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SHORT-TERM NATIONAL ACCOUNTS IN FINLAND

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I. HISTORICAL BACKGROUND

By the autumn of 1958, when the planning of quarterly calculations of the national accounts was begun, the following data on the national income of Finland had been published:

1. For 1926–48, rough annual figures of net domestic product at current prices by industrial origin, as well as indices of volume of domestic product of some main industry groups.
2. For 1948–57, relatively detailed annual data on domestic product, national income, and national expenditure.

Current annual computations were carried out principally in summer, and the results – the first, relatively detailed calculations for the preceding year – were prepared in August and published in September. Simultaneously a rather rough forecast of the national supply and demand balance was published for the current year as a whole.

At the same time as plans were being made for quarterly accounts, an optimum solution was sought for the development of national income statistics in general. The constraints that had to be taken into account included:

1. The smallness of the national accounting staff and its insufficient training.
2. Relatively weak short-term primary statistics.

The objectives striven for were:

1. To initiate long-term national income research (for 1850–1926 or for 1900–26) for the purposes of growth studies and other allied investigations.
2. To commence input-output studies.

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3. To commence national income calculations on a regional basis.
4. To commence flow-of-funds, capital stock and national wealth accounts studies.
5. To improve the reliability of the statistics radically.
6. To *commence quarterly national income calculations.*

The last-mentioned objective was regarded as one of the most important, and steps were immediately taken toward its achievement.[1]

The first quarterly study, done as an experiment, showed nonetheless that the staff of the Division for National Accounting had to work a great deal of overtime, that other divisions of the Central Statistical Office had to give it extra assistance, and that some of the current tasks of the Division for National Accounting had to be omitted and new tasks postponed indefinitely. Hence, in reporting the results of these first quarterly calculations it was stated that they could not be continued without increasing the staff of the Division.

The publication of the first quarterly series generated nevertheless a rapidly increasing demand for them, with the outcome that appropriations for a substantially increased staff were included in the next state budget. Since then, quarterly national income calculations have been made twice a year, in February and August, in the latter case in connection with the annual calculations and revisions of previous calculations. In addition,

[1] Since this decision, too, was made within the framework of a whole set of simultaneous decisions, there is also reason to list the others:

(*a*) The Bank of Finland (the central bank) initiated a national income study for the period 1850–1960 (a kind of Kuznets study). Nearly the whole research staff of the Division for National Accounting participated in this project.

(*b*) An *input-output study* was begun under the direction of the research staff of the Division for National Accounting. The study related to 1956 and was financed partly by private organizations and partly by the Government. It was chiefly conducted separately from the official current duties of the Division. An input-output study relating to 1959 and accomplished as a regular official duty will be completed in 1963.

(*c*) *Regional accounting* started in 1963 and first results will be published in the winter of 1964–5. They concern the years 1961–2. These calculations are made provisionally for public committees.

(*d*) Calculations of *flow-of-funds, capital stock and national wealth* so far are subject to provisional experiments. There is a plan to publish the tables of the so-called Oslo-Re-Fi model relating to Finland during the year 1964. It should be noted, however, that balances of sources and uses of money funds for 1953–9 have been published by the Bank of Finland.

(*e*) The low *reliability* of some of the calculations has been regarded as one of the worst shortcomings. To overcome these, the accuracy of the primary statistics should be improved substantially.

a decision has been made to develop a relatively rough short-cut method for making monthly estimates. The scope of these estimates will be such that one researcher (together with computation assistants) is able to manage it as part of his job.

In the following an account will be given of some of the most crucial problems associated with quarterly accounts in Finland, as well as of the attempts that have been made to solve them. Particular emphasis will be placed on the usefulness of the calculations and the reliability of the results. Some remarks are also made, later, on forecasting error and on seasonal adjustment of monthly data.

II. ADVANTAGES AND DRAWBACKS OF QUARTERLY ESTIMATES

The main intent of any statistical system for the description of economic phenomena is to help provide information which is capable of assisting decision-makers. To achieve this goal it is necessary to have:

(1) a sufficient amount of primary data (data on real and financial flows for sufficiently long periods, cross-section survey data, and so on) for the discovery of causal relationships: and
(2) sufficiently recent data, descriptive of the situation in the immediate past, for the discovery of the direction and size of the changes that are taking place currently.

The first of these requirements implies that there should exist accurate, reliable and detailed series that are relevant from the point of view of the construction and testing of theories concerning the economic causal relations. The second requirement emphasizes that the current situation and the tendencies present in it must be known. In practice, the weight to be given to these two requirements, which need not invariably be fully compatible, must be evaluated using some rule of thumb when the goal is the optimum use of given research resources. When the decision to initiate quarterly national income calculations was made in Finland (that is, a decision to acquire[1] recent short-term

[1] This does not actually signify that collection of a large number of primary statistics has been started for the quarterly accounts. What is meant, primarily, is that the short-term statistics collected by head offices or departments of various

data) the second requirement was in the foreground. Not exclusively, however; for, in the course of time, quarterly calculations will produce an abundance of long series. Thus, they also meet the first of the above requirements.[1]

It should be borne in mind, in addition, that quarterly calculations do not only increase our body of knowledge; they also amount to an improvement in this body of knowledge.[2]

In point of fact, national accounts furnish a framework for the co-ordination of statistical investigation and, in general, for collaboration as far as economic statistics are concerned. The adequacy of information gathered from a variety of sources is being tested through fitting it into the framework provided by national accounts. By making use of a system of national accounts – that is, the definitions and identities underlying the system – new information, too, may be inferred from the available body of data. This possibility of deducing new information provides an excellent means for the testing of separate and independent investigations. When the calculations are made on a quarterly basis, this kind of testing and control of the data is performed more frequently and in greater detail.

An example may be mentioned here to illustrate how short-

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types – private organizations, Government agencies, etc. – have been gathered in the Central Statistical Office, subjected in some cases to re-treatment, and taken for active use. This applies specifically to:

agriculture: the use of labour on the farms subject to continued observation;

forestry: the monthly surveys by the State Board of Forestry and the Ministry for Social Affairs concerning timber fellings and employment;

land and water construction: the monthly reports of the Ministry of Communications and Public Works;

transport: the monthly reports of the State Railways;

other services: the quarterly statistics of sales by restaurants, collected by the State Alcohol Monopoly.

In this way, in addition to the generally known short-term statistics, the less generally known sources, various kinds of by-products and the like, have been taken into centralized use.

[1] In March 1961, i.e. two years after the publication of the first quarterly series, quarterly data on, for instance, domestic product at current and constant prices, by industrial origin, were published for the years 1948–60.

The starting-point was provided by the final annual values, for the years 1948–57, which were divided between the different quarters. Since these calculations were regarded as 'final', they could not be compared with any previous calculations; hence, it has not been possible to analyse the error component as far as these calculations are concerned. The error component will be discussed later for the years 1958–61, for which years both preliminary and final calculations have been carried out.

[2] See also 'Kvartalsfall for Nasjonalregnskapet', *Statistiske Meldinger*, No. 10, 1953, Statistisk Sentralbyrå, Oslo, p. 279.

term national income calculations can also improve annual results. Many of the price indices for the whole year are unweighted arithmetic means of monthly indices. As a consequence, each month has the same weight, irrespective of its length or the amount of transactions carried out during the month. The use of these unweighted indices in deflating annual value figures causes bias, which is the larger the more uneven is the distribution of the transactions between the months (when prices are changing). Deflation carried out on a monthly (seasonal) basis reduces the bias.

An additional advantage, related to the use of computer capacity, is associated with this improvement of data: quarterly calculations often yield aggregates capable of being used automatically, as they stand, for provisional or even final annual figures, thus reducing the work necessary for annual calculations. For example, the value and volume of the gross output of house construction are computed (except for certain forecasts) on a quarterly basis in such a way that the sums for the whole year automatically become the final annual figures.

A remarkable advantage provided by quarterly calculations is the possibility of checking and revising forecasts and programmes at shorter intervals than previously.

In addition to these advantages there is the market effect of quarterly data: the general usefulness of national income data is increased as the series of transaction flows are published on a short-term basis and with a short lag.

Now it may be asked: is the utility of quarterly calculations – dealt with rather superficially in the foregoing – sufficient, relative to the great amount of work they require?

To carry out the entire product-income-expenditure system relatively completely four times a year would tie up too large a proportion of the computer capacity.[1] It was, therefore, decided to carry out the quarterly calculations twice a year – in February and in August – as already indicated. The calculations made in February deal principally with the four quarters of the preceding year. At the same time, a forecast is made for the first quarter of the current year and, also, a very rough one for the second quarter. In August figures are computed for all the

[1] Of course, the situation will change after the quarterly calculations have become a matter of routine and are carried out chiefly through programmed data processing.

quarters of the current year, those pertaining to the second half being forecast; and the quarterly estimates of the previous year are checked and revised in the light of new annual data that are available at that time.

Thus, the decision-makers have at their disposal, even in the worst case, a rough picture of recent developments with a lag of no more than about one quarter. It has been found that there is demand for more frequent reports – to be published, for instance, in May (shortly before the beginning of the summer holiday season) and in December.[1] Therefore, it has been decided to develop a relatively rough and easily manageable method for following up the monthly movements in the most essential transaction flows. However, at the time of writing, these monthly estimates are not available.

Even rough national income data, computed on a monthly basis, are valuable from the point of view of following cyclical fluctuations and, in particular, the timing of cyclical downturns and upturns. Moreover, short-term forecasts in general can thus be kept at least approximately up to date. Further, even rough monthly data provide essential additional information concerning seasonal fluctuations. *The traditional division of time into quarters is not, in fact, based on any structural regularities in seasonal movements; quite the contrary, essential features of seasonal fluctuations are blurred by it.*

A few additional remarks should perhaps be made in support of this assertion. From the point of view of seasonal analysis, quarterly figures as such are far from sufficient because the highs and lows, possibly falling in the same quarter, cancel each other out, so that the picture received of the quarter is smoothed in this respect. In addition, the quarters are usually quarters of calendar years (January-February-March, April-May-June, etc.); this may also affect the picture.

The following example, relating to seasonal fluctuations in the output of Finnish industry, is intended to illustrate these remarks. The primary series used was the index of industrial output per working day in 1951–4. Applying the method of

[1] Most annual reports, surveys, budgets, forecasts, and so on are in effect made at that time. This is truly a rather difficult problem. For reasons of tradition, which are often quite difficult to break, business needs information of national aggregates in January, whereas relatively good national income data for the last quarter of the preceding year are not available until the 15th or 20th of February, when nearly all monthly statistics and some quarterly statistics for the preceding year appear in provisional form.

moving averages, a so-called constant seasonal index S was computed from this.[1]

	S	I	II	III
January	99·5			
February	100·6	101·6		
March	104·6		104·0	
April	106·9			106·1
May	106·9	104·2		
June	98·8		93·0	
July	73·3			87·5
August	90·3	88·9		
September	103·0		99·6	
October	105·4			104·9
November	106·4	105·4		
December	104·4		103·4	
				101·5
January	99·5			
February	100·6			

We see that the way in which successive months are combined into quarters significantly affects the picture of seasonal fluctuations. The third of the alternatives yields the largest variance and gives in this sense the best picture of seasonal variations.[2]

Therefore, there is reason to divide the computer capacity between quarterly calculations and superficial monthly calculations to reach the optimum.

III. SOME PROBLEMS RESULTING FROM THE REGISTRATION OF TRANSACTIONS

As is well known, the flows of income are registered in national income statistics on a payment due, rather than on a cash basis.[3] However, from the point of view of many econometric problems (such as those concerned with propensities to

[1] First, twelve-month moving averages and, then, the averages of the relative deviations for the different months were computed.

[2] If the index numbers are classified into groups of three from the highest to the lowest, regardless of the sequence of the months, the minimum arrived at is the same as that obtained in case III above (87·5) and the maximum, 106·7, departs only slightly from the maximum in case III (106·1), from which it is obtainable through replacing the index for March by that for November.

[3] Consequently, each transaction is referred to the point in time at which the liability to pay an amount of money or its equivalent is generated and the ownership changed. See 'National Income of Finland 1956–59 and a Survey of the Concepts Used'. (*Tilastokatsauksia – Statistiska översikter – Bulletin of Statistics, 1959: 9, p. 65.*) See also *A Standardized System of National Accounts and Supporting Tables, Studies in Methods, No. 2*, Statistical Office of the United Nations, New York, Revised Edition, p. 96.

consume, income elasticities, etc.) registration of income on a cash basis may be of more value than registration on the payment-due basis.[1] It is therefore planned to estimate some of the income flows separately on a cash basis as well as a payment-due basis. As a matter of fact, the Finnish national accounts already show the national wage bill on both bases.[2]

Another interesting registration problem concerns the expenditure account. As is well known, consumption is ordinarily described in national income calculations in terms of purchases of consumer goods; this may lead to biased interpretations. In point of fact, consumption should only include the flow of the services rendered by consumer goods. To the extent that a consumer good retains its capability of rendering services in the future (i.e. beyond the accounting period), its acquisition represents saving (i.e. postponement of consumption). Technically, this shortcoming means that depreciation on consumer goods is not distributed adequately over the whole period of their use; instead, consumption is regarded as taking place in the period when the item is bought.[3] It should be noted, on the other hand, that data on actual consumption are required for relatively few models. What is intended to be explained are the purchases of consumer goods.

Problems such as those just mentioned become serious, particularly in a small country, when the accounting period is

[1] It cannot be claimed, of course, that the only relevant matter from the point of view of the use of income and of consumer's choice would be the time at which the payment takes place. The time at which income is earned may also exert appreciable influence on consumer's behaviour, particularly in cases where it amounts to a large proportion of total income and is received regularly (i.e. if the consumer is 'accustomed' to receive it and has 'adjusted' his consumption accordingly). Furthermore, if the system of payment is such as to raise the income of some certain period very markedly relative to other periods, the difference may be regarded by the consumer, in part, as saving (i.e. as a change in asset holdings rather than in income), so that it does not affect the consumption decisions in the period concerned with its full force.

[2] A theoretically interesting case in point is the registration of wages and salaries for annual holidays. In calculations carried out on a cash basis these are included in the quarter of payment, whereas in ordinary national income calculations they are divided between all the four quarters: according to the law, the payment for holidays is a function of the time worked. In principle, it accumulates month by month, but is paid only once a year, in summer. What is of relevance in national income calculations is the time of income generation; in the flow-of-funds studies, the time of payment.

[3] It is appropriate in this context to note a detail which may seem obvious. All the calculations relating to periods shorter than one year are in Finland based on the concepts used in annual calculations. So, for instance, capital goods are defined in the same way as in the annual calculations (goods lasting longer than one year). Thus shortening of the observation period in no way changes the relation of capital goods to intermediate goods.

shortened. A case in point, as far as consumption is concerned, is the acquisition of cars by households. In a country, such as Finland, where the imports dependent on the granting of licenses have varied sharply according to cyclical fluctuations, enormous car purchases may be concentrated within a relatively short period.

The reduction of the number of transactions is a serious problem as far as efforts to predict the future with the aid of relationships derived from time series are concerned. The estimates of the parameters become quite uncertain when chance factors have the possibility of influencing the results in a large measure (the problem of small samples).[1]

IV. THE ROLE OF SUBSTITUTE AND INFERRED ESTIMATES

The influence of different types of error may be aggravated when certain series are substituted for others. For example, in the absence of corrections for inventory change, the use of output and import figures to represent sales may lead to greatly biased results since, in fact, goods may be produced or imported long before their sale.

Furthermore, because of the absence of adequate statistics resort must be made to definitional equations (and, at times, to institutional and technical equations). This may take place, even prior to the national accounting stage, in compiling the primary economic statistics.[2]

Thus, for example, in some industry groups it is possible to compute either the volume of output or employment directly; one or the other must be derived from the definitional equation $L \times T = Q$ (L = employment, Q = volume of output, T = productivity), productivity being considered as given. Productivity has been estimated with the aid of annual series and its

[1] As an example taken from foreign trade, it may be stated that the exports of ships, large factory machines, etc., are so bulky in themselves that the quarter (or month) within which the deliveries happen to fall affects the series decisively.

[2] These statistics are obtained with a lag of one to five months. Some are in the nature of preliminary estimates subject to later revision on the basis of annual statistics. Others, such as price indices, are final. An example of the use of a technical equation follows:

Some of the volume indices for the metal industry are computed on a monthly basis from a Cobb-Douglas type of model $Q = a\, L_h^{\alpha} K_e^{\beta}$ (L^h = number of hours worked, as registered on a monthly basis and K^e = consumption of electric energy). The parameters have been estimated from annual data.

quarterly movements are obtained through interpolation (subsequent revisions) or extrapolation (forecasts). When inferred information of this type is used there is a danger, of course, that an analyst who is not familiar with the *a priori* basis of the series may consider it as verifying some regularities that have been used by way of definition.

V. REVISION POLICY

It may be of interest to summarize the revision policy used for the accounts in Finland as a background for the next section dealing with the quantitative aspects of error (as measured by the revisions):

1. In August of the year x estimates are made for the first and second quarters of the year x and forecasts for the third and fourth quarters of the year x.

2. In February of the year x + 1 estimates are made of the last two quarters of the year x as well as forecasts for the first two quarters of the year x + 1. At the same time, some of the calculations concerning the first two quarters of the year x are revised. These revisions are worked out in the accounts of agriculture and forestry and, somewhat less fully, in those of construction. The estimates for the other industries are not revised at this stage. The revisions mentioned above are naturally reflected in the figures of income and other magnitudes as well.

3. Thus in February of the year x + 1 estimates for the four quarters of year x are available (some of those of the first two quarters having been revised). These four quarterly estimates will be referred to below as the provisional quarterly estimates. Also, their sum constitutes the provisional annual estimates.

4. In August of the year x + 1 the four 'provisional' quarterly estimates of year x are revised in the light of the annual information for the year x that has become available by that time (and, in some sectors, in the light of more up-to-date quarterly and monthly data). These revised figures will be referred to below as the final quarterly estimates. The revision here involves bringing the four quarterly provisional estimates of the year x up to the level of the annual estimates. The latter will also be referred to below as the final annual estimates.[1]

[1] Although these annual estimates are in the present context referred to as final, they may, in fact, be revised further at a later date, as new information

It should be noted that this last revision is carried out in such a way that each of the quarterly figures is altered in proportion to the change caused by the revision in the annual figure, so as to make the sum of the quarterly figures equal to the revised annual figure. This adjustment may give rise to a discontinuity which is particularly serious for comparisons of the estimates for the last quarter of one year with those for the first quarter of the following year.[1] It will be clear, therefore, that for short-term comparisons it may be preferable to use the unrevised quarterly estimates rather than the mechanically revised ones. However, it is hoped that it will prove possible to develop an adjustment technique which is based on more realistic assumptions than those now in use and which will avoid the problem of discontinuity and preserve the reliability of short-term as well as longer-run comparisons.

VI. DESCRIPTION OF ERROR IN THE PROVISIONAL ESTIMATES (AS MEASURED BY REVISIONS)

We now turn to a description of error in the provisional quarterly estimates as measured by subsequent revisions. This error may be calculated through computing the difference between the provisional annual estimate (arrived at by adding up the four provisional quarterly figures) and the final annual estimate. These differences represent, of course, the revisions in the provisional figures and can be arrived at by calculating the difference in the level of the provisional and final estimates; and the difference in change from one year to the next in the provisional and final estimates. Both calculations have been made and the results are shown in Tables I and II below. The reason for calculating the revisions on an annual basis rather than on a quarterly basis is that, owing to the technique of adjustment (see Section V), a comparison on a quarterly basis

from different sources becomes available (chiefly in August of the year x + 2, and in connection, principally, with the completion of the annual statistics of agriculture, forestry and the industrial sector). However, it will be clear that it is not possible to determine the difference between the true values and the values arrived at finally after all the information that has become available is incorporated.

[1] It should be noted that this discontinuity may be increased by the corrections made in later years on the basis of the sources referred to in the above-mentioned footnote.

does not give essentially more information about the properties of the error than a comparison on an annual basis. The problem of seasonal variation is a further factor which considerably diminishes the reliability of the quarterly calculations, and the series subjected to analysis here have not been available in a seasonally adjusted form. In the description of errors that follows, only those estimates are included which have been published and could, therefore, be regarded as official. The available provisional figures may be divided into the following two groups when the analysis is performed on an annual basis:

1. Since 1959, an estimate concerning the economic development during the preceding year has been drawn up in February on a quarterly basis. The errors in this are due to errors and deficiencies in the provisional data.[1]

2. The balance of national supply and demand for the current year has been prepared in August since 1953. Errors in this are due both to prediction mistakes and to provisional data.[2]

The number of observations in either group are comparatively few, so that care must be taken in interpreting the results. Regarding the observations in the first group (1) it should be noted, further, that they relate mainly to years of a cyclical upswing. The calculations presented in the present section are confined to the first group. Those pertaining to the second group (2) are shown in Section VII below.

Table I shows the absolute means (that is, ignoring sign in summation) of the differences between the provisional and final estimates of level; as well as the algebraic means (that is, taking sign into account in the summation) of these differences.[3] The former of the means shows the extent to which, on average, the provisional estimate has failed to represent the final estimate, irrespective of whether the former was larger or smaller than the

[1] Error = estimate made in August of year x + 1 less estimate made in February of year x + 1.

[2] Error = estimate made in August of year x + 1 less forecast made in August of year x.

[3] The figures in Tables I and II were computed as follows: The means $\bar{x}_f$ of the final observations x_f are presented in column 1. The $|\bar{e}| = \Sigma |x_f - x_p| /n$, where the x_p are provisional figures and n is the number of observation years, are presented in column 2. The $\bar{e} = \Sigma(x_f - x_p)/n$, showing whether there is systematic error in the provisional figures, are given in column 4.

In column 3 there are presented the ratios $|\bar{e}| / |\bar{x}|$, and, in column 5, the ratios $\bar{e}/\bar{x}_f$, indicating the relative mean deviation and bias of the provisional figures from the final figures. Since all items of change during the period were positive $|\bar{x}_f| = \bar{x}_f$ in Table II. In view of the very small number of observations, not much significance can be attached to the 'bias'.

TABLE I

Measures of error in gross national product and its components computed on the basis of short-term statistics, annual estimates 1958–61 (1,000 million mk)

	Means of final estimates	Absolute means of revisions	Relative size of revision %	Algebraic means of revisions ('bias')	Relative size of 'bias' %
Gross national product	1,475·35	11·91	0·8	7·22	0·5
Consumer expenditure	975·56	7·73	0·8	6·76	0·7
– private	790·04	6·10	0·8	6·10	0·8
– general Government	185·52	2·73	1·5	0·66	0·4
Gross domestic capital formation	498·16	8·23	1·7	0·61	0·1
Exports of goods and services	344·66	1·45	0·4	0·41	0·1
Imports of goods and services	343·02	1·12	0·3	0·55	0·2
Net domestic product					
– agriculture	133·37	4·42	3·3	2·45	1·8
– forestry	101·60	1·45	1·4	0·48	0·5
– industry and handicrafts	341·29	3·84	1·1	−0·47	−0·1
– construction	109·15	2·66	2·4	−0·07	−0·1
– transport and communication	86·26	2·82	3·3	−2·32	−2·7
– commerce	135·66	2·81	2·1	2·81	2·1
– general Government	128·48	2·48	1·9	0·65	0·5
– other services	68·87	0·23	0·3	0·20	0·3
Wages and salaries	625·45	5·27	0·8	3·43	0·5
Income from unincorporated enterprises	258·20	4·89	1·9	1·82	0·7
Corporation profits	88·53	3·82	4·3	−1·58	−1·8

latter. The algebraic mean, on the other hand, indicates whether the provisional estimates contained a systematic error or bias.

Table II shows corresponding figures for the year-to-year changes. To make the analysis consistent, all the percentage deviations were computed from the corresponding values of the previous year as observed at the moment of the computation of the provisional or final figures. In this way the effects of imperfect knowledge concerning the previous year could be eliminated at least for the most part. Usually the changes referred to above are most interesting in practice.

A detailed analysis of the reliability of the quarterly national accounts will be carried out in what follows. Many of the remarks are based upon the results presented in the tables; some comments, however, concerned mainly with the quarterly distribution, are based upon personal judgement and intuition.

The different total aggregates – domestic product, national income and national expenditure – are often computed more or less independently. In practice, the aggregates arrived at by adding up the factor incomes, the net value added of each industry and the final expenditure (less imports) are almost invariably unequal. For the purposes of publication, however, it is necessary to make some little adjustments in these aggregates in such a way that the conventional book-keeping identities hold for them. This is done using the most reliably estimated aggregate as the point of departure.

In other words, the size of the most reliably estimated aggregate (in Finland, the domestic product) determines – after allowing for the transfers abroad – the size of the other aggregates (national income and national expenditure). In the absence of sufficient data, and because of the methods of computation used, the estimates concerning the distribution of the components (or structure) of these aggregates differ from one another greatly in respect of reliability.

In most instances, it is the total (quarterly) gross output of an industry that is computed directly. A considerable proportion of the other information is inferred from various kinds of partial investigations and surrogate techniques. Net output is generally estimated assuming that the relative share of the deduction items, in terms of the volume, remains the same throughout the year. On the other hand, the changes in the prices of deduction items and the prices of output are followed up separately.

TABLE II

Measures of error in gross national product and its components computed on the basis of short-term statistics, annual percentage changes, 1958–61

	Means of final estimates	Absolute means of revisions	Relative size of revision %	Algebraic means of revisions ('bias')	Relative size of 'bias' %
Gross national product	9·21	0·87	9·4	0·58	6·3
Consumer expenditure	8·11	0·50	6·2	0·49	6·0
– private	7·65	0·95	12·4	0·38	5·0
– general Government	10·20	1·97	19·3	1·04	10·2
Gross domestic capital formation	13·10	1·23	9·4	0·60	4·6
Exports of goods and services	11·55	0·40	3·5	0·09	0·8
Imports of goods and services	13·19	0·39	3·0	0·17	1·3
Net domestic product					
– agriculture	8·60	3·07	35·7	0·92	10·7
– forestry	13·25	1·37	9·6	−0·18	−1·4
– industry and handicrafts	8·79	1·34	15·2	0·41	4·7
– construction	9·40	2·36	25·1	0·64	6·8
– transport and communication	7·24	3·24	44·7	−2·75	−38·0
– commerce	9·22	2·18	23·6	2·18	23·6
– general Government	10·27	1·65	16·1	1·08	10·5
– other services	6·54	0·34	5·2	0·33	5·0
Wages and salaries	9·04	0·86	9·5	0·86	9·5
Income from unincorporated enterprises	10·21	2·63	20·1	0·14	1·4
Corporation profits	7·52	3·85	51·2	−1·28	17·0

Thanks to this starting-point, the figures for domestic product by industrial origin are relatively good and need not be altered to any great extent in connection with the later revisions. Especially the gross national product in aggregate can be computed in this way rather accurately, as the errors compensate each other. To be sure, during periods of cyclical upswing in particular, the fact that the estimates are in many instances based upon one and the same constant sample gives rise to bias, in the sense that the changes taking place are underestimated because no account is taken, for example, of the appearance of new firms.

By contrast, the quarterly picture of income flows by type of income is not equally reliable, even though independent information is in many instances obtained about employment and the level of earnings – and, consequently, about the wage bill.

Figures for the income from unincorporated enterprises are obtained chiefly on the basis of information about corresponding domestic product and some price, wage and salary data. In Finland, the bulk of the income from unincorporated enterprises consists of the income of farmers (40 per cent) and of the private forest owners' labour and stumpage incomes (23 per cent). Since the timing of these incomes with respect to different quarters is based upon a rather inflexible and mechanical procedure of reasoning,[1] the quarterly distribution must be regarded as unreliable. The other income types are obtained, in aggregate, mostly as residuals. The item 'interest paid abroad', which is quite small, can be computed fairly reliably on a quarterly basis.

On the other hand, it has been possible to estimate relatively well the year-to-year changes in the national income items from the quarterly calculations despite the fact that only few data of the primary short-term statistics relate to them directly.

The data on the distribution of the main components of national expenditure, i.e. consumption and investment, between the quarter-years must be regarded as the least reliable. This is

[1] In agriculture, the point of departure is the growth processes of the crop and the livestock, looked at from the point of view of the inputs. In forestry, the accrual of the stumpage earnings can be followed from the data on fellings. It is not entirely clear, however, whether the payment-due principle implies that these incomes should be referred to the date when the deal is concluded or to the date when the timber is felled. The latter alternative has been adhered to in Finland. If the cash principle were applied, data should be available on the timing of the payments.

why quarterly figures on these are published only in a footnote and subject to numerous reservations. The information is inferred from data on flows of goods and services, i.e. from preliminary data on production, imports and exports. As already mentioned, the consequences of the lack of statistics of inventories is felt particularly strongly: frequently goods are, in fact, produced long before their sale. Because of climatic factors alone, the timing of imports, for example, can be largely at variance with the sales of imported goods.

Although the quarterly data on consumption and investment are rather poor, the annual aggregates thereof give a rather good picture of the national expenditure during the whole year. The lag between production and sales is less harmful on an annual than a quarterly analysis, in which seasonal fluctuations in the inventories are certain to give rise to a great deal of bias.

In the foregoing we discussed the reliability of the estimates by industries and by income and expenditure types. Finally, we propose to discuss separately the error for the price and the volume component.

As regards domestic product and national expenditure, it should be noted that the error in price and that in volume are usually not intercorrelated to any significant extent. The error in the value figures will fall between the errors in the price and volume figures.[1]

The value figures of national income are not, as a rule, divided into a price and a volume component except for the wage bill:

$$W = A\,L$$

W = index of the wage bill
A = index of the level of average earnings
L = volume index of the labour input.

The Division for National Accounting publishes a quarterly index of the level of earnings (for industries, separately for wage earners and for salaried employees), as computed from

[1] Generally the errors in these price components are smaller than those in the volume components, because rather comprehensive price data can be obtained with a short lag. However, according to Mannermaa's calculations that are not published here the estimation of the price components in the domestic product by industries has not succeeded as well as that of the volume components. The reason for this is that we have no price data on many national income items and no direct information about the development of the value of the national product. See also Section VII.

Laspeyres's formula.[1] The data on the wage level are received with a relatively short lag and the wage shift is possible to estimate relatively accurately on the basis of past experience. Hence, the error here is quite small. The principal source of error in computing the wage bill is, in fact, on the volume side: in the error in the employment figures. The employment figures for agriculture and forestry are principally responsible for this error.

The difference between the quarterly and the annual price data is due to two different factors:

(*a*) the sample underlying the annual calculations is markedly larger; and
(*b*) the methods applied in the annual calculations differ in some respects from those employed in the quarterly calculations.[2]

It should be noted, however, that the information on prices, derivable from quarterly national accounts, is not commonly used in Finland as an indicator of the changes in the price level. The only exceptions to this rule are provided by some price indexes of national expenditure (private and public consumption, private and public fixed capital formation) and a separately computed official index of the level of earnings.[3]

VII. A NOTE ON PREDICTION ERROR

Following is an analysis of the reliability of the forecasts concerning the current year that are made in August on the

[1] See Niitamo, O. E., 'Quarterly Statistics on Wages and Salaries', *Bulletin of Statistics*, Helsinki, 1958, 10, pp. 4–6.

[2] In annual calculations, the volume has generally been computed from Laspeyres's formula. When the final value index is divided by this volume index, it follows that the price index will be one computed from Paasche's formula.

$$V = \Pi L = \Lambda P$$

V = value index
Λ = Laspeyres price index
Π = Paasche price index
L = Laspeyres volume index
P = Paasche volume index

In the quarterly calculations, the value index is in some instances computed in an inconsistent way: it is a Laspeyres price index multiplied by a Laspeyres volume index.

[3] The generally used price-level indicators or the official price indexes (the wholesale price index, the cost of living index, the building cost index, etc.) are computed generally on a monthly basis, the unweighted arithmetical twelve-month averages of them being used as the corresponding annual indexes.

basis of the quarterly computations. Here, too, the forecast is compared with the corresponding final estimate. The percentage changes, which one tries primarily to forecast, are subjected to analysis. As stated above, the balance of national supply and demand for the current year has been prepared in August since 1953. In the case of each item, separate predictions have been made of the price and the volume component.

The calculations concerning the properties of the errors have been made employing Theil's inequality coefficient U.[1] U is of the form

$$U = \frac{\sqrt{\frac{1}{n}\ \Sigma(P_i - A_i)^2}}{\sqrt{\frac{1}{n}\ \Sigma P_i^2} + \sqrt{\frac{1}{n}\ \Sigma A_i^2}}$$

where $P_1, P_2, \ldots P_n$ are provisional data and $A_1, A_2, \ldots A_n$ results obtained through later revisions. The value of U lies between zero and one, the former value indicating that provisional primary statistics or predictions have given the best possible result, i.e. $P_i = A_i$ for all i.

U can be decomposed into three terms the sum of which equals one:[2]

- U^M or the proportion of inequality due to unequal central tendency (bias).
- U^S or the proportion of inequality due to unequal variation.
- U^C or the proportion of inequality due to imperfect covariation.

The most desirable possible distribution of the three components is $U^M = U^S = 0$, $U^C = 1$. For the estimates to be unbiased it is clearly required that $P = A$. Likewise, a large value of U^S is indicative of systematic error in predictions, for it signifies that the provisional values do not vary enough or that they vary too much in comparison with the revised values. A large U^C, again, indicates that non-systematic errors due to random factors are present in the provisional values. One cannot, of course, expect to get a perfect positive correlation between the provisional and the revised figures.

The results of the calculations are set out in Table III.

[1] H. Theil, *Economic Forecasts and Policy*, Amsterdam, 1958, p. 32. Theil gives a thorough discussion of the characteristics of U on pp. 32–48.

[2] For details, see Theil, op. cit., p. 34–38.

TABLE III

Inequality coefficients and their proportions of bias, of unequal variation and of imperfect co-variation. Percentage change estimates made in August for the current year 1953–60

	Values				Volumes				Prices			
	U	U^M	U^S	U^C	U	U^M	U^S	U^C	U	U^M	U^S	U^C
Gross national product	0·19	0·55	0·04	0·41	0·29	0·53	0·00	0·47	0·15	0·12	0·12	0·76
Imports	0·13	0·39	0·01	0·60	0·18	0·40	0·03	0·57	0·12	0·06	0·00	0·94
Exports	0·14	0·81	0·13	0·06	0·19	0·60	0·01	0·39	0·12	0·04	0·10	0·86
Investment	0·27	0·44	0·05	0·51	0·38	0·53	0·04	0·43	0·11	0·16	0·04	0·80
Consumption	0·18	0·37	0·01	0·62	0·24	0·15	0·15	0·70	0·15	0·19	0·04	0·77
Total	0·17	0·47	0·00	0·53	0·22	0·40	0·03	0·57	0·13	0·01	0·01	0·98

The price predictions have proved fairly successful, which is only natural, because unexpected shocks occur only rarely in general price movements.

The errors mainly concentrate in the volume component. Especially, the difficulties met in predicting investment show that the lack of data on investment plans has considerably impeded the efforts to keep the calculations up to date. In recent years, however, important improvements have been effected in this respect.

The forecasts concerning exports and imports have been the best ones in terms of the criterion employed, probably because the coverage and quality of the data for the early part of the year are superior to those obtainable for the other components. This observation finds support in the fact that, in comparison with the price and volume predictions, the predictions of the value of these items have been more successful than the predictions of the other items. The most important sort of information about exports and imports, obtainable from the short-term statistics, related to their value, whereas the forecasts concerning the other items are based primarily upon price and volume data.

Regarding the various components of the inequality coefficient it should be stated that U^S has been generally small; i.e. the cautiousness aspect often met in prediction – there is a tendency to underestimate changes[1] – is not very prominent in our forecasts. In price predictions, U^M is also small; i.e. there is little systematic error in them. By contrast, the bias component is comparatively large in the volume and value predictions. During the period under study they have been too pessimistic. This related to exports, in particular, the explanation being that the organizations representing the wood-processing and paper industries tend to give, for labour market policy considerations, an overly conservative picture of expected exports of timber and paper products, which form by far the largest part of Finland's total exports.

VIII. A NOTE ON SEASONAL ADJUSTMENT

As already indicated, in Finland monthly calculations are under consideration. It should be borne in mind, therefore, that while the following observations are relevant to quarterly

[1] See Theil, op. cit., pp. 154–92.

statistics they are particularly important from the point of view of the planned monthly calculations.

The changes in time series based on periods shorter than a year may be divided, for instance, as follows: (1) underlying direction of change, (2) seasonal fluctuation and (3) random variation.[1] Underlying direction, in turn, may be split up into the trend and cyclical fluctuation.

The seasonal movement may be broken down into the following components:

(1) The changes due to factors related directly to the calendar, i.e. the number of working days in the time period.
(2) The changes due to other seasonal factors.
    (*a*) Average or normal seasonal fluctuations
    (*b*) Specific seasonal fluctuations.

The impact of the factors related to the calendar is due to the fact that we divide time into periods of unequal length (months and quarters) in a way reflected, for example, in the figures representing production, income formation and use of incomes. By unequal length we refer primarily to the varying numbers of working days but, also, to the variation in the numbers of working days of different lengths.

One essential factor is the number of Sundays and other holidays, as well as of week-ends. For instance, if the lengths of different quarter-years are measured roughly in terms of working days in such a way that the Sundays and other holidays are eliminated, the following values are obtained for the years 1957–62 (1st quarter 1957 = 100).[2]

	I	II	III	IV
1957	100·0	96·1	103·9	98·7
1958	98·7	96·1	103·9	98·7
1959	96·1	97·4	103·9	100·0
1960	100·0	96·1	103·9	100·0
1961	98·7	96·1	103·9	97·4
1962	101·0	97·0	103·6	98·4

[1] The random variations are irregular movements in time series, due to exogenous factors (wars, strikes, administrative changes and the like). In practice, the changes accounted for by this component depend upon how the other components are determined. Random variation consists of the changes for which one has been unable to find – or has not attempted to find – any explanatory model. Of course, the way in which the other components are defined and measured depends, in turn, upon the degree of composition, i.e. the number of different components striven for.

[2] In 1962, for example, the number of calendar days was as follows:

	I	II	III	IV
Number of calendar days	90	91	92	92

In addition to the number of working days there are certain other periodic factors dependent upon the calendar, such as the number of pay days, shopping days, etc. On a superficial view, the elimination of the factors associated with the calendar may appear simple. In practice, however, a very careful examination of the lengths of time actually worked and identification of the calendar factors relevant to each particular phenomenon is necessary.[1]

In a separate study, 'On the Measurement of Seasonal Variations', Pertti Kukkonen[2] gives an account of an analysis of the seasonal fluctuations in industrial production and a method resembling that of Shiskin's (Bureau of Census Method II),[3] that has been programmed at the Bank of Finland Institute for Economic Research for electronic computers and used, for instance, in the analysis of, and elimination of seasonal fluctuations from some Finnish national income series.

In his analysis of the volume of industrial production, Kukkonen decomposes the seasonal fluctuation into average or normal and specific seasonal fluctuations. By normal seasonal fluctuation one means the seasonal movement that would result if the meteorological conditions in each season were such as they are in that season on the average. Nevertheless, as meteorological conditions display variations from year to year, even marked deviations from the normal pattern occur in seasonal fluctuations. These deviations have been termed specific seasonal fluctuations and they have been investigated by means of regression analysis. The deviations from normal seasonal fluctuation, ascribable to cyclical fluctuations, were also reckoned as specific seasonal fluctuations. Customs and institutional factors, along with meteorological factors, affect the normal level of seasonal

[1] There are (1) phenomena that are not affected by the number of calendar days. Salaries, for instance, are as a rule independent of the length of the month. There are (2) activities of a kind not essentially affected by the numbers of Sundays, holidays or week-ends. Milk production, in agriculture, may be regarded as a typical example. Certain industrial processes, too (such as, say, the production of mechanical and chemical wood pulp), that are discontinued for a few days a year only. And there are (3) fields in which overtime work is arranged so as to eliminate the effect of the discontinuations due to the holidays. A mechanical correction for Sundays and holidays may in such cases result in still more complicated time series, which are of little use as indicators of the direction of development.

[2] This study appeared as an appendix to a previous draft of this paper. It is published in Series D: 4 *Mimeographed Studies*, Institute for Economic Research, Bank of Finland, Helsinki, October 1963.

[3] For an account of this method see, e.g., *Seasonal Adjustment on Electronic Computers*, Publications of the OECD, Paris, 1962, pp. 81–150 and 390–8.

fluctuation. The normal seasonal fluctuation changes with time, but this change is assumed to be slow and trend-like in general.

The above-mentioned computer programme for the analysis of seasonal fluctuations has been used in Finland since the middle of 1962 for 'mass production' of seasonally adjusted time series. Attempts have been made to give this procedure, which was originally programmed for the Elliott 803 unit, the widest possible scope of application. It is based upon the use of moving averages and is of the 'ratio to moving average' type. Flexibility in the application of the programme has been secured, first, through the possibility of selecting the type of adjustment in each particular instance from among a great many different alternatives; and, second, through making the programme applicable for the analysis of any kinds of time series regardless of whether they are computed on a monthly or quarterly basis, or employing some other unit period.

IX. CONCLUDING REMARKS

In the foregoing there was a brief discussion of the adequacy of the decisions related to national accounting from the point of view of the use of the results and the resources that could be devoted to this work. At the same time, consideration was given to the shortcomings attaching to the calculations. It should be stated, now, that in Finland the processing of the basic statistical data officially collected has been considerably extended (in the direction of economic analysis).

An example is provided by the short-term forecasts which can easily be connected with historical, ex-post accounting. The same applies to the seasonal analysis of certain national income calculations.[1]

Provided that national accounting in Finland is put on a monthly basis, the worst remaining shortcomings in the short-term calculations will be the following:

[1] These decisions concerning quarterly calculations are indicative of a general forward step in the sphere of official statistical work. In the past, descriptive sums (national income, product, etc., size of population, its sex and age distribution, etc.) and certain simple characteristics (value, price and volume indices; life expectancy figures, various kinds of percentage distributions, etc.) have been regarded as adequate. Now parameter tables of fairly elaborate models are regarded as necessary. The matrices of input-output coefficients, their inverse matrices, etc., are typical examples.

1. The lack of a systematic description of strategic flows of funds. At present, even the yearly calculations of these flows are deficient.
2. The inaccuracy of the estimates.

The first point is of particular importance since financial accounting is, in view of its use, short-term accounting *par excellence*.

The second problem is a very general and highly topical one. It concerns both statistical work and econometrics. Obviously, we have passed the stage in which the worst obstacles in the way of empirical study are deficiencies in

(1) systems of description (systems of accounting identities),
(2) methods of explanation (theories and estimation methods), or
(3) techniques of computation (electronic computers),

and the future problems will be observational errors and the lack of observations.[1] Not until we are able to record the relevant phenomena substantially more accurately than now can we expect to be able to make efficient and sufficient use of the possibilities offered by the development of the systems and methods listed under (1) to (3) above.

In point of fact, such a reduction of the observational errors seems to be within the limits of the possible. According to my optimistic view, a second revolution in the accounting technique of decision units (economic units) is before us. If firms, for instance, desire to make use of the theory of decision-making (including mathematical programming, the theory of games, etc.) in their business operations, it will be necessary for them to bring their accounting operations (including forecasting and programming) on to an entirely new, more detailed and accurate basis. The primary statistics (including adequate household statistics) will then furnish a foundation for fairly reliable short-term national accounting statistics.

This will charge short-term national accounting with entirely novel tasks, but also open up new possibilities. The development of decision models will, no doubt, also bear on the integration of real money-flow accounting systems.

[1] L. R. Klein wrote: 'I look towards improvements in precision of econometric judgements of the order of magnitude of fifty per cent as a result of a better knowledge of the functioning of economic institutions, through the use of new measurements on variables, and through the use of more accurate data.' L. R. Klein, 'Single equation vs. equation system methods of estimation in econometrics', *Econometrica*, vol. 28, 4 (October 1960).