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UNIVERSITY OF CAMBRIDGE

**DEPARTMENT OF  
APPLIED ECONOMICS**

**FIRST REPORT  
ACTIVITIES IN THE YEARS  
1946-1948**



*November 1948*



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DEPARTMENT OF APPLIED ECONOMICS**

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## FIRST REPORT

## ACTIVITIES IN THE YEARS 1946-1948

## I. THE RESEARCH POLICY OF THE DEPARTMENT

1. In a field as large as applied economics any research institute, and especially one of moderate size, must specialize. The Department's programme, though in one sense wide in scope, is intended to form a unity, and the object of this section is to discuss the nature of the programme and the aims which it serves.

2. We see the aims of applied economics to be as follows. Through the processes of observation and testing it should develop economic theories so that they stand established as applicable to the actual world, and on these foundations it should seek to provide the basis for making reliable predictions. The realization of these aims presupposes a certain degree of progress taking place at one time along a number of different lines.

3. In the first place the theories to be tested must be stated with sufficient exactness to be brought into relation with observations. While economic theories frequently specify the variables that are supposed to enter into relationships, they do not as a rule specify either the exact form of the relationship nor how the connexions between economic phenomena manifest themselves through the course of time. Accordingly there is much work to be done in shaping economic theories so that they can be subjected to the test of observation.

4. Secondly, the necessary observations must be brought into being if they are not already available. There are two aspects to this. Much can be gained through the collation and adjustment of existing material and indeed this is the only approach available so far as the past is concerned. At the same time it is obvious that such methods suffer from the fact that when everything useful has been done there are still gaps, and the resulting estimates are likely to be biased and of uncertain reliability. Hence there is great scope for the development of new methods of collecting economic data which will incorporate as far as possible those contemporary ideas of statistical



design which have led to such remarkable achievements in other fields, notably in biology and agriculture.

5. Thirdly, the procedures for testing hypotheses under non-experimental conditions must be developed so that they are suited to the conditions of economic problems. In general, statistical procedures involve assumptions about the nature of the data to which they are applied. There is no *a priori* expectation that the statistical procedures that are suited to the analysis of, say, biological experiments are also suited to economic data, and it has long been recognized that economic time series, which inevitably form a large part of the data available to the economist, do not in general satisfy the assumptions underlying the classical methods of regression analysis that have been so fruitful in other fields. The applied economist cannot achieve his aims until the techniques appropriate to his subject have been developed. Much has been done in recent years, but large advances still remain to be made.

6. The Department's research programme has been conceived as a group of interrelated investigations which should yield results along each of these main lines of activity. As, however, the most pressing problems of applied economics to-day turn on the inadequacy of suitable data and methods of analysis, our first attention has been given to these. Accordingly a number of the projects are concerned with building up systematic bodies of data for the British economy. An example of this is the construction of the annual estimates of consumers' expenditure from 1900 to 1919 designed to be comparable so far as possible with the estimates being made at the National Institute of Economic and Social Research for the years 1920-38 and at the Central Statistical Office for more recent years. Other examples are the estimation of wages and salaries paid in different branches of activity in the United Kingdom over the years 1920-38, and the construction of a monthly index of industrial production for the post-war period. Other studies are intended to help in the development of new methods of collecting quantitative data. An example of this is the social accounting project which is designed to systematize the problems of classifying transactions underlying all investigations into national income and expenditure and to relate these problems to the character and limitations of contemporary business records and accounting technique. Going beyond a purely methodological enquiry of this kind is the projected survey of the social accounts of Cambridgeshire. It is hoped that this investigation will eventually lead to the collection of economic data on a systematic

basis by means of sampling methods, but at the moment attention is being concentrated on the sampling methods themselves since the highly skew distributions met with and the rather small samples which are almost inevitable in economics for practical reasons raise certain novel problems of efficient sample design.

7. These last two examples are intended to assist in improving methods of collecting data. Other enquiries are designed to enable more efficient use to be made of data that already exist. In this field attention has so far been concentrated mainly on meeting difficulties in the statistical analysis of time series. In particular a considerable amount of work has been done on the problem of serial correlation, an aspect of the general problem on which more work was urgently needed. A feature of this work has been the use of realistic constructed examples to ascertain the efficiency of different methods in small samples (the realistic case) in conditions where at best only large sample theory is available.

8. In the field of testing economic hypotheses and determining the impact of one variable on another, work has been done on demand analysis and on the factors that account for aggregate consumption. The work in demand theory has made use both of time series and family budgets and seems to indicate the importance of factors which are not purely economic in the determination of long-run changes. This brings us up against the limitations of economic theory in attempting to explain actual changes in demand. A realistic theory of demand requires the co-operation of economic historians and sociologists who alone could provide an account of other factors that are at work.

9. The present state of knowledge in applied economics has shaped the character of the Department's research activities. Moreover, as a university research centre, we believe it right to attempt to contribute to different branches of our subject so that we may provide an opportunity for different types of economic interest and ability to work in co-operation. Our hope is that we may succeed in creating a milieu for young research workers, where their capacities may be developed. It is obviously important, for example, that the research worker who is engaged on improvements in statistical techniques should be in day-to-day contact with those who will have to apply his methods in specific investigations and who will have to provide the material on which they are to be used.

10. This account makes clear that it is the Department's considered policy to concentrate its resources on the investigation of fundamental



problems in applied economics. While, however, it does not deal with day-to-day practical issues posed by economic policy, it is our belief that fundamental research in applied economics is a necessary condition of its usefulness. Those who are working in the practical application of economic studies to contemporary problems do in fact act on the presupposition that certain fundamental problems have been solved. Many economists thus engaged are well aware that this is not so but perforce they have to act 'as if'. At the present time when the understandable pressure on research workers to devote their time to urgent problems is increasing, we believe that it is necessary to emphasize the place of fundamental studies. The applied economist as such may or may not be well equipped to offer a solution for the country's economic problems, but he is equipped to add something to our knowledge of the economic forces at work.

## II. THE EARLY HISTORY AND CHARACTER OF THE DEPARTMENT

11. The establishment of the Department of Applied Economics in the Faculty of Economics and Politics was approved by the University in 1939. The reasons for bringing into existence a new body to be devoted to research was the realization that there existed in Cambridge no provision for systematic applied research in economics, at a time when a rapid development of studies in this field was taking place. By the establishment of the Department the University recognized the growing importance of applied economics as a distinct economic discipline and acknowledged the need for improvement in the opportunities for applied studies which were required for the satisfactory development of economics in Cambridge.

12. The new Department had a purely formal existence until the end of the war, with a Committee of Management of six members of the Faculty Board under the chairmanship of the late Lord Keynes. It was largely owing to his warm and active support, and to his profound conviction that the theoretical achievements of Cambridge economics required the testing that could be provided only by realistic studies, that the new department was brought into existence. As its first Chairman he gave it his energy and care even in the middle of his heavy official tasks; the Department suffered a severe blow with his death in 1946 at the outset of its active life. Lord Keynes was succeeded by Mr E. A. G. Robinson as Chairman of the Committee.

13. It had been considered desirable, in 1939, to postpone the Department's effective operation until after the war. As the end of the war approached steps were taken to put it on a working basis. On the recommendation of the Committee the new office of Director of the Department was approved by the University in May 1945, and Mr Richard Stone was appointed Director from July 1945. The first Report of the Department will accordingly give an account of its development and activities during the first two and a half years of its effective operation, from April 1946 to October 1948.

14. The Department's organization as a research body is governed both by the conception of what a research unit in applied economics ought to be, which has already been described in Section I of this Report, and by its functions as a University organization. The scale of its operation has meant that its staff must be sufficiently large to permit of the appointment of several types of specialist research worker, and that its facilities must include a computing staff and mechanical equipment that are adequate to the extensive econometric researches that need to be undertaken. The present strength of the Department is, in addition to the Director, six senior research workers, four junior research workers and a clerical and computing staff of seven. At the end of its first five years of existence it is anticipated that the research staff will consist of eight senior research workers and six junior research workers.

15. The Department has aimed from the outset at cultivating research relationships with other institutions at home and abroad, and it is an integral part of its staffing policy to draw at least one or two of the members of its staff from abroad, either from similar institutions or from official centres of research. This policy has been put into practice from the outset and the research staff in the last three years has always included at least two members from other countries—so far from Canada, Eire, the Netherlands and the United States.

16. In addition to staff appointments, the intellectual ties with other centres of research have been strengthened through a series of visits by scholars from abroad who have accepted invitations to spend short working periods here. It is clear that the achievement of the systematic synthesis, at which the research policy of the Department aims, means that a very wide field of data, techniques and ideas must be covered, and not all of these can be developed in a single centre of research. The relationships that are cultivated by means of staff appointments of research workers from abroad and visiting



scholars are intended to increase the Department's own experience, as well, it is hoped, as to make a contribution to the experience of others. The Director has been able to make a number of visits to research centres abroad and active working relations have been fostered with University and other research centres at home. Direct and frequent intellectual contacts are recognized to be an essential ingredient in the progress of the natural sciences and they are no less necessary in economic research.

17. A further consequence of the approach to applied economic research that has guided the Department's development is that other disciplines than economics must from time to time be drawn upon in the solution of economic problems. The complex task of putting economic hypotheses to the test of experience is likely to mean that the investigator cannot always confine himself within the boundaries of economics pure and simple. Such different fields as accountancy and psychology have their contributions to make, and the Department has already sought the co-operation of an accounting specialist through the part-time appointment to its staff of an accountant who has made a distinguished contribution to the formal analysis of accounting practice and theory.

18. The contribution that the Department can hope to make to the progress of economics in Cambridge will be shown not only in the research results that it achieves but also in the numerous informal services and activities which it carries out as a University body. Thus seminars, intended for the help of its own research staff, are open to all members of the Faculty; some of the members of its staff have given courses of lectures and have taken a share in the duties of supervision of undergraduates and research students; the visits to the Department of distinguished foreign scholars contribute to the general enrichment of intellectual life in the University.

19. It is, moreover, a function of the Department to provide, as far as possible, help of a technical and computational character that may be requested for the researches undertaken by members of the Faculty other than the research staff of the Department. The Department has already provided the means for active research co-operation between other members of the Faculty and the research staff, and it looks forward to the growth of such fruitful working associations within the Faculty. In Section IV there is described the investigations undertaken for the new index of industrial production which resulted from such a working relationship.

### III. FINANCE

20. The Department has enjoyed from the beginning of its active life the support of the Rockefeller Foundation. In 1945 a development grant for one year was made, and this was replaced in January 1946 by a very generous grant of £23,500 towards the general budget for a period of five and a half years. This grant is on a matching basis for the last two years of the period, when the payments will match funds to be provided by the University from other sources.

21. In 1946 the Trustees of the Nuffield Foundation agreed to assist the development of the Department's work and to this end offered to provide for the appointment of research fellows up to a total cost of £2000 a year for five years. This very helpful offer was accepted with gratitude, and the first Nuffield Research Fellows, Dr R. C. Geary and Mr F. Sewell Bray, were appointed in October 1946. In 1947 Mr E. J. M. Buckatzsch was appointed Research Fellow. A fourth appointment to a Research Fellowship, that of Dr Guy H. Orcutt, was made in January 1948, Dr Orcutt having been a member of the Department's staff from the end of 1946. The most recent appointment to a Research Fellowship is that of Professor Gerhard Tintner, of Iowa State College, U.S.A., who joined the Department in August 1948. Nuffield Research Fellows are appointed by the Trustees of the Foundation on the recommendation of the Director of the Department.

22. At present the income of the Department is very largely drawn from the benefactions of the two Foundations, the Director's stipend and the initial provision of the Department's premises being borne by the University, which has in addition made a capital grant of £2000 towards the expenses of equipment. The degree of University financial aid for the Department, however, will increase considerably and the Department looks forward to receiving from the University funds for its adequate and continuing support. The expansion of Government funds for the social sciences which has been made available through the new social sciences sub-committee of the University Grants Committee has eased the task of making the necessary provision from University funds for the Department's future. At the end of the present quinquennium therefore it is anticipated that financial responsibility for the maintenance of by far the greater part of the Department's activities will be accepted by the University.

23. In addition to the sources of general income the National Institute of Economic and Social Research gave a two-year grant



towards the cost of the enquiry into national output, 1920-38, which is being carried out in the Department and which is an integral part of the Institute's own programme of studies into the national income, output and expenditure for the period between the two wars. This is described in paragraph 26 below.

#### IV. RESEARCH ACTIVITIES, 1946-1948

24. The various pieces of research undertaken at the Department can conveniently be grouped together under three heads.

##### (a) *National Income, Product and Social Accounting Projects*

##### *Expenditure, Product and Income of the United Kingdom before 1920*

25. Work on this enquiry began in the autumn of 1946 when Dr A. R. Prest joined the Department and started work on the consumers' expenditure section. The aim is to continue backwards the series of estimates for the inter-war period that are now being constructed in London at the National Institute of Economic and Social Research. When this is done the empirical basis for a comprehensive view of the development of the British economy from about 1870 onwards to the present day will be available; and at the same time there will be available the longer series of the components of income and expenditure that are needed for econometric analysis. In addition to the work on consumers' expenditure, a provisional series of annual estimates of the national income since 1870 has been prepared for the purpose of making analyses of demand and these estimates have now been published in a paper contributed by Dr Prest to *The Economic Journal* and reprinted as no. 9 in the Department's Reprint Series. In the final stages of this work Dr Prest had the assistance of Mr A. D. Roy and Mr A. A. Adams. A volume on consumers' expenditure in the United Kingdom, 1900-19, is awaiting publication.

##### *The Product of Different Branches of Activity in the United Kingdom, 1920-38*

26. This investigation is proceeding by the estimation of different types of income payment by industrial source. A beginning has been made with the earnings of employees and the resultant study will cover the industrial distribution of salary and wage payments and also of employment and earnings during the period. The completion of the enquiry by providing a corresponding analysis of

property incomes and professional earnings depends upon the accessibility of income-tax data. Until the Board of Inland Revenue releases the statistics bearing on profits this enquiry, like so many other investigations in applied economics, will necessarily remain incomplete. For while it may be possible to make estimates of profits in certain industries from other sources, it will not be possible to cover the whole field of profits or of interest and rent without access to these fundamentally important income-tax figures. Miss Agatha Chapman, who had worked on national income statistics in Canada, joined the Department in April 1947 to undertake this research, and Mrs R. Knight was appointed to assist her in October 1947. A volume on the Industrial Distribution of Wages and Salaries will shortly be ready for publication.

##### *Regional Income and Income-generating Activity*

27. Mr E. J. M. Buckatzsch, who came to the Department from Balliol College, Oxford, was appointed in October 1947 to undertake this project. Owing to ill-health the progress of the work has been delayed and the programme is in its early stages. A number of studies are now in progress including an investigation of the regional distribution of the net output of the census of production industries in 1935 and a similar study for the output of agriculture. The principal object of this work is to discover whether the observed regional distribution of industries can be described in terms of a restricted number of factors identifiable with economically meaningful influences. In addition a great deal of material has been collected for studying the regional pattern of income-generating activity over the sixty years before the first world war.

##### *A New Index of Industrial Production*

28. The Department enjoys close working relations with the London and Cambridge Economic Service, and it was for its *Bulletin* that the construction of a new index of production was undertaken. The enquiry was organized by a small working group consisting of Mr Stone as chairman, Mr W. B. Reddaway, Lecturer in Economics, and Mr C. F. Carter, Lecturer in Statistics, with Mr F. Winter as its assistant. A monthly index from January 1946 on the base 1946=100 was constructed and published in the *London and Cambridge Economic Service Bulletin* of February 1948. This was the first post-war index to be made publicly available and it was followed shortly after by the new official interim index prepared in the Central Statistical



Office. It was gratifying that between the Department's unofficial index and the official one there was found to be a very close agreement. The very considerable labour of producing the index was greatly eased through the generous help given by a number of government departments. A detailed description of the methods used in the construction of the index, including the link between 1935 and 1946, is published (December 1948) under the title of *The Measurement of Production Movements* as the first of the Department's new series of Monographs.

29. The Index of Industrial Production is kept up to date month by month and circulated to a small list of subscribers, whose generous support the Department wishes to acknowledge.

#### *Social Accounting*

30. Mr Sewell Bray and Mr Stone are working on a study of the accounting basis for the measurement of aggregates of transactions. The aim of the project as a whole is to provide a common meeting place for the theoretical requirements of the economist and practical possibilities set by business records and accounting technique. At present work is concentrated on the accounting aspects of a system of social accounting designed to bridge the gap between national income statistics and accounting records. The first results have been embodied in a book by Mr Sewell Bray entitled *Social Accounts and the Business Enterprise Sector of the National Economy*, which is now in the Press and will appear as the second of the Department's new Monographs. As time permits similar investigations will be made for other sectors of the economy.

31. Arising out of this work Messrs Bray and Stone recently contributed an article to *Accounting Research* on 'The Presentation of the Central Government Accounts', which was reprinted as no. 12 of the Reprint Series.

32. The development of a social accounting system in practical terms provides an orderly framework for almost the whole of economic statistics. If such a system could be used as a basis of collecting statistics, it would make possible the introduction of the much-needed element of statistical design into the whole field of estimates of national income and wealth. This idea is being followed up in the project described in paragraph 35.

33. It is intended later to make an attempt to extend the ordinary system of definitions so as to take account of social as contrasted with purely private costs and benefits.

#### *Measurement of Profit*

34. Mr Bray recently completed a book with the above title. Since the concept of profit plays an important part in systems of accounts, the working out of a sound definition of profit and of methods of measurement capable of practical application raises some of the thorniest problems of this whole field. The investigation is throwing light on the problem of the reconciliation of the views of accountants and economists who deal from differing standpoints with very much the same set of factors. In view of the urgency of this problem from the accountant's standpoint and the interest of the Society of Incorporated Accountants in this work, arrangements have been made for its separate publication. Arising out of this project an article on 'The Nature of Income and Capital' was contributed by Mr Bray to *Accounting Research* and appeared as no. 13 of the Reprint Series.

#### *The Social Accounts of Cambridgeshire*

35. It is proposed to undertake a new project in 1949 under the above heading. The main purpose is to try out the feasibility of collecting economic information about transactions on a designed basis, that is, by means of sampling methods based on an integrated set of accounting statements covering all sectors of the economy, the area of collection being Cambridgeshire. Such a survey will involve a preliminary investigation of the population to be sampled. It will be necessary to establish working relations with numerous individuals and organizations who can assist the project. This will provide a welcome opportunity to widen the Department's interest in the Cambridge region and, at the same time as the theoretical purpose is served, to make a contribution to regional economics. The work of sampling economic populations will require extensive development together with the detailed design of the system of questionnaires. The project as a whole will take several years to carry through, and it will be broken down into a number of special enquiries. Mr J. E. G. Utting, who will join the Department early in 1949, will be in charge of the project. He will be assisted by Mr J. Durbin, who began work at the Department in September and will concentrate on the sampling problems that are involved.



(b) *Statistical Methods in Economics*

*The Analysis of Time Series*

36. Dr R. C. Geary was engaged on this project while on leave of absence from the Department of Industry and Commerce in Dublin. He came to the Department in the autumn of 1946 and returned to Eire in July 1947 in order to take up the appointment of Director of Statistics. During the year of his work in Cambridge Dr Geary devoted himself to certain problems in the analysis of economic time series. The particular part of this field to which he contributed new work was in the estimation of parameters where all the variables are assumed to be subject to error. The published results of these investigations will appear in two papers. The first, on 'Studies in Relations between Economic Time Series' (Reprint Series no. 8), deals with a reconciliation of multiple regression methods and factor analysis, indicates how improved estimates can be made, and considers their sampling variance. The paper gathers together much recent work on the two subjects which have not previously been considered in relation to one another and carries the whole analysis a stage further. The second paper, on 'Determination of Linear Relations between Systematic Parts of Variables with Errors of Observation, the Variances of which are Unknown', which will appear in *Econometrica*, January 1949, deals with the question of obtaining unbiased linear estimates when all variables are subject to error.

37. While visiting the Department in the summer of 1948, Professor T. W. Anderson of Columbia University contributed a paper on 'The Asymptotic Distributions of the Roots of Certain Determinantal Equations', commenting on certain aspects of Dr Geary's first paper. This paper has also appeared in no. 8 of the Reprint Series.

38. Dr Guy H. Orcutt, who came to the Department from the Massachusetts Institute of Technology towards the end of 1946, has also been working on problems connected with the analysis of economic time series. He has concentrated most of his attention on the difficulty which arises from the lack of independence of successive sets of observations over time. Classical methods assume serial independence of the residual in a regression equation and little has been done on the discovery of appropriate methods of analysis when this assumption of independence is removed. Dr Orcutt's work, which has relied to a considerable extent on the analysis of

constructed examples, has been greatly aided by the use of a thermoelectric regression analyser of his own design which he has installed and is using in the Department. Dr Orcutt read a paper to the Royal Statistical Society in December 1947 with the title 'A Study of the Autoregressive Nature of the Time Series Used for Tinbergen's Model of the United States, 1919-1932' (Reprint Series no. 7). A further paper resulting from his work is 'A New Regression Analyser' (Reprint Series no. 14) in which the apparatus designed by Dr Orcutt is described in detail and its functions for the purposes of statistical analysis explained. A paper, jointly with Mr S. F. James, on 'Testing the Significance of Correlation between Time Series', and two further papers, jointly with Mr D. Cochrane, on 'Application of Least Squares Regression to Relationships containing Auto-correlated Error Terms' and 'A Sampling Study of the Merits of Autoregressive and Reduced Form Transformations in Regression Analysis' are in course of publication. These investigations are in the nature of preliminary work on problems whose solution is preparatory to the construction of a general econometric model for the British economy.

39. In August 1948 Professor G. Tintner came to the Department from Iowa State College. His earlier work on time series included a study of the variate difference method (Cowles Commission Monograph no. 5) and an essay on 'Tests of Significance in Time Series' which appeared in *Annals of Mathematical Statistics*. While in Cambridge he intends to investigate stochastic processes which are also subject to errors of observation and in particular the problems arising in systems of stochastic differential equations with constant coefficients. In this work emphasis will be placed on methods of statistical estimation and prediction.

*Multivariate Analysis*

40. At the same time Professor Tintner will continue his investigations into the use of multivariate analysis in economics. The main object here is to develop a unified theory of multivariate analysis which would include the following as special cases: discriminant analysis, various types of factor analysis, canonical correlation and weighted regression.



(c) *Verification and Estimation of Economic Relationships*

*Demand Analysis*

41. Work in this field was started by Mr G. Stuvél, of the Centraal Planbureau at The Hague, during his year at the Department from April 1946 to April 1947. Preliminary calculations were made for a comparison of demand analysis from time series and budget material with reference to the United States. This project is temporarily in abeyance. An analysis was also made of data on food expenditure of individual families in the Netherlands and it is expected that a paper on this subject will appear shortly.

42. In the course of his work on consumers' expenditure in the United Kingdom before 1920, Dr A. R. Prest made a number of analyses of the market demand for various consumers' goods. A paper on this subject entitled 'Some Experiments in Demand Analysis' is in course of publication.

43. Mr Stone has continued his work on the analysis of market demand, making use of time-series data for the United Kingdom over the inter-war period. A paper entitled 'The Analysis of Market Demand: An Outline of Methods and Results' will appear shortly in the *Review of the International Statistical Institute*.

*The Consumption Function*

44. Dr James Duesenberry of Harvard University spent the summer of 1948 at the Department working with Dr Orcutt on a statistical investigation of the consumption function. A number of proposed relationships were tested on the basis of the new annual United States Department of Commerce income data. Estimation was carried out both by the ordinary least squares method and by methods developed at the Department for dealing with time series.

45. Dr Orcutt has also been engaged with Mr A. D. Roy on a further study of the consumption function. Emphasis has been placed on determining short-run variations of consumption by use of monthly data for the United States over the period 1935-41. This study also makes use of the methods indicated above.

*Tests for Homogeneity*

46. Following his recent theoretical investigation (to appear in *Econometrica*) into various economic situations in which the demand and supply functions are homogeneous of degree zero in prices and incomes, Professor Tintner is undertaking an empirical test of these

ideas by investigating the British labour market. An attempt will be made to discover whether or not the demand and supply functions for labour are homogeneous of degree zero in prices and wages.

V. OTHER ACTIVITIES

*Seminars*

47. The Department has held a series of seminars conducted either by its own members or by others closely associated with its work, and by a number of distinguished visitors. The following seminars have been held:

1947		
21 January	Dr Orcutt	Demonstration of a new regression analyser.
3 June	Dr Geary	Indifference curves and index numbers.
17 June	Dr Orcutt	Description of work on representation of economic series by various autoregressive schemes and schemes involving moving averages.
7 July	Dr Prest	Work on consumers' expenditure from 1870 to 1920.
25 July	Dr Geary	Regression problems where all the variables are subject to error.
15 August	Professor Wold	Estimation of economic relationships.
	Mr Stone	Prediction from autoregressive schemes.
1 November	Mr Colin Clark	A dynamic model of the economic system.
1948		
21 January	Dr Orcutt	Dr Klein's model of the United States economy.
4 February	Mr Stone	The theory of games.
19 February	Mr Carter	A new index of industrial production.
11 March	Miss Chapman	Industrial breakdown of the national wages bill, 1920-38.
22 April	Professor Frisch	Optimum problems in economics.
15 May	Mr Cochrane and Dr Orcutt	Statistical analysis of linear stochastic equations involving non-random error terms.



1948		
9 June	Professor Anderson	The use of structural equations in economic models.
14 June	Mr Durbin	Sampling methods for social accounting surveys.
14 August	Dr Klein	Some aspects of economic planning in Norway and the Netherlands.
17 August	Dr Duesenberry	The consumption function.
19 August	Dr Klein	An econometric model for Canada.
18 October	Professor Samuelson	Sequential analysis and gambler's ruin.

#### *University Relationships*

48. As a Department within the Faculty of Economics and Politics the Department has, apart from its own research activities, made some contribution to the work of the Faculty. The Director is a member of the following Boards and Committees: Faculty Board of Economics and Politics, Degree Committee of the Faculty, Board of Research Studies, Committee of the Mathematical Laboratory. Several members of the research staff are members of the Faculty. During both the academic years 1946-47 and 1947-48 Mr Stone gave a course of sixteen lectures on national income and social accounting, and Professor Tintner was invited to give a course of lectures on econometrics during the academic year 1948-49. Two lectures, open to all members of the University, were given in May 1948 by Professor T. W. Anderson of Columbia University, who spent part of the summer working at the Department. Mr Stone has undertaken the supervision of research students in applied economics and supervision of undergraduates is undertaken for certain colleges by various members of the staff.

49. In October 1947 a Diploma in Mathematical Statistics was established in the University and during the academic year 1947-48 the two candidates whose selected field of application was economics worked under supervision in the Department.

#### *Relationships with Other Bodies*

50. The Department is closely associated with the work of the London and Cambridge Economic Service, on whose Editorial and Executive Committees Mr Stone serves. Besides the major project of the construction of the index of industrial production, already

mentioned in paragraph 28, work has been carried out at the Department in connexion with other contributions to the *Bulletin* in association with Mr Carter and Mr Reddaway.

51. For some time before the Department became active in 1945 Mr Stone had undertaken for the National Institute of Economic and Social Research the direction of a study of the national expenditure, output and income of the United Kingdom between the two wars. When the Department started work it was decided that the output section of this enquiry should be carried out at Cambridge. The state of this work has been described in paragraph 26.

52. In July 1948 the Director was elected one of the three Honorary Secretaries of the Royal Statistical Society on the Council of which he has served for some years.

53. The Director has served as a member of the following government committees:

#### *(a) Interdepartmental Committee on Social and Economic Research*

This committee was constituted in October 1946 under the chairmanship of the Registrar General 'to survey and advise upon research work in Government Departments and in particular (i) to bring to the notice of Departments the potential value for research purposes of the material which they collect and to suggest new methods and areas of collection; (ii) to advise on how there could be made available to research workers information gathered for their own purposes by the Departments which has potential value as material for research'.

#### *(b) The Cost of Living Advisory Committee*

This committee was reconstituted in 1946 'to advise the Minister of Labour and National Service on the basis of the official cost-of-living index figure and on matters connected therewith'.

#### *(c) Sub-Committee on Social Sciences of the University Grants Committee*

In May 1947 this sub-committee was set up to advise the University Grants Committee on matters arising out of the Report of the Clapham Committee on the Provision for Social and Economic Research and, in particular, on the distribution of special earmarked grants in respect of expenditure in the field of Social Sciences.



### *Relationships with Bodies Overseas*

#### *Visits abroad*

54. Invitations to the Director to visit similar research institutions and departments abroad have assisted the Department in maintaining contacts with the development of economic and statistical research abroad. In October 1945 the invitation to spend four months as a visiting member of the staff of the Institute for Advanced Study, Princeton, was accepted, leave of absence being granted for this purpose. This period was largely devoted to the preparation of a Memorandum on the *Definition and Measurement of the National Income and Related Totals* written in the capacity of chairman of the Sub-Committee on National Income Statistics of the League of Nations Committee of Statistical Experts. This appeared in 1948 appended to the Report of the Sub-Committee on the *Measurement of National Income and the Construction of Social Accounts*, being no. 7 in the League of Nations series of Studies and Reports on Statistical Methods.

55. The Director has made the following visits abroad for purposes of lectures and discussion:

The Netherlands in May 1946 at the invitation of the Nederlandsch Economisch Hoogschool in Rotterdam and the Centraal Planbureau at The Hague.

Norway and Sweden in spring 1947 at the invitation of the Socialøkonomiske Institutt in Oslo and the Konjunkturinstitutet in Stockholm.

The United States in September 1947 to attend the International Statistical Conferences held in Washington.

France in April 1948 at the invitation of the Institut de Science Économique Appliquée.

The United States in July 1948 to discuss recent advances in sampling surveys and national income and expenditure studies.

56. The European meeting of the Econometric Society held at The Hague in September 1948 was attended by the Director, Professor Tintner, Dr Orcutt and Mr Durbin. The following papers were contributed to the proceedings of the Conference:

Mr Stone. 'The Analysis of Market Demand: An Outline of Methods and Results.'

Professor Tintner. 'Homogeneity in Mathematical Economics.'

Dr Orcutt. 'A Sampling Study of the Merits of Certain Transformations in Regression Analysis.'

Mr Durbin. 'Sampling Methods for Business Enterprises.'

### *Distinguished Visitors*

57. These contacts with other countries have been reinforced by the visits to the Department of a number of distinguished economists and statisticians from abroad. These have been as follows:

*August 1946.* A number of representatives from the Statistisk Sentralbyrå and the Kgl. Finans- og Toll Departement in Oslo and of the Konjunkturinstitutet in Stockholm visited Cambridge to hold discussions on national income problems.

*August 1947.* Professor W. W. Leontief of Harvard University; Professor Herman Wold, Director of the Statistiska Institutionen, Uppsala Universitet.

*November 1947.* Mr Colin Clark, Director of the Bureau of Industry in Brisbane.

*April 1948.* Professor Ragnar Frisch, of the Universitetets Socialøkonomiske Institutt in Oslo.

Professor T. W. Anderson of Columbia University spent several weeks at the Department during the spring and summer. He gave two lectures on the Theory of Testing Serial Correlation and on Estimating Linear Relationships.

*June 1948.* Dr J. Duesenberry of Harvard University spent about two months at the Department during the summer. During his stay he worked in collaboration with Dr Orcutt on the consumption function.

*July 1948.* Dr L. Klein of the Cowles Commission, University of Chicago, spent a month at the Department as part of a tour of European countries which was undertaken to study problems of economic planning and econometric research.

*September 1948.* Mr G. Bøe of the Universitetets Socialøkonomiske Institutt, Oslo, is spending a period of several months at the Department working on problems connected with social accounting.

*October 1948.* Professor Paul A. Samuelson of the Massachusetts Institute of Technology spent a fortnight at the Department.



## VI. PUBLICATIONS

58. The publication arrangements for the Department's work fall at present into three sections. The Cambridge University Press will publish the Department's research findings, apart from contributions to learned journals.

### Reprints

59. At the end of 1946 the Department started a series of reprints which includes selected papers contributed to learned journals and other publications by members of the Department's staff and by others who are working in direct collaboration with the Department. These are circulated to institutions and individual scholars in this country and abroad.

60. The following reprints have so far been issued:

- No. 1. 'On the Interdependence of Blocks of Transactions', by Richard Stone (*Supplement to Journal of the Royal Statistical Society*, 1947).
- No. 2. 'Economic Models with Special Reference to Mr Kaldor's System', by Richard Stone and E. F. Jackson (*The Economic Journal*, December 1946).
- No. 3. 'John Maynard Keynes 1883-1946', by E. A. G. Robinson (*The Economic Journal*, March 1947).
- No. 4. 'The Measurement of National Income and Expenditure: A Review of the Official Estimates of Five Countries', by Richard Stone (*The Economic Journal*, September 1947).
- No. 5. 'Testing for Normality', by R. C. Geary (*Biometrika*, December 1947).
- No. 6. 'A New Index of Industrial Production', by C. F. Carter, W. B. Reddaway, Richard Stone and F. Winter (*London and Cambridge Economic Service Bulletin*, February 1948, and *The Times* for 18 February 1948).
- No. 7. 'A Study of the Autoregressive Nature of the Time Series used for Tinbergen's Model of the Economic System of the United States, 1919-1932', by G. H. Orcutt (*Journal of the Royal Statistical Society*, June 1948).
- No. 8. 'Studies in Relations between Economic Time Series', by R. C. Geary and 'The Asymptotic Distributions of the Roots of Certain Determinantal Equations', by T. W. Anderson (*Journal of the Royal Statistical Society* (Series B), vol. x, no. 1, 1948).

- No. 9. 'National Income of the United Kingdom 1870-1946', by A. R. Prest (*The Economic Journal*, March 1948).
- No. 10. 'The Theory of Games', by Richard Stone (*The Economic Journal*, June 1948).
- No. 11. 'Social Accounting, Aggregation and Invariance', by Richard Stone (*Cahiers du Congrès International de Comptabilité, Paris*, 1948).
- No. 12. 'The Presentation of the Central Government Accounts', by F. Sewell Bray and Richard Stone (*Accounting Research*, vol. 1, no. 1, November 1948).
- No. 13. 'The Nature of Income and Capital', by F. Sewell Bray (*Accounting Research*, vol. 1, no. 1, November 1948).
- No. 14. 'A New Regression Analyser', by G. H. Orcutt (*Journal of the Royal Statistical Society* (Series A), vol. cxi, no. 1, 1948).

### Monograph Series

61. The first two Monographs are:

- No. 1. *The Measurement of Production Movements*, by C. F. Carter, W. B. Reddaway and Richard Stone (published December 1948).
- No. 2. *Social Accounts and the Business Enterprise Sector of the National Economy*, by F. Sewell Bray (to be published shortly).

### Joint Series with the National Institute

62. The Department and the National Institute of Economic and Social Research are sponsoring jointly a single new national income and expenditure series to be published by the Cambridge University Press under Mr Stone's editorship. Much of the work on national income that is going on in both places is determined by one conception and is intended to build up a single economic and statistical picture. The series will contain work bearing on the measurement and analysis of the size, trend and interrelations of the components of the British national income, output and expenditure. It will be restricted to work that is being done either at the Department or at the National Institute and will include only those enquiries that involve actual quantitative investigations. Purely methodological enquiries such as the setting up of social accounting forms or enquiries will appear in the normal Monograph series of the Department.



## VII. PREMISES AND FACILITIES

### *Premises*

63. Until the latter part of 1947 the Department was accommodated on the top floor of the Marshall Library. A temporary brick building was erected by the University in one of the courts on the Downing Site, close to the Marshall Library, and the Department moved in on 19 September 1947. The new building is excellently equipped and provides eight research rooms, a small library and meeting room, offices and a computing room, but it is already proving too small for all the requirements of the Department.

### *Computing Facilities*

64. The computing room was designed originally for four computers but it has been found possible to accommodate up to six workers. The Department has six electric calculating machines (four Marchants, one Monroe and one Madas). The computing staff at present numbers four.

### *Library*

65. The library, which is in course of being built up, is intended to be a small specialist library concentrating mainly on the fields of interest to the Department's programme of research. It specializes particularly in works on econometrics and statistics. The Department naturally draws freely on the resources of the Marshall Library. At present its own library stock consists of approximately 820 books and pamphlets and 840 British government publications of a similar kind. Seventy-six periodicals are at present being received and considerable runs are available of many of the more important ones.

66. The Department gratefully acknowledges donations from the Marshall Library of books from the libraries of Lord Keynes and Mr Shove. It is also grateful for the valuable loan of runs of certain periodicals by Professor D. H. Robertson.

## VIII. STAFF

67. The staff of the Department is set out below

### RESEARCH STAFF

*At October 1948*

Mr J. R. N. STONE, M.A. (Cantab.), Fellow of King's College.	Director.
Mr A. A. ADAMS, B.A. (Cantab.).	Junior Research Worker.
Mr F. SEWELL BRAY (Senior partner of Messrs Tansley Witt and Co., London; Member of the Research Committee of the Society of Incorporated Accountants).	Senior Nuffield Research Fellow.
Mr E. J. M. BUCKATZSCH, M.A. (Oxon) (formerly Lecturer in Economics at Balliol College, Oxford).	Nuffield Research Fellow.
Miss A. L. CHAPMAN, M.A. (Toronto) (formerly on the research staff of the Bank of Canada).	Senior Research Worker.
Mr J. DURBIN, B.A. (Cantab.).	Junior Research Worker.
Mrs R. KNIGHT, B.Sc. (Econ.) (Lond.) (formerly on the research staff of the National Institute of Economic and Social Research).	Junior Research Worker.
Dr G. H. ORCUTT, B.S., M.A., Ph.D. (University of Michigan) (formerly at Massachusetts Institute of Technology, Cambridge, Mass.).	Nuffield Research Fellow.
Dr A. R. PREST, M.A., Ph.D. (Cantab.) (on leave of absence on a Rockefeller research fellowship).	Senior Research Worker.
Mr A. D. ROY, B.A. (Cantab.).	Junior Research Worker.
Professor G. TINTNER, Ph.D. (Vienna) (on leave of absence from Iowa State College, Ames, Iowa).	Senior Nuffield Research Fellow.



*April 1946–September 1948*

Dr R. C. GEARY, D.Sc. (on leave of absence from Department of Industry and Commerce, Dublin, Eire). Senior Nuffield Research Fellow, 1946–47.

Mr G. STUVEL, ec.drs. (on leave of absence from the Centraal Planbureau, The Hague, Netherlands). Senior Research Worker, 1946–47.

Mr F. WINTER, M.A. (Cantab.). Junior Research Worker, 1947–48.

# ADMINISTRATIVE STAFF

*October 1948*

Mrs B. M. Wilkes, B.A. (Lond.) Secretary to Director  
Mrs L. Karmel Clerical assistant  
Miss J. Hulyer Junior clerical assistant

# COMPUTING STAFF

*October 1948*

Miss P. Gunnell Acting senior computer  
Miss B. K. Emmines Computer  
Miss L. Myking Computer  
Mrs N. S. Smithies Computer