they are not listed and catalogued in Annual Index Volumes from our Irish Stationery Office, by which research students are so much facilitated. These loose sheets of figures are sometimes reprinted in the newspapers - in this way I discovered from the *Freeman's Journal* that the Agricultural Statistics for 1923 have recently been issued; sometimes one finds the new figures quoted in editorial comments by newspapers that have not reprinted the array of statistics; but in most cases the sheets are probably consigned to the editorial wastepaper basket as too indigestible for journalistic use. In the meantime, "the hungry sheep" (such as myself and my students), who are ever on the look out for this most welcome statistical nutriment, are certainly "not fed". What we want really is the "Detailed Report", containing the full official commentary

and explanations: that is the only thing that has scientific value for the purpose of economic interpretation. That we have not had for any year later than 1917.

I have said that the handling by statesmen of the problems of self-government requires that the facts of Irish life be reduced to measurement in the form called statistics. I have described the present confused condition of the public statistics of the Free State of Ireland as discreditable. I will take our Agricultural Statistics as an illustration, but similar illustrations could be drawn from many other branches of Irish public statistics. A student may quote the agricultural statistics of Ireland from many different sources, viz., (1) the preliminary figures issued in the early General Abstracts; (2) the revised figures, now withheld, which have previously appeared in the Detailed Reports; (3) the Irish Census General Reports; (4) the British Agricultural Statistics which endeavour to give figures for the former United Kingdom, and where the Irish Statistics are presumably obtained from Irish official sources; (5) the Statistical Abstracts issued by the British Board of Trade, also for the so-called United Kingdom; (6) numerous works of reference, such as Thom's Directory, Purdon's Almanack, Whitaker's Almanack, *Daily Mail* Year Book, and others. It is a source of constant perplexities to students of statistics that the figures obtainable from one of these sources for any statistical fact are different - often surprisingly different - from the figures for the same statistical fact obtainable from any of the others. Take, for example, the figures for the "Divisions of Land" in Ireland: namely, the areas covered respectively by Land under Crops, Pasture Land, Woods and Plantations, Bog, March, Rough Mountain Grazing, Waste Land, included Inland Waters, excluded Greater Waters and Tideways, and the Total Area in acres of the whole country. The Detailed Report on Agricultural Statistics used to commence by a statement, "According to the Census of Ireland for (say) 1911, the following are the figures" etc. When you have looked up the Census Report in question you are met by the statement, "These figures were kindly supplied by the Department of Agriculture". Now, in all probability the real source for the figures is neither, and is the Ordnance Survey Office; but this body is never saddled with a responsibility for the problematical degree of accuracy that attaches to the figures, and, in any case, it is a body that never publishes an annual report that could be quoted. But this shuffling of the responsibility from one Government Office to the other does not worry people who assume that because they are somehow "official" the figures must be the same figures in both cases. Now, my point is that the two sets of figures are not the same; they are always different, with the signal exception of Sir Robert Matheson's Census for 1901. The student of statistics may swear "A Plague on Both Your Houses!" But, in the end, he has to choose the one, and stick to that one source for his figures throughout, ignoring the other source consistently. One often has a doubt, if a writer be quoting statistics, to decide whether he is really competent to handle statistics or not; this doubt is easily to be decided (a useful tip!), for unless the writer scrupulously refers to the source that is the authority for his statistics it is perfectly certain that he is a duffer who is incompetent to handle a statistical statement. But, as the dramatists say, this tip is an aside. Let me quote the year 1911 as an example of many others:-

Ireland, 1911 : Divisions of Land *(Acres)*

Extent in Acreage	Census Report (1912 – 13) Cd. 6663).	Agricultural Statistics (1912 – 13, Cd. 6377).
Under Crops (including Hay)	4,861,224	4,861,224
Under Grass (and Grazed Mountain)	12,431,804	12,430,798
Under Woods	295,809	299,791
Non-Agricultural-		
Turf Bog	848,187	847,660
Marsh	350,418	350,341
Barren Mountain	500,143	500,143
Waste Land	965,515	943,633
Included Waters	*	117,135
Total Area	20,253,100	20,350,725
Excluded Waters	601,622*	487,418
Total Surveyed Area	20,854,722	20,838,143

*Footnote:- In the Census column, the total (20,253,100 acres) represents Land only. A footnote states that the 601,622 acres of Water had contained 481,293 acres "under larger rivers, lakes and tideways". This cryptic remark is then made nonsense by omitting the whole 601,622 acres of water! What the cryptic remark really means is that the 481,293 acres of Larger Waters were to be omitted, and the balance of 120,529 acres was to be counted in with the "Waste". Had that been done, the Total Area of the country (viz., 20,373,629 acres) would then be the same figure as the sum of the Four Provinces, as it ought!.

The two columns of figures brought together in this table purport to measure the same facts at the same date, and they are both "Official" figures: they ought to be identical figures, and they are not. The discrepancies may seem unimportant at a casual glance, and they alter in no way the interpretation. *But the point is that there should be here no discrepancy whatever;* rather one column should corroborate the other. The worry caused to students by such incompatibilities in Official figures is immense; so that many have abandoned the further study of statistics in sheer despair - unless they have acquired in time a healthy contempt for the "Officials" who supply them with this rotten garbage - the sort of officials denounced in Milton's lines already quoted: "that scarce themselves know how to hold a sheep-hook" etc. I have been comparing here two blue-books, both produced in Ireland. But, like statistics relating to Ireland, could be quoted from the British Agricultural Statistics or from the British Board of Trade's Statistical Abstract, which would be found still more irreconcilable and inconsistent both with themselves and with the corresponding figures published here in Ireland. This kind of confusion is far too prevalent, and is calculated to bring the public statistics of Ireland into contempt.

One suggestion I would like to make. The practice of publishing "preliminary" statistics in prompt time, which are then "released" to English or other statistical offices as being the Irish figures they have been waiting for, and of then sitting down leisurely to produce "revised" figures (which often differ considerably from the "preliminary" statistics); this practice is one chief source of the confusion. It is a bad practice, and it ought to be suppressed rigidly. The preliminary figures ought to be "right" (i.e., as good as humanly possible - for all statistics contain errors!) from the first, and ought to be the only figures published for the year: in other words, the results

of “revision” ought to be reserved until next year, and ought then to enable an improvement in the accuracy of the next year’s figures.

You will observe in the last table that the total area of Ireland is represented by two different acreages. The Census said it was 20,253,100 acres (taking Land only), the Agricultural Statistician said it was 20,350,725 (which includes 117,135 acres of the smaller inland Waters). Now it perplexes young students to explain how Ireland can have two different sizes at the same time, 1911. But one learns as one gets older that the thoughts of Irish statisticians “grow wider” with the progress of the years. At the Census years 1841, 1851, 1861, 1871, 1881, Ireland behaved reasonably, for its Total Area - according to Mr. Butler’s Report for 1911 (Cd. 6377) - remained at the same figure, 20,328,753 acres. For 1891 and 1901 Ireland rose higher out of the Atlantic, for the statisticians make its Total Area to be 20,333,344 acres. But in 1911 Mr. Butler was able to lift Ireland to 20.350,725 acres. If Mr. Blythe could spend a little more money on getting out the next Irish Census, it is possible that our Irish statisticians would be able to provide enough new land for all the “landless men” in the Free State. That result would be hailed (throughout the statistical world anyhow) as a typically “Irish” solution of a difficult political problem. But I find that Mr. Butler only made Ireland reasonable by the simple process of “watering the milk”. Take the year 1851: I find in the Agricultural Statistics for that year (Parl. Papers, 1852-53, vol. 93) that the Total Area of Ireland is there put at 20,316,979 acres, which included Smaller Waters to the extent of 139,918 acres. Now Mr. Butler lifted these waters up to 151,692 acres, which brought Ireland up to the required mark, viz., 20,328,753 acres. That is one device by which the perplexities of students can be alleviated. There is another item called “Fallow Land”, which is tillage land that lies uncropped for the year; it may run up to 195,053 acres as in 1851, or it may run down to 10,886 acres as in 1901. Now the more frequent practice has been to count in this item with the Waste Land; but sometimes it is not counted at all, and sometimes it is counted in with “cropped land” (which is then discreetly called “arable land”). Economically, it is “uncropped”, and yet it is “tillage land” and “arable land”, but, for the time being, it is also “waste land”. Now, some uniformity in the practice of statisticians in regard to the placing of “fallow land” is much wanted by those students who try to investigate honestly the very important question of the decline of tillage in Ireland since 1851.

There are dozens of other perplexities in our agricultural statistics. The number of “Horses” in Ireland was “returned” in the Census 1851 as numbering 543,312; and the same men who brought out that Census also brought out the Agricultural Statistics of 1851. Now, 1851 is the standard year with which all subsequent years are compared. Yet at a certain point of time you will find this figure make its appearance at 521,706. I have often pointed to this discrepancy, and I have suggested that the correct figure should be reinstated, viz., 543,313. But I was wrong. I discovered only last week in a Paper which Dr. Grimshaw read to this Society in 1888 that he there quoted for the year 1851 the statistics as follows:- Horses = 521,706, Mules = 21,607. If Dr. Grimshaw had found authority for that from the statistical records of the Registrar-General’s Office the point is cleared up, and we must owe the correction to him. It shows that the 1851 Report (as published) was wrong, because under the term “Horses” it gave us the “Horses + Mules and Jennets”. So that is that!

I will only trouble you with one other example of perplexity, but it is a very important one. It is in regard to “Land under Grass”. In the Census for 1911 the Land under Grass is stated at 12,431,804 acres, or 61.3 per cent. of Total Area; in the previous Census the corresponding figure was stated at 10,577,.238 acres, or 52.3 per cent. There is no footnote in 1911 to explain how the “Grass” increased in ten years by the huge figure of 1,854,566 acres, nearly 10 per cent of the Total Area. We all took it to be sad evidence of the decay of agriculture in Ireland. But it is

nothing of the sort; it is a mere change of classification made in the Office, which altered the figures but not the facts (it was first made by Mr. Adams between 1905 and 1906). The earlier 1901 Census gave for "Barren Mountain" the large figure, 2,223,420 acres; the later 1911 Census gives it as 500,143 acres; so "Barren Mountain" has been changed in the Office - the 2,223,420 acres of 1901 were sub-divided into 1,723,277 acres rightly renamed as "Rough Mountain Grazing", and 500,143 acres still called "Barren Mountain". Then the Census of 1911 silently added the former to "Land under Grass". The public was misled; the 1,854,566 acres of new Grass Land, during that decade, 1901-10, was in actual fact only 131,289 acres, because the other 1,723,277 acres were merely this transfer of Mountain Grazing into the category of Grass Land - this transfer alone equals 8.4 per cent. of the whole area of the country. Think what it all means! People studying the decay of tillage in Ireland will take the figures of 1851 and of 1911, and will assume that nothing more is needed than to compare the two sets of figures. That would be a fallacious assumption. The 1911 figures were "doctored" by lifting 8.4 per cent of Total Area out of the category of "Barren Mountain" and adding it to the other category of "Grass Land" by a figure equal to 8.4 per cent of the Total Area of Ireland. Translating actual acreages into percentages of Total Area, the change is as follows:-

Change in the Use of the Soil of Ireland

	1851 (Revised)	1911 (Census)	1851 (Census)
All Crops except Hay	22.7	11.4	22.7
Hay, including permanent Meadow	6.1	12.3	6.1
Grass Land, with Mountain Grazing	51.4	61.3	43.0
Woods	1.5	1.5	1.5
Non-Agricultural, (incl. Small Waters)	18.3	13.2	26.7
Total Area	100.0	100.0	100.0

We learn from the first and second columns that the following changes have taken place in the sixty years. viz. - (1) Grass Land is increased by 10 per cent of Total Area of Ireland (10 per cent of 20 million acres). (2) Half that new Grass came from the reclamation of Bog, Marsh, Waste, for the Non-Agricultural Land changed from 18.3 to 13.2 per cent. (3) Half the new Grass came from Cropped Lands, for the percentage under all crops changed from 28.8 to 23.5. (4) Of the Cropped Lands themselves, the area under Hay Crop has doubled; the Area under Other Crops has become halved. These four points accurately state what has happened to Irish Agriculture during those sixty years.

Enough has been said. I will conclude with a Day Dream. I would like to see formed for the Free State of Ireland a Central Statistics Office which would be responsible for the issue to the public of all the public statistics of our Government. Some of the Dominions, such as Australia, posses such an Office, which is there presided over by a Chief Statistician, who compiles and edits a Dominion Year Book containing an exposition of the Dominion's statistical position in all branches of national effort where statistics emerge and are needed. But for the Free State I would prefer that there should be rather a Central Statistical Board composed of the separate statisticians of such departments of government as mostly supply the statistical material at present. To that Central Statistical Board I would entrust the direction of our Irish Stationery Office (which is not yet functioning properly as a publication office). The editing and planning of all the statistical material as well as the supply of that statistical material to the representatives of other Nations included in the British Commonwealth, and of all Foreign Nations interesting themselves in the affairs of our Free State, I would charge as the undivided responsibility of that Central Statistics

Board. A complete file of our Government Publications should be placed by this Central Statistical Board for reference purposes (with proper conditions attached) at our National Library in Dublin, at all central Municipal Libraries, at all libraries attached to University Colleges, and with certain selected Chambers of Commerce that will accept the prescribed conditions. Only through the authority of such a Central Body can the confusion and discredit that now attaches to our public statistics be rectified and purged. That Central Statistical Board should be used by our Free State Treasury as its instrument for securing that every distinct department of the administration in our Free State shall not live enshrouded in secrecy (as so many of them live at present), but shall put its yearly operations upon open record in an Annual Report issued regularly and with a reasonable promptness after the close of each financial year. Could such things be, and overcome us like a summer cloud, how much more common among our patriotic citizens would be the effective capacity for self-government.

Appendix 8

This article is reproduced from the Agricultural Statistics Report, 1847-1926.

Internal Cattle Trade Movements, 1926

The 1847-1926 Report contained the results of a detailed Study on the internal movements of cattle within the State. This is a well-known but seldom documented movement from the South-west to the West and finally to the Eastern counties for finishing.

'In the Saorstát there is a very large internal trade in cattle, the 13 Central Eastern Counties importing great herds of calves and store cattle from the 7 South-Western and from the 6 North-Western Counties. Before describing this trade it will be helpful to obtain an accurate impression of the ages of the calves and store cattle in the country on the 1st of June and for this purpose the results of special inquiries made in June, 1913 and 1918 are presented here.

Calves are born (and milk production begins) earlier in the South-West than in the Central Eastern Counties and earlier in the latter than in the North-West. In the South-West 34 per cent of the calves are born in March, but only 17.6 per cent in the North-West; 25.5 per cent are born in May in the North-West but only 13.3 per cent in the South-West.

Table A shows that 73 per cent of the cattle under 1 year on 1st June were in fact under 3 months at that date; accordingly, most of the cattle 1 to 2 years old on 1st June were presumably from 12 to 15 months old, most of the cattle 2 to 3 years old on 1st June are 24 to 27 months old, etc.

Exceedingly few calves are either exported from or slaughtered in the Saorstát and, accordingly, as on 1st June, 1926, there were 78 cattle under 1 year in the Saorstát per 100 milch cows, it follows that any district or group of holdings having much more than 78 cattle under 1 year per 100 milch cows on 1st June must have imported these animals and any district with much less than 78 must have exported them. Table D shows that Meath with 121 cattle under 1 year per 100 milch cows, Kildare with 114, Westmeath with 113, Offaly with 106 and Carlow with 103, in fact 11 of the 13 counties in the Central Eastern wedge and even Kilkenny, Clare and Monaghan imported these young calves before 1st June. Limerick with only 57 per 100 milch cows, Kerry with only 63, Cork with 70, Leitrim with 71 and Donegal with 73 were the counties which exported the largest proportion of their young calves before the 1st of June. (The low figure for Dublin is presumably due to importation of milch cows for supplying the city with fresh milk). Section B of the following Table B shows that farmers in the Central Eastern Counties with all sizes of farms - even those with less than 30 acres - purchased these young calves before 1st June.

Table A Percentages of Calves Born in each Month of the Year.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
13 C.E. Counties													
1912 – 13	7.5	9.5	19	21.8	17.7	2.6	2.9	3.4	3.6	3.4	3.6	5	100
1917 – 18	7.8	10.5	19.1	22.1	20.3	2.2	2.1	2.6	2.7	3	3.2	4.4	100
Average	7.6	10	19.1	21.9	19	2.4	2.5	3	3.2	3.2	3.4	4.7	100
6 N.W Counties													
1912 – 13	4.9	7	18.5	27.8	24.5	2.4	2.3	2.7	2.4	2.1	2.4	3	100
1917 – 18	5.4	7.9	16.7	26.4	26.5	2.7	2.3	2.5	2.1	2.1	2.3	3.1	100
Average	5.1	7.5	17.6	27.1	25.5	2.6	2.3	2.6	2.2	2.1	2.3	3.1	100
7 S.W Counties													
1912 – 13	4.9	11.6	35.1	29.7	12.2	0.6	0.5	0.7	0.8	0.8	1.1	2	100
1917 – 18	3.9	11	32.9	34	14.3	0.4	0.3	0.3	0.3	0.5	0.7	1.4	100
Average	4.4	11.3	34	31.8	13.3	0.5	0.4	0.5	0.6	0.6	0.9	1.7	100
26 Counties													
1912 – 13	5.4	10.2	28.2	27.7	15.9	1.4	1.4	1.7	1.7	1.6	1.9	2.9	100
1917 – 18	5.1	10.3	26.4	29.6	18.2	1.3	1.1	1.3	1.3	1.4	1.6	2.4	100
Average	5.2	10.3	27.3	28.7	17	1.4	1.2	1.5	1.5	1.5	1.7	2.7	100

Notwithstanding the considerable importation of calves before 1st June each of the 13 Central Eastern Counties had on 1st June fewer calves per 100 acres than any other county (see table B). Dublin has now immediately fallen into its appropriate place in cattle densities.

Table D shows that on 1st June, 1926, Meath had 157 cattle 1 to 2 years old per 100 cattle under 1 year on 1st June, 1925. Accordingly, out of every 157 cattle 1 to 2 years old on 1st June, 1926, in Meath, at least 57 were imported in the previous twelve months. Most of these cattle were 12 to 15 months old on 1st June, 1926. Similarly, Dublin with 149 cattle 1 to 2 years per 100 cattle under 1 year, Kildare with 134, Westmeath with 133, Louth with 127 must have imported large numbers of these cattle, the other 4 counties (Offaly, Longford, Roscommon and Galway) with over 100 must also have imported. Kerry with only 45 cattle 1 to 2 years old on 1st June, 1926, per 100 cattle under 1 year on 1st June, 1925, Limerick with only 53, Cork with 56, Leitrim with 65 and Cavan with 66 got rid of proportionately the largest number of these animals. Section C in Table B shows that although farmers in the Central Eastern Counties with under 30 acres are now selling these cattle (they purchase the younger calves), farmers with 30 to 50 acres or larger holdings are still buying in. As a result of the above movements it is now seen in Table C that Meath which is 26th in density of milch cows and 25th in density of calves, is now 8th in density of cattle 1 to 2 years old on 1st June. It will also be seen that Limerick and Kerry, first and second highest in density of milch cows and second and third highest in density of cattle under 1 year, are now second and third lowest in density of cattle 1 to 2 years old.

Table D shows that on 1st June, 1926, Dublin had 184 dry cattle 2 to 3 years old per 100 cattle 1 to 2 years in the country on 1st June, 1925; accordingly, Dublin as well as Meath with 175, Kildare with 161 and Westmeath with 131 are large importers of these older stores which Louth with 117 and Longford with 110 also import. The Counties which get rid of proportionately the largest number of this class of cattle are Monaghan with only 48 two to three years old per 100 one to two years, Donegal with only 52 and Cavan with only 53 - the South-West got rid of most of their cattle at an earlier age. Section D in Table B shows that farmers in the Central Eastern Counties with 30 to 50 acres are now selling these stores (they purchased the younger and older calves) as well as the smaller farmers but that all farmers with over 50 acres are still purchasing. As a result of the movements of the three different classes of cattle referred to, Meath with the lowest density of milch cows has now the highest density of dry cattle 2 to 3 years old on 1st June; it is also densest in dry cattle 3 years old or over (see Table C).

In consequence of the internal movements of cattle, Table D shows that each of the 13 Central Eastern Counties have more dry cattle per 100 milch cows than any county in the North or South-West. Meath had on 1st June, 1926, no less than 1,063 cattle other than milch cows per 100 milch cows whereas Kerry had only 124.

The internal trade in cattle and the densities of cattle, sheep and pigs will be easily followed if it is taken for granted that the denser the milch cows in any district or on any group of holdings, the less food for other cattle (and accordingly the earlier the age at which the other cattle must be sold off), the less food for sheep (and accordingly the less dense the sheep), the more milk for pigs and the greater the density of pigs, which unlike sheep and dry cattle do not compete with milch cows for grass.

Table B Cattle Trade between different Classes of Farmers, Saorstát Éireann, 1st June, 1926.

District	On holdings of					All holdings
	1 –30 acres No.	30 – 50 acres No.	50-100 acres No.	100-200 acres No.	Over 200 Acres No.	No.
A Milch cows on 1 June, 1926 per 100 acres of crops and pasture.						
7 S.W. Cos[5]	188	169	143	106	55	133
6 N.W. Cos[2]	134	97	78	56	31	104
13 C.E. Cos	105	68	55	38	22	57
26 Counties	136	114	104	74	34	97
B Cattle <1 yr on 1 June, 1926 per 100 milch cows on that date.						
7 S.W. Cos[1]	69	72	73	74	77	72
6 N.W. Cos[6]	76	80	82	77	77	78
13 C.E. Cos	88	96	96	101	95	93
26 Counties	77	79	78	80	83	78
C Cattle 1-2 yrs on 1 June, 1926 per 100 cattle less than 1 yr on that date.						
7 S.W. Cos[1]	54	53	61	80	118	65
6 N.W. Cos[2]	61	82	101	132	154	75
13 C.E. Cos	84	109	119	138	183	112
26 Counties	67	74	78	99	147	81
D Dry Cattle 2-3 on 1 June, 1926 per 100 cattle 1-2 yrs on that date.						
7 S.W. Cos[1]	48	55	67	95	142	78
6 N.W. Cos[2]	47	63	83	104	134	65
13 C.E. Cos	60	86	117	156	204	115
26 Counties	52	69	87	119	173	90
E Dry Cattle 3+ on 1 June, 1926 per 100 cattle 2-3 yrs on that date.						
7 S.W. Cos[1]	20	19	21	29	42	28
6 N.W. Cos[2]	20	20	27	41	71	28
13 C.E. Cos	25	30	41	66	111	61
26 Counties	23	25	31	48	85	45
F All Cattle bar milch cows on 1 June, 1926 per 100 milch cows on that date.						
7 S.W. Cos[1]	132	140	162	220	374	174
6 N.W. Cos[2]	153	203	265	343	495	192
13 C.E. Cos	224	328	417	635	54	406
26 Counties	167	194	218	318	630	233

[5] Munster Counties & Kilkenny
[6] Ulster Counties and Mayo, Sligo and Leitrim

Table C Cattle on 1st June, 1926 per 1,000 Acres of Crops and Pasture

Milch Cows		<1 year		1 –2 years		2 – 3 years*		3 years + *	
Limerick	179	Waterford	103	Tipperary	80	Meath	121	Meath	117
Kerry	161	Limerick	102	Waterford	76	Westmeath	91	Kildare	79
Cork	146	Kerry	102	Sligo	73	Dublin	89	Dublin	72
Waterford	127	Cork	102	Kilkenny	71	Kildare	88	Westmeath	67
Donegal	113	Tipperary	89	Louth	69	Louth	80	Offaly	38
Leitrim	111	Clare	85	Roscommon	69	Longford	71	Longford	27
Tipperary	109	Donegal	83	Clare	68	Tipperary	68	Louth	25
Cavan	106	Cavan	82	Meath	67	Offaly	59	Mayo	22
Mayo	100	Monaghan	81	Donegal	65	Waterford	57	laoighis	21
Dublin	98	Leitrim	80	Longford	64	Carlow	55	Galway	21
Sligo	97	Kilkenny	80	Westmeath	64	Kilkenny	55	Tipperary	21
Clare	95	Mayo	79	Carlow	62	Laoighis	54	Carlow	20
Monaghan	94	Sligo	77	Mayo	62	Roscommon	54	Wicklow	19
Kilkenny	90	Roscommon	67	Monaghan	59	Limerick	53	Waterford	19
Wicklow	70	Carlow	63	Wexford	57	Wexford	51	Wexford	17
Roscommon	70	Longford	60	Laoighis	56	Sligo	50	Kilkenny	15
Longford	69	Wexford	59	Offaly	56	Wicklow	49	Roscommon	14
Wexford	65	Loaighis	59	Galway	56	Galway	49	Limerick	13
Laoighis	62	Wicklow	57	Cork	55	Mayo	48	Clare	11
Louth	61	Louth	57	Dublin	55	Clare	46	Cork	9
Carlow	61	Galway	56	Cavan	54	Cork	38	Donegal	9
Galway	61	Offaly	51	Wicklow	54	Donegal	36	Kerry	9
Offaly	47	Westmeath	45	Kildare	53	Leitrim	34	Sligo	8
Westmeath	40	Kildare	42	Limerick	52	Kerry	33	Leitrim	7
Kildare	36	Meath	40	Kerry	46	Monaghan	33	Cavan	7
Meath	33	Dublin	36	Leitrim	45	Cavan	31	Monaghan	6
Saorstát Èireann	97		76		61		55		24

* Dry Cattle other than milch cows, bulls, and heifers in calf on 1st June.

Table D Cattle on 1st June, 1926

Under 1yr per 100 milch cows on 1 June, 1926		1 to 2yr per 100 under 1 year on 1 June, 1925		2 to 3yrs* per 100 under 1 to 2 years on 1 June, 1925		3 yrs or over* per 100 2 to 3 years* on 1 June, 1925		All cattle bar milch cows per 100 milch cows on 1 June, 1926	
Meath	121	Meath	157	Dublin	184	Dublin	92	Meath	1063
Kildare	114	Dublin	149	Meath	175	Meath	92	Kildare	785
Westmeath	113	Kildare	134	Kildare	161	Kildare	88	Westmeath	698
Offaly	106	Westmeath	133	Westmeath	131	Westmeath	67	Offaly	462
Carlow	103	Louth	127	Louth	117	Offaly	56	Louth	393
Laoighis	96	Offaly	110	Longford	110	Mayo	49	Carlow	351
Roscommon	96	Longford	109	Offaly	96	Galway	45	Longford	330
Louth	93	Roscommon	108	Wicklow	95	Laoighis	37	Laoighis	324
Galway	92	Galway	101	Laoighis	94	Wicklow	37	Galway	307
Wexford	90	Wexford	99	Limerick	91	Longford	36	Roscommon	300
Kilkenny	90	Sligo	96	Carlow	88	Waterford	35	Wexford	295
Clare	90	Carlow	95	Galway	87	Carlow	34	Wicklow	274
Longford	87	Wicklow	92	Tipperary	86	Wexford	33	Dublin	265
Monaghan	87	Tipperary	89	Wexford	85	Tipperary	30	Kilkenny	258
Wicklow	82	Laoighis	86	Roscommon	78	Louth	29	Tipperary	248
Tipperary	82	Kilkenny	83	Mayo	76	Kerry	28	Clare	227
Waterford	82	Clare	83	Waterford	75	Kilkenny	27	Mayo	222
Mayo	79	Mayo	81	Kilkenny	73	Limerick	25	Sligo	220
Sligo	79	Donegal	76	Kerry	71	Cork	24	Waterford	213
Cavan	78	Waterford	72	Clare	70	Roscommon	24	Monaghan	202
Donegal	73	Monaghan	70	Leitrim	70	Clare	23	Donegal	176
Leitrim	71	Cavan	66	Cork	65	Donegal	23	Cavan	173
Cork	70	Leitrim	65	Sligo	63	Cavan	22	Leitrim	155
Kerry	63	Cork	56	Cavan	53	Leitrim	18	Cork	150
Limerick	57	Limerick	53	Donegal	52	Monaghan	18	Limerick	131
Dublin	36	Kerry	45	Monaghan	48	Sligo	15	Kerry	124
Saorstát Èireann	78	Saorstát Èireann	81	Saorstát Èireann	87	Saorstát Èireann	43	Saorstát Èireann	233

* Dry Cattle other than milch cows, bulls, and heifers in calf on 1st June.