PRICES, PRICE INDEXES AND COST OF LIVING IN AUSTRALIA.

I.—INTRODUCTION.

1. **General**.— Probably no subject has recently attracted a greater amount of public attention than the extent of variations in prices and the exchange-value of gold, a matter which, in its relation to the cost of living, is fraught with importance to every section of the community. It is stated in many quarters that during the last few years there has been a world-wide rise in the cost of living, and that this fact is borne out by the deep-seated unrest which has expressed itself in many ways in various countries—in bread and meat riots, in resentment against taxation, in strikes and syndicalism, in socialistic agitation, and in blame of all sorts of persons and conditions. Numerous investigations on the subject, both official and unofficial, have been made during the past few years, and it has recently been proposed that an International Commission on the Cost of Living" should be appointed to make a comprehensive study on an international basis, using as its foundation the results of various national investigations already made, or now in progress.

While this Report is not directly concerned with either the alleged causes of price-movements, or the various suggestions as to proposals to obviate these, it will be well to draw attention to the difficulty and complexity of the questions at issue, and to the danger of concentrating attention merely on such facts as may chance at the moment to be specially prominent, and may perhaps be alleged to constitute the sole causes.

The majority of the reports on the subject that have been issued in various parts of the world allege that the increased production of gold has been an effective factor in raising prices, while others believe it to be due to a wide-spread advance of credit, greater velocity of the circulation of currency, and consequently a diminished need for gold, and also generally increased banking facilities. Many investigators believe that the true explanation lies in the effect of legislation affecting tariffs. Others allege that the increased cost of living is merely a change in the standard of living, that it reflects luxury, or even extravagance—in other words, the prevailing condition is more appropriately referred to, not as the "high cost of living," but the "cost of high living." Many, again, allege that the advance has been due to an "increase in the world's armaments" and "governmental extravagance" in general; the cost of the South African and Russo-Japanese wars; the increasing public burden of maintaining social and economic reforms; investments in public undertakings, such as railways, public works, etc. The operations of trusts, combines, and trade agreements are also stated to be the prime cause. Some, on the other hand, emphasise the evil results of over-capitalisation, and others point to the increased wages, shorter hours, and diminished output resulting from trade-union conditions. The increase of middlemen and of middlemen's profits, the substitution of modern methods of soliciting business by commercial travellers, **and**

expensive advertising are other alleged causes, as also are the concentration of population in cities and the emigration from food producing localities; increased consumption of ·food products; droughts; the increased cost of primary products because of higher land values and wages; the increased cost of transport as production is pushed into regions not readily accessible; the progressive exhaustion of natural resources and the reduction of soil fertility.

Almost equally diverse are the proposals as to remedies. These range from suggestions as to currency-reform to "raising potatoes on empty city allotments." In the Continent of Europe there are movements demanding lower duties on food and the importation of frozen meats, while another proposed remedy is a lowering of the monetary (though not necessarily the physiological) standard of living, that is, a resort to a "simpler life."

Before any adequate discussion of the situation is feasible, however, *it is necessary that price-fluctuations should be accurately measured,* and such measurements should precede any attempt to remedy the condition of things. Hitherto no systematic and comprehensive effort has been made to exhaustively measure the course and extent of price fluctuations in Australia, or to examine the subject with that breadth of view which is now necessary. It is the primary object of this Report to meet, to some extent, the deficiency and furnish measurements of price-fluctuations for past years and for the present moment, in so far as the limitations of a due economy and expedition permit. This special object of the Report has been carried out in close connection with the organisation of the Labour and Industrial Branch of this Bureau, with a view to ensuring that the periodic statements as to prices, the issue of which is to be commenced in the near future, will be directly comparable with the figures furnished in this Report for past years.

2. **Scope of Investigation.**—It has, apparently, been generally assumed that the relations between import, wholesale and retail prices are so close that results based on either of the first two may be taken as, in some measure, directly proportional to, and as indicating with a fairly close degree of accuracy, changes in the cost of living. This assumption appears to be due largely to the fact that import and export and wholesale prices are the more readily accessible, and one or the other has therefore been ordinarily selected as the medium for the purposes of an inquiry into cost of living. The assumption is clearly not justified by the facts, and it may well be asked whether a result based upon import and export or wholesale prices of commodities can be said to indicate changes in the *general* purchasing-power of money, seeing that the great majority of the people make their purchases retail and not wholesale. A further qualification of the value of results based on import and export or wholesale prices as a test of cost of living is that they include mainly material things, and exclude largely labour cost and payments for services, as well as rent.

A careful examination made in this Bureau of methods followed in other countries and of the principles involved, and the unsatisfactory nature of general statements, have led to the organisation of a more comprehensive and systematic means of treating the subject of prices. It was decided that in order to furnish anything like an adequate basis for investigations into the question, from different points of view and

for different purposes, it was necessary to follow the fluctuations of the following, viz. :—

(a) *Retail Prices.*

(b) *Wholesale Prices,* and

(c) *Import and Export Prices.*

For example, for the purpose of investigating any relation between prices and the increase in the production of gold, import and export prices, which include the cost of commodities for which there is a world-wide market, are to be preferred: as reflecting trade and industrial conditions, wholesale prices, representing the cost of commodities, both raw and manufactured, in bulk, are the most suitable: while as an indication of the cost of living, retail prices, which represent the actual cost to the consumer, are the most appropriate.

The main object of this Report is to furnish for past years particulars relating to each of the three main divisions of the subject. This has been done with a view both to providing a proper basis with which records for the current and future years may be compared, and also to publishing the results of the investigations which have been made into a subject to which such special interest is attached at the present time. It will be found that each of the main divisions—(a) Retail Prices, (b) Wholesale Prices, and (c) Import and Export Prices are dealt with separately in this Report; the results are then compared, both with each other, and with results of various inquiries which have been made in other countries.

Before proceeding to discuss, individually, or in any detail, the plan and scope of any of these main lines of investigation, it is desirable that certain general matters of procedure and technique should be briefly touched upon, for the benefit of those who desire to so inquire into the matter that its full significance shall appear; for it will be shewn hereafte that the wide diversity between results obtained by various investigators are due in part to certain erroneous, though wide-spread, assumptions regarding the arithmetical technique of deducing price-indexes.

3. General Plan of Investigation.—One of the first steps taken in regard to the present investigation was the examination of all available material bearing on the subject. This necessarily involved the study of a large number of Reports, as well as of much current literature bearing on the subject. [A bibliographical reference to some of the various books, reports, and other documents referred to or used in this investigation, may be found in Appendix I. hereof.] The methods of technical computation and the presentation of facts had to be carefully weighed, as to whether and how far they were in accordance with fundamental principles and were suited to present requirements, as altered or necessitated by recent progress.

Concurrently with this investigation, steps were taken to ascertain what information, as to prices in Australia, was already available from various sources, and to ensure the collection of systematic and reliable records for the current and future years. The general plan followed in each of the three main branches of inquiry, viz., (a) Retail, (b) Wholesale, and (c) Import and Export Prices, was to select for each branch a comprehensive list of suitable commodities, and to trace the course of prices for each commodity year by year.

This can be illustrated by an example. Suppose that between two periods the average price of tea rose from 1s. 3d. to 1s. 6d. per lb., and the price of bread rose from 3d. per 2-lb. loaf to 3½d. per 2-lb. loaf. The price-ratio of tea would be $\frac{6}{5}$, and that of bread, $\frac{7}{6}$. If, however, bread, owing to its greater economic importance, exerted twice as much influence on expenditure as tea, then the price-index would be

$$\frac{(\frac{6}{5} + (2 \times \frac{7}{6})}{1 + 2} = \frac{53}{45} = 1.18, \text{ nearly.}$$

The method of price-ratios has been used extensively by economists, different methods of weighting being employed. Dutot, for example, weighted his price-ratio with the prices of units of the different commodities at the first period under review. Carli used equal weights for his price-ratios—that is, he assumed that all commodities had an equal influence on prices—an assumption that is obviously invalid. Yet the well known index-numbers of the London "Economist" have, till quite recently, been computed on this hypothesis. Young weighted his price-ratios with the total exchange-value of the commodities at some period, and Scrope used the number of mass-units—that is, the price-ratio for each commodity is multiplied by a number indicating the relative extent to which the commodity is used.

It is impossible to study the tables drawn up in accordance with the theory of price-ratios without being struck with the discrepancies exhibited. Tables, purporting to shew the variations in price in the same country over the same period of time, will shew the greatest differences in the ratio with which prices are rising and falling, and sometimes one table will shew a rise, whilst another will shew a fall This arises partly from the different lists of commodities adopted, partly from differences in the weighting, and partly from defects inherent in the method of price-ratios itself.

A serious defect in the use of price-ratios is that the results obtained are *irreversible,* as price-indexes are usually calculated. By this is meant that if the price-index, say, between 1901 and 1911 (1901 being taken as the basic year) was found to be I., then the price-index between 1911 and 1901 (1911 being taken as the basic year) should be $\frac{1}{I}$, but, *as a matter of fact, it never is,* except in a variation of Scrope's method, when the weighting is according to the geometric mean of the two expenditures, a method somewhat tedious, arithmetically. Taking the former example of the bread and the tea, where, as before, the respective weights are 2 and 1. Let us this time take the second period as our basic period. The two price-ratios become $\frac{5}{6}$ and $\frac{6}{7}$, and the price-index ought to become $\frac{1}{1.18}$ or expressed as a decimal, 0.8490. As a matter of fact,

$$\text{we get price-index} = \frac{(\frac{5}{6}) + (2 \times \frac{6}{7})}{1 + 2} = \frac{106}{127} = 0.8492$$

Though this sensibly agrees with the preceding (0.8490), that fact is but accidental, for if the two price-ratios were further apart in actual value, the differences between the two price-indexes would have been much greater. Suppose, for example, the two price-ratios in the first case were $\frac{5}{6}$ and $\frac{1}{6}$, we should have

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Concurrently with this investigation, steps were taken to ascertain what information, as to prices in Australia, was already available from various sources, and to ensure the collection of systematic and reliable records for the current and future years. The general plan followed in each of the three main branches of inquiry, viz., (a) Retail, (b) Wholesale, and (c) Import and Export Prices, was to select for each branch a comprehensive list of suitable commodities, and to trace the course of prices for each commodity year by year.

(a) As regards *Retail Prices,* information available was found to be meagre and unsatisfactory; and, as these prices depend largely upon local conditions, it was decided to collect, *de novo,* information for the whole of the Commonwealth period (since 1901, inclusive) for 46 commodities (to which house-rents were also added) from thirty important centres of population in Australia. As will appear hereinafter, these prices refer to the "predominant" or most frequently sold class, grade, or quality of each commodity. Existing data for years prior to 1901 were found to be available from official reports for the towns of Sydney and Hobart only. Index-numbers based on these data, which were, however, only for a limited list of commodities, have accordingly been worked out, and are shewn from the year 1911 as far back as 1850 and 1881 respectively (in addition to the index numbers already referred to for the Commonwealth period).

(b) As regards *Wholesale Prices,* an attempt was first made to compile (from market reports, etc.) prices of a representative list of commodities for the capital town of each State; as it was found impossible, however, with due regard to uniformity in class and quality, to obtain comparable returns for other than a very limited list, this attempt was abandoned, and the prices were traced back as far as the year 1871 for 80 representative commodities in Melbourne. This involved a considerable amount of research, and, in the first instance, has been restricted to results readily procurable, viz., those for the Melbourne markets only. It is believed that the general conditions affecting wholesale prices throughout the Commonwealth are fairly well reflected in the Melbourne markets. Thus, these prices afford a representative basis for the whole Commonwealth for the purpose of the investigation. The prices refer generally to definite grades or qualities of the various commodities.

(c) As regards *Imports and Exports,* the prices furnished by dividing the total *value* of imports or exports, as the case may be, by the total *quantity* are of a nature of a general average for all classes or qualities of the several commodities; these prices were computed for 44 representative commodities of the nature of raw materials back to the year 1901.

The methods adopted in each of these three branches of the inquiry are set out in the appropriate parts of this Report.

4. **Local and International Variations in Exchange-Value of Gold, Price-Ratios, and Price-Indexes.**— Economic observers of the last century have directed a considerable amount of attention to the periodic rise and fall of prices, a phenomenon not peculiar to any one country, but world-wide in its incidence. Obviously, the accurate measurement of this variation in its widest aspect, if possible, is of the highest importance. This variation is observable in countries whose staple commodities are very diverse, for example, countries whose staple is rice and those whose staple is wheat, as well as in countries where large sums are spent, for example, on opium, and in others where capital is invested in industrial enterprises. If a precise measurement is to be obtained of variations in prices under

such diverse conditions, it must be through some medium which can be brought into relationship with all commodities. This measurement is obtained from observations of the fluctuations in the exchange value of *money*.

The *exchange-value* or *purchasing efficiency of money* is measured by the amount of any commodity which a unit of money will purchase, the latter, of course, varying directly as the former, and inversely as the price of the commodity. Thus, if the price of tea was doubled during any period, then a unit of money would only purchase half as much tea as before, and the "exchange-value" of money in relation to the commodity, tea, would be halved.

If one commodity only, or, at the utmost, only a few in fixed proportions, were being considered, then it might not be difficult to obtain a very reliable estimate as to the fluctuations in the purchasing efficiency of money. But the list of commodities to be considered is enormous, and the problem is complicated by the fact that this list is constantly being extended in ways that cannot be anticipated. For example, the cycle industry is the growth of fifteen years only, and the rubber industry of ten. Other commodities also for which formerly there was a great demand have gone out of general use. Suppose a comparison is to be instituted between two periods, which we will call year 0 and year 1 respectively. Suppose that the price of a unit of a certain commodity was a at the first period and a^1 at the second. The price-ratio of the commodity at the second period as compared with the first would be denoted by the fraction a^1/a.

The method which has been most in vogue amongst economists during the last half-century for determining the fluctuations in the purchasing efficiency of gold has been the *determination of a price-index* based upon a series of price-ratios. As both of these terms will be frequently used in the demonstrations which follow, a definition of them is appended.

For example, suppose that in 1901 the average price of butter was 1s. 3d. per lb., and in 1911 the average price had risen to 1s. 6d. per lb., the price-ratio in 1911 of butter, as compared with 1901, would be 1s. 6d. $\div$ 1s. 3d. *i.e.*, $\frac{18}{15}$ or $\frac{6}{5}$. The price-ratio in 1901, as compared with 1911, would be the reciprocal of this, that is, 1s. 3d. $\div$ 1s. 6d., or $\frac{5}{6}$.

If all commodities were equally important in the scale of expenditure (which, of course, is *not* the case), then the determination of the effect caused by a rise or fall in prices would be a comparatively simple matter. Different commodities are really far from being of the same economic importance. Cotton, for example, is much more important than silk, and brandy less so than tea. Many economists, who recognise this difference of importance, endeavour to give expression thereto by means of a series of "weights" or multipliers.* The price-ratios are then multiplied by them, each by its appropriate "weight," and the sum of the products is divided by the sum of the weights. The result gives what may be called a weighted *price-index*. The reciprocal of a *price-index*, properly determined, would be the measure of the relative purchasing efficiency of gold between the two periods.

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* In other words the price-ratio of any given commodity is counted several times over, viz., as many times as is represented by the multiplier.

This can be illustrated by an example. Suppose that between two periods the average price of tea rose from 1s. 3d. to 1s. 6d. per lb., and the price of bread rose from 3d. per 2-lb. loaf to 3½d. per 2-lb. loaf. The price-ratio of tea would be $\frac{6}{5}$, and that of bread, $\frac{7}{6}$. If, however, bread, owing to its greater economic importance, exerted twice as much influence on expenditure as tea, then the price-index would be

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the second price-index should be $\frac{18}{7}$. i.e., 2.571, but it really becomes

$$\frac{(\frac{6}{5} + (2 \times 6)}{1 + 2}$$ i.e., $\frac{66}{15}$, or 4.4; a very wide divergence.

In order to obviate the theoretical defect in this method, it is desirable to avoid the use of price-ratios altogether as a means of establishing price-indexes. But before doing this it is well to notice which of the different weightings, that have been adopted from time to time in conjunction with price-ratios, lead to the best results. It will be found that one of the many variations of Scrope's method most nearly satisfies the test of reversibility. In Scrope's method, the price-ratio for every commodity is multiplied by the number of mass-units used, and these are taken as the weights, it being assumed that the same number of mass-units is used at both periods under comparison. If now the number of mass-units of any commodity be multiplied by the price per mass unit, this gives the aggregate expenditure per commodity. Scrope's method, consequently, gives us the ratio of the aggregate expenditure for the two periods, assuming that equal mass-units are used in both. From this idea it is only one step to the method of computing price-indexes which has been used in this Report. The essential feature in this is that a fixed list of commodities is drawn up, and it is assumed that a definite number of mass-units of each is consumed every year. The definite number fixed upon must be chosen carefully with a view to the relative importance and availability of each commodity. For example, the amount of pig-iron would be estimated in tons, and the amount of radium in milligrams. It is desirable that the list of commodities should be of international usage. This body of commodities in definite amounts would constitute what might be called the "complex economic unit," or briefly the economic unit. The ratio which the aggregate expenditure upon this "economic unit" every year bears to the aggregate expenditure thereon for the basic year constitutes the price-index for the former year, and the price-index is the inverse measure of the *purchasing efficiency of gold.* This will be denoted the *"aggregate expenditure method."*

In order that an inquiry adequate to the importance of the subject should be conducted, an examination has been made into the price-ratio methods of computing price-indexes associated with the names of Dutot, Carli, Evelyn, Young, Scrope, and Drobisch. A further investigation has been made with the object of establishing the mathematical justification for the use of the "aggregate expenditure" method of computing price-indexes, and the necessity for the establishment of the standard international list of commodities and the "complex economic unit." The results of these investigations are embodied in Appendixes VIII and IX., to which any inquirer wishing to thoroughly understand the subject is referred.

5. **Aggregate Expenditure Method Adopted in this Report.**—
For the reasons indicated briefly above, and set out more fully in Appendices VIII. and IX. hereof, the index-numbers presented for Australia in this Report are based on the aggregate expenditure method,* and represent the ratios between the total aggregate cost of definite quantities of a number of commodities at a given date and the price of

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* See formula (2) in Appendix VIII.

the same quantities of each commodity at some other date selected as a base or standard; each of these ratios is then multiplied by 1000. To make this clear, it will be well to first take a simple numerical example. Suppose that in 1901 the average price of butter was 1s. 3d. per lb., of bread was 3d. for 2lb. loaf, of mutton was 3d. per lb., and of milk was 4d. per quart; and suppose that in 1911 the prices of these four commodities were 1s. 6d. for butter, 4d. for bread, 5d. for mutton, and 5d. for milk.   Now the total quantities of each of these commodities consumed in Australia per annum are approximately 90 million lb. butter, 470 million 2lb. loaves bread, 330 million lb. mutton, and 300 million quarts of milk.   Therefore, the actual expenditure of the people of Australia on these commodities in 1901 and 1911 respectively would be as follows :—

Computation of Index Numbers : Illustrative Example of Aggregate Expenditure Method.

Particulars.	Unit.	Quantities Consumed (0,000,000 omitted).	Prices.		Total Expenditures.	
			1901.	1911.	1901.	1911.
			d.	d.	d. (0,000,000 omitted)	d. (0,000,000 omitted)
Butter ..	lb.	9	15	18	135	162
Bread ..	2lb. loaf	47	3	4	141	188
Mutton ..	lb.	33	3	5	99	165
Milk ..	quart	30	4	5	120	150
					495	665

The relative aggregate expenditure was 495 in 1901, and rose to 665 in 1911; in other words, the index-number in 1901, taking the expenditure in 1911 as the base (= 1000) was $\frac{495}{665} \times 1000 = 744$, and the index number in 1911, taking the expenditure in 1901 as the base (= 1000) was $\frac{665}{495} \times 1000 = 1343$, which might, of course, have been obtained directly by taking the reciprocal of the result previously obtained. If now, instead of only four commodities, a representative group of fifty or more were treated in this way for a series of years, the numbers thus obtained would furnish a satisfactory index of the variations in price from year to year.[*]

In view of the fact that the above method of computing index-numbers is different to the methods ordinarily adopted by statisticians and economists, it is desirable to refer briefly to certain fundamental principles underlying the question.

The various commodities which are required in the civilised world may be roughly classed under the following heads, viz. :— (a) Food; (b) Clothing; (c) Furniture, Tools and Utensils; (d) Housing; (e) Miscellaneous. Under these various heads may be classed items susceptible of more or less exact definition and evaluation as to price.   Not all commodities are equally important in any division; for example, a staple commodity such as flour as compared with a commodity used merely for flavouring, such say as nutmegs.

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[*] See formula (2) in Appendix VIII.

There are several senses in which things are important, for example, from the standpoint of hygiene, or merely from that of actual usage. With the latter we are alone concerned, and since money (gold) is the *medium of exchange,* and everything being expressed in relation thereto by its *price,* or the quantity of money that a unit of the commodity costs, it is the one commodity in which the value of all others is immediately expressed.

Now to express quantitatively the relative importance of commodities we must have regard to the average relative expenditures thereon. In economic inquiries of the kind under consideration we are thus really concerned only with the actual habits of the people in regard to the number of units of each commodity, that is to say either the relative quantities of the commodities or the relative expenditure upon them. The intrinsic value or necessity is quite another question, as is obvious in comparing, for example, food and house equipment, one of which is a necessity and the other to some extent a convenience.

The relation of the money unit to commodities, expressed as price, constitutes the data for the investigation, and the *fluctuations in price* shew the variation of the *purchasing power* of the money unit (£1). As already pointed out, the measure of the importance of a fluctuation in the price of any commodity is the measure that the expenditure on the commodity bears to the expenditure on the whole group. The practice has arisen of deducing a general measure of the fluctuation by computing the *price-ratios* for a series of commodities, the price-ratio being found by dividing the price at any time by the price at some other time arbitrarily selected as the base or standard. Commonly the number so found is multiplied by 100 or 1000, so that the number minus 100 or 1000, as the case may be, represents the rate of increase on 100 or on 1000. Each price ratio is then " weighted," that is to say, is multiplied by a number representing the importance of the commodity based on the total relative value of the commodity consumed. The sum of these weighted results divided by the sum of the weights gives the weighted index number.*

Many economists, however, recognising that the attribution of different degrees of importance to different commodities involves a considerable amount of arithmetical labour, have advocated the practice of simply taking the arithmetic mean of the price-ratio under the impression that this was sufficiently accurate.†

As shewn in Appendix VIII. hereof, both of these methods are invalid and yield incorrect results, and for that reason neither of them has been followed in the computation of the price-indexes given in this Report for the Commonwealth. The method of simply taking the mean of the price-ratios (unweighted) cannot be justified theoretically under any circumstances, and the method of using weighted price-ratios gives correct results only if the geometric, and not the arithmetic, mean of the weighted products is taken.‡ The computation of the results by taking the geometric mean involves, however, a considerable amount of arithmetical work, and is neither so direct in its application nor so readily understood as the " aggregate expenditure" method adopted in this Report. Moreover, there is no ground on which any other method can be regarded as preferable to the " aggregate expenditure" method.

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* See formula (10) in Appendix VIII. † See formula (22) in Appendix VIII.
‡ See formula (11) in Appendix VIII.

In order to exhibit arithmetically the value and reliability of the different methods, a careful examination was made as to the index-numbers computed by the several methods for the wholesale prices in Melbourne of 73 commodities in 1871 computed with prices in 1911 as base (= 1000). The results were as follow:—

Price-Indexes, Examination as to Reliability of Various Methods.

Particulars.	Aggregate Expenditure Method.*	Weighted Price-Ratio Method (Geometric Mean).†	Weighted Price-Ratio Method (Arithmetic Mean).‡	Unweighted Price-Ratio Method.§
Index Number for 1871 with 1911 as base year (= 1,000)	1,194 (valid).	1,195 (valid).	1,289 (Invalid).	1,310 (Invalid).

* See Formula (2) in Appendix VIII.   † See Formula (11) in Appendix VIII.   ‡ See Formula (10) in Appendix VIII.   § See Formula (22) in Appendix VIII.

It may be seen that the results obtained by the first two methods are almost identical. Moreover, it is shewn in Appendix VIII. that these results are *reversible,* that is to say by taking the reciprocals of the index-numbers thus obtained with the year 1911 as base, the same result is obtained for the index-number for 1911 with the year 1871 as base, as is obtained by calculation from the original data, and *vice-versa.* As will appear hereinafter *this question of reversibility is of great importance. In neither of the other cases are the index-numbers reversible,* and, further, the differences between the last two results are considerable, and they both differ widely from the uniform results obtained by the first two methods.

The matter is so important that it has been thought desirable to discuss it at length. It will suffice here to remark, primarily, that it is obvious that the actual commodities, and the quantities thereof used, will affect the result obtained. It is therefore necessary first of all to inquire how many units of each commodity a community uses on the average. A list shewing both the commodities and the number of units used might properly be called the *regimen* on which any deductions are based. This *regimen* is important, and constitutes a necessary foundation for the deduction of the variations in the exchange-value of the money unit. The common-sense and obvious way of measuring these variations is to multiply the price of each of these commodities by the corresponding number of units used of that commodity in the *regimen,* and finding the sum of these products. The total so found gives an aggregate cost, and the ratio of the aggregate cost of any year to the aggregate cost for the initial or basic year furnishes the price-index required. Ordinarily it will be convenient to multiply it by 100, 1000, 10,000, etc., according to the precision required. In this Report each result has been multiplied by 1000.

We may call the regimen indicated a *complex-unit*: and in this scheme it is the varying price of the complex-unit with which we are concerned. No better measure than this can be found for deducing the variation of the exchange-value of the money unit (£1).

Here it may be said that figures deduced for this purpose may be misleading simply because the list of commodities *was not well chosen,* or because the mode of calculating was not satisfactory, or for both reasons together. The whole question divides itself, therefore, into two

branches, viz.—(a) the inquiry into what should be the list of commodities and the number of units used on the average; and (b) the technique followed in the computation of results. The latter being of high importance, but somewhat technical, has been dealt with in an Appendix, and will not further be referred to except therein. (See Appendix VIII.) It will suffice here to say that the method of basing deductions directly on aggregate expenditure has been preferred to that of basing them on price-ratios for the reasons already referred to, and which are more fully set forth in Appendixes VIII. and IX.

II. RETAIL PRICES, HOUSE RENT AND COST OF LIVING.

1. **General.**—Cost of living is affected by two things, viz.—(i) *Variation in the units and items of the regimen,* i.e., change in the standard of living, which strictly includes also changes in quality or class of commodity consumed; and (ii.) *Variation in the exchange value of gold,* since this affects the *cost* of any regimen whatsoever. With the former question, viz., standard of living, this investigation is not immediately concerned. That is a matter for determination by the analysis of household budgets or in some other appropriate manner; the latter remains to be considered.

Assuming, then, for the present that the regimen is exactly defined, then cost of living may be measured by the amount of money necessary to purchase it, that is to obtain definite amounts of food, clothing, housing accommodation and other necessaries, as well as comforts and luxuries. It will therefore be seen that in order to measure variations in the cost of living it is essential to obtain accurate and representative record of three things, viz.:—

(a) The nature of the commodities, requirements and services ordinarily bought or paid for by the mass of the community.

(b) The relative quantity or extent to which each item is on the average consumed.

(c) The prices at which these items are bought or paid for by the consumers.

Before discussing these three questions in detail it is desirable to refer briefly to certain general considerations concerning the value and utility of index-numbers based on Retail Prices.

It has been alleged by various economists and statisticians that the formation of reliable and useful index-numbers based upon retail prices is precluded by the following considerations, viz.:—

(a) The absence of standardisation of grades and of standard retail quotations for the same article over a series of years.

(b) The rapid variations in the quality and the general nature of retail articles, which are powerfully influenced by changes of fashion and the varieties of production; and

(c) The local and non-typical character of retail prices.

To meet the last of these objections first, it may at once be stated that the matter of obtaining typical or representative prices is merely one of statistical organisation, and, as will appear hereinafter, steps have been taken to ensure that the quotations which have been, and are being,

collected in Australia are such as will afford a satisfactory basis for the computation of prices of a representative character. It will be seen later that the prices actually collected refer to those classes, qualities, or grades of commodities most frequently sold. While it is true that the grades are not in all cases well standardised, by obtaining the "predominant" or "most frequent" prices, an average price applicable to the purchases of the masses of the community may readily be computed. Furthermore, the objection raised to the absence of standardisation and the rapidity of variations in the quality of commodities, due to changes in fashion and other matters, must equally apply to wholesale prices, since practically all commodities, and all classes and grades thereof, which are sold retail are also sold wholesale.*

The regimen may be changed either in respect of quantity or quality. Change in quantity ordinarily takes place slowly, and it is not of importance in an investigation extending over only a small number of years; it must be met by a periodic revision of the "mass-units" or the "weights." Change in quality is continually taking place in regard to all commodities, and nearly every two samples of a commodity would be found, on strict analysis, to differ (e.g., in chemico-physical analysis). The question is really only one of degree, and each case must be decided on its merits. If the objection that strictly applies, viz., that change of quality must invariably be taken into account, were allowed to have weight, we should be landed in an absurd position, viz., that no deductions could strictly be made. It is of importance, therefore, to notice that, by the device of obtaining the "predominant" or "most frequent" price, the class, quality or grade of commodities comprised in the regimen always refer to that class, quality or grade which is most frequently sold. The method, though not theoretically perfect, has distinct advantages.

This may be explained in the following manner :—Suppose that in an investigation into prices, either wholesale or retail, certain grades or qualities of commodities have been selected as representative of the grades or qualities most commonly used, and as furnishing typical price movements for the several commodities included in the regimen, and suppose that owing to a change in quality or in the habits of the people these selected grades cease to be representative either of the quality consumed or of the price movements, then the successive index-numbers, being based on a regimen which no longer prevails, cease to be of value. If, however, the data collected referred to the "predominant" or "most frequent" prices, then the prices obtained continually relate to the grade or quality most frequently used, whatever that grade or quality may be. Of course, in the case of certain commodities in regard to which all the varieties of production and all the changes of fashion have their full influence, it may be impossible either to select any grade, which is representative in quality and which truly reflects changes in prices, or to determine any quality which is most frequently sold. It is for this reason that certain commodities, such as clothes, boots, furniture, etc., have been excluded from the present investigation. It appears, therefore, that the objections which have been raised to the formation of an index-number based on retail prices are not valid, and that, in any case, they apply equally to one based on wholesale prices.

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* This is generally true with the exception of a few commodities such as clothes made to order and a few other special commodities, in the making of which skill or personal service plays an important part.