GUIDE TO NEW ZEALAND OFFICIAL STATISTICS

BY

E. P. NEALE
M.A., LL.B., D.Sc., M.Com.

Gen.

NEW ZEALAND
WHITCOMBE & TOMBS LIMITED
Auckland, Wellington, Christchurch, Dunedin
and Invercargill
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FOREWORD.

This book has been written to meet a long felt need. Statistics attempt to represent facts and express their characteristics and relationships in a numerical way. They are being used increasingly as the material on which judgments on events are formed and as the basis for private and public policies. But the meaning of statistics is not self-evident. It is necessary to know how they are collected, and for what purposes, how they are arranged and calculated, and what limitations and pitfalls in their use must be guarded against. Otherwise judgments passed upon them may be false and perverse. This is evident from much of the controversy over social problems of recent years.

In this book Dr. Neale refers the reader to the main sources of Official Statistics in New Zealand, describes how they are collected and compiled, explains the methods of calculation adopted in the various index numbers, and indicates the main limitations and pitfalls. The book is concerned more especially with New Zealand conditions, but should be of interest outside the Dominion because of the light which it throws on general problems connected with the use and interpretation of statistics.

In addition to his training as an economist, Dr. Neale has had several years' experience in the Census and Statistics Department. He was for several years lecturer on economic subjects and statistical methods at Victoria University College, and is at present lecturer in statistical methods at Auckland University College. As Secretary to the Auckland Chamber of Commerce for the past eleven and a-half years he has been in close touch with business men and their problems. Hence, there are few in New Zealand who possess his qualifications for the task. I can confidently recommend his book to students in economics, business men, politicians, and all who are interested in economic and social problems.

H. BELSHAW,
Professor of Economics and
Dean of the Faculty of Commerce,
Auckland University College.

PREFACE.

Such originality as this book possesses arises from the collection in compact form of material not otherwise readily accessible to students, business men, and other "consumers" of statistics rather than from any originality in the matter itself. The writer has, in fact, drawn freely on the past and present publications of the Census and Statistics Department, as well as in a lesser degree on statistical publications of other administrations and on standard text-books on statistical method. Special thanks are due to Professor H. Belshaw, of Auckland University College—but for whose encouragement the book would never have been written, and who suggested in broad outline the form it should take; to Mr. J. W. Butcher, Government Statistician, Wellington—who has supplied information on numerous points where the writer was not sure of the facts; to Mr. Malcolm Fraser, C.V.O., O.B.E., former Government Statistician, Wellington—under whom the writer learnt much, and who was the first to suggest to him the writing of a "text"; and to Professor B. E. Murphy, of Victoria University College, Wellington—from whom the writer obtained his first acquaintance with statistical methods.

In these pages the writer will have occasion time and again to stress the limitations of the New Zealand Official Statistics. Lest the reader thus obtain a false perspective, he is counselled, after reading this book, to turn to the article by Professor A. L. Bowley in "Economica" for October, 1921, where he will find the work of the New Zealand Census and Statistics Department more than favourably compared with those of other parts of the Empire. Statistics, though a very useful instrument when rightly used, are nevertheless in most cases a far from perfect tool. If this book can help its readers to know where to look for the statistics they require and can help them to realise and allow for the limitations of such data without unduly discouraging their use, then the writer will be satisfied that his main task has been achieved.

E. P. NEALE.

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CHAPTER I

POPULATION STATISTICS

The census forms the foundation of "demography"—the science of population; the data provided by these periodical enumerations being reviewed and brought up to date regularly in conjunction with the statistics of migration and with the "vital statistics" (i.e. the statistics of births, deaths, and marriages).

The census yields instantaneous population data for the demographer in cross section (or "statically"); the migration and vital statistics are the dynamic aspect of the same study, indicative as they are of movements over a period of time in the numbers and characteristics that are the demographer's special field.

I. THE CENSUS

1. SOURCES OF DATA.

The Monthly Abstract of Statistics gives the more important results of the census as the population count is completed from time to time after each enumeration.

The New Zealand Official Year Book gives similar data.

The Census and Statistics Department's General Report on the Census (issued at an interval of about four years after the enumeration to which it relates) gives much more detailed results.

The Census and Statistics Department's Special Volumes of Census Results (each dealing with a particular aspect of the demography of New Zealand and issued at intervals of from one to four years after the enumeration to which they relate) give the most detailed results of all. Successive censuses differ somewhat in their scope, but the following special reports appeared in connection with the 1926 census:—

Geographical Distribution
Pacific Dependencies
Ages
Conjugal Conditions
Orphanhood and Dependency
Race Aliens
Birthplaces
Religions
Occupations
Unemployment
Incomes
Families
Dwellings
Maoris and Half-Castes
Libraries and Places of Worship
Poultry

2. HISTORY OF THE CENSUS.

The fullest recent treatment of the history of the Census with special reference to New Zealand is to be found on pages 2 to 11 of the New Zealand General Report of the Census and Statistics Department on the 1921 Census.

In 1851, under the Census Ordinance of that year, the first general census was taken. The actual enumeration was left to the Provincial Governments of New Ulster and New Munster, but identical schedules were employed throughout. Settlers and whalers in some of the remoter parts were not included.

The Census Ordinance of 1851 provided for a census in the first, fourth, and seventh years of every decade. However, through oversight, certain provinces failed to carry out complete censuses in 1854 and 1857, and those that observed the law held them in different months and according to different methods. This unsatisfactory situation led to the passing of the Census Act, 1858, providing penalties for default in holding an enumeration, and an unbroken succession of censuses followed. In 1874 the holding of the census was removed from the provincial to the central authorities, with resulting economies and improvements in uniformity of treatment.

The Census Act of 1877, though mainly a consolidating Act, altered the sequence, ordering a census in 1878, then in 1881, and thenceforward in every fifth year, thus establishing the quinquennial intercensal period which still exists, though under the Census Postponement Act, 1930, the 1931 Census was eliminated as "an economy measure".

A list of census dates, with the day of the week for which the census was taken, is as follows:—

December,	1851		28th March,	1886	(Sunday)
24th December,	1858	(Friday)	5th April,	1891	(Sunday)
16th December,	1861	(Monday)	12th April,	1896	(Sunday)
1st December,	1864	(Thursday)	31st March,	1901	(Sunday)
19th December,	1867	(Thursday)	29th April,	1906	(Sunday)
27th February,	1871	(Monday)	2nd April,	1911	(Sunday)
1st March,	1874	(Sunday)	15th October,	1916	(Sunday)*
3rd March,	1878	(Sunday)	17th April,	1921	(Sunday)
3rd April,	1881	(Sunday)	20th April,	1926	(Tuesday)
			24th March,	1936	(Tuesday)

* Postponed from the autumn to the spring on account of the Great War.

The elimination of the enumeration that would normally have been held in 1931 will probably in the years to come be looked back upon as one of the most ill-considered of the so-called "economies" of the depression years. Decennial comparisons for the future have been seriously impaired, inasmuch as there had been a census in each year ending in a "1" right back to 1851.

whereas—as explained above—there is a regular sequence of census numerations in years ending in a "6" only as far back as 1886. While our records of external migration and of births and deaths are so nearly accurate that the numbers of the total population of the Dominion are known with a considerable degree of precision even in the absence of a regular census, the same is far from being true (owing to the impracticability of securing accurate records of internal migration) of our inter-censal estimates of population for portions of the Dominion. For want of a 1931 census we lacked proper denominators on which to calculate birth-rates and other important coefficients for different parts of the country, and we were without the necessary data to enable the country to be repartitioned into electorates in sympathy with the changing geographical distribution of our populace. We were without accurate knowledge of certain demographic movements vaguely believed to have been very important, e.g. the northward drift of population, the disturbance of normal age distributions under the influence of war losses and the declining birth-rate, and the concentration of population in certain larger centres at the expense of smaller ones under the influence of the motorisation of transport.

Some countries still have a census only once in 10 years, but for the most part these are countries where the population is more stationary than in New Zealand, and undoubtedly the trend of the age throughout the world is in the direction of shortening the interval between successive enumerations.

3. SCOPE OF THE CENSUS.

The principal objects of the New Zealand Census are thus stated in the General Report on the 1926 Census, page 1:—

(a) To furnish "an accurate survey and a detailed account not only of the numbers, location, increase, and characteristics of the people, but also of their social condition from several aspects."

(b) To fill the need for complementary population data in almost all branches of statistics, arising from the universal importance of population data. Per capita rates, for example, are required in almost every department of statistical enquiry.

(c) To facilitate the periodic adjustment of parliamentary representation upon a population basis.

(d) To collect "information on divers minor subjects of inquiry, sometimes having little connection with a population census, but for which census machinery of collection offers the best means available."

The present tendencies are in the direction of reducing the number of questions of a non-population character and of confining the scope of the census more and more strictly to demographic enquiries. In 1936 poultry was the only head of inquiry under (d) above. There is, on the other hand, a tendency to ask more and more as to the conditions under which the people live, these enquiries covering details as to dwellings, their nature, size, rental value, material of which constructed, tenure, etc.

The extent of the topics covered by the census in any country is limited by:—

(a) The intelligence and education of the people. In New Zealand these are very high; and, except for the Maori population, there is no bilingual difficulty such as exists in Canada or South Africa.

(b) The attitude of public opinion. Officers of the Census and Statistics Department must not divulge individual particulars—under threat of dire penalties. To prevent the inquiry regarding incomes seeming inquisitorial the question asked in the last two Censuses required the informant to classify himself or herself in certain broad classes rather than indicate his actual income. By the Census and Statistics Act, the informant has the right to decline to mention his religion.

(c) The danger of overloading the census schedules to a point such that some of the answers are recorded carelessly. Former inquiries regarding "literacy" have been dropped in recent New Zealand census schedules partly owing to this consideration and partly in view of New Zealand's high standard of literacy. Former inquiries regarding infirmity have been dropped, one consideration being that information as to the degree of infirmity (which alone it is really important to have) cannot be secured in that way.

(d) The undesirability of using the expensive census machinery to secure data that could be collected just as cheaply and satisfactorily in other ways.

(e) The need for keeping the cost of the census within reasonable limits.

Readers interested further in this topic are referred to the General Report on the 1926 Census, pages 2 to 3.

A comparison of the scope of the census in the different British Dominions will be found on page 13 of the General Report on the 1921 New Zealand Census.

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4. MODES OF REFERRING POPULATION TO LOCALITY.

There are two modes of referring population to locality; one depending on domicile, or the place one regards as one's permanent home, the other depending on one's actual location at the date of the Census. The former is known as the "de jure" enumeration, the latter as the "de facto" enumeration. The results of enumerations on these two bases are sometimes known as the population "de droit" and the population "de fait" respectively.

For the de facto method may be claimed the merit of simplicity. Against the de jure method we have the almost insuperable difficulty of deciding what constitutes temporary and what permanent residence in a locality; consider for example a person who resides in New Zealand during the summer and autumn and in Australia or the Pacific Islands during the rest of the year. For the de jure method, on the other hand, it may be claimed that it is not reasonable to include as part of the population of any particular locality mere casual visitors, or to exclude temporary absentees; consider in this connection the population of a seaside resort.

A few countries (e.g. Belgium, France, Germany) attempt to enumerate population from both points of view. Most countries enumerate only the de facto population, choosing the time for the Census at an hour and date when population displacement is at a minimum. Proximity to Easter, for example, obviously must be avoided.

5. PRESENT MACHINERY OF COLLECTION AND COMPILATION.

A. *The Householder v. The Canvasser.*

The difference between the householder and the canvasser methods hinges on whether the original entries are made by the householder or by the enumerator.

For the householder method (employed in New Zealand) it may be claimed:—

(a) The liability to error is smaller; all statements rest on the informants' own authority.
(Under the canvasser method a large proportion of the particulars are obtained by questioning the housewife, and she is not always conversant with the necessary details concerning her husband, e.g. length of residence in the country, etc. Where, as is frequently the case, details are obtained from some third party, there is much greater uncertainty still).

(b) It economises the enumerator's time.

(c) Labour of writing particulars is diffused, and there can therefore be more questions included.
(d) By this method alone can anything approaching a perfectly synchronous estimate of population be made.
(e) More time is given individuals for consideration.

To the householder method it can be objected:—

(a) The accuracy and scope of the enquiry is limited by the intelligence and literary capacity of the people. Hence in India, Ireland and Ceylon the canvasser method has been employed. In Canada and the United States the same method has been employed, but the reason here has been rather the extensive and complicated character of the enquiry.
(b) Under the canvasser method the particulars are collected by an individual who knows exactly what is required and can be trusted to see that a reasonable reply is furnished to every query.

B. *Handling the Schedules.*

Enumerators' Districts (slightly larger on the average than county divisions) are selected, local postmasters being usually appointed as enumerators. To each enumerator are forwarded two copies of maps of his district (prepared by the Lands and Survey Department). On the maps are coloured lines defining the boundaries of all local governing districts such as counties, ridings, road districts, boroughs, and town districts. Boundaries of provincial districts, electoral districts, and goldfields are also indicated. On these maps the enumerator marks his proposed sub-districts, guided by general instructions issued to him, by the dictates of his own local knowledge, and by suggestions recorded by preceding enumerators in that district. One copy is then submitted to the Census and Statistics Department in Wellington, and when the sub-districts are finally approved a map or maps of each is prepared by the staff of the nearest Chief Surveyor. For each sub-district, a Sub-Enumerator is appointed, although in a few cases two sub-districts are allotted to one man. Both Enumerators and Sub-Enumerators subscribe to the statutory declaration in connection with the non-divulging of information.

The Sub-Enumerator's principal duty is to deliver a household schedule at every dwelling in his sub-district before Census night, and to collect it as soon as possible thereafter. He is required to keep in a book provided for the purpose a note of all schedules delivered and collected, with particulars of the number of persons, distinguishing the two sexes, returned on each schedule.

On the Sub-Enumerators' maps the whole territory is cut into very small blocks by means of dotted coloured lines. On the

map, which is fixed inside his collecting book, the Sub-Enumerator enters the number of people residing in each block, this being done primarily for the information of the Representation Commissioners, who are charged with the preparation of new electoral districts based on the population disclosed by each census enumeration. For details of the repartition based on the 1936 Census readers are referred to 1937 Parliamentary Paper H-45*.

Responsibility for complete and accurate entries is placed by law upon the householder, or occupier, manager, captain, or person in charge of the "dwelling" generally. A first check is made by the Sub-Enumerator on collecting the schedule; a second is made by the Enumerator. It is sometimes necessary to return schedules for completion of entries. Certain summaries of population and dwellings in autonomous districts are prepared by Enumerators and the total populations of such districts are immediately telegraphed to the Census Office for dissemination through the press.

The whole of the final examination of material and the compilation is carried out in the Census and Statistics Department in Wellington.**

The return in 1926 to a week-night census in place of a Sunday-night census has been attended with satisfactory results. Eleven of the nineteen general censuses of New Zealand have been timed for a Sunday night, but the growing habit of "week-ending" now renders that night disadvantageous, particularly in view of the de facto basis of population enumeration employed in New Zealand. Moreover it is an advantage during the Census collection to have the day preceding the census a week-day when full facilities of transport and communication are available.

C. *Compilation.*

The mechanical tabulation of the census data is fully described in Section II of the General Report on the 1921 Census. Two separate cards are necessary, one for each individual of the population, and one for each dwelling. The former are called for convenience of reference the "personal card," the latter bear the title of "household card." The sortings, etc. are affected as a result of particular positions on the cards being punched to indicate different characteristics of the individual or the household as the case may be.

Some of the heads of inquiry require to be reduced to a numerical form for the purpose of the cards by a system of coding (e.g. 1 denotes male, 2 female).

* For the sake of convenience the Appendices to the Journals of the House of Representatives will be referred to throughout this book as Parliamentary Papers.

** The above account follows closely the General Report on the 1926 Census, page 3.

The principal advantages of sorting, tabulating and calculating machines in connection with the census are:—

(a) When once the initial punching of the cards, etc. is completed, combinations of data can be achieved more rapidly and economically, thus enabling the scope of the tabulation to be extended.
(b) Much of the sheer drudgery of statistical work is eliminated.
(c) Greater accuracy is secured because the personal equation is largely—but not completely—eliminated.
(d) A great economy of labour is secured, so that the machinery more than pays for itself.

6. ANALYSING THE DATA.

A. Centre of Population.

This term (See 1926 General Census Report, page 11) may mean either:—

(a) The median point, i.e. the point of intersection of a line dividing equally the population north and south with a second line dividing equally the population east and west.
(b) The centre of gravity; under which a unit of population numbering 10,000 and situated 100 miles from the "centre" has precisely the same effect in determining its exact position as a unit of, say, 40,000 only twenty-five miles from the "centre." The peculiar advantage of employing this species of "centre" is its sensitiveness to movements of population. In the case of the median point it is possible that large fluctuations may occur without exerting any influence upon the location of the point, e.g. the whole population of Marlborough County might migrate to the Southland district without affecting the median point at all. On the other hand, this migration would at once be responded to by a south-west movement of the centre of population.

B. Masculinity.

What is called a coefficient of masculinity is often employed to indicate the proportions of the sexes in the whole population, amongst births or deaths, or in some other field.

This term is somewhat ambiguous:—

If m = the male population

and f = the female population;

masculinity is variously defined as:—

(a) $\frac{m}{f}$

(b) $\frac{m}{m + f}$

(c) $\frac{m - f}{m + f}$

C. Misstatements of Age and Length of Residence.

Experience has shown that there is a considerable degree of error in the statement in census schedules of particulars regarding age, duration of residence, etc.

As regards age the principal sources of misstatement are from the following influences:—

(a) Misreading of instructions, especially confusion between months and years for the very young.

(b) A desire to secure some legal advantage: e.g. to marry without parental consent; to receive an old age pension on attaining the necessary age; to be exempt from military service, etc.

(c) Understatement, especially amongst women for matrimonial and similar reasons.

(d) Exaggeration of longevity amongst the very aged from a desire to be unique.

(e) Especially with increasing age, and especially amongst persons born outside New Zealand, ignorance of the true facts or unwillingness to make the necessary calculations; so that in fact there is a tendency to return the ages, etc. in round numbers and avoid certain concluding digits*:—

(i) There is a marked tendency to state ages in numbers ending in 0.

(ii) There is a considerably less marked tendency to state ages in numbers ending in 5.

(iii) There is a still less marked tendency to state ages in numbers which are even. For numbers ending in 4 this tendency is masked by the still greater charm of the adjacent numbers ending in 5.

(iv) Of the odd numbers 1 is easily the least popular as a unit, and this may be wholly accounted for by the proximity of such numbers to numbers ending in the very popular digit 0.

(v) The tendency to state ages in even numbers is relatively stronger amongst males and in multiples of 5 relatively stronger amongst females.

* Similar tendencies are shown in the vital statistics but to a less marked degree.

This source of error can be largely corrected by quinquennial or decennial grouping or by refined mathematical graduating processes.

The actual ages can, of course, easily be checked from the birth records if the persons concerned are New Zealand born.

D. *Indexes of Overcrowding.*

A building may in general be said to be overcrowded if the number of its inhabitants and the manner of their disposal about that building is such as to challenge health and decency. Overcrowding in this sense cannot in practice be statistically investigated. Indexes of overcrowding are however computed from the census results by working out the proportion of households in each area where there are an average of 1½ persons or more per room. The figure of 1½ persons per room is more or less arbitrary; so that the statistics are of little value taken absolutely; relatively however (e.g. in a comparison between Dunedin and Wellington conditions) they are of considerable value, thought the exent of overcrowding really varies also with:—

(a) the different sizes of rooms;

(b) the different age, sex, and marital constitutions of the household.

(c) the nature of ventilation and other hygienic considerations.

See General Report on the 1926 Census, pages 93 to 94.

E. *Occupations.*

The following classification is adopted:—

(a) *Breadwinners*

(i) Primary
(ii) Industrial
(iii) Transport and Commercial
(iv) Commerce and Finance
(v) Public Administration and Professions
(vi) Domestic and Personal Service
(vii) Other

(b) *Dependents*

Each of the above classes is divided into numerous orders and sub-orders.

There are many difficulties resulting from border-line cases, dual occupations, etc.; and the inquiry must be regarded as one of the least satisfactory of the whole Census.

A cross-division to that just that discussed has also been adopted in New Zealand whereby the 'grades' of occupations of the people are shown; that is, the population is divided according as one or other of the following terms is applicable:—

(E) Employer of labour in connection with business or profession. (No public servant or company manager, as such, can be classed as an employer).

(O) In business on own account, but not employing others.

(A) Relative assisting, but not receiving wages or salary.

(W) Working on wages or salary at the date of the Census, i.e. an employee in employment.

(WN) Wage-earner unemployed.

(NA) Classification not applicable (mostly dependents).

(NS) Not stated or not indicated.

F. *Urban Areas.*

This conception is fully explained in the Year Book. A useful map of the Urban Areas will be found in the 1926 Census Report, Vol. I (Geographical Distribution).

G. *Other Demographic Data*

A perusal of the General Report on the Census will give the reader some idea of the wide range of data made available by the census. For reasons of economy only a small proportion of the total possible combinations of data are tabulated, even in the more detailed Volumes of Census Results.

Many of the demographic data upon which the census sheds light are closely correlated with past movements in population—a point which is made manifestly clear by the author's review of the present effects of past migration in New Zealand published in "The Future of Immigration Into Australia and New Zealand" (Angus and Robertson Ltd).

II. INTERCENSAL ESTIMATES OF POPULATION

1. SOURCES OF CURRENT DATA.

The Census and Statistics Department's Annual Report on Population and Buildings provides very full data regarding population, migration, and buildings, together with population estimates for all the important geographical divisions as at 1st April in each year.

The Monthly Abstract of Statistics gives less full data, viz:—

A. Quarterly estimates of population for New Zealand as a whole, both including (sexes separately) and excluding Maoris; also mean population for twelve months.

B. Monthly permits for new buildings in 21 major towns with suburbs (also for the four main centres separately).

C. Monthly data regarding migration, specifying the purpose and nature of the migration.

D. The calendar year's figures regarding marriage (numbers and rates) and divorce, when the compilations are complete.

2. METHODS OF COMPUTING INTERCENSAL ESTIMATES OF POPULATION.

A. *For New Zealand as a whole.*

(a) *The Formula.*

The formula adopted is:—

Present Population = Census Population + Natural Increase since last census + Excess of Arrivals over Departures since last Census; Or (in other words)

Present Population = Last Census Population + Children Born Alive since last Census − Deaths since last Census + Arrivals since last Census − Departures since last Census

(b) *Sources of Error in Estimates for New Zealand as a Whole.**

The main sources of error in the inter-censal estimates for New Zealand as a whole are:—

(i) Errors in the census results themselves. The 1851 enumeration purported to be a census only of the settlements. During the gold rushes of the sixties, it is believed at least 3000 diggers went unrecorded at the 1861 census. Now, however, the results are pretty complete.

(ii) Omissions from the migration figures. There is reason to believe the departures from New Zealand were greatly understated in the late eighties and early nineties of last century. These omissions may result from passengers stowing away, or from shipping companies not being willing to admit they carried an excess complement of passengers, etc.

Crews of vessels are now allowed for in estimates of arrivals and departures. Prior to the beginning of the last decade discrep-

* This treatment follows closely but brings up to date the 1916 General Report on the Census, pages 12 and 13.

ancies could arise from very different numbers of vessels being in New Zealand waters at the dates of successive census enumerations; or from the number of oversea crews paid off in New Zealand being in excess of those taken on—as would be likely when arrivals greatly exceed departures.

(iii) Omissions of births. That a few births are overlooked (either from inadvertent omission or, in certain obvious cases, from a desire to avoid publicity) is clear because every year certain of the births registered under the provisions of what is now the Legitimation Act, 1908, are found not to have been previously registered as illegitimate. Additional proof that all births are not registered at the proper time is afforded by the registrations effected under the various Extension Acts passed from time to time (and now superseded by the Births and Deaths Registration Act, 1924) to provide for the registration of births after the lapse of the statutory limit.

(iv) Omissions of Deaths. The system of registration of deaths in the Dominion makes it impossible for any death (other than odd cases of drowning, etc., where the death is not witnessed and the body not found) to remain unregistered. The duty of registration was imposed on the undertaker. In the remote event of his overlooking the requirements, there was a formidable array of checks in the form of notifications by police and certificates from medical men, coroners, and clergymen, not to mention those inquiries for proof of death which in most cases sooner or later arise from assurance institutions, banks, lawyers, and the like. Since 1937 the onus of registration has been on the medical practitioner.

(v) The fact that births and deaths registered during any period are considered as occurring during that period. Actually there is a lag in registration. Each quarter's registrations of births and deaths thus include a proportion which occurred in the preceding quarter, while deceased persons whose deaths are not yet registered are included in the population estimates. The registrations for the next quarter, of course, include these; and, though by next census they will be offset by the corresponding non-registrations at that time (which by the usual process of averaging up will not in the ordinary course of events differ materially), it is quite possible for exceptional circumstances to exert a disturbing influence. Moreover, in an interval of five years the number of births or deaths in a quarter (and consequently the number unregistered at the end of the quarter) may alter considerably.

(vi) The fact that the census is not always held right at the end of a quarter.

(vii) As regards the estimates of Maori or European populations separately, changes from census to census in the treatment of persons of mixed Maori and European parentage.

(viii) Changes in the boundaries of New Zealand (e.g. inclusion of additional islands).

B. *For Portions of New Zealand.*

The only records of internal migration are as between the two main Islands; and these could hardly be as accurate as between New Zealand and other countries (where the sea crossing is longer, where smaller numbers are involved, and where the established lines of communication have a complete monopoly of the trade). People crossing Cook Strait by private launch, yacht, or 'plane do not have their migrations recorded, though all crossings by public conveyances (including aeroplanes) are recorded.

The estimates of population for areas smaller than a whole Island are little more than "educated guesses" based on the increases of the Island in which the area is situated, considered in conjunction with such evidences of its share in the progress of its Island as are afforded by such criteria as the excess of new dwellings over dwellings demolished.

Changes in boundaries are a frequent source of confusion in tracing the populations of boroughs, etc., down the years.

3. METHODS OF COMPUTING MEAN ANNUAL POPULATIONS.

These were at one time computed in New Zealand by adding the population on 31st December of the previous year to the population on the same date in the year under investigation and dividing by 2.

Other countries have sometimes assumed that the population on 30th June was a reasonable mean population for the year.

These procedures can hardly be valid unless the numbers of arrivals, departures, children born alive, and deaths are evenly distributed over the year.* Actually, as regards children born alive and deaths the distribution is fairly evenly spread; but as regards the migration figures there is in New Zealand usually an excess of arrivals over departures in the summer half of the year, and an excess of departures over arrivals in the winter half.** Accordingly, the mean populations arrived at by averaging the 31st December figures would be in excess of the true

* For a further discussion on this point see E. P. Neale in Journal of Royal Statistical Society, March, 1923, pages 226-241.

** It is normal in New Zealand for arrivals to exceed departures on the aggregate over the year except in years of very acute depression such as the late eighties or early nineties of last century and the early thirties of this. See E. P. Neale in International Labour Review, December 1932, pp. 813-825 and his series of articles in New Zealand Accountants' Journal, September-December, 1933.

mean population and the mean populations arrived at by taking the 30th June figure would be in defect.

The present method is to use the following formula:—

Mean Population for Calendar Year = $\frac{1}{8}$ (population at previous 31st December) + $\frac{1}{4}$ (population at 31st March) + $\frac{1}{4}$ (population at 30th June) + $\frac{1}{4}$ (population at 30th September) + $\frac{1}{8}$ (population at 31st December of the year under investigation).

Similar formulae, mutatis mutandis, are used to ascertain mean populations for March years, etc.

III. VITAL STATISTICS

1. SOURCES OF CURRENT STATISTICAL DATA.

The Monthly Abstract of Statistics provides for each urban area monthly numbers and equivalent annual rates of births, deaths, infant mortality, and still-births, as well as principal causes of death. The Monthly Abstract also gives a summary for each quarter for the whole Dominion covering the preceding $2\frac{1}{4}$ years. Dominion annual totals and rates for marriages and also Dominion annual total divorces are published early in the New Year on the last page of the Monthly Abstract of Statistics.

*The Year Book** gives fuller annual data.

The Annual Report of the Census and Statistics Department on Vital Statistics (usually published late in the year following that to which it relates) gives the most detailed annual tables of all.

*Parliamentary Papers H-7 and H-31*** deal with mental hospitals and ordinary hospitals respectively. The 1937 H-31A (Report of Committee of Inquiry into Abortion) is of special note.

* Special articles in this field that are fruitful in illustrations of sound statistical method appeared as follows:—

Year Book Issue	*By*	*Subject*
1917 & 1926	J. W. Butcher	Cancer Mortality in N.Z.
1925	C. & S. Dept.	Effect of Nativity Order on Infantile Mortality.
1927	L. S. Polden	N.Z. Mortality Rates.

**The Appendix to the Annual Report of the Department of Health contains the particular figures on which the summary figures in the actual Report are largely based. This Appendix is not a Parliamentary Paper.

2. SOME DEFINITIONS.

A. *Births.*

The term "birth" sometimes means "confinements"; sometimes "total children born"; the occurrence of multiple births rendering the former figure smaller than the latter. Usually still-births are omitted from births, but before comparisons are made with the numbers for other countries it is desirable to make sure that there is a uniform practice in this matter. Where any ambiguity is possible, the terms "confinements" and "children born alive" should be substituted for "births."

B. *Marriages.*

Marriage rates are computed on the basis of the number of marriages; which is one-half the number of people married.

Effective Marriages are arrived at by subtracting Divorce Decrees Made Absolute from total marriages. Especially when there are differences in the law or in public opinion regarding divorce a correction on account of the divorces should in strictness be made to all marriage rates.

Legally, death and a decree absolute are the only events that terminate a marriage; however an effective separation is demographically just as important as a decree absolute.

C. *Infant Mortality.*

The rate of infantile mortality is usually arrived at by dividing the total number of deaths under one year of age recorded in any calendar year by the number of children born alive in the same year and multiplying the quotient by 1000. In strictness, however, this practice is a violation of the statistical axiom that numerator and denominator should be logically agreeing magnitudes, and for two reasons:—

(i) Deaths under one year of age occurring in any calendar year are largely drawn from children born in the preceding year

(ii) Neither birth nor death REGISTRATIONS for every calendar year represent exactly the occurrences for that year.

So long as the number of births, however, remain fairly constant from year to year no very appreciable error is introduced.*

Sometimes deaths of infants during the first five years of life are considered in connection with infantile mortality—instead of deaths during the first twelve months of life. Note the following conceptions:—

* A fuller treatment of pitfalls in infant mortality statistics by the author will be found in Journal of the American Statistical Association, September, 1925, pages 354 to 367.

(a) $\frac{1000 \text{ (Children Born Alive} - \text{Deaths of Children under one)}}{\text{Mean Population for Year}}$

= "Residual" Birth Rate or "Effective" Birth Rate.

(b) $\frac{\text{Residual Birth-Rate}}{\text{Actual Birth-Rate}}$ = Survival Factor or Survival Coefficient

3. STANDARDISATION OF RATES.

In calculating rates of births, deaths and marriages, it is difficult to secure a denominator which logically agrees with the numerator.

The number of unmarried women (i.e. never married plus widowed plus divorced) women of childbearing age (which may be taken as 15 to 44 last birthday) is perhaps as satisfactory as any other denominator for women's marriage rates. Even then there may be internal changes in the age constitution of this group from time to time that would vitiate comparisons.

Likewise, the "crude" or uncorrected birth-rates of two communities are immediately comparable only if the relative numbers of persons of each sex, age and conjugal condition are identical; since the birth-rate then presumably reveals fecundity under identical physiological conditions. Finally crude death rates may be seriously misleading as a result of changing age constitutions of the populations. A population containing an excess of persons between the ages of five and forty-five—with relatively few infants or old people—will clearly show a smaller death rate than a more normal population if the "specific death rates" (i.e. the deaths per 1000 of population at each of the different age groups) are the same in both populations.

Since different communities at the same time and since the same community at different times are in fact not homogeneous in respect of age and other relevant considerations, appropriate methods must be devised through which rigorous comparisons can be effected. As a basis for all comparisons—especially interplace comparisons at the same time—it is usual to adopt a population so characterised as to represent all populations as nearly as possible. Such a population is called a "normal" or "standard" population; and any character in regard to which it has been standardised may be called a "norm."

Thus, in order to obtain a rigorous comparison of the mortality rates of various countries, the standard population compiled by the International Institute of Statistics, according to age and sex distribution (twenty-two groups in all) of the population of nineteen European countries at their censuses nearest to the year 1900 is used in Australia and New Zealand in the computation of the 'Index of Mortality' as distinguished from the crude death rate.

AGES (in years last birthday)	MALES			FEMALES		
	Standard Population	N.Z. Death Rate, 1935	Product / 10,000	Standard Population	N.Z. Death Rate, 1935	Product / 10,000
Under 1	132	36.42	.48	130	28.55	.37
1 — 4	469	2.60	.12	467	2.15	.09
5 — 14	1037	1.06	.11	1032	.79	.08
15 — 24	905	2.06	.18	927	1.48	.14
25 — 34	725	2.25	.16	755	2.33	.18
35 — 44	593	3.49	.21	613	3.35	.20
45 — 54	454	7.57	.34	485	6.48	.32
55 — 64	337	17.38	.59	371	14.02	.52
65 — 74	187	43.72	.82	218	35.74	.78
75 — 84	64	110.01	.71	81	95.74	.78
85 & over	7	282.38	.20	11	249.11	.27
TOTALS	4910		3.92	5090		3.73

The distribution per 10,000 according to sex and age in the eleven age-groups for each sex used in the computation of the "Index of Mortality" is given in the table opposite in the columns headed "Standard Population."

In computing an index, New Zealand's death rate in the year under investigation is ascertained for each age-group for each sex and then multiplied by the corresponding number under the heading "Standard Population." The sum of the results represents the "Index of Mortality," or standardised Death Rate. Thus in the above example, 3.92 + 3.73 = 7.65 is the standardised death rate for 1935 as computed when a distinction is drawn between death rates by sex as well as by age.

Similar methods, mutatis mutandis, may be adopted for standardising birth rates, marriage rates, etc.

Corresponding devices may be adopted to secure rigorous comparisons of vital statistics in the same community at different times. Thus, if we assume the proportions of women of each conjugal condition and age to remain constant (if—in a word—we "standardise" the female population of reproductive age), and if we attribute the fecundity of an existing later population to such a standardised population, age group by age group and conjugal condition by conjugal condition, it is possible to arrive at a "fecundity index" or standardised birth-rate for that later population strictly comparable with the similar figures worked out for the standard year, say 1916. The 1916 New Zealand Census showed the following classes of women to constitute the following percentage of the total female population 15 and under 45:—

AGE GROUP	UNMARRIED	MARRIED	
15 and under 20	16.99	.40	
20 „ „ 25	12.30	5.16	
25 „ „ 30	7.01	11.14	TOTAL
30 „ „ 35	4.38	13.36	
35 „ „ 40	3.62	12.96	100.0%
40 „ „ 45	2.73	9.95	
	47.03	52.97	

The average fecundity of all women of reproductive age is then ascertained, using the above figures as weights in the averaging of the specific fecundity rates for each of the twelve classes separately.

Thus the number of illegitimate children born per 1000 unmarried women 15 and under 20 is weighted 16.99, the number of legitimate children born per 1000 married women 40 and under 45 is weighted 9.95, and so on.

This method involves a standardisation of the female population on the basis of the 1916 population.

Even now the method is not absolutely rigorous:—

(a) It assumes no illegitimate children are born to married women.

(b) It assumes an identical fecundity for the divorced, the widowed and the never-married.

(c) It does not allow for the influence on fecundity of:—
(i) The ages of husbands;
(ii) The number of previous issue;
(iii) The age at which child-bearing initiated.

(d) It assumes no illegitimate children are registered as legitimate.

Except (b) these shortcomings are however difficult to overcome in practical statistical work.*

Often interest centres primarily however on whether or not the population is reproducing itself.

The fact that the birth rate exceeds the death rate in many countries at the present time does not prove the population is reproducing itself, as many populations (including that of New Zealand):—

(a) are deficient in that large proportion of old people (with a high death rate) which we would possess were our present rates of reproduction and mortality at the different ages of life perpetuated for a generation;

(b) contain a larger proportion of people at the reproductive ages than we shall have in the future when the effects of our present lowered birth rates move up into the reproductive ages.

The "gross reproduction rate" is the average number of female children that would be born per female child born and reaching the end of her reproductive period if present reproduction rates at each age were perpetuated and if there were no mortality amongst such females. Alternatively, it may be defined as the sum of the specific female fertility rates of the female population (ratio of female births to female population) at the different individual years of age.

The "net reproduction rate" is obtained by multiplying the specific female fertility rates (ratio of female births to female population) of the individual years of age by the proportions of female survivors at those ages according to the life table, and summing these products. It gives approximately (assuming that present fertility and mortality rates are perpetuated) the average

* The author has discussed these points more fully in Journal of the American Statistical Association, December, 1924, pages 454 to 467.

number of girls who will eventually be born to each newly born girl. If this figure is less than unity a population is failing to reproduce itself.

4. PITFALLS.

The data in this department of the New Zealand statistics may be considered very good, being governed by official figures for omission of which a penalty is provided. Moreover, New Zealand's good type of settler led to an early recognition of the advantages of registration; and no part of the country is so isolated as to render registration difficult.

There are however certain sources of error in this type of statistics in addition to those which the standardisation of rates is designed to check:—

(a) There are errors of recording in the actual registration (e.g. in ages of parents, etc.) similar to those of the census already mentioned.

(b) Owing to the small numbers dealt with, the consequent risks of random fluctuations, and the varying lengths of the months, some of the rates given in the Monthly Abstract tables represent a "spurious" accuracy, and too much attention in particular should not be paid to the figures for a single month relating to the smaller urban areas.

(c) It is not always easy to return the exact cause of deaths and there is danger of spurious accuracy in this field, owing to:—

  (i) difficulties of obtaining standardised descriptions of diseases;

  (ii) the presence of two or more diseases (or diseases plus accident) in conjunction. It is the duty of the statistician in such cases to decide which of the two or more diseases is to be assigned as the cause of death; and for this purpose certain general rules of procedure, applicable in the great majority of cases, are laid down by the American authorities and followed with some degree of closeness in New Zealand;

  (iii) Faulty diagnosis;

  (iv) Reluctance on the part of medical practitioners to record disgraceful diseases.

(d) Sickness reporting is—for obvious reasons—not nearly so complete as death reporting. It follows that lethality rates generally work out fictitiously high; a lethality rate (or "case fatality") being defined as the percentage of deaths to cases notified.

It is here again hard to decide what the denominator should be. Age, sex, and economic position affect the rate of attack in many diseases, and it is not easy to secure an average with real significance.

(e) In this field there is particular danger of the fallacy of "objectivity" or "fetishism." Thus the illegitimate (sometimes called the "ex-nuptial") birth rate is not necessarily a good measure over the years of changes in the state of sexual morality. It ignores, inter alia:—

(i) increased knowledge of contraceptive practices, abortion, etc.

(ii) possible changes in the extent to which children who are really illegitimate are registered as the legitimate offspring of their mother (if she is already married) or of the woman who is in fact their maternal grandmother.

(iii) changes in the proportion of the unmarried women in the population (due to rising average ages of marriage or other causes); thus altering the proportion of those who are liable to have illegitimate children recorded to them.

(iv) changes in the willingness and promptitude with which the fathers of extra-nuptially conceived infants are prepared to marry the mother before the birth of the child. Some infants extra-nuptially conceived are born more than nine months after marriage; the Australian practice assumes that these approximately offset cases of infants conceived after but born less than nine months after marriage. The New Zealand practice (of considering as "prejudiced" only those cases where the period elapsing between marriage and the birth of the first child is under seven months) deliberately errs on the conservative side.*

(v) the fact that, where illegitimate birth-rates are computed as a percentage of total births, the disturbing effects of the fall of the legitimate birth-rate are apt to be lost sight of.

Similarly, the taking of divorce rates as an index of sexual morality overlooks such disturbing influences as:—

(i) changes in the ease with which the law and the Courts are prepared to grant divorces.

(ii) changes in the number of divorces due to changes in economic conditions.

* See Knibbs, Mathematical Theory of Population, page 236 ff.

(iii) the influence of past fluctuations in marriages. (Such statistics as are available in N.Z. rather suggest the existence of a "critical" duration of marriage—some eight or nine years, while the relative ages of the parties to the marriage seem also to have some bearing on the risk of divorce).

(f) Like cautions, mutatis mutandis, apply to simultaneous international comparisons in this field; and there are also further difficulties in international comparisons due to differences in definition and statistical practice. Such terms as "still births" are, for example, quite differently defined in different countries.*

(g) Because of the presence of hospitals, doctors, etc. in the centres of population, births and deaths are likely to occur there in good numbers in respect of persons who are normally domiciled in the country.

To overcome the difficulties in inter-regional comparisons arising from this tendency to flock to the towns for vital events, these occurrences are now allocated according to the domicile of the persons concerned—not the actual place of occurrence.

This practice, if its existence is overlooked, may lead to misleading conclusions in certain directions.

(h) Insanity rates per 10,000 of population are apt somewhat to overstate the increase in the incidence of mental derangement, owing to the following facts:—

(i) There has been increasing emphasis on hospital treatment for mental disorders.

(ii) The prolongation of human life, coupled with the fall in the birth-rate, has brought it about that an increased proportion of the total population is at the age-group most subject to the risk of insanity.

* Pitfalls arising from lack of uniformity in definitions of "stillbirths" are discussed by Malcolm Fraser in Economic Record, May 1928, pages 27 to 38; Journal of the Royal Statistical Society, 1929, pages 428 to 444.

CHAPTER II

METEOROLOGICAL STATISTICS

1. SOURCES OF DATA.

The New Zealand Official Gazette publishes very detailed monthly figures for a range of stations throughout New Zealand.

The New Zealand Official Year Book summarises and analyses these data.

Parliamentary Paper H-34 (Annual Report of Scientific and Industrial Research Dept.) also contains information in this field.

2. PITFALLS.

(a) Temperature drops with altitude. Therefore to make statistics generally comparable with those of stations at sea-level 9°F is added to the readings per kilometre of height. The Rotorua values are for example increased 2.5°F; the station being 925 feet above sea-level. Before temperature data are compared with those of other countries, it is important to find out whether similar corrections have been made. It is equally important to remember that where corrections for altitude are applied it is not the real temperatures that are tabulated.*

(b) Owing to the varying lengths of the months, rainfall and similar statistics that are aggregates and not averages should be reduced to a per diem basis when seasonal variations are being studied. (The same cautions apply to similar seasonal comparisons in other fields, e.g. migration, births, deaths, exports, etc. and are not repeated in the list of pitfalls for those types of data).

(c) Mean, maximum and minimum monthly temperatures and similar records are not universally computed on the same basis; and the exact definition of the terms should be inquired into before effecting comparisons.

* Somewhat similar corrections to barometric pressures are also often made; but here the formula is rather more complicated.

CHAPTER III

TRADE STATISTICS

I. EXTERNAL TRADE

1. SOURCES OF DATA.

The Monthly Abstract of Statistics contains monthly trade statistics covering the following matters:—

(a) total value of imports from and exports to the main countries with which New Zealand trades;
(b) total quantities and values of exports under some 75 major heads;
(c) total values (also quantities where available) of imports under some 200 major heads;
(d) shipping by ports, distinguishing coastal and oversea;
(e) cargo handled at each port, distinguishing coastal and oversea;
(f) direction of trade in respect of some 40 major imports (values, not quantities)—quarterly only.

The January issue contains for the previous calendar year (separately for each of the four main ports):—

(g) main countries of destination of exports—values only;
(h) main countries of origin of imports—values only;
(i) quantities and values of exports of 50 major commodities.

The New Zealand Official Year Book provides fuller statistics (by calendar and by June years) as to trade and as to customs revenue and in a later section as to shipping.

The Census and Statistics Department's Reports on Trade and Shipping (published with the collaboration of the Customs Dept. about June and November respectively) give the fullest calendar year data of all. Part I. shows each export by countries of destination and each import by countries of origin and by rate of customs duty; the data as to values being supplemented by data as to quantities wherever the heading covers articles sufficiently homogeneous for these to be given. For the main exports the data are also shown separately by principal exporting ports. Finally, for all the imports, data regarding the main importing ports are given. There is, at the end, a summary table showing aggregates of exports and imports for each country separately with which

New Zealand trades. All other summary tables are however relegated to Part II., which also contains data regarding movements of shipping.

The Quarterly Bulletins of the Dept. of Industries and Commerce and

The Dept. of Industries and Commerce Annual Report (*Parliamentary Paper H-44*) contain additional information on trade.

The Marine Dept.'s Annual Report (*Parliamentary Paper H-15*) contains further information on shipping.

An interesting statistical survey of New Zealand's oversea trade—largely historical—from the pen of Dr. J. B. Condliffe appeared as an appendix to the 1915 New Zealand Official Year Book.

2. INCLUSIONS AND EXCLUSIONS.

Different countries adopt different practices as regards what should be included in their statistics of oversea trade; and due consideration should be given to this point before comparing trade statistics prepared by different administrations.

New Zealand includes all the following:—

(a) imports placed in bonded warehouses;
(b) exports shipped from bonded warehouses;
(c) bullion and specie;
(d) imports of the products of whale fisheries;
(e) exports of ships' stores to whale-fisheries to the same extent as other ships' stores. (See exception to exclusions—item (d) below);
(f) articles sent by parcel post (but in the case of exports not under their appropriate headings);
(g) trade between New Zealand and Western Samoa;
(h) returned goods, temporary exports (articles for exhibition, etc.) on exportation and subsequent reimportation;
(i) imports and exports on account of the General Government of New Zealand; articles for the Governor-General and foreign Consuls;
(j) passengers' dutiable baggage (in imports).

New Zealand excludes each of the following:—

(a) Goods in transit transhipped at New Zealand ports;
(b) imports of fresh fish caught in extra-territorial waters (except trade with whale fisheries);
(c) inward ships' stores, bunker coal and fuel oil unless and until landed or the vessel engages in coastwise trade;
(d) outward ships' stores except:—
    (i) ships' stores ex warehouse or under drawback;

(ii) the unconsumed balance of New Zealand shipped fuel (Dominion produce or not) remaining on board at the time of the clearance of the vessel;

(e) trade with Cook and other annexed Pacific Islands*;

(f) temporary imports—e.g. travellers' samples;

(g) ships on their own bottoms, bought and sold;

(h) passengers' baggage (except dutiable).

3. INDEX NUMBERS.

A. *Technique of Compilation.*

Where p_o = price per unit of a commodity in the base year;

p_n = price per unit of that commodity in the year n;

q_o = quantity of that commodity in base year;

q_n = quantity of that commodity in year n;

and Σ (being the Greek capital letter 'sigma") connotes, in accordance with standard mathematical usage, "sum of all expressions like";

the following formulae are applicable to the computation of index numbers by the "aggregate expenditure method" for Prices, Volumes (or Quantities), and Total Value — indicated by P, Q, and T respectively:—

$$P = 100 \times \frac{\Sigma p_n q_n}{\Sigma p_o q_n}; \quad Q = 100 \times \frac{\Sigma p_o q_n}{\Sigma p_o q_o}; \quad T = 100 \times \frac{\Sigma p_n q_n}{\Sigma p_o q_o}$$

Then

$$PQ = 100 \times \frac{\Sigma p_n q_n}{\Sigma p_o q_n} \times 100 \times \frac{\Sigma p_o q_n}{\Sigma p_o q_o}$$

$$= 100 \times \frac{\Sigma p_n q_n}{\Sigma p_o q_o} \times 100 = 100\,T$$

This relationship is useful for checking the three index numbers against each other, provided (which, as will be seen later, is not always the case) weights for the price index are based on the quantities of the year under investigation and not on those of the base year. Further uses for this relationship will be found on pages 49 and 53.

* Separate tabulations of this trade are however made. See Trade and Shipping Part II; Parliamentary Papers A-3 (Cook Islands Dept. Annual Report) and H-44 (Annual Report of Dept. of Industries and Commerce).

In 1931 and 1935 fish products exported from New Zealand were as below:—

Commodity	Unit	1931			1935			Value of 1935 Quantity at 1931 Prices Per Unit (£)
		Quantity	Value (£)	Price per Unit (£)	Quantity	Value (£)	Price per Unit £	
Fish	Cwt.	16180	44588	2.756	55463	140683	2.536	152856
Oysters	Doz.	45557	531	.012	197117	2136	.011	2365
Whale-Oil	Gal.	40788	3761	.092	71601	5051	.070	6587
Totals			48880			147870		161808

$$\text{Then } P = 100 \times \frac{\Sigma p_n q_n}{\Sigma p_o q_n} = \frac{147870}{161808} \times 100 = 91$$

$$Q = 100 \times \frac{\Sigma p_o q_n}{\Sigma p_o q_o} = \frac{161808}{48880} \times 100 = 331$$

$$T = 100 \times \frac{\Sigma p_n q_n}{\Sigma p_o q_o} = \frac{147870}{48880} \times 100 = 303$$

Thus, taking as our base year 1931, and regarding its index numbers as 100, we have that the 1935 index number of the prices of fish exports was 91, of the quantities of fish exports was 331, and of the total value of fish exports was 303. Actually, more than one class of fish is usually exported; and very accurate work would require the first heading to be subdivided into the different varieties of fish if these showed any tendency to vary from time to time in the matter of the proportion of the different classes to the total.

The computation of the Index Number of Customs Revenue compared with imports is effected by taking each year's percentage of customs revenue to total merchandise imports and dividing by .02649; 26.49% being the ratio of customs revenue to total imports in the base year 1895.

B. *The More Important Index Numbers.*

The following are the most important indexes that are computed for publication in the Year Book in connection with oversea trade but that do not relate to prices:—

Subject-Matter	Base Year	Separate Computations (if any)	Frequency of Compilation	Date of Commencement of Publication
Customs Revenue Compared with Imports	1895	....	Yearly	1915
Total Trade Volume	1926	gold; N.Z.; sterling	"	1935
Export Volume	1900	(i) total; (ii) per head	"	1921-22
Export Volume	1926	gold; N.Z.; sterling	"	1935
Import Volume	1926	"	"	"
Export Values	1926	"	"	"
Import Values	1926	"	"	"

The following are the most important relevant indexes of prices:—

Name of Price Index	Base Year for Prices	Base Year for Weights	Place Where Prices Quoted	Grouping of items, if any	% of Total Field Covered	Frequency of Publication	Place of Publication	Period during which Published
Export	1901	Present	N.Z.	(1) incl. gold (2) excl. gold	98-99	Yearly	Year Book	1915-19
„	Previous	„	„	„	„	„	„	„
„	10 years ended 30/6/99	„	„	„ *	„	„	„	„
„	1909-13	„	„	5 groups	95	Monthly	Monthly Abs'ct**	July 1925 to April 1932
„	„	last 5 years	„	7 groups; all pastoral; all.	98-99	„	„	From May 1932
„	1926	„	„	„	„	Yearly	Year Book	From 1935
Wholesale Import	1926	1926-30	Exporting Country	nil	75	„	Year Book	„
Wholesale Imported Commodities	(i) 1909-13 (ii) 1926	1909-13	N.Z.	„	about 40	Monthly Yearly	Monthly Abs'ct** Year Book	From July 1926 From 1935

* Also 4 major exports separately.

** Also Year Book, Section on Prices.

4. PITFALLS.

(a) Owing to the seasonal nature of much of New Zealand's trade (especially exports) data for fractional parts of a year should be compared only with data for the corresponding periods in other years.

(b) There is spurious accuracy as regards countries of origin, especially where an article is partly manufactured in several countries. "Goods imported from a British country are regarded as being the produce of that country only when they are:—

(i) Wholly the produce or manufacture of that country; or

(ii) Manufactured within the country from raw materials or from certain partly manufactured materials not produced in that country; or

(iii) Partially produced or partially manufactured in that country, provided that the final process of manufacture has been performed in the country, and provided also that the expenditure in materials and/or labour executed in British countries is not less than one-half of the factory or works cost of the goods in their finished state. With regard to goods partially manufactured in Australia, such goods are not regarded as the produce of the Commonwealth unless at least 50 per cent. of their factory or works cost is represented by Australian labour and/or materials.

"In the case of imports of foreign manufacture, where the goods are not wholly the produce of one foreign country, the country of origin taken is the country of final manufacture." (Trade and Shipping, 1935, Part I, page iv.)

(c) As regards exports, quantities and values are recorded under each country of destination as far as practicable, but it is impossible to foresee what proportion of the exports will be consumed in the country to which the goods are first shipped. (The country of destination taken for purposes of the export statistics is that indicated on the shipping documents, but in cases where bills of lading do not show a definite destination the probable destination is recorded.)

(d) As regards exports the treatment of goods shipped by parcel post tends to understate the actual exports of goods which lend themselves to sending abroad in this way.

(e) Difficulties may arise from differences in customs practice as regards valuation:—

(i) New Zealand values exports f.o.b.

(ii) It has long been the practice in New Zealand to value imports at 110% of the current domestic value in the country of origin at date of shipment; which is intended

to approximate to the c.i.f. value, it being reckoned that freight, insurance, etc. on the average equal 10% of the f.o.b. value.

For statistical but not for duty purposes import values have since 1st January 1935 been converted to New Zealand currency at the rate of exchange at the date of exportation from the country of origin.

Australia still values exports f.o.b. Australian currency and arrives at totals for imports on the basis of 110% of the sum of all pounds irrespective of whether sterling, New Zealand or other —a practice which can scarcely be defended apart from legal subtleties.*

(f) In some respects the manner of presenting the revenue statistics is misleading; as primage duties and surtax are not included. No doubt, at a time when it was intended that these duties should be levied but temporarily, such a treatment was justifiable. On present indications, however, it would seem these duties are with us to stay; but there is little except the desire to preserve comparability with the statistics of the last few years to justify a perpetuation of the present practice of ignoring these duties.

(g) Despite great vigilance on the part of the Customs Department, there are no doubt evasions, particularly as regards imports, of articles valuable in proportion to their bulk. There is also a temptation to undervaluation of imports.

Since no revenue is derivable from most exports, it is to be expected that Customs officials would pay rather less attention to the correctness of export values than to the correctness of import values. Great care is however actually taken in both matters.

(h) In any case export values can only be expressed by an educated guess where goods leave the Dominion on consignment.

(i) Changes of destination may occur to a vessel en voyage.

(j) Complications often occur in connection with the export and import of the precious metals.

The valuation of specie also presents a problem. New Zealand takes it at its face value; other countries may take account of the premium on gold.

* For duty purposes New Zealand still adheres to this practice, pounds of any country being treated as being in New Zealand currency without addition of exchange, and foreign currencies being converted to sterling at current rates, the result being regarded as being in New Zealand currency without addition of exchange. Thus, merchandise valued at £U.K.100 and £A.124½ would both be treated for purposes of the import statistics as £N.Z.124½ × 1.1 = £137 nearly; but a 20% ad valorem duty would in the one case be £1.1 × 100 × ⅕ = £22 (i.e. less than 18% of the value for statistical purposes) and in the other £1.1 × 124½ × ⅕ = just over £27. The statistical treatment is clearly more logical than the customs treatment. (See E. P. Neale in Economic Record, June 1933, pp. 41-48; J. B. Brigden, ibidem, December 1933, pp. 202-213; Report of N.Z. Tariff Commission, Parliamentary Paper 1934 H-28).

(k) The minute gradations of quality and grade that exist often lead to problems of classification that might not be similarly handled by all administrations, thus impairing the comparability of the statistics of trade in particular commodities.*

(l) Changes in the value of money impair the comparability of these statistics unless steps are taken to correct them on this account. (See Section on Index Numbers, page 33.)

(m) Sometimes the destinations of goods are deliberately mis-stated. Recorded exports to Guam in time of war are greatly in excess of the real exports thereto.

(n) Confusion sometimes arises with regard to re-exports. The figures relating to the external trade of any country are also affected in varying degree by the extent to which they include transit or re-export trade. This class of trade represents a much greater proportion of the trade of Switzerland and Belgium than that of most other countries. France and the United Kingdom also re-export largely, whereas in Canada, Australia and New Zealand the same class of trade represents a comparatively small proportion of the total trade.**

"Special trade" may be defined, according to the interpretation of the British Board of Trade as (i) imports entered for consumption in the country (as distinguished from imports for transhipment or re-export), and (ii) exports of domestic products.

* For an interesting examination of errors arising under this head, as well as (b), (c), and other heads, the reader is referred to A. G. B. Fisher in South African Journal of Economics, March 1937, pages 1-10. This treatment has special reference to New Zealand.

** It will be clear that both export and import values are subject to a considerable margin of error, especially the figures for the trade with particular countries.

The limitations of the statistics of the balance of trade wth particular countries are fully set out in the Year Book; but it should be stressed that a given percentage of error in the values of both the imports and the exports is quite consistent with a very much greater percentage error in the balance of trade, this being merely a special case of the oft-forgotten fact that errors in differences are apt to work out at a much greater percentage of the difference than the percentages of error in the original quantities between which the differences are taken. In the following example a 20% margin of error in both recorded imports and recorded exports is assumed:

	£
Recorded Exports	500,000
Real Exports	400,000
Recorded Imports	400,000
Real Imports	480,000
Recorded Excess of Exports Over Imports ..	100,000
Real Excess of Exports Over Imports	—80,000

The error is £180,000, or 180% of the recorded value of the balance of trade.

(o) In shipping statistics, a ship from abroad is "entered" at the first port at which she discharges cargo, a ship for abroad is "cleared" at the last port at which she embarks cargo. All ships are entered as of a definite nationality, and on entering port must show their papers, stating whence they came, where they last broke bulk, what cargo is carried, and registered tonnage. Sailers and steamers are distinguished, as also are coastwise and oversea voyages. Coastwise means between any two ports of the home country or islands in home seas, oversea is from or to a port outside the home country. The aggregate voyages of the home ships and the quantity of work done by them cannot be determined from statistics. Confusion in Shipping Statistics may arise from several causes:—

(i) Diversion on the voyage from port to port;

(ii) In case of regular trips records of tonnage may be more or less nominal (e.g. Wellington-Lyttelton). Moreover, New Zealand ships often make important voyages between oversea ports and are not entered in the home statistics at all.

(p) Tonnage measurements are extremely complicated, there being at least four measurements in use:—

(i) Displacement is the weight of the ship (unloaded) which equals the weight of the water displaced.

(ii) Burden is carrying capacity.
(Neither of these is much used in shipping statistics.)

(iii) Gross Tonnage is the number of times 100 cubic feet is contained in the ship, measured according to certain rules; 100 cubic feet is taken as representing one ton of cargo, but a ton of coal occupies only about 45 cubic feet, and a ton of water about 35. Light or loosely packed cargoes occupy more space.

(iv) Net Tonnage is obtained from the gross tonnage by subtracting—according to certain artificial rules—space occupied by the engines (with an allowance for bunker and air space), by the crew's quarters, and by the parts necessary for navigation. The remainder, reckoned as before 100 cubic feet to the ton, is supposed to represent the carrying capacity of the ship, and is called registered tonnage.

Actually, under this wholly artificial and complicated system, registered tonnage bears no close relation to carrying capacity, and all recent statistics give net or registered tonnage. Sailing-ship tonnage (which includes no allowance for propelling machinery) should be kept apart from steamer tonnage. Marine architects build to keep the registered tonnage as low as possible; for

dock dues are charged in proportion to this tonnage, and the aim is to make the deductions as great as possible. In other words, marine architects try to reduce the registered tonnage relatively to the carrying capacity of the ship. The growth of shipping tonnage thus falls short of actual growth of carrying capacity, and the Plimsoll mark, which regulates the weight a ship can carry, was some years ago raised to allow a greater weight without altering the registered tonnage. Shipping statistics are thus not very useful for fine or extended comparisons.

II. INTERNAL TRADE AND TRANSPORT

1. SOURCES OF DATA.

A. *Coastal Shipping.*

The Monthly Abstract of Statistics gives monthly particulars of vessels and cargoes handled in the coastal trade, data for each port being shown separately.

The N.Z. Official Year Book gives summarised annual data.

The Census and Statistics Department's Annual Report on Trade and Shipping, Part II, gives the fullest annual data of all.

B. *Railways.*

The New Zealand Gazette publishes at four-weekly intervals particulars of traffic, revenue and expenditure, distinguishing the seven main systems.

The Monthly Abstract of Statistics presents a summary of these statistics, together with a figure for the net ton mileage of goods traffic, which is very useful as a business index.

The New Zealand Official Year Book summarises the main annual data.

The Railways Statement (*Parliamentary Paper D-2*) is the most complete source of information as to Railway operation; though reference should be made to the Public Works Statement (Parliamentary Paper D-1) for data as to railway construction.

C. *Tramways.*

The N.Z. Official Year Book gives annual details of tramway operation.

The Local Authorities Handbook (published annually) gives details of the operation of municipally-owned electric tramways.

The Annual Miscellaneous Statistical Report of the Census and Statistics Department gives details of all tramway services (including cable).

D. *Road Transport.*

The Monthly Abstract of Statistics publishes data regarding motor vehicle licences in force at the end of each quarter; also monthly statistics of motor vehicle accidents.

The Annual Report of the Transport Department (*Parliamentary Paper H*-40) is mainly concerned with road transport but is also a very useful source of reference on most other forms of transport. A number of special investigations have been carried out under the auspices of the Department and the results are given in different annual reports.

The Public Works Statement (*Parliamentary Paper D*-1) deals fully with roading policy.

The N.Z. Official Year Book summarises the data of the two preceding reports.

E. *Posts and Telegraphs.*

The Monthly Abstract of Statistics publishes the following data regarding Post & Telegraph Department activities:—

Savings Bank deposits and withdrawals (also figures for trustee savings banks and for deposits with investment societies and trading companies).
Radio licences in force.

The Annual Report of the Post and Telegraph Department (*Parliamentary Paper F*-1) gives the most detailed statistics.

The N.Z. Official Year Book summarises these.

2. PITFALLS IN RAILWAY ETC. STATISTICS.

The data are twofold, based respectively on the details of the train service and on the number of passengers or the quantity of goods conveyed; the former relating to expense, the latter to remunerative work done.

For each train journey the guard sends in a report as to the times (actual and due) of arrival at and departure from each stopping point, the number of waggons, empty and loaded, hauled each section of the journey, and other details. For each journey of each engine the driver reports the time he was working with the engine, and how it was allotted to standing, running and shunting; coal taken on; etc. Returns are made by the guard of all consignments, showing where they were received, where delivered, and cash paid therefor.

The main pitfalls are due to:—

(a) *Lack of real homogeneity in the units;* e.g.

(i) *Mileage.* Some tracks are single, other double; while the relative mileages of sidings varies greatly with dif-

ferent lines. Again, from the point of view of haulage costs, a mile on the Rimutaka Incline is a very different thing from a mile on the Canterbury Plains.

(In tramway statistics certain ratios are computed at so much per section. Here varying lengths of sections may vitiate comparisons.)

(ii) *Train-miles.* This unit may differ greatly as a result of differences in the average length of trains. On certain sections the K locomotive can handle in less than two goods trains what the Ab can only handle in three. On branch lines goods trains are apt to be smaller not only on account of the employment of lower-powered locomotives (e.g. Wf) but also on account of the smaller amount of traffic offering.

(iii) *Tons.* In assessing the total amount of traffic the absence of homogeneity between passenger and goods traffic necessitates keeping these two types of traffic apart, as far as it is practicable to do this when "mixed" trains are run. Live-stock traffic is a borderline case; and in practice is usually reduced to tons on the basis of certain standard conversion quotients, e.g.

Horses and Cattle	..	3 beasts to 1 ton
Calves and Pigs	..	20 beasts to 1 ton
Sheep	..	25 beasts to 1 ton

Sometimes net tonnage of goods traffic is taken (i.e. the actual weight of the goods handled), sometimes gross tonnage (the actual weight of the goods plus the weight of the truck). In practice the loaded truck is usually weighed to secure the gross tonnage and the net tonnage is arrived at by subtracting the "tare" (i.e. the weight when empty) of the waggon, which is marked in white letters on the side.

(In shipping statistics the tonnages of cargo are not as a rule arrived at by actual weighing but are converted from cubic feet to tonnage by a suitable conversion quotient.)

(iv) *Waggon-Miles.* Sometimes waggon-miles (the sum of products of number of waggons moved and number of miles run separately for every section at the beginning of which the train's composition was altered) are employed as units and these are in some respects more homogeneous than other units, in other respects less; for, though the service rendered by a train with thirty waggons is three times as great as that of another with ten similar waggons, the costs of the two services do not differ very greatly. Besides, waggons differ among

themselves. An N truck in New Zealand weighs little more than two tons; a Vb truck nearly 20 tons.

(In the same way in the tramway statistics there are big differences in the carrying capacity of different trams, which may vitiate comparisons.)

(v) *Engine-Hours.* Engine-hours are of course the aggregate of the hours an engine was working, running and shunting being distinguished. Train miles per engine hour, waggon miles per engine hour, gross ton miles per engine hour and similar relations can then be easily ascertained, thus providing a ready test of efficiency in relation to cost, especially when the statistics distinguish the different types of locomotives employed within the system, or disclose other matter bearing on efficiency.

(vi) *Density of Traffic.* This may be defined as the number of trains per unit of time. In practice it would usually be computed as:—

$$\frac{\text{Train-mileage}}{\text{Mileage of System}}$$

(vii) *Passenger.* Difficulty in arriving at a homogeneous total of passengers carried arises on several grounds:—

(i) Different distances travelled. A passenger travelling five miles is a different proposition from one travelling five hundred.

(ii) In any case what is a passenger? Is a person taking a return rail-ticket from Timaru (in the South Island) to Taumarunui (in the North Island) to be counted 1, 2 or 4 passengers?

These two difficulties might be got over by devising a new unit of passenger-miles, but there still remains a further difficulty in arriving at a truly homogeneous total, viz.:—

(iii) The existence of season-ticket holders. These are usually shown separately from ordinary passengers.

(viii) *Capital Cost.* Difficulties arise as to whether this should be assessed on original cost or on the capitalised value of recent earning capacity. In New Zealand we have a rough compromise between the two. Allowance for depreciation and obsolescence is also a very difficult matter in compiling railway statistics.*

* Readers interested in pursuing this subject further are referred to the article by H. Valentine in Economic Record, June 1934, pages 50 to 80.

(b) *The seasonal nature of much of the traffic.*

Goods traffic is apt to be at a peak in the South Island in the harvest season; though in the distribution of imported goods from the ports the peak occurs just before Christmas. Christmas and Easter are responsible for the main peaks in passenger traffic; though school term holidays, race meetings, shows, international football events and the like also cause large peaks in passenger traffic.

The financial year ends on 31st March; with the result that some financial years include two Easter holiday periods, others none at all.

If the figures were compiled monthly there would be further disturbances owing to the varying lengths of the months and to the varying constitution even of months of the same length as regards the number of week-ends they contain. This difficulty is partly overcome by the use of 13 four-weekly periods; but this is not a perfect solution because there are always the odd days (2 days in leap years) after the 52 weeks are completed. For this reason, in order to have the four-weekly periods always ending on a Friday (except at the end of the financial year) the first and last periods of the financial year more often than not do not contain exactly 28 days.

CHAPTER IV

JUSTICE STATISTICS

1. SOURCES OF DATA.

The Census and Statistics Department's Annual Report on Justice Statistics contains the fullest annual data on the subject; Bankruptcy however being dealt with in the Department's Annual Miscellaneous Report.

"For the purpose of compiling statistics of justice, returns are collected by the Census and Statistics Department from Clerks of Magistrates' Courts, Registrars of Supreme Courts, and Gaolers and other officers in charge of prisons and State reformative institutions throughout the Dominion.

"Clerks of Magistrates' Courts furnish at the end of each quarter individual cards giving particulars of each criminal case dealt with during the quarter, together with a covering return giving a summary of the individual cards. A return of civil business is also supplied quarterly.

"Registrars of Supreme Courts supply quarterly returns of civil business, and annual returns of divorce business. For criminal cases in Supreme Courts the method adopted is to prepare individual cards in the Census and Statistics Office from the particulars contained in the returns sent in each session by the Registrars.

"At the end of the year Gaolers and other officers in charge of institutions under the control of the Prisons Department supply an individual card for each person received into the institution during the year, an individual card for each person in the institution at the end of the year, and a summary return of admissions and discharged." (Census and Statistics Dept.'s Report on Justice Statistics 1935, page v.) Persons on remand or awaiting trial are included in the returns, but are, of course, distinguished from prisoners serving sentences.

The Justice Department keeps a register of all inquests, and from this a table is compiled showing the findings of the coronial inquests.

The insolvency statistics are compiled from data supplied by Official Assignees and the Stamp Duties Dept.

The Monthly Abstract of Statistics contains monthly data regarding insolvency.

The New Zealand Official Year Book summarises the data.

2. PITFALLS.

The main pitfalls are:—

(a) Differences (either in place or in time) in the law creating, abolishing, and varying the nature of offences and the nature of civil remedies;

(b) Differences in the administration of the law; sometimes the magistracy and the police pay particular attention to checking certain types of offence, at other times to others. Dissatisfaction with a particular Official Assignee in a particular district may increase the proportion of private assignments to total insolvencies;

(c) Differences in the habits of the people—the motorisation of transport has greatly increased the number of traffic offences brought before the Courts;

(d) Differences in the age-constitution of the people and other factors affecting the incidence of crime, etc.;

(e) Differences in the number of the police*;

(f) Allowance must always be made for undetected crime.

(g) Multiple charges may cause confusion, the number of persons charged almost invariably being less than the total charges on account of the prevalence of such cases.

* For details as to Police Force see Parliamentary Paper H-16. Parliamentary Papers H-20, H-20A and H-20B deal with prisons and prisoners.

CHAPTER V

PRODUCTION AND CONSUMPTION STATISTICS

The term "production" is used here in its popular acceptation, i.e., as including such processes as the growing of crops, extraction of minerals, capture of fish, manufacturing, etc.—in economic phrase, the creation of "form utilities." It does not include various activities which are no less "productive" in a broad and strictly economic sense, such as (a) transportation, refrigeration, merchandising, etc., which add to commodities already worked up into form the further utilities of "place", "time" and "possession," and (b) personal and professional services, such as those of the hairdresser, teacher and the doctor not concerned with commodities at all, but representing, in economic language, the creation of "service utilities."

I. PRIMARY PRODUCTION

1. SOURCES OF DATA.

The New Zealand Official Gazette publishes each year estimates of the yields of wheat, oats and barley (February); of the areas sown in these crops and in potatoes (November); and of the existing stocks of wheat, flour, and oats (December).

The Monthly Abstract of Statistics usually publishes these data and other important annual information regarding farm production as the compilations are complete; as well as data for stocks of wool and grain-milling (about September), estimates of the season's lambing (about December), and particulars of eggs and egg-pulp in cool storage (at intervals throughout the year). Monthly data in the field of primary production that are published regularly in the Monthly Abstract include land transfers by districts (town and country separately), and mortgages registered and discharged (by districts).

Parliamentary Papers that have a bearing on primary production are:—

Subject	No.	Report Title
Lands	H-3	Report of Land Transfer and Deeds Registration Department.
	C-1A	Report on Surveys.
Crown Lands	C-1	Report on Settlement of Crown Lands.
	C-5	Report on Land for Settlements Act.
	C-9	Report on Discharged Soldiers' Settlement.
	C-14	Report on National Endowments.
Native Lands	G-9	Report on Native Land Courts, etc.
	G-3, 4	Accounts of East Coast Native Trust Lands.
	G-10	Report of Board of Native Affairs.
Agricultural and Pastoral Production	H-29	Report of Department of Agriculture.
	H-30	Report of Primary Products Marketing Department.
	H-23	Annual Sheep Returns.
	H-34	Report of Scientific and Industrial Research Department.
	B-13	Report of State Advances Office.
	B-14	Report of Rural Intermediate Credit Board.
Forestry	C-3	Report of State Forest Service.
Fisheries	H-15	Report of Marine Department.
	H-22	Report of Internal Affairs Department.
Mining	C-2	Mines Statement.
	C-2A	Report on State Coal-mines.
	C-12	Report on Kauri-gum Industry.
	H-34	Report of Scientific and Industrial Research Department.

A number of special Parliamentary Papers appearing in particular years also contained valuable statistical data, notably the Report of the Economic Committee (1932 B-3) and the Report of the Dairy Industry Commission (1934 H-30).

The Census and Statistics Department's Annual Report on Agricultural and Pastoral Production is published about the January following the production- (usually a March-) year to which it relates. This Report (up to 1920, Vol III. of the Statistics of New Zealand) provides annual statistics in great detail by counties and land districts. Commercial Forestation statistics are however to be found in the Census and Statistics Department's Miscellaneous Report; and Poultry Statistics in the appropriate Census volume.

The New Zealand Official Year Book covers the same ground in a condensed form and with a wider range of comparisons with previous years.

A special article by Messrs. E. J. Fawcett and W. N. Paton (of the New Zealand Department of Agriculture) on Live Stock Production appeared in the 1929 New Zealand Official Year Book.

The Economic Record has also contained a number of interesting articles of a statistical character on the economic position of the New Zealand farmer; e.g. J. B. Condliffe and H. R. Rodwell on the Course of Rural Land Values in New Zealand, 1914-25, May 1927, pp. 35-51; H. Belshaw on The Economic Position of the Farmer in New Zealand, May 1928, pages 53-70; and F. B. Stephens on Some Problems of Dairy Marketing, October 1932, pages 133-147.

Much valuable information is also contained in Agricultural Organisation in New Zealand, by H. Belshaw and others, published by the Institute of Pacific Relations, as well as in the Annual Reports of the various export control boards.

2. COMPILATION OF INDEX NUMBERS.

The method is similar to that employed in connection with oversea trade:—

Index Number for Gross Value of Farming Income (1934-35 on base 1928-29)

$$= \frac{\text{1934-35 Value} \times 100}{\text{1928-29 Value}}$$

$$= \frac{47.9}{66.7} \times 100$$

$$= 72$$

Index Number for Volume of Production* (1934-35 on base 1928-29)

$$= \frac{\text{1934-35 amounts at 1928-29 Prices} \times 100}{\text{1928-29 amounts at 1928-29 Prices}}$$

$$= \frac{\text{1934-35 amounts at 1928-29 Prices} \times 100}{\text{1928-29 Values}}$$

$$= \frac{80.7}{66.7} \times 100$$

$$= 121$$

Index Number for Prices of Farm Products (1934-35 on base 1928-29)

$$= \frac{\text{Index No. for Value of Gross Farming Income} \times 100}{\text{Index No. for Volume of Production}}$$

$$= 100 \times \frac{72}{121}$$

$$= 59$$

(For method see page 33.)

(For the Index Number of Farm Expenditure see Chapter VII.)

* Where the total does not consist of quantities expressed in homogeneous units that may be simply summed.

3. SHORTCOMINGS.

(a) Agricultural statistics do not always satisfy the desideratum of homogeneity. Though units of acreage and live-stock are alike there is much variation in the true significance of an acre of wheat from place to place and from season to season. Sheep too may differ considerably according as they are bred for wool or for meat.

The same remarks apply to statistics of mineral products and of fisheries. One of the most serious shortcomings of ordinary fisheries statistics arises from the fact that common names of fishes are apt to be differently applied in different places Thus the kingfish of Dunedin is the hake of Wellington, and the lemonfish of Auckland; while the kingfish of the North Island is identical with the kingfish of European waters, and is not found in the South Island. Any satisfactory statistic of fisheries would require to be compiled in such a way that the correct scientific names are employed, together with a note as to the names by which the fish are commonly known in various parts.

(b) The N.Z. statistics of fisheries and mining have in the past been rather inadequate. In the United States and even in Australia more elaborate statistics of fisheries are collected and tabulated, the principal heads of enquiry being:—

(i) Location of Fishing Grounds.
(ii) Port of Landing.
(iii) Nationality of Fishing Vessel.
(iv) Nature of Motive Power of Vessel.
(v) Method of catching (Nature of Apparatus).
(vi) Weight of catch of each variety of fish.
(vii) Value of catch of each variety of fish.

These are tabulated in various combinations. Particulars are also collected by regions of the number and value, and nature of motive-power of fishing vessels; number and value of pieces of apparatus; number, value and locality of production of by-products. Saltings, curings, and freezings are also separately shown.

(c) In the farm statistics such terms as "holdings" have a technical significance, the mention of which in the Year Book should be noted. A "holding" consists of any area of land 1 acre or over in extent situated outside borough boundaries. Small areas complying with the foregoing requirements but used exclusively for residential, ornamental, or pleasure purposes, are not regarded as holdings unless they depastured live-stock on 31st January. Lands held by Maoris on the communal system, as well as unoccupied Crown land, are not enumerated.

Two or more holdings carried on independently of each other by the same occupier are treated as separate holdings. If worked in conjunction, however, they are treated as one holding. Where a holding is situated in two or more counties, the practice is to return the holding in the country in which the homestead is situated. Counties lying partly in two land districts are included in the land district containing the greater number of occupied holdings and of live-stock.*

(d) Notice the Year Book reference to the treatment of products consumed on the farm; also the treatment of sacks and containers. Other countries may settle this practical statistical problem in a different manner.

(e) The terms "agricultural", "pastoral" and "farming" are all somewhat ambiguous, and are used in different senses by different statistical administrations and even by the same statistical administration in different connections.

II. MANUFACTURING & BUILDING PRODUCTION

The statistics of manufacturing production present an annual balance sheet of each major industry of the Dominion; so that the individual manufacturer, knowing his own position (which is of course not disclosed in the published statistics), will be able to see in what directions he is above or/and in what directions below the average. For example, if one manufacturer finds that the percentage of labour cost to the value of the product is higher in his factory than in the average of businesses of the same class, he has prima facie evidence that he is not using his labour to the best advantage, and that he should look to improving his organisation. Again, the statistics suggest which industries afford the best prospects of expansion with profit to the Dominion.

1. SOURCES OF DATA.

The Monthly Abstract of Statistics publishes a summary of the main results of each production year's collection of manufacturing and building statistics as the compilations are completed—usually about the September to December issues. Monthly statistics of new buildings in 21 major towns (with suburbs) also appear in the Monthly Abstract.

The New Zealand Official Year Book gives rather more detailed results, with a wealth of comparison with back years.

The Census and Statistics Department's Annual Report on Factory Production contains the full tabulation of the results of each year's enquiry.

* See Census and Statistics Department's 1935-36 Report on Agricultural and Pastoral Production, page vi.

The Annual Report of the Department of Scientific and Industrial Research (*Parliamentary Paper* H-34) and

The Annual Report of the Department of Industries and Commerce (*Parliamentary Paper H-44*) give particulars of recent developments in their respective provinces.

The Public Works Statement (*Parliamentary Paper D-1*) deals exhaustively with electric power generation.

2. COMPILATION OF INDEX NUMBERS.

The method is similar to that used in connection with farm production, but—

(a) The base is not 1928-29 but the average of the factory years 1925-26 to 1929-30; and

(b) There are 21 separate groups of manufacturing industries for which data are compiled.

Corresponding to the index number of farm expenditure there is an index number of the prices of the principal materials used in factory production.

Corresponding to the index number of volume of farm production there is an index number of the volume of factory production.

3. SHORTCOMINGS.

(a) The term "factory" has a somewhat arbitrary definition for purposes of these statistics, and it has not always been the same in New Zealand, while other countries at the present time define their term differently.

(b) Data for certain industries are suppressed to avoid giving away confidential information. (The suppressed data are however always included in any relevant totals.)

(c) Such statistics are liable to vitiation by changes in the value of money, and difficulty in finding a constant measure. But the index numbers of factory production first computed in 1937 now overcome this difficulty.

(d) The monthly statistics of building activity in the 21 main centres (with suburbs) relate to the months in which the permits are granted. There is often a lag in the actual start of construction.

(e) Note the ambiguity in the term "manufacturing production", not only from the point of view of whether the processing of primary products is to be regarded as a manufacture but also by reason of the distinction between value of products—sometimes called "gross production"—and added value—sometimes called "net production."

(f) Other warning notes are sounded in the relevant Year Book section.

III. TOTAL PRODUCTION

1. SOURCES OF DATA.

The New Zealand Official Year Book, Miscellaneous Section, provides data in this connection.

The Monthly Abstract of Statistics publishes the yearly estimates when the compilation is complete—usually about the January following the factory year to which they relate.

2. COMPILATION OF INDEX NUMBERS.

Index No. of Value of Production (for 1934-35 on base 1928-29 = 1000)

$$= \frac{1000 \times \text{Value of 1934-35 Production}}{\text{Value of 1928-29 Production}}$$

$$= 1000 \times \frac{97.0}{126.6} = 766$$

Index No. of Volume of Production

$$= \frac{1000 \times \text{Index No. of Value of Production}}{\text{Index No. of Production Prices}}$$

$$= 1000 \times \frac{766}{739} = 1037$$

The per capita index numbers are arrived at by dividing by June year mean population in the initial calculations.

The field covered by total production is the same field as is covered by the export price index, plus the locally produced (and consumed) grouping of the wholesale price index. Hence the combination of these two price indexes for June years in due proportion in order to make the necessary correction.

Note that the prices for this investigation are taken in the main marketing centres—rather than on rail at country stations and the like, as in subsection I of this chapter.

IV. TOTAL CONSUMPTION

1. SOURCES OF DATA.

The New Zealand Official Year Book gives annual data in this connection.

2. CAUTIONS.

(a) Consumption = Imports + Local Production − Exports.

Allowances should be made in all very accurate work for changes in carry-overs where necessary—see the wheat and flour estimates (Year Book, Agricultural Production Section) and the wool estimates (Year Book, Pastoral Production Section).

(b) Note also the ambiguity in the term consumption. Total Consumption = Household Consumption + Industrial Consumption.

3. COMPILATION OF INDEX NUMBERS.

Index Numbers of Value of Goods Available for use (base 1926 = 100) are computed on the basis of the above as follows:—

$$100 \times \frac{\text{Value of Goods Available for use in 1934-35}}{\text{Value of Goods Available for use in 1925-26}}$$

$$= 100 \times \frac{88.3}{116.6} = 76$$

The Index Number of the Volume of Goods Available for use in 1934-35 (1926-27 = 100) is computed as 10,000 times:—

$$\frac{\text{1934-5 Value of Retained Production}}{\text{1934-5 Index of Prices of Retained Products*}} + \frac{\text{1934-5 Value of Imports}}{\text{1934 Index of Import Prices**}}$$

$$\text{1926-7 Value of Retained Production} + \text{1926-7 Value of Imported Commodities.}$$

$$= 10000 \times \frac{\frac{54}{86} + \frac{34.3}{76}}{65.1 + 47.3}$$

$$= 100 \times \frac{63 + 45.1}{112.4} = 100 \times \frac{108.1}{112.4}$$

$$= 96.$$

* = on base 1926-27 = 100; ** = on base 1926 = 100.

CHAPTER VI

FINANCE STATISTICS

I. PUBLIC FINANCE

1. SOURCES OF DATA.

The Monthly Abstract of Statistics gives the latest monthly data regarding public works expenditure and employees, consolidated fund revenue and expenditure, sales tax collections, stamp duties department revenue, totalisator investments, etc. The more important annual data for local bodies finance, public debt, etc., are published on the last page of the Abstract when the compilations are complete.

The New Zealand Official Year Book gives the main annual data, with past comparisons and comments.

The Local Authorities Handbook, published annually by the Census and Statistics Department about 15 months after the close of the March years to which the data relate, gives the fullest information regarding local body finance and district valuations.

Up to and including 1920-21 these data appeared in Vol. IV of the Statistics of New Zealand, from 1921-22 to 1923-24 in the Annual Statistical Report on Local Government (and as regards boroughs also in the Municipal Handbook, which appeared biennially prior to the middle twenties).

Parliamentary Papers dealing with public finance are many; the principal annual papers being:—

Subject	No.	Title of Report
Public Finance	B-1	Public Accounts.*
	B-2	Report and Accounts of Public Debt Commission.
	B-6	Financial Statement ("Budget").
	B-7	Appropriations chargeable on Consolidated Fund and other Accounts.
	B-7A	Appropriations chargeable on Public Works Fund.
	B-10	Public Securities held.
	D-1	Public Works Statement.
State Advances	B-13	Report of State Advances Office.
	B-14	Report of Rural Intermediate Credit Board.
Pensions	H-18	Report of Pensions Department.
Superannuation	H-26	Report of Public Service Superannuation Board.
	E-8	Report on Teachers' Superannuation Fund.
	D-5	Report on Government Railway Superannuation Fund.
National Provident Fund	H-17	Report of National Provident Fund Board.
Local Bodies	H-22	Report of Internal Affairs Department.
State Employees	H-14	Report of Public Service Commissioners.

* Quarterly figures in summary form are also gazetted.

Prior to 1921 the contents of many of these papers were reproduced in Vol. III of the Statistics of New Zealand.

2. PITFALLS.

As far as they go, the data are excellent. This is largely because the arrangement of accounts in such a way as to be easily audited and supervised lends itself to statistical purposes.

The following pitfalls must however be guarded against:—

(a) There is current a widespread belief that statistics based on accounts are from the very nature of the case more likely to be accurate than statistics not so based. When it is remembered however that no two accountants would make the same allowance for depreciation, etc. in connection with the same business, it will be realised that the apparent accuracy of statistics based on accounts is really at least in part illusory.

(b) Moreover, the dangers of compilation and interpretation are by no means negligible. Difficulties of classification are numerous; in particular the dividing line between revenue from services and from taxation is often very hazy. In New Zealand many of our Stamp Duties are paid through the purchase of adhesive stamps at the Post Office, and there was a long standing dispute between the two Departments concerned as to what proportion of the revenue of the Post Office should be passed to the credit of the Stamp Duties Department.

(c) Again, difficulties of interpretation exist through revenue being in some cases given net, while in other cases gross revenue and gross expenditure are both given, thus rendering comparisons risky.

The distinction is hazy between "productive" and other classes of debt and certain loans have been raised for dual purposes, partly "productive" and partly not. The simultaneous conversion of a number of different loans also creates difficult problems when it is sought to analyse the present indebtedness according to the purpose for which it was incurred.

(d) As regards the taxation figures and the figures for the income and expenditure of the Government care must be taken not to overlook that special emergency taxation and expenditure is often segregated in a special account; the contents of which must be added to the Consolidated Fund figures. This of course is always done by the Census and Statistics Department when compiling total taxation data.

(e) Note the ambiguity in the term "public debt". It may relate to the debt of the general government only or to that of the general government plus that of the local authorities. There is a similar ambiguity in the term "taxation".

(f) In estimating the total amount of "public debt" it might at first sight appear correct to add the indebtedness of the General Government to that of local bodies. Much money is however borrowed by the General Government to be subsequently lent out to local bodies, and the above procedure would count this twice over. To arrive at a correct figure for public indebtedness it is therefore necessary to add to the debt of the General Government only the debt of local bodies other than amounts borrowed from the General Government.

(g) Care must be taken to add net indebtedness to net indebtedness, and gross to gross. Only thus can homogeneous totals be arrived at.

(h) Public indebtedness is by no means a homogeneous thing from country to country. A finger of scorn is often pointed at New Zealand as a country having an extravagant public debt for its size. But it must not be overlooked that bulking largely in our public debt figures are amounts that would in other countries appear as the capital of railway companies, etc., while the debt on account of State Advances in New Zealand corresponds to certain items in the balance sheets of certain types of banks in other countries. International comparisons are thus seen to be particularly dangerous in this field.

(i) Public Debt expressed in New Zealand and Australian pounds is added to Public Debt expressed in sterling. For most purposes this is an unjustifiable procedure.

The often misleading nature of the form in which the New Zealand Public Accounts are given is stressed by L. W. Holt in Economic Record, June 1933, pages 115-121; and in further notes at approximately annual intervals in later issues thereof.

II. PRIVATE FINANCE

1. SOURCES OF DATA.

The Monthly Abstract of Statistics gives the essentials of the latest monthly data regarding totalisator investments, land transfers, mortgages registered and discharged, deposits with building and investment societies and banking companies (quarterly), savings banks, trading banks and reserve bank (weekly*), radio licences, motor vehicle licences, insolvency, and estates certified for stamp duty.

The New Zealand Official Year Book gives comparative annual figures, with appropriate comment.

* These also appear weekly in the *New Zealand Gazette*.

Parliamentary Papers that deal with Private Finance are numerous; the most important being:—

Subject	No.	Title of Report
Banking	B-15	Balance Sheet of Bank of New Zealand.
	B-16	Report of the Reserve Bank of N.Z.
	F-1	Report of Post and Telegraph Dept.
Insurance	H-8	Report of Government Insurance Commissioner.
	H-6, 6A	Report of State Fire Insurance Office.
	H-12	Report on Fire Brigades.
Friendly Societies	H-1	Report of Registrar of Friendly Societies.

The Census and Statistics Department's Annual Report on Insurance Statistics gives the most detailed annual figures in all branches of insurance and assurance, except marine insurance, on which there are no data. Prior to 1921 life assurance data were published in Vol. IV of the Statistics of N.Z.

The Census and Statistics Department's Miscellaneous Annual Report deals with banking, building societies, incomes, bankruptcy and commercial afforestation. Prior to 1921 such of these data as were then published appeared in Vol. III of the Statistics of New Zealand.

The Census Results frequently give data on particular financial inquiries that are best conducted through the census; e.g. life insurance in 1921; incomes in 1926 and 1936.

2. SHORTCOMINGS OF THE PRIVATE WEALTH STATISTICS.

(a) The term is ambiguous.

The aggregate Private Wealth of any community constituting a nation together with its corporate possessions, may be called its National Wealth.

In regard to ownership, the wealth of any country may mean several things: viz. either (a) the wealth owned by the people domiciled therein, (i) the corpus itself being within the country; or (ii) without that restriction; and (b) the wealth within the country irrespective of the domicile of the owner. It is (a) that is of interest when questions of taxation, etc. are of importance; it is (b) that is prominent when what is at issue is the inalienable wealth of the country in the geographical sense (for purposes of war, etc.). A Dominion capitalised from the Home Country may be poor judged by the wealth of its inhabitants, but rich in its resources and the actual yield within its borders.

The term Private Wealth is used in contradistinction to Public or Semi-Public Wealth. It would cover all that wealth the

proprietorship of which resides in individuals in their *private* capacity, and is not vested in the General or Local Government. It would include (i) wealth under the direct control of the individual proprietors thereof; (ii) wealth administered in trust or by delegation in the interest of individual proprietors; (iii) wealth which by the intermediary of shares, debentures, stock, mortgages, etc. is allocated directly or indirectly, wholly or in part to individual proprietors; and (iv) wealth such as the property of clubs, churches, etc, which is collectively owned by groups of private persons without any specific allocation to individual proprietors —"social private wealth".

If (a) (ii) be adopted the National Wealth may be defined as "the sum total of the exchangeable and transferable possessions of the inhabitants of a country (whether individual or corporate) held, including their foreign possessions and excluding the wealth within the country held by foreigners."*

Government Debentures and Stock held locally are part of the private wealth of a country, but in assessing the national wealth they are usually not counted—as being cancelled out by the corresponding debt on the part of the State.

The New Zealand estimate described in (b) below conforms however to the (b) definition of the second paragraph of this subsection.**

(b) "The Probate Return", "Devolution Rate", or "Succession Method" is the method adopted in New Zealand. The fundamental principle involved is that the aggregate wealth of persons dying during any period constitutes a "fair sample" of that of the living. The principle of the method might be thus stated:—

(i) Assuming that at each age the wealth of those dying fairly represents that possessed by the living at the same age, the ratio at that age of the living to the dying is to be multiplied into the aggregate wealth possessed by those dying, thus arriving at the wealth of the living.

(ii) The wealth possessed by the sexes should be estimated separately in order to secure precision in the results, since the sexes differ both as to mortality rate and as to wealth possessed.

(iii) If the incidence of death varies as between different classes of either sex at any age, the wealth of these classes should, if possible, be estimated separately, e.g. there is reason to believe the death rate is lower for the wealthy.

* Carr-Saunders & Jones, Social Structure of England and Wales, page 105.

** Death Duties Act, 1921, Sections 3 and 5.

(iv) As far as possible the effects of all circumstances tending to produce a systematic difference in the average wealth possessed at any age as between the living and the dying at that age (e.g., life insurance and marriage settlements) should be evaluated and allowed for in order to secure accurate results. Estimates of aggregate wealth are in defect whenever wealth passes without record, and to secure complete accuracy the circumstances of marriage settlements and other gifts "inter vivos" should be known as regards the amounts and the ages of donors and donees so as to ascertain the proportion passing in a unit of time. As far as marriage settlements are concerned, the rate of passing is obviously appreciably greater than the passing of wealth by the death of its possessor.

(v) To eliminate the effect of the irregular appearance of large estates in the returns, a triennial, quinquennial or better still a decennial average should be struck.

At the present time there is no adequate estimate of wealth based on succession estimates owing to the difficulties of allowing for settlements, life assurance, etc. Moreover, estimates of wealth for probate are always likely to be in defect for obvious reasons.

(c) The possibilities of the inventory method hinge largely on the existence of valuations of various kinds, e.g. plant and machinery engaged in industries, etc. Further, in certain items direct valuation is not possible, and estimates based on general knowledge and indirect data must be employed, e.g. valuations of clothing based on the known number of persons and an assumed value per head, valuations of furniture based on the number of houses of various sizes or of various rental values.

This method possesses the following advantages:—

(i) It is cheap, and data can be compiled at relatively short intervals.

(ii) Unlike the succession method, it relates approximately to a definite point of time.

(iii) This method furnishes most readily a comprehensive view of the various classes of wealth constituting the aggregate.

(iv) It enables a fair idea to be obtained of the degree of uncertainty involved in each item.

On the other hand:—

(i) The method furnishes no means of classifying the wealth according to the size of the estates involved

(ii) It does not furnish any facilities for a detailed comparison of assets and income in individual cases.

(iii) Its employment presupposes the existence of suitable valuations.

(iv) The personal equation of the compiler is not without influence.

In New Zealand the use of this method is confined to the estimates of *public* wealth; in Australia it is used throughout.

(d) It is difficult to have an estimate relating to a particular point of time by any of the methods just discussed. A census of wealth (such as was held in 1915 in Australia) overcomes this difficulty. Australian net assets of non-residents were included. Note the following advantages of the Census Method:—

(i) Particulars are obtainable of the number and amount of estates at any given size; and, by including provision for a record of income on the Census form, valuable information concerning the relation of wealth to income under various circumstances is obtainable with a minimum of labour.

(ii) The information being furnished in each case by the owner, the labour of valuation is widely distributed and is borne by the person most intimately in touch with the requisite data.

(iii) The estimate relates to a definite point of time.

Disadvantages however also exist:—

(i) The results are costly to tabulate and compile.

(ii) The extreme sensitiveness of many members of the community as regards their wealth renders inapplicable the ordinary census method of collecting schedules, and special machinery requires to be devised for the collection, thus increasing the expense and delaying the results.

(iii) Fear of subsequent taxation conduces to understatement.

(e) Any estimate is at best nothing more than a rough approximation.

(f) Valuation of businesses presents difficulty when the future of taxation is highly uncertain. Is one to capitalise present earnings accruing to the owner of a business or the earnings one imagines he will receive after the repeal of a special emergency tax?

(g) Change in the wealth statistics may be due to the emergence of wealth not susceptible of money measurement into a category that can so be measured (e.g. a Company formed to acquire rights in the work of a great inventor with a capital of £10,000; where previously there was but an annual income of £1000 from his talent).

(h) Goods which provide an income of enjoyment or use rather than of money—e.g. jewellery—present a serious difficulty. Should we assess them at the present shop value of their equivalents, or keep to the figure representing their original cost?

(i) Changes in the amount of national wealth may be masked or exaggerated by secular price changes.

3. SHORTCOMINGS OF INCOME STATISTICS.

(a) Note the ambiguity of the "National Income"*. It is generally understood as meaning the aggregate of the incomes of the members of a nation; the incomes arising locally in favour of denizens of other countries being as a rule excluded and the incomes arising abroad and payable to inhabitants of the country under investigation being included.** But there is no entirely uniform practice in this matter. The term "National Income" includes such diverse quantities as £4 received as a week's wages by a ploughman and the same sum received for a short consultation by a medical specialist, and whether any homogeneity of measurement can exist in such diverse cases is open to question. This does not end the difficulties of the matter. It can be argued that redistribution payments (such as what is taken from taxpayers and paid to Government pensioners) should be excluded as they do not represent in the hands of the final recipients a quid pro quo for *current* services: others reason differently. Many consider the rental value of houses occupied by the owners should be regarded as part of their incomes; and if allowance is made for this the value of the unpaid domestic services of wives and daughters should, it is often argued, also be assessed. Certainly, when one begins to make allowance for all cases of unpaid services, difficulties crop up; and many prefer to confine the conception of income to paid services plus an allowance for the value of services partly rewarded in kind (e.g. free housing for farm workers). When the estimates are so confined, however, it is possible for a fictitious increase in national income to be recorded as a result of changes in social habits and practices increasing the volume of services paid for in money in the face of no actual increase in the services, e.g. a farmwife buying instead of making bread and spending the time saved on rearing extra eggs and poultry for the market.

(b) The limitations of the employment charge returns method adopted in New Zealand, and the need for educated guesses to cover gaps in the data, are fully discussed in the New

* See for example Sir Josiah Stamp, Journal of Royal Statistical Society, 1934, pp. 423-466, 541-557; here the New Zealand estimates are specifically referred to.

** See for example Employment Promotion Act, 1936, Section 17.

Zealand Official Year Book. The inducements for taxpayers to understate their incomes are moreover considerable.

(c) The limitations of the income tax return plus census enquiry method are:—

(i) In order to prevent the inquiry seeming unduly inquisitorial, the mesh of income classes in which people are asked to classify themselves is made fairly wide; and there is room for a considerable margin of error in assuming—as was done in 1926—that all cases within each class are equal to the mid-value of the class. Such an assumption actually does violence to every known formula of income distribution.

(ii) There are always a fair number of unspecified cases in the census returns. It may be seriously in error to allocate these cases between the various classes in proportion to the numbers already in those classes.

(iii) It has not always been found possible to have the lower limit of the income tax correspond to the limit of any of the census categories; with the result that some overlapping has occurred, requiring more or less arbitrary treatment.

(iv) Owing to various exemptions (e.g. company dividends, income from tax-free bonds, most farm incomes), the income tax data used for the higher incomes contain certain gaps which have to be filled by educated guesses. Moreover the dividing line between allowable deductions of expenses incurred in earning income and non-allowable deductions is more or less arbitrary and the matter has not been uniformly decided always and everywhere. (See article by Prof. A. G. B. Fisher in Economic Record, Nov. 1930, pp. 221-234; also article by F. B. Stephens, ibidem, Dec. 1936, pp. 231-256).

(v) The informants are apt to err in the direction of understatement because they fear taxation or other burdens, though actually the Department is punctilious in observing the statutory injunction not to divulge particulars of individual census returns.

CHAPTER VII

INDUSTRIAL STATISTICS

I. STATISTICS OF PRICES, WAGES, AND HOURS OF LABOUR.

1 SOURCES OF DATA

The Monthly Abstract of Statistics gives the latest monthly and annual figures for each group of retail prices, for wholesale prices (separating also imported and locally produced), for export prices (pastoral and total), for share prices, for adult male wages, for farm expenditure (annual only), and for import prices (annual only), as far as possible not only in relation to the base period, but also in relation to 1909-13, to 1914, to 1926, and to the corresponding period of the previous year. The latest retail price indexes are also given by groups for each main centre separately on base 1926-30; and for 25 centres in respect of the three food groups and rent. The latest export price and wholesale price indexes are given by groups for the Dominion as a whole on base 1909-13.

The New Zealand Official Year Book is mostly concerned with annual data but gives useful explanatory matter; as well as many index numbers not mentioned in the Monthly Abstract.

In an appendix to the 1919 Year Book will be found the results of an interesting investigation into New Zealand wage rates from the pen of Mr. G. W. Clinkard, M.Com.

The Report on Prices, etc., published annually by the Census and Statistics Department, gives the fullest details of all (notably monthly as well as annual). Actual price quotations are now however confined to the four main centres' retail prices for food items and rent; the quotations for other groups and the wholesale price quotations being dropped for reasons of economy after the 1930 issue.

The Cost of Living in New Zealand—an Inquiry into Retail Prices, 1891-1914 and *Prices*, 1891-1919*, published by the Census and Statistics Department, are the fullest sources of information

* These were not the first investigations into Prices in New Zealand. The pioneer in the field of wholesale prices in N.Z. was Dr. James W.

as to methods, and also as to actual price quotations. But they are not up to date; inasmuch as since the last of them were published, Clothing and Miscellaneous Groups have been added to the retail prices investigation; and all the other price indexes have been even more drastically revised at least once. These revisions are described in the following publications:—

	Report on Prices	Year Book
Wholesale Prices ..	1925	1927
Retail Prices	1930	1932
Export Prices	1925 & 1931	1926 & 1933
Farm Expenditure ..	..	1932
Share Prices	1932	1933
Import Prices	1933	1935
Wages	1930 & 1935	1930
Hours of Labour ..	..	1931 & 1938

Revisions of the details of the retail price index number have usually been preceded by a household budget inquiry. Booklets are distributed through various channels to householders, who are requested to enter details of their expenditure for several months. It is difficult for householders to keep such records for a full year; but one disadvantage of a shorter period is that owing to seasonal fluctuations in expenditure a typical figure for the year may not be achieved. Another reason why the results so secured may not be typical is that not every householder is of a temperament such that he can be persuaded to keep the necessary records. Different households are differently constituted as regards age, sex composition, presence or not of lodgers, etc., and it is mostly households constituted in such a way that the householder has a fair amount of leisure that are likely to supply the returns. As an inducement to householders to complete these records with accuracy and neatness, prizes are offered for the most carefully compiled booklets.

The 1891-1919 Special Report on Prices mentioned at the foot of page 64 contained details of the New Zealand household budget inquiries up till that date. The 1930 inquiry is described in the 1931 Year Book, pages 793-795; more fully in the 1929 Miscellaneous Statistical Report, pages xi-xvi. A further investigation was commenced in 1936 by the newly-formed Bureau of Social Science.

McIlwraith. His researches were published by the New Zealand Government Printer in 1911 under the caption "The Course of Prices in New Zealand." Dr. McIlwraith was concerned only with wholesale prices, and the range of commodities covered by him was somewhat circumscribed as compared with what the Government Statistician—with compulsory powers—could secure. The Census and Statistics Department in its first full investigation into retail prices relied largely upon "Inqury into the Cost of Living in New Zealand, 1910-11" prepared by the N.Z. Dept. of Labour. The results of an earlier official attempt to investigate changes in wages and retail prices in N.Z. are to be found on page 540 of the 1903 Year Book

2. TECHNIQUE OF COMPILATION.

With certain almost negligible exceptions the method adopted throughout is the aggregate expenditure method; of which an example is given below.

The exceptions are:—

(1) most of the sub-groups of the clothing and miscellaneous groups of the retail price index are dealt with on the basis of the geometric average of price ratios. (See footnote (4) on page 70).

(2) in the case of the export price index the "mass-units" (or weights) are not constant but are changed annually. (See the full discussion of these points on pages 77 to 80).

The following hypothetical computations for Group II of the Retail Price Index and Group IVD of the Wholesale Price Index indicate the method. (Most calculating machines multiply better than they divide. Instead, therefore, of dividing the aggregate expenditure for the period under investigation by the base year's aggregate expenditure, the aggregate expenditure for the period under investigation is multiplied by the reciprocal of the base year's aggregate expenditure.)

It will be clear from the wholesale price index example how the data for the class indexes (by uses) and for imported commodities are secured incidentally to the compilation of the group price-indexes.

The asterisks indicate the actual computations.

RETAIL PRICE INQUIRY.
GROUP II—DAIRY PRODUCE.

Town: Christchurch* Year: 1934* Month: Annual Average*

Article	Unit of Quantity	Weight	Av. Price (in d.)	Total Expenditure
Milk	Quart	1120	4.2*	4704*
Bacon (shoulder) ..	lb.	40	10.5*	420*
Bacon (middle cut) ..	,,	110	12.5*	1375*
Bacon (ham)	,,	60	13.5*	810*
Butter	,,	500	9.6*	4800*
Cheese	,,	120	7.2*	864*
Eggs	Dozen	100	14.4*	1440*

Aggregate Expenditure	14413*
Base Aggregate Expenditure	23560.37
Reciprocal of Base Aggregate Expenditure	.000042444155
Index number for Group	612*

WHOLESALE PRICE INQUIRY.

GROUP IV D—OTHER MANUFACTURED ANIMAL FOODSTUFFS AND GROCERIES.

Year: 1930* Quarter or Month } Annual Average*

Commodity	Unit of Quantity	PRICE (IN PENCE)				Average of 4 Centres	Weight	EXPENDITURE		
		Auckd.	Welling.	Chch.	Dunedin			Class 1	Class 2	Total
Butter	lb.	15.3*	15.5*	15.5*	15.7*	15.5*	21400	331700*	xxxx	331700*
Cheese	lb.	8.8*	8.0*	8.8*	9.7*	8.8*	4300	37840*	xxxx	37840*
Candles	lb.	8.5*	8.5*	8.5*	8.5*	8.5*	4000	xxxx	34000*	34000*
Soap	ton	7057.0*	6260.0*	6127.0*	8817.0*	7065.2*	10	xxxx	70652*	70652*
Herrings	dz. lb.	100.2*	100.2*	99.8*	104.5*	101.2*	85	8602*	xxxx	(8602)*
Salmon	dz. lb.	114.0*	143.0*	127.0*	130.2*	128.6*	85	10931*	xxxx	(10931)*
Sardines	dz. ½lb.	100.0*	97.2*	94.2*	103.2*	98.7*	85	8390*	xxxx	(8390)*
						Aggregate Expenditure		397463*	104652*	502115*
						Base Aggregate Expenditure			390694	
					1000 times Reciprocal of	Base Aggregate Expenditure			.002559471	
						Index number for group			= 1285*	
						Total Aggregate Expenditure imported items			(27923)*	

Fuller details of the compilations are set forth in the accompanying table:—

Name of Index	Point at which quotations taken	No. of Towns	No. of Commodities	No. of Sub-Groups	Frequency of Collection & Compilation	Base Year for Prices etc.	Weighting within Groups Based On	Weighting as Between Groups Based On
Retail Prices.								
Groceries	Retail Shops	25	29	3(1)	Monthly (1)	1926-30	Household Consumption	Budgetary Studies
Dairy Produce	„ „	25	7	0	„	„	„	„
Meat	„ „	25	22	0	„			
Three Food Groups	„ „	25	58	3	„		„	
Rent	Hse. Owners & Agents	25	3	0	Feb'ary (2) & August	„	„	
Fuel and Light	Retail Shops	4	7	0	Monthly	„	„	
Clothing	„ „	4	About 60	8(3)	Quarterly	„ (4)	„ (4)	
Miscellaneous	„ „	4	„ 85	9(3)	„	„ (4)	„ (4)	
All Groups			„ 210		Monthly			
Wholesale Prices.								
Foodstuffs of Vegetable Origin	Merchants (5)	4	49	4	Monthly (5)	1909-13	Household + Industrial Consumption	(6)
Textile Manufactures	„	4	17	0	„	„	„	„
Wood and Wood Products	„	4	16	0	„	„	„	„
Animal Products	„	4	31	4	„	„	„	„
Metals and their Products	„	4	14	0	„	„	„	„
Non-Metallic Minerals & their Products	„	4	25	3	„	„	„	„
Chemicals and Manures	„	4	25	0				
All Groups	„	4	177(7)	7	„	„	„	„

Imported Wholesale Commodities	„	4	113	0	„	„	„	„
Wholesale Import Prices.	Exporting Country	..	220	0	Yearly	1926	Imports	„
Export Prices	N.Z. Export Statistics	All N.Z.	34	7	Monthly	1909-13	Exports of last 5 June years	Exports of last 5 June years
Share Prices	N.Z. Stock Exchange Records	..	49	10	Monthly	1926	No. of Shares held in N.Z.	No. of Shares held in N.Z.
Farm Expenditure	As Wholesale Price Index	4	17	0	Yearly	1914	Farm Budgetary Studies and Records of Dept. of Agriculture.	
Wages.								
Nominal (Adult Male)	Awards (8)	4	217	14	Quarterly	1926-30	Census and Factory Production Statistics (9)	
Nominal (Juvenile Male)	„	4	33	12	Yearly	„	„	
Nominal (Adult Female)	„	4	15	4	„	„	„	
Nominal (Juvenile Female)	„	4	5	3	„	„	„	
Effective (Adult Male)	„	4	..	14	„	„	„	
Hours of Labour.								
Male Adult	„	4	217	14	„	1926-30	„	
Female Adult	„	4	15	5	„	„	„	

For footnotes see pages 70 and 71.

(1) Index Numbers for sub-groups published annually only.

(2) Annual indexes are computed thus: $\frac{3}{8}$ (Feb. figure) + $\frac{1}{2}$ (Aug. figure) + $\frac{1}{8}$ (next Feb.'s figure).

(3) Sub-groups index numbers used in computation of data are not published.

(4) In connection with the items covered by the "clothing" and "miscellaneous" groups, except in the case of train and tram fares (for which the aggregate expenditure method is adopted), no information is procurable which would enable individual weights to be allotted to each item within each sub-group; but by "selective balancing" (i.e. by including a range of qualities of articles of major importance) and by arranging these items in representative subgroups a measure of weighting is secured, each subgroup being treated as a separate unit. Weights are however allotted to the subgroups on the results of the budget collection undertaken by the Census and Statistics Department during 1930.

In order to facilitate the dropping of obsolescent items and the inclusion of new items (particularly in the clothing group, subject as it is to such marked vagaries of fashion), the initial computations of price ratios are based on prices in the year immediately preceding the collection of the data, the group averages being in turn linked to the 1926-30 base.

The method can be illustrated from the following example:—

RETAIL PRICE GROUP VI (g) POSTAGES & TELEGRAMS.

Service	Price in Pence in Base Period	Price in Pence in Year x	Price in Pence in Year x-1	Ratio of Two Preceding Columns
Postage on 1 oz. Letter	1	2	1	2.000
12-word inland ordinary telegram	9	12	9	1.333

Geometric Mean of Price Ratios (x to x —1) = $\sqrt{2.000 \times 1.333}$

Log (Geometric Mean of Price Ratios) = $\frac{1}{2}$ (log 2 + log. 1.333)

= $\frac{1}{2}$ (.3010 + .1249) (from log table)

= .2129

Therefore Geometric Mean of Price Ratios = 1.633 (from antilog table).

As prices were identical in base period and in year x-1, this mean can be reduced to base period by multiplying by unity. Had however prices in year x-1 been 1.5 times prices in the base period, the index number for year x would have been not 1633 but 1633 x 1.5. (Had there been n price ratios instead of 2, we should have taken $\frac{1}{n}$, not $\frac{1}{2}$ of the sum of the logarithms of the price ratios.)

(5) Where no local market exists (e.g. newsprint) recourse is had to the import statistics. Price indexes for the fresh fruit and vegetables subgroup are computed annually only, as most lines are not continuously on the market.

(6) "In order to have each group exert its proper influence on the total result it was found necessary in the case of three groups to multiply the group aggregate expenditure by certain numbers which may be termed group weights to distinguish them from individual commodity weights. For example, the difficulty of obtaining a wide range of stan-

3. PITFALLS.

A. *General*

(a) The choice of the exact details according to which one constructs an index number depends on the purpose in mind. It is rarely that ready-made index numbers are 100% suitable for the purpose in hand.

(b) The base may not be a typical year or series of years. This will affect both prices and mass units or weights. It can however be algebraically demonstrated that errors in weights are in general less serious than similar percentage errors in prices.

(c) Prices may differ according to the service and credit terms granted (e.g. booked delivered v. cash over counter), and comparisons may be misleading on this account.

(d) Some tables of index numbers have a common base throughout, so that the numbers are comparable vertically and horizontally. Others may have separate bases for different groups or different areas, and data will then be directly comparable in one direction only.

(e) A rise in prices of x% means a fall in purchasing power not of x% but of $\frac{100x}{100 + x}$ per cent

(f) Index numbers are usually based on data that are just "samples". Rarely do data cover the whole field. It may be seriously inaccurate to assume the unmeasured items moved to the same proportionate extent in the same direction as the measured ones.

dard articles in the textiles group necessitated what was in effect the application of a group weight of 2 to the aggregate expenditure thereof. In practice the same result was achieved by multiplying instead all the weights for the individual items in this group by this factor—an expedient which simplifies the actual compilation of the index numbers." (1927 Year Book, page 819).

(7) Also 4 cross classes based on use to which commodities put, viz. I Consumers' Goods: Foodstuffs; II Consumers' Goods: Non-Foods; III Builders' Materials; IV Materials for other industries.

Of the total base aggregate expenditure, Class I recently represented 30.1 per cent, Class II 20.5 per cent., Farm Expenditure 11.8 per cent., Class III 7.4 per cent. and Class IV 30.2 per cent., while the imported items aggregated 42.8 per cent. of the total.

(8) Where no awards exist, recourse is had to large employers of labour. Data regarding farm labour are derived from orders under the Agricultural Workers' Act, 1936 (Inspectors of Factories prior to 1936).

(9) "In cases where these do not provide the necessary data recourse is had to trade-union membership, but rather as a means of comparison of one industry with another than for the acceptance of absolute figures. The value of these figures depends, inter alia, on (a) the degree of unionisation of the industry; (b) the accuracy with which the returns of membership are compiled; (c) the extent to which any particular industry employs female labour; and (d) whether or not an occupation has an exclusive union." (1935 Prices Report, page ix.)

(g) The price data are usually based on quotations at a particular date in the month (most often 15th); which may not be typical. By way of exception the export price data are comprehensive, covering all exports through the month.

(h) The choice of the right system of averaging is a matter of some nicety.

The arithmetic mean of price ratios has an upward bias (see any elementary text-book on algebra); and therefore, where the aggregate expenditure method is not used, the geometric mean of price ratios method is usually adopted, although it is both laborious to compute and not commonly understood.

Medians of price ratios (i.e. the mid-value when the ratios are ranged in order of magnitude) were used by McIlwraith in New Zealand. The index numbers so arrived at possess the following advantages:—

(i) They are easy to compute—a quick arrangement of the materials followed by a simple counting of the items takes the place of casting sums and taking out a quotient. In these days of calculating machines, however, this advantage of the median is reduced if it does not actually become negative.

(ii) They are not greatly affected by abnormal fluctuations (but whereas the geometric mean increases the influence of only the larger numbers, the median exercises its influence on all alike).

(iii) Price dispersion upwards from an average has no limit, and is therefore great; price dispersion downwards is limited by zero, and is therefore comparatively small. Hence the case for the employment of an average from which large deviations upwards count no more than small deviations downwards.

But—

(i) Index numbers derived from the median of price-ratios are not perfectly reversible; that is, they cannot validly be shifted from one base to another by simple division.

(ii) The median does not answer to its definition when several of the items to be averaged have identical values; and if the items are even in number the median may be indeterminate, though within a determinate range.

(iii) Such index numbers do not lend themselves so easily as most others to algebraic manipulation. Medians of different groups cannot be combined, averaged, or otherwise manipulated as can arithmetic or geometric means.

(iv) When the number of items to be averaged is small index numbers computed in this way are erratic in their behaviour.

(i) Price data derived from export or import statistics may mask changes in qualities of goods. In so far as "modal" quotations (i.e. quotations for that grade of each commodity of which the largest quantities are sold) are secured from retailers, merchants, etc.—as in the retail and wholesale price investigations—this difficulty will be reduced but not eliminated.

B. *Retail Prices*

(a) Except in the case of rents, those furnishing returns to the Government Statistician for purposes of the retail price investigation are asked to give the prices per unit of that grade of each commodity of which the largest quantity is sold; i.e. the "mode". It may well be that the grade of salmon commonly sold in Dunedin differs from that more commonly sold in Christchurch, and fictitious price-differences between places may arise on this account.

(b) All quotations from the same town are simply averaged in the Census and Statistics Department without weighting. If one shop does 90% of the trade in a particular commodity in a town at a lower price than its five competitors, the average price for that town would be recorded at a fictitiously high level.

(c) Where quotations are received from the four chief centres only, they are simply averaged without weighting. This gives undue importance to Dunedin's quotations and insufficient to Auckland's. Where 25 towns are considered the weighting is in accordance however with the census populations.

(d) A representative selection from the necessaries, comforts and the commoner luxuries ("conventional necessaries") consumed by the people of New Zealand is made, and the total relative household consumptions of these articles during a typical or base period are calculated from a consideration of the statistics of trade and production, according to the formula "Consumption = Production + Imports − Exports − Amount used in Manufacturing processes". Thus a "regimen" (or list of articles with the relative quantities of each consumed) which is typical of the average New Zealand household is arrived at. It is not any particular constitution of household that is considered, therefore, by the Census and Statistics Department, but a hypothetical one which is an average of all New Zealand households.

The mass-units or weights are revised only at infrequent intervals and they may have ceased to accord with usage, through:—

(i) *Permanent Changes*, e.g. electricity may have largely replaced candles and kerosene. To overcome this type of difficulty the weights of the export price index are revised annually and a method of computing retail price indexes of clothing is adopted which facilitates the dropping of obsolescent commodities (see

footnote (4), page 70). In general however it may be affirmed that changes in consumption—dependent as they are so much on habit and custom—are much less marked than changes in production —which depend so much on the vagaries of weather, overseas customs tariff policy, and other unstable conditions.

(ii) *Temporary Non-Recurrent Changes.* War sometimes causes artificial shortages of certain commodities and necessitates a switching over to substitutes.

(iii) *Seasonal Changes.* Mass units are based on annual consumption and are not 100% suitable for shorter periods. It is not practicable to allow for seasonal changes due to:—

(1) Certain articles not being demanded at certain seasons, e.g. firewood in summer.

(2) Certain articles being on the market only at certain times, e.g. fresh fruits and vegetables of many kinds.

(3) Certain articles being in short natural supply at certain seasons of the year or in certain localities (e.g. eggs, fresh fish), the price rising in sympathy with the scarcity. When prices rise a household may do one of three things:—

(*a*) It may continue to consume the same quantities of the same commodities as before (only the wealthier households can afford to do this);

(*b*) It may consume the same commodities as before but reduce the quantities of those which have risen in price;

(*c*) It may endeavour to cope with the situation by substituting cheaper for dearer commodities. In every case the total domestic expenditure of the household probably alters; in cases (b) and (c) an additional factor (the standard of life) varies as well. The term "cost of living" clearly means a different thing according as the standard of life is or is not varied. There is in fact no adequate statistic extant whereby it would be possible to allow for changes in the standard of living; and all that the Department attempts to do is to measure changes in the general level of retail prices as indicated by the price movements of the commodities selected by it as typical.

(e) The mass units relate to the Dominion as a whole and may not be applicable to certain parts:—

(i) In a town of the size of Blenheim transport costs between home and work are negligible: in a place of the size of Wellington they are substantial.

(ii) Not all towns have both gas and electricity supplies.

(iii) Certain articles are supplied in different qualities in different districts; e.g. coal, firewood, gas, fish.

(iv) Differences in climate and usage cause a difference in consumption; Dunedin consumes more oatmeal, domestic coal, and woollen underwear; Auckland consumes more ice-creams, light dresses, etc.

However errors in weights are less important than errors in prices, and these finer points could hardly be allowed for except at prohibitive cost and risk of delay and error (owing to the mass of calculations).

(f) Rents move sluggishly; and the average rents being paid —many of which were fixed years ago—may be very different to the rental asked from a new tenant entering into occupation today.

(g) Movements in rentals are not always fully sympathetic with movements in housing costs; which may relate to houses occupied by the owner of the freehold with or without encumbrance or being occupied by an instalment buyer. The correspondence will however usually be sufficiently close for most practical purposes.

(h) The groups are combined on the basis of household budgets; which may not be typical at the time of collection and certainly become more or less out of date with the passage of time. Differences in price-movements as between the different groups would of themselves alter the percentage to the total domestic expenditure accounted for by each group without any changes in consumption habits taking place.

C. *Wholesale Prices*

(a) The points (a) to (e) made in connection with retail prices apply, mutatis mutandis, to wholesale prices.

(b) In the retail prices inquiry the quantities of the various commodities used annually for household consumption throughout the Dominion determine the weights; in the wholesale prices inquiry the total quantities consumed in the Dominion annually, whether in households or in industry, are substituted. These two quantities frequently differ appreciably—e.g. the amount of coal consumed in households is fairly small in proportion to the total (domestic plus industrial) consumption. Some authorities have advocated instead the adoption of weights proportioned to the actual quantities marketed locally; or, what amounts to much the same thing, weights proportioned to local production or local consumption, whichever is the greater. In the case of any given commodity the quantity marketed exceeds the amount consumed by the amount of local production for export; this difference being considerable for New Zealand in the cases of such staple items of export as kauri-gum, phormium, meats, dairy-produce, wool, etc. A separate index number for the prices of exported commodities is available, however; so the New Zealand Census and Statistics Department has thought it better to adhere to the consumption standard for assessing weights—" a standard which incidentally yields a wholesale index number which at once permits of more satisfactory comparison with movements of retail prices in New Zealand and at the same time is more comparable with the wholesale-price indexes of adjacent countries in the

Southern Hemisphere, all of which have adopted the same system of weighting." (1927 Year Book, page 818)

(c) The figures arrived at as weights by computing production plus imports minus exports for the various commodities included in the investigation were verified by the Census and Statistics Department wherever possible by enquiries from wholesale merchants as to the amounts of these commodities sold for local consumption. The Department has made no attempt to avoid double counting in allotting weights—e.g. to deduct from the weight for wheat an amount equivalent to that portion of the wheat which would be encountered again in the form of flour, or to reduce the weight allotted to flour on the ground that this had already been partly accounted for in dealing with wheat. The Department felt that, not only are practical difficulties in the way of making such allowances with any degree of precision very often insuperable, but in any event the theoretical case in favour of avoiding double counting is by no means impregnable. "The effect of adopting a system of weighting that involves double counting is to exaggerate the importance of raw materials in the New Zealand index number as compared with their importance in the index number of a country which does seek to avoid double counting. In a country like New Zealand, where raw materials are relatively very important in the total economy of the country, this exaggeration is by no means necessarily a fault". (1927 Year Book, page 818)

(d) "Tests have established that the effect on the value of the index number of weighting quotations for each town in proportion to the consuming populations concerned, instead of giving them equal weights, is rarely a matter of more than one or two points (i.e. rarely more than one or two tenths of 1 per cent). The population of no one town of the four differs by more than at the most 40 per cent. of its own population from the average of the four. In practice, moreover, it is found that the differences in prices of a given commodity as between the different centres are rarely of great magnitude save in cases of one or two bulky commodities whose production is strictly localised (e.g. kauri). Price-differences between the four towns are usually, in any case, relatively constant for any one commodity; and so long as this is strictly the case for all the commodities included in a group, that group's index number—which is, after all, a device for measuring price-movements from time to time—is unaffected by the system of weighting adopted as between the different towns covered. The only circumstances under which this constancy is not substantially achieved are those rare cases when coastal or railway freights have moved very differently from the prices of the commodities concerned, or where the operations of temporary cut-throat competition, for example, within a special locality, may have for a space affected the situation. No statistician has ever

seriously claimed that his index number accurately reflects price-movements within the limits of 1 or 2 per mille; the facts that the index number is based on certain sample commodities taken as being representative of each group, and that the price data are obtained from certain sample establishments alone, accounting for some failure on the part of the index number to measure price-movements with perfect accuracy". (1927 Year Book, page 819)

(c) The wholesale-price index computed prior to the 1925 revision gave an excessive importance to raw materials and foodstuffs to the exclusion of manufactured articles. This made it seriously defective for a number of purposes, e.g. verifications of the purchasing power parities principle.

D. *Farm Expenditure*

(a) The item "interest on mortgage" relates to actual interest payments only, no allowance being made for interest on the capital value of unencumbered farms. Similarly, "wages" covers only actual payments, no allowance being made for the value of services of the farmer and members of his family.

(b) The weights were fixed by a farm budget enquiry which may not have been typical. There is some reason to believe that it is not typical, relating as it did mostly to larger farms.

(c) It was impossible to obtain any satisfactory price data respecting 2 per cent. of the total farm expenditure, so that these items were omitted from the tabulations. The effect of this omission is to give these items the same movement as the general average movement of the items covered.

E. *Export Prices*

(a) As changes in the actual relative importance of the different commodities concerned are usually small it is customary to disregard them in the computation of a price-index, and to base the computation on a "regimen" which is chosen as being as near to the facts as possible, and which is kept constant throughout. In the original planning in 1925 of the New Zealand index number for export prices this principle was, however, departed from because it was clear on an examination of the relevant figures that there had been enormous fluctuations in the relative amounts of the different items which it was necessary to include in the index. Over a period of twenty years prior to 1932, for example, the quantity of butter exported increased more than six-fold and the quantity of cheese nearly four-fold, while on the other hand the amount of phormium fibre exported fell to one-tenth of what it was twenty years earlier, the amount of timber to one-fifth the amount that it was, gold to less than one-third, and kauri gum to about two-fifths.

In avoiding in 1925 the errors involved in the use as weights of constant quantities exported, the Census and Statistics Department probably erred in the opposite extreme when it gave a weight to each item equal to the varying quantities exported in the month or year under consideration—though it was careful at the time to point out the shortcomings of this procedure (see 1925 Report on Prices, pages xv-xvi). For example, the monthly index number for June, 1931, indicated the relationship between the total value in that month of the quantities of the various commodities exported during that month, to the prices of the same commodities on the average during the years 1909 to 1913, the base period of the investigation. The weight or importance of each item in the regimen varied according to fluctuations in the quantities exported from month to month and from year to year. The following rather curious results emerged:—

EXPORT PRICE INDEXES

(Base: Average Prices 1909-13 = 1000)

	Dairy Produce	Meat	Wool	Hides, Skins & Tallow	Miscellaneous	All Groups
May 1931 ..	936	1,265	767	951	1,307	962
June 1931 ..	888	1,257	742	892	1,284	992

It will be noted that between May and June, 1931, each of the various group index numbers fell and yet the all-groups index number actually rose. There was no arithmetical error involved, and the apparent anomaly was entirely due to the fact that in June, 1931, the quantities of the different commodities exported were substantially different from those exported in May, 1931; commodities which had slumped heavily in price (e.g. wool) featuring largely in the export figures for May, 1931, and to a minor extent for June, 1931. The fact is that the export of several of New Zealand's staple products exhibits a marked and well-defined seasonal cycle so that certain commodities are scarcely represented for certain months of each year. If the commodity thus regularly appearing and disappearing has exhibited a price-level very different from most of the other export commodities the index number for the export prices of commodities as a whole exhibits fluctuations from month to month that are in a sense fictitious.

In order to remedy this weakness of the index number the system of weighting was altered in May, 1932, the weight allotted to each item included in the new series being adjusted annually to the average quantity of that item exported during the five previous seasons.

It follows that the export price-indexes (unlike the wholesale and retail price indexes) do not relate to a regimen that is

fixed as regards the nature of its contents and the quantities thereof.

The same difficulty has been overcome in Australia by computing two separate export price indexes, one with fixed weights according to the aggregate expenditure method and the other with changing weights.

The second Australian export price-index merely aims at comparison of one month with the corresponding month of the preceding year, or the period of the trade year ended in any month with the same period of the preceding year. To multiply the quantity of a commodity exported in the period under investigation by its price in that period and separately by its price in the corresponding period of the previous year, and to compare the two aggregates (at the two periods separately) of these products for all the commodities gives one possible index of the change in prices over the period. An apparently equally valid index of the change in prices could be obtained by multiplying these two sets of prices by the quantities exported in the earlier period. Actually Irving Fisher's "ideal" compromise is adopted—the two price-indexes as separately computed with the different sets of quantities are multiplied together and the square root of the product is extracted.

(b) Seasonal variations in grades exported are apt to be upsetting with monthly export price-indexes, and for this reason the new Australian export price-indexes use actual price quotations of particular grades as the source of the data instead of the average values per unit quantity (irrespective of quality) as revealed by the customs entries.

(c) Gold was not included in computing the 1925 New Zealand or in the earlier Australian export price-indexes; but the fact that the price of this commodity moved upwards while the prices of all other export commodities moved downwards during the recent depression caused it to be decided in 1932 that its inclusion in the New Zealand index was desirable. The exclusion of gold had exaggerated the upward movement of export prices in times of prosperity and overstated the fall in times of depression. When Australia in 1937 followed New Zealand's lead in this matter it however decided that, "as the monetary uses of gold may give rise to movements which are irrelevant for the purposes of an export price index", gold should be weighted by the quantity produced, not by the quantity exported.

(d) It must not be overlooked that, in the case of export price-indexes as distinct from other price-indexes, quantities exported, not quantities consumed, determine the weights. New Zealanders consume only about one-fourth as much lamb as mutton; but they export almost thrice as much lamb as mutton by weight. This relatively greater importance of lamb in the export

price-index is the main cause of the at-first somewhat surprising differences in certain years between the movements in the export and wholesale price-indexes for meats.

(The above treatment follows closely E. P. Neale in Economic Record, December 1932, pages 293-297; W. K. Williams, in Economic Record, December 1937, pages 243-246; and the New Zealand Monthly Abstract of Statistics, May 1932, pages vii-ix).

F. *Wage Rates*

(a) In computing effective wage rates no allowance is made for changes in the hours of labour or in other working conditions; or for changes in any other factors affecting the distinction between real and nominal wages.

(b) An addition is made to nominal wages for meals and/or lodgings where these are supplied. The value of this can only be roughly assessed.

(c) In some instances rates of wages are above award rates, on which the wage statistics are mainly based. To this extent the real fluctuations in wages are understated by the index numbers.

II. OTHER INDUSTRIAL STATISTICS

1. SOURCES OF DATA.

The Monthly Abstract of Statistics provides a summary of the unfilled applicants for employment on the books of the Labour Department week by week. It also provides quarterly data on industrial disputes.

The Census and Statistics Department's Annual Report on Prices, etc., collects the employment data of the Monthly Abstract for the whole year. It also provides detailed tables on industrial accidents—except in mining (see Parliamentary Paper C-2) and those other activities where appropriate data are not yet collected.

The Annual Report of the Labour Department (*Parliamentary Paper H-11*) is also informative in this connection.

Particulars regarding the Department's Employment Division now appear in a separate Paper (H-11A).

The N.Z. Official Year-Book summarises and analyses the data on the subject available from all sources.

2. PITFALLS OF ACCIDENT STATISTICS.

(a) The number of industrial accidents per 100,000 man-hours worked is by no means a perfect measure of hazard, for it takes no account of the fact that the average accident is much more severe in (say) the electric-lighting industry than in (say) the meat-freezing industry.

(b) "Compensation paid is not a very satisfactory measure of the economic cost of industrial accidents; for (probably mainly as a precaution against malingering) no system gives full compensation for the worker's immediate economic loss; moreover, systems of compensation have frequently been varied from time to time within a country, while they almost invariably differ at the same time as between different countries." (1926 Year Book, page 804)

(c) "Likewise, wages lost would not prove a satisfactory index of the severity of different occupational hazards, since wages vary appreciably from occupation to occupation, as well as from time to time, from district to district, and according to the age and sex and experience of the worker." (1926 Year Book, page 804.)

(d) Time lost as a measure of the severity of industrial accidents is preferable to the above conceptions; but it entirely ignores the non-physical effects of the accident. Calendar days lost are probably a better measure of severity than working days lost, the former being an identical unit for all industries, the latter varying considerably. In each industry the average time lost on account of temporary disability is assumed to be identical, where no data are available on the point, with that lost in the case of accidents occurring in that industry for which the time lost is available. As the cases where this information is not available will for the most part be the severer cases where the injured worker has not yet returned to his job, the effect of this expedient is to err on the side of understatement of the real toll of industrial accidents in time lost.

(e) The loss of working hours per 100,000 man-hours worked (L) is arrived at from the following formula (see 1926 Year Book, page 805) :—

$$L = \frac{\frac{44\ W}{7} + 60{,}000T + \Sigma 600\ P'I'}{H}$$

(Where H = hundreds of thousands of man-hours worked in the industry or occupation concerned; W = the number of calendar-days' work lost on account of temporary disability; T = the number of cases of death and permanent total disability; P' = the number of cases of permanent partial disability involving a given percentage of total disability; I' = that given percentage of total disability. Σ = sum of all expressions like).

This formula has certain more or less irremediable shortcomings —

(i) It has been assumed by the Census and Statistics Department that deaths of workers through industrial accidents result in New Zealand in a loss of 60,000 working-hours in each case, a round figure which is arrived at deeming a normal working year to comprise 50 weeks of 44 hours each, on the basis of the average expectation of working-life (which is assumed not in any case to extend beyond 65)—as ascertained from the New

Zealand life tables—of a male worker meeting with an accident at the average age at which accidents to male workers occur in New Zealand factories.

"Death clearly entails total cessation of labour-power; so that the time lost is manifestly identical with the working-life expectancy of the individual concerned—a period which is less than the total life expectancy of the individual under consideration by the interval, if any, between the date at which voluntary or enforced retirement from gainful employment would have taken place and the date at which death would have ensued subsequent to that retirement but for the injuries which resulted in his premature demise. While it is recognised that significant differences exist in the average ages of workmen in different industries, and in different occupations within the same industry, and while it cannot be gainsaid that more labour power is on the average lost by the death of a worker aged 20 than by that of a worker aged 50, yet it would seem that the age of the individual killed is not particularly relevant to the character of the hazard from which the injury has resulted. If severity weights in the case of death were made to vary with the ages of the persons injured the resultant severity rates would be distorted by purely fortuitous age-variations amongst the victims of industrial accidents". (1926 Year Book, page 804.)

(ii) As the primary object is to measure industrial hazard rather than economic loss, it seems on the whole expedient to treat fatalities and permanent total disabilities in an identical manner, disregarding the fact that permanent total disability usually imposes a greater economic burden upon the victim's family upon the community than does a death (though admittedly a person who technically is permanently and totally incapacitated may in certain cases still be capable of performing services which increase the total family income and/or reduce the total family expenditure).

(iii) The assessment of time lost in the case of permanent partial disability is more or less arbitrary. Under the legislation of most countries, compensation in such cases is a fixed proportion of what is paid in the event of death occurring as a result of the accident, ignoring the fact that the actual impairment of earnings as a result of a given injury will depend largely on the training and skill of the injured worker and will differ markedly from industry to industry. These scales for assessing compensation for permanent partial disabilities differ from country to country; and to secure international comparability time lost on account of permanent partial disability is standardised (without any addition for actual time lost) on the basis of a scale which is adopted in the following slightly amended form to meet New Zealand conditions (vide 1926 Year Book, page 805):—Loss

of use of both eyes, 100 per cent.; dismemberment or loss of use of leg from above knee, or arm from above elbow, 75 per cent.; dismemberment or loss of use of arm from at or below elbow, 60 per cent.; dismemberment or loss of use of hand, 50 per cent.; dismemberment or loss of use of leg from at or below knee, 50 per cent.; loss of hearing of both ears, 50 per cent.; dismemberment or loss of use of foot, 40 per cent.; permanent disability of thumb and four fingers, 40 per cent.; permanent disability of four fingers, 30 per cent.; permanent disability of thumb and two fingers, 25 per cent.; permanent disability of three fingers, 20 per cent.; permanent disability of two fingers, 12½ per cent.; permanent disability of thumb, 10 per cent.; loss of hearing of one ear, 10 per cent.; permanent disability of great toe, 5 per cent.; permanent disability of any two or more toes, 5 per cent.; permanent disability of one finger, 5 per cent.

This method carries the advantage that such cases are permanently accounted for, as regards severity, in connection with the statistics for the year of their occurrence.

(f) In comparing the figures for comparatively unimportant sub-groups too much should not be concluded from the figures for a single year, for in an industry employing few hands the occurrence of a single fatality in any one year will have the effect of bringing about an exceptionally high severity rate.

(g) Different countries adopt different practices in the matter of excluding trivial occurrences and in the matter of distinguishing industrial accidents and industrial sickness.

3. LIMITATIONS OF UNEMPLOYMENT STATISTICS.

(a) The Bureau Registrations do not cover all the unemployed, and therefore do not permit of ratios of unemployed to total wage-earners being computed. For this reason from about 1926 New Zealand unemployment statistics were secured from trade unions; but these quarterly collections were discontinued in 1932, when the bureau registration figures became available on a new and broader basis.

(b) Even differences in the Bureaux's unfilled applications are misleading, as at different times and in different places the inducements to register have undoubtedly varied.

(c) All unemployment figures are subject to marked seasonal fluctuations; and all comparisons should in consequence relate to corresponding periods in different years.

(d) All other sources of unemployment figures are inferior to those provided by the census when it is sought to investigate the relationship between unemployment and such other possibly

relevant factors as age, birthplace, conjugal conditions, etc. The census is, however, too infrequent to be of much use as a source of unemployment statistics, and it shed no light on (and may be misleading because of) the important seasonal fluctuations to which unemployment is subject.

For fuller information on these points readers are referred to 1927 Year Book, Section XXXIX.

CHAPTER VIII

INDICATORS OF BUSINESS CONDITIONS

1. SOURCES OF DATA.

The Monthly Abstract of Statistics is the primary source of data in this connection; and it also publishes comments on the various series indicative of fluctuations in business activity.

The Quarterly Bulletin of the Department of Industries and Commerce, while covering the same ground as the Monthly Abstract, gives certain additional data, mostly of a descriptive rather than purely statistical character.

The Commerce Journal (the Official Organ of the Auckland Chamber of Commerce) in alternate issues graphs and comments on the more important leading series in this connection.

The Bulletin of the Canterbury Chamber of Commerce in every third issue does the same with a somewhat different approach.

2. PRINCIPAL SERIES OF USE IN THIS CONNECTION:

The following points are worthy of note on this subject:—

(a) Many of the series of use in this connection show marked seasonal fluctuations, so that comparisons of whole years, or of corresponding periods of successive years, or of twelve monthly moving averages alone are valid without correction in such cases. In the case of the ratio of banking deposits to advances the Auckland Chamber of Commerce has worked out (by the Link Relative Method of Professor Persons) the normal monthly fluctuations to be expected on the basis of past experience; and it adjusts (on the basis of resulting separate correction factors for each month) the recorded figures month by month so as to eliminate the seasonal fluctuations in this series.

(b) The best single indicator of business conditions in New Zealand is probably the official index number of export prices; fluctuations in New Zealand's prosperity being largely bound up with and consequent on fluctuations in this series. The Auckland Chamber of Commerce graphs this along with a corrected index number of the prices of imported commodities—Section (g) below—so as to indicate changes in the terms of international interchange of goods.

(c) The excess of exports over imports (N.Z. currency values) is probably second only in usefulness to the index number of export prices.

Caution in dealing with it is necessary:—

(i) Even under normal conditions an upward movement of this graph may not indicate an improvement in the economic outlook; e.g., an upward movement was necessary about 1931 in order to bridge the gap caused by the closing of the London money market to the usual amount of new borrowing on the part of New Zealand. When there is no borrowing an excess of exports over imports of about £10m per year is normal, representing as it does approximately the amount of New Zealand's annual interest bill.

(ii) Occasionally (as on sundry occasions during the early stages of the recent depression) the existence of a maladjustment between exports and imports is rectified by the transport of specie; which does not go out as ordinary merchandise but as a correcting influence. More recently there occurred a further export of specie which had become redundant on account of the changes in banking policy embodied in the Reserve Bank Act. The recent silver re-coinage also caused specie movements. The investigator of certain aspects of business activity might be misled unless care were taken to exclude specie from the trade figures used, and to confine the data employed to those covering exports and imports of commodities.

(iii) It is liable to seasonal fluctuations in sympathy with the fact that imports come in fairly evenly over the year but with a rising tendency just before Christmas; while exports go out mainly in the summer half of the year.

(d) Increases in exports from New Zealand, raisings of loans abroad, and certain other transactions tend to increase the deposits to the credit (or to reduce the advances to the debit) of New Zealand bank customers and add to the London funds of New Zealand banks; while imports into New Zealand, payment of New Zealand interest abroad, repayment abroad of sums borrowed by New Zealand overseas and other transactions to the debit of New Zealand tend to be associated with a depletion of the deposits of New Zealand banks' customers (or an increase of their overdrafts), together with a reduction of the London funds of the banks trading in New Zealand.

(e) For the reasons just mentioned the ratio of bank deposits to advances is a good index to New Zealand business conditions.

(f) For the same reasons so also is the series for the net oversea funds of New Zealand banks, though this may be upset by abnormal conditions, e.g. the 1933 raising of the N.Z.-London exchange not only encouraged oversea creditors to leave funds in New Zealand (to secure the benefit of the anticipated restoration of the exchanges to parity) but also affected the volume of trade—see (g) below.

(g) The volume of imports is closely correlated with fluctuations in the level of export prices, but with a lag. The connection operates mainly through the condition of the London balances of the banks. The volumes of imports are arrived at monthly by the Auckland Chamber of Commerce by correcting the actual value of imports by an "adjusted" index of the wholesale prices of imported commodities. The Census and Statistics Department index number of import prices is published at yearly intervals only; but the index number of the wholesale prices of imported commodities appears monthly and (though less comprehensive in range of commodities) is used with a constant adjustment (which is revised after each customs tariff revision, etc.) for the extent to which wholesale prices in New Zealand have diverged from values in the country of origin by reason of such factors as the recent successive increases in the import duties on motor-spirits and the like. (The index number of the volume of exports is less sensitive to changes in prosperity than the index number of the volume of imports; but when export prices fall there is a tendency to hold back from export non-perishable goods (such as wool) in the hope of a rise next season. The raising of the exchanges from £N.Z.110 to £N.Z.125 = £U.K.100 in January, 1933, had the temporary effect of diminishing the volume of imports and increasing the volume of exports by offering a temporary bonus on exports and barrier against imports. These effects have now worn off.)

(h) The following further series (most monthly) are all sensitive indexes of New Zealand business activity:—

(i) Net Sales Tax collected.
(ii) Net Bank Note circulation.
(iii) Bank debits to individual accounts.
(iv) Coastal cargo.
(v) Net ton miles of railway goods traffic.
(vi) Totalisator investments.
(vii) Some of the series listed at the beginning of (i) below are also at times fairly prompt in their response to improving business conditions.

(i) The following series (mostly monthly) also move in sympathy with general business conditions, but the movement is usually more or less sluggish, so that there is a lag in the response of these series to fundamental changes in New Zealand's economic conditions:—

(i) Mortgages discharged*.
(ii) Mortgages registered*.
(iii) Land Transfers under Land Transfer System.**
(iv) Building permits granted in some 21 larger towns and their suburbs.
(v) Share prices.
(vi) Radio Licences.
(vii) Motor Vehicles on register (quarterly).
(viii) Bankruptcies***.
(ix) Applications for employment remaining in the Labour Department's Books.***

(j) Some series are indicators not of general prosperity but of the prosperity of particular classes more than others. A rise in the ratio of $\frac{\text{Adult Male Wages}}{\text{Retail Prices}}$ spells improved conditions to the wage-earner, worsened conditions to the entrepreneur—at least in the short run.

(k) The Canterbury Chamber of Commerce, in the Bulletins it publishes in collaboration with the Economics Department at Canterbury University College, considers and tabulates most of the statistical series described above. It also publishes each quarter a chart which concentrates on three series, A being exports less imports, B bank deposits less advances, and C internal business transactions. Generally the series move in that order; curve A being a chief cause of movements in curve B, and curve B having a decided influence on curve C. (The method follows as closely as practicable that used by the Harvard Economic Service.)

* The data for mortgages discharged are more incomplete than the data for mortgages registered. Little real significance accordingly attaches to the excess of on of thes series over the other. The series for mortgages discharged is rather more sensitive to fundamental changes in the economic situation than is the series for mortgages registered; consequently, if it is sought to eliminate the effect of changes in the value of money by casting the series in the form of a ratio, it must be remembered that $\frac{\text{mortgages registered}}{\text{mortgages discharged}}$ moves downwards and $\frac{\text{mortgages discharged}}{\text{mortgages registered}}$ upwards as prosperity increases.

** Transactions under the Deeds Registration System are now so infrequent as to be negligible.

*** These series, in contradistinction to all the others, move downwards as prosperity increases and upwards as properity wanes.

The Canterbury computations involve a statistical technique beyond the scope of the present work, but are briefly described below for the benefit of students who have taken a course in statistical analysis.

For Curve A the Canterbury service takes first imports and exports quarterly, which it adjusts by correction factors for seasonal variation. A long term trend (the logarithmic linear trend, computed by the method of least squares, using logarithms of numbers) has been worked out for 1900-1930 and has been continued. The percentage deviation from the trend is taken for exports and imports separately, and the import deviation for each quarter is subtracted from the export deviation, giving a plus or minus figure. This figure is then divided by the standard deviation of the whole series and the result is plotted. By this method the figures are plotted on a scale in which the unit is the standard deviation of the series and the curve shows the extent of variation from the normal trend at the dates given.*

Curve B is similarly computed. Bank advances and deposits are taken, including government business at the Reserve Bank, so that the figures are comparable over the "long period." Quarterly totals are corrected for seasonal variation, and the percentage deviation from the trend is computed. For each quarter deviations of advances are subtracted from deviations of deposits, and the remainder is divided by the standard deviation of the series. Again, the scale unit is the standard deviation of the series and the curve shows variations from the trend.

For years prior to 1928, when the series for bank debits was first published, curve C was a combination of several series. It is now based solely on bank debits. The weekly average for each quarter is taken, corrected for seasonal variations, expressed as percentage of the 1928-1919 average, and divided by the standard deviation of the series. This curve therefore shows the variation from the 1928-1929 level and takes no account of long term trend, the data for computing which are lacking owing to the comparatively recent date at which the publication of bank debits was inaugurated.

* The author is indebted to Professor A. H. Tocker for the example on page 90, as well as for other valuable assistance in connection with this Chapter.

CANTERBURY ADJUSTMENT OF EXCESS OF EXPORTS OVER IMPORTS FOR PURPOSES OF GRAPHICAL REPRESENTATION

(Figures are in Millions of Pounds)

	Imports (Including Specie)		Exports (Including Specie)	
	First Quarter 1937.	Second Quarter 1937.	First Quarter 1937.	Second Quarter 1937.
Quarter's Figure (crude)	13.03	12.79	22.28	19.82
„ „ (corrected for seasonal fluctuation)	12.6	14.2	15.3	17.4
Annual Equivalent of above (a)	50.3	56.8	61.2	69.4
Trend { log + .0042	1.7194	1.7236	1.7706	1.7748
Trend { antilog of above figure (b)	52.4	52.9	59.0	59.5
Deviation (a-b)	—2.1	+3.9	+2.2	+9.9
Deviation as Percentage of Trend $\frac{100\ (a-b)}{b}$	—4.0	+7.5	+3.8	+16.3

	First Quarter 1937.	Second Quarter 1937.
Export Figure Minus Import Figure	+7.8	+8.8
Above divided by Standard Deviation (viz. 12.1) ..	+0.64	+0.73

It is the figures of the last line that are plotted—on a scale that ranges from—3 through 0 to + 3.

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