THE USE OF COMPUTERS IN THE NATIONAL ACCOUNTS OF NORWAY

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Both the yearly and the quarterly national accounts of Norway are derived with intensive use of electronic computers, punchcards and magnetic tapes.

The introduction of the paper gives a short description of the Norwegian national accounting system. Four aspects are stressed. First, the accounts are built up by the production approach with the main purpose of, on the one hand, showing the domestic product at market prices by industry of origin and, on the other hand, showing a detailed breakdown by categories of expenditure. Second, the main part of the system consists of an input/output matrix of about 1700 commodities, 130 industries, and 150 final demand sectors. The input/ output table is thus not made separately but is the main body of the national accounts. Third, this annual input/output table is used as a basis for estimating quarterly accounts. Fourth, an econometric model for analysing and forecasting developed by the Norwegian Central Bureau of Statistics is closely linked to the national accounts.

The paper concentrates on how the computers and punchcards are used. It describes how all available information on the supply and use of commodities, prices, etc., is brought together. As far as possible punchcards from the basic statistics are taken over for further processing. As the end result each flow in the national accounts is represented by a punchcard.

The paper discusses what has been gained by switching from worksheets to punchcards. There are advantages during the work and there are advantages of having the final results on punchcards.

The final sections describe how the punched cards for the yearly accounts data are used as basis for preliminary estimates of quarterly accounts and also in a model for forecasting.

I. INTRODUCTORY EXPLANATIONS

A. *The Norwegian National Accounting System*

For ten years computers have been used intensively in national accounting work in Norway. Before describing the use of computers, it is necessary to give a brief description of the Norwegian national accounting system. No discussion of the methods for estimating the different series or of their reliability is intended; the purpose of this paper is only to describe how computers have been used as technical aids in our national accounting work.

Four aspects should be stressed when describing the Norwegian national accounting system. First, the accounts are built up by the production approach with the main purpose of, on the one hand, showing the domestic product at market prices by industry of origin and, on the other hand, showing a detailed

breakdown by categories of expenditure. Second, the main part of the system consists of an input/output matrix of about 130 industries and 150 final demand sectors. The input/output table is thus not made separately but is the main body of the national accounts. Third, this annual input/output table is used as a basis for estimating quarterly accounts. Fourth, an econometric model for analysing and forecasting, which is developed by the Norwegian Central Bureau of Statistics, is closely linked to the national accounts.

The accounting system includes *production accounts* for each of the 130 *producing sectors* (industries) showing a detailed breakdown of their deliveries to input in other industries (producing sectors), to fixed capital formation in different main industries, to different categories of private and public consumption, to exports, and the changes in inventories (final demand sectors). All changes in inventories are allocated to the producing (or importing) sector.

In the same way as domestic production is classified into 130 producing sectors each having a production account, imports are classified into a corresponding set of *importing sectors* each having an *import account*. Each commodity imported is allocated to the importing sector corresponding to the main domestic producer of that commodity. There are also a few importing sectors for commodities not produced in Norway, such as sugar, coffee and automobiles.

The accounting system also includes *accounts for* the different *sectors of final demand*. Thus there are about 20 accounts for fixed capital formation, one for each main industry of use. For government consumption there is one account for each purpose of expenditure.[1] For private consumption one account has been introduced for each of the 125 items on the consumers' classification list. There is only one account for change in inventories and one account for exports. Special *accounts* are established for the other *main aggregates*, such as total fixed capital formation, total government consumption, total private consumption, total imports and total gross domestic product at market prices (equal to the sum of the products of the different sectors).

By adding the deliveries from all domestic industries and from imports to a certain sector of final demand, e.g., to a certain category of consumers' expenditure, we arrive at the total amount available for this category.

Behind the classification by 130 *industries* (based on the ISIC) is another classification by about 1700 *commodities* (groups of goods and services). This commodity classification is, as far as goods are concerned, based on the BTN (Brussels Tariff Nomenclature). The reason for this is that both our foreign trade statistics and our manufacturing production statistics are based on this nomenclature. The commodity classification used in the national accounts is, as far as possible, constructed in such a way that one commodity can be used for only one category of expenditure and also so that the different goods within one commodity have the same trade margin. For instance the commodities are constructed to distinguish between goods used only for consumption (and inventories) and goods used only for fixed capital formation (or inventories).

1. At the moment there are only 4 accounts; civil and military purposes under central and local government. However, the system will be expanded to cover several purposes, health, education, etc.

Naturally there will be many exceptions to this rule. One of the most difficult examples is private cars which go both to consumption and capital formation. Many of these 1700 commodities are produced within several domestic industries and also imported. In such cases the domestic industry having the greatest production of the commodity is called the *main domestic producer* of that commodity.

Thus on each production and import account we can show either the *commodity flows* (i.e. the individual commodities) or the *sector flows* (e.g. the sum of all commodities) to the different receiving sectors.

All flows are estimated in four price systems, that is, at producers' and at purchasers' value, both of them calculated at current prices and at prices of a base year for constant price estimates. In the producers' value systems all flows are valued at the prices to the producer (or importer), and trade margins are shown as separate flows to the different final demand sectors and as separate flows of intermediate input of the producing sectors. In the purchasers' value systems all flows are valued at the prices paid by the purchasers, and the trade margins on all products delivered by an industry are debited as an additional input on the production (or import) account of that industry. For each domestic industry the sector product, or the contribution to gross domestic product at market prices, is arrived at as the difference between the gross production (output) and the intermediate input. The sector products should, of course, be the same in the producers' and the purchasers' value systems; this is obtained by treating trade margins as described.

The trade industry is treated quite differently from all the other industries. The gross production (output) of this industry consists mainly of trade margins. These are estimated as the difference between the purchasers' and the producers' values of the output of all other domestic industries and of imports. In this way the trade margins also cover transport costs and most of the indirect taxes.[2] The intermediate input of the trade industry consists of transport costs and different kinds of commodity input, such as wrapping paper, etc. Thus the sector product at market prices for the trade industry will include most of the indirect taxes. The customs duties are, however, not included in trade margins. The customs duties are technically treated in the same way as commodities and they are delivered from a separate notional "industry".

The national accounts at constant prices should in principle show the flows (baskets of goods and services) measured at the prices of a base year. In practice three price indexes are constructed for each commodity, one for imported goods[3], one for domestically produced goods sold to domestic purchasers, and one for exported goods. All deliveries at current producers' values are deflated by these indexes. Trade margins are obtained by assuming that for each category of use of a separate commodity the value of the trade margin at constant prices can be computed as a fixed percentage of the supply at constant producers' value (for imports c.i.f. plus customs duties). In other words we assume that the trade margin coefficients for each category of use over short

2. In Norway most indirect taxes are paid by retailers.
3. The amount of unprocessed re-exports is negligible for Norway.

periods are constant not only for each good but also for each commodity (group of goods).

In addition we make separate estimates by industry of indirect taxes, subsidies, depreciation and compensation of employees. The difference between the gross domestic product at market prices and these components gives us, as a residual, the operating surplus classified by industry. Our national accounts include separate accounts for these income flows. For statistical reasons our national accounts show few other estimates of income flows. We do, however, have very detailed government accounts.

B. *The Statistical Sources*

The National Accounts Division is a part of the Central Bureau of Statistics. We have the advantage of having almost all kinds of statistics produced in this institution, providing easy access to all the basic statistics.

We have fairly good yearly production statistics for agriculture, forestry, fishing, all "large" manufacturing and mining establishments (here "large" in general means those having five or more employees), electricity, shipping, air and rail transport, and a few other service industries. For most of the service industries our main sources are the decennial censuses of population and of establishments. When quinquennial or decennial information is used, the data are adjusted serially in intervening years, i.e., the previous year's estimates are used as preliminary estimates for the current year and are subsequently adjusted on the basis of annual sample surveys and other available information.

The weakest spots in our system of production statistics are the construction and trade industries. The output of the construction industry must be calculated mainly from information from the most important using sectors and from statistics on supply (from domestic production and import) of building materials plus employment figures. For trade the yearly basic statistics are not very useful for national accounting purposes. We have indexes of retail sales and of wholesale and consumers' prices. Our import and export statistics are very satisfactory.

We have reliable information on intermediate input in agriculture, mining and manufacturing (again "large" establishments), shipping, and air and rail transport. We have been successful in having the official government accounts changed in such a way that we obtain all necessary breakdowns. An important budgetary reform was carried out some years ago, with the main purpose of obtaining a budget from which the Government and the Parliament could see the real economic aspects of the proposals and the decisions. Consequently the distinction between transfers, consumption, capital formation, and financial investment (all with sub-categories) was introduced in all parts of the budget and the accounts. The central government accounts are still, however, on a cash basis. For fixed capital formation in enterprises some information is obtained directly from the investing establishments in mining, manufacturing, electricity, and several transport industries, but for the most part we rely on estimates

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of the supply of building materials, machines and equipment. Our basic statistics of inventories relate only to producers and wholesalers and are not very reliable.

C. *Types of Computers and Punchcards*

The mechanization of the national accounts has been developed and extended continuously during the last ten years. We have, of course, been obliged to use the computers available in the Central Bureau at the time. That is, we started with ordinary tabulators and calculators which are no longer used. Some years ago the Bureau bought the English Electric electronic computer—Deuce—which at that time the Bureau considered to be the best computer for statistical purposes. Now, this computer is obsolete and the Central Bureau scrapped it at the end of 1965. A few years ago the Bureau also acquired an IBM 1401 and all programmes for the yearly national accounts are now carried out on this computer. In 1967 we shall switch to an IBM 360/40 which has a much greater capacity.

Most of the work is done on punchcards. However, in 1965 we started to use magnetic tape for part of the work. Since our basic statistics give the figures in Kroner, the first part of the national accounting work is also carried through in this unit. In the middle of the process we switch to 100,000 Kroner and all final figures are in this unit, though published in millions of Kroner.

Some technical details have to be given although it is not intended that the paper should be a manual. I shall therefore restrict the details as much as possible. In any case I shall not tire the readers by describing all the different kinds of statistical and computing controls done at different stages of the work.

Each commodity flow and each sector flow is stored on a punchcard. Each punchcard contains the following information:

Code for supplying sector/account
Code for receiving sector/account
Code for category of use
Code for commodity
Code for type of card
Value at current producers' prices
Value at current purchasers' prices
Value at constant producers' prices
Value at constant purchasers' prices

The coding system is built up in such a way that we show for each flow both the supplying and the receiving sector. The supplying sector is in most cases a producing or an importing sector. The receiving sector is in most cases a sector for final demand or a producing sector (for the use of intermediate input). The accounting system consists of about 600 accounts.[4]

The code for category of use has two purposes. First, it denotes the category of use (e.g. intermediate input or private consumption) regardless of receiving

4. 130 production accounts, 130 import accounts, 150 final demand accounts, plus accounts for main aggregates, income flows, and a few dummy accounts.

or supplying sector. Second, it is used for a further breakdown of the categories, e.g., fixed capital formation is broken down by buildings, other construction and works, transport equipment, and machinery and other equipment.

The commodity code consists of two parts. The first only indicates the place in the 1700-classification. The second part gives the sector number of the main domestic producer of that commodity. The punchcards for sector flows do not, of course, include the columns for commodity numbers.

The "type of card" code is only for identification purposes and includes information on which year or which quarter the set of cards contains, whether final or preliminary figures, on which year the preliminary figures are based, etc.

To give a concrete example: Imported tractors used in agriculture will have:

Supplying account	2.384	(Import account, "other transport industry")
Receiving account	3.010	(Fixed capital formation in agriculture)
Category of use	24	(Machinery and other equipment)
Commodity	8701 384	(Tractors, mainly produced in "other transport industry")

By mechanical sorting of the punchcards and by listing (tabulation) we obtain the different kinds of accounts and tables. Sorting by supplying account gives gross production by industry and imports by importing sector. Sorting by receiving account gives intermediate input by industry and final demand by categories.

II. THE CONSTRUCTION OF YEARLY NATIONAL ACCOUNTS

A. *Survey of the Procedure*

Before describing in detail the construction of our yearly national accounts I shall give a short survey of the whole procedure.

The purpose of the work is to obtain *sector flows* showing how the total supply of each producing and importing sector (supplying sectors) is distributed as intermediate input in different producing sectors and as different categories of final demand (receiving sectors). The supply of each sector consists of several commodities, and each of them might flow to several receiving sectors. Each sector flow thus consists of several *commodity flows*. It has been found preferable to distribute the supply of each commodity separately and thus first construct an accounting system showing the commodity flows. Later these commodity flows are added to sector flows.

Further, one particular commodity might be supplied both by one importing sector and by several domestic producing sectors. Our procedure is first to estimate the total supply of a particular commodity and to distribute this supply among the different receiving sectors. Next, this distribution is expanded to show how the supply of this commodity from each sector is distributed to the different receiving sectors. Then it is only a question of reclassification before all the commodity flows between two sectors can be added to a sector flow between them.

For each commodity, final or preliminary figures are estimated for the

supply and for all uses except change in inventories. A preliminary figure for the latter is computed as a residual. A thorough checking of the preliminary accounts obtained from the computer necessitates a new round of mechanical operations. The checking of the preliminary results is done on the commodity flows. It is also the detailed commodity flows which are deflated to constant prices.

The process is complicated by the following three facts. First, for some producing sectors and categories of final demand, we do not have statistics on total production and total input, viz., total use. These totals have to be estimated. Second, for several producing sectors and categories of final demand we do not have the total broken down by commodities. Such breakdowns have to be estimated. Third, all available information on the supply of commodities is at producers' prices while information on the use of commodities is at purchasers' prices. It is, therefore, necessary to estimate trade margin coefficients.

The whole procedure can be divided into the following eight steps which are dealt with in the following sections:
1. Estimation of the supply of each commodity at current producers' prices.
2. Estimation of the use of each commodity at current purchasers' prices.
3. Use of trade margin coefficients for calculating the use of the commodities at current producers' prices.
4. Calculation of residual figures for changes in stocks for each commodity.
5. Checking and correction of the preliminary tables for commodity flows.
6. Allocation of the uses of each commodity to the supplying sectors.
7. Deflation of the commodity flows.
8. Calculation of sector flows, etc.

Steps 1 and 2 are based on basic statistics from other divisions or estimates in the National Accounts Division; the processing of these figures is mechanical. Steps 3–4 and 6–8 are done by mechanical processing. However, no mechanical device is introduced for the very important step 5.

B. *The Supply of Commodities at Current Producers' Prices*

The first step in establishing our yearly national accounts is thus to estimate the total supply of each commodity. We have six statistical sources for the supply of goods and services.

For the "large" mining and manufacturing establishments we take over for further processing the punchcards for manufacturing production statistics which are produced by another division in the Bureau. These cards show the production of each good by manufacturing sub-group. Applying two sets of master cards to these cards provides (after reduction) about 3,000 cards showing the value of production of each commodity within each mining and manufacturing industry.

For small manufacturing establishments, the manufacturing statistics give the total value of production in each manufacturing sub-group (based on a sample survey) without any breakdown by commodities. Special research work was done several years ago to find for each manufacturing industry the distribution by commodity of production in these small establishments. The same

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percentage distributions are used each year, and these "distribution keys" are stored on punchcards. Applying these "distribution keys" to cards for the total production within the small establishments provides cards showing the estimated production within each industry group by commodity. These cards are added to the cards for production in large establishments.

Similarly, for imports covered by foreign trade statistics we take over for further processing the cards from our division of foreign trade statistics, and match these cards with a set of master cards. As a result we obtain about 1,000 cards, one for each commodity, which, at the same time, give information on the importing sector.

Customs duties are estimated in the foreign trade statistics for each good. These cards are reduced to cards for the customs duties on each commodity.[5] The customs duties are considered as commodities delivered by a special notional production sector. These cards are in the further process treated exactly like cards for commodities delivered from other domestic production sectors.[6]

For production in industries other than mining and manufacturing and for imports not covered by foreign trade statistics, we must ourselves punch the cards showing the value of production or imports in each industry and commodity.

The process described above gives, as the end product, the total supply from domestic industries (including the "customs duties industry") and from imports classified by commodities and supplying sectors. The supply is valued at producers' prices for domestic production and at c.i.f. prices plus customs duties for imports. All this information is stored on about 5,000 punchcards.

C. The Use of Commodities at Current Purchasers' Prices

The next step is to start from the other end and estimate the different uses of the commodities. For some receiving sectors/categories of use we have direct information on total value. For other sectors/categories we as a first approximation try to make estimates of the changes in value from the previous year. Our sources for the different uses of the commodities give the value at purchasers' prices.

5. Since the estimates in the foreign trade statistics are based on the customs rates, with no adjustment for repayments, the total arrived at exceeds the actual customs duties as reported in the government accounts. The customs duties on each commodity are therefore reduced mechanically to correspond to the total in the government accounts. Since we do not have information on repayments, the same percentage reduction is used for all customs duties figures (with one important exception).

6. This treatment is in accordance with the treatment in the UN Secretariat "Proposal for the Revision of SNA" (Document E/CN.3/320, 9 February 1965). The treatment is also an example of how practical considerations have to be taken into account to make the mechanical operations as simple (standardized) as possible. Previously customs duties were included in trade margins. This caused practical difficulties since "Other trade margins" (other than customs duties) are considered to be the same on the c.i.f. value plus customs duties on imports of a commodity as on the producers' value of the corresponding domestically produced commodity. Then in 1965, we introduced the idea of treating the customs duties parallel to the c.i.f. value, having two separate cards and calculating trade margins on each of them.

Exports covered by the foreign trade statistics are treated similarly to imports.[7]

For both central and local government consumption we get each year a breakdown by purpose from our Division of Financial Statistics. About every five years we study in detail the central government accounts and a sample of local government accounts. These studies give a percentage distribution by commodities for each purpose of government consumption. This information is stored on punchcards and in each of the five following years applied together with cards for the total consumption classified by purpose. This gives as a result cards both for central and for local government consumption by commodities.[8]

In our system there are 125 sectors for (categories of) consumers' expenditure and four or five sub-categories of fixed capital formation for each of about 20 sectors of use. We have no direct information on the value of these flows. However, we try at this stage to make a preliminary estimate of the percentage increase in value from the previous year.[9] Further we assume that for each sector/category of use the distribution among commodity groups is the same as in the previous year. By punching one card for the percentage change in the form of value indexes for each sector/category of use, and by applying these cards together with the cards (magnetic tape) for the previous year, the result is a full distribution by commodity groups for these sectors/categories of use.[10]

Intermediate inputs of goods in the different sectors (industries) are usually taken from the same sources as production and treated in a corresponding way. The treatment of input in the construction industry is a little more complicated.

Total intermediate input of services is usually obtained as the difference between the total estimated production of the commodity (or service) and what has been allocated to final demand. This residual is mechanically distributed by industries in the same percentage as for the previous year.

This second step now described gives, as an end-product, about 7,000 punchcards for commodities classified by receiving sectors/categories of use. We have obtained estimates, some of which are only first approximations, for all categories of use except for changes in inventories.

D. *The Use of Commodities at Current Producers' Prices*

All the cards for the use of commodities classified by receiving sectors/categories of use give the value at purchasers' prices. To be able to compare them

7. Actually exports are treated slightly differently. There are several reasons for this. First, trade margins must be deducted from export figures while they must be added to import figures as they appear in foreign trade statistics. Second, when it later comes to deflation, price indexes for exports are at purchasers' prices while other price indexes are at producers' prices. Third, when it later comes to allocation to supplying sectors, all exports are considered delivered from the main domestic producer of the particular commodity.

8. This process is carried out for government consumption excluding payments to civil servants. Direct information on compensation of government employees by industrial group is taken from the annual government accounts.

9. This is done by using all available information such as consumers' price indexes, supply of certain kinds of commodities, capital formation figures from the enterprises, etc.

10. These preliminary results will be checked and revised at a later stage.

with the cards for the supply of commodities classified by supplying sector we need to express the former also at producers' prices. This is done by dividing these cards by a corresponding set of cards containing trade margin coefficients.[11] The result is a new set of cards for commodities classified by receiving sectors/ categories of use valued both at purchasers' and producers' prices.

E. *Change in Inventories as a Residual*

For each commodity we now have a number of cards. On the one hand we have the supply distributed among the domestic production sectors, imports (c.i.f.), and customs duties. On the other hand we have all the uses of that commodity, except changes in inventories, distributed by sectors/categories of use. The difference between all the supply cards and all the cards showing the use of a commodity is computed and the result is punched in a card giving preliminary estimates for changes in inventories. The value is put both in the column for producers' prices and in that for purchasers' prices since those two values usually are the same for changes in inventories.

F. *Checking the Preliminary Results*

All the cards for the use of commodities (including those for changes in inventories) are now listed, giving one classification by receiving accounts and categories of use and another classification by commodities. Further, all the cards for the supply of the commodities are listed giving a classification by supplying (i.e. producing or importing) sector. On the first two lists the difference between the totals at purchasers' and at producers' prices gives the total trade margins or (the main part of) the gross production of the trade industry. The difference between the total supply of each producing sector shown on the last list and the total intermediate input into the sector shown on the first list gives the figure for the sector product. Then the results on these lists are checked carefully. In particular the residual figures for changes in inventories must be looked into.

For the processes which have been outlined above, two main points should be stressed. First we have mechanized work which was previously done by statistical clerks. Second, we have at an early stage tentatively introduced aggregates (e.g. for categories of private consumption), which we expect to arrive at on the basis of other statistical information.

The next thing to be done, the checking of the preliminary results, is the really difficult part of the national accountant's job, which I shall not try to

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11. The cards for trade margin coefficients are obtained by first dividing the value at purchasers' prices by the value at producers' prices for the previous year both taken from the cards (magnetic tape) for that year. For each commodity, only one trade margin coefficient is computed for each category of use. However, the trade margin coefficients may change from year to year, and we mechanically adjust some of the coefficients first arrived at. This concerns particularly different categories of consumers' expenditure. Adjustments must be made, for example, if there are differences between the changes in wholesale prices and the changes in the corresponding retail prices.

describe in this paper. The result of this scrutiny is that a great many corrections need to be made to the lists. The revised figures are punched, and these new cards replace the old ones.

G. *Allocation of the Uses of Commodities to the Supplying Sectors*

The remaining part of the process is carried out on magnetic tape. For each commodity group we have two breakdowns. One shows the supply at producers' prices broken down by different domestic producing sectors plus imports c.i.f. plus customs duties. The other shows the uses, both at producers' and at purchasers' prices, broken down by receiving accounts and categories of use. We might illustrate this in matrix form (see Table 1.).

We know the figures (have cards) for the row sums and the column sums. The next step is to fill in the cells of the matrix.[12] Having no other information, we assume that for each commodity the supply from each sector is distributed among different uses proportionately to the total supply of that commodity. By reading into the computer the 6,000 supply cards and the 7,000 use cards, we obtain as a result about 20,000 supply/use "cards" on magnetic tape expressed both at producers' and purchasers' prices.[13]

H. *Deflation*

Calculation in constant prices is done by first dividing the current producers' value in each of the 20,000 supply/use cards by a price index stored on a set of punchcards. This gives constant producers' value. Second, this constant producers' value is multiplied by trade margin coefficients calculated from the base year material and stored on another set of punchcards. This gives constant purchasers' value. Both operations are done simultaneously, and the resulting 20,000 cards (magnetic tape) give all four values.

For imports c.i.f. and exports f.o.b. the price indexes from foreign trade statistics are used. For domestic production a price index is constructed (in collaboration with the divisions for production statistics) for the domestic use of each commodity. Usual index technique is applied such as that of using

12. The further procedure could have been the following:

By deflating all the flows as described below in section H and by punching cards for the trade margins and the sector products mentioned above in section F, we will have all necessary information for a closed system of accounts. Such a system would be similar to the system contained in the UN Secretariat "Proposal for the Revision of SNA" in one important respect. It would show production of the domestic sectors and imports classified by commodities and also intermediate input of the domestic sectors and final demand categories classified by the same commodities. No sector flows (i.e. from sector to sector) would be shown.

In the future we might switch to such a form of accounting system. It may be recalled that our commodity code contains information on the main producer of each commodity. The commodities can therefore easily be condensed to a classification by main producers. However, our present computers do not have enough capacity so that a two-step (sector/commodity, commodity/sector) input/output table can be used as a basis for quarterly accounts and in the model for forecasting.

13. Actually exports are treated a little differently; see footnote 7.

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TABLE I
COMMODITY No. 1

Using sector and category / Supplying sector	Intermediate input						Exports		Private consumption					Increase in Inventories		Total	
	Sector No. 1		... ...	Sector No. X	... ...	Sector No. 130			Sector No. 1		...	Sector No. 125		....				
	V_1	V_2		V_1	V_2	V_1	V_2	V_1	V_2	V_1	V_2		V_1	V_2	V_1	V_2	V_1	V_2
Domestic sector No. 12																	X	
„ „ No. 14																	X	
„ „ No. 17																	X	
„ „ No. 20																	X	
Import sector No. 17																	X	
Customs duties																	X	
Total	X	X		X	X	X	X	X	X	X	X		X	X	X	X	X	X

V_1 = producers' value.
V_2 = purchasers' value.
X = known figures.

price indexes for representative commodities in those cases where indexes for all commodities cannot be constructed. For some commodities the indexes are constructed on the basis of the indexes for the input used for the production of that commodity. In many cases volume indexes are first constructed and the price indexes calculated implicitly. The point is that at least one price index must be punched for the domestic use of each commodity. For commodities which are supplied both by domestic producers and by imports, two price indexes must be constructed. And for commodities subject to customs duties a third price index must be constructed.[14]

Trade margin coefficients are computed for each category of use of each commodity by dividing the purchasers' value by the producers' value in the base year.

I. Calculation of Sector Flows, Trade Margins and Sector Products

Next the commodity flow cards (the 20,000 supply/use cards) are condensed to sector-flow cards. This is easily done since the former include indications of supplying and receiving sectors.

At this stage offsetting cards with negative values are punched for second-hand goods. These commodities have been treated as delivered from dummy accounts. The negative-valued cards balance the dummy accounts and take care of the deductions in the delivering sectors.

While the production of all other industries is calculated and stored on punchcards both at producers' and at purchasers' prices (and both at current and constant prices), no production of the trade industry is yet shown explicitly in the system. This production has now to be calculated as sector flows from the production account of the trade industry to the input-side of the other production and import accounts or to the accounts for final demand. The flows will be different in the producers' value system and in the purchasers' value system, while the flows in the two systems, of course, will sum up to the same total. In the producers' value system the intermediate input flows are valued at producers' prices and a separate input flow for the trade margins on the input must be allocated to each production account. Similarly separate flows

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14. Price indexes for customs duties might be considered a strange concept. We have introduced it to be able to treat the punchcards for imports c.i.f. plus customs duties in the same way as the cards for domestic production. For each commodity group we assume that the customs duties at constant prices are proportional to the imports c.i.f. at constant prices. Then we can construct the following formula:

$$\text{Price index} = \frac{Dic}{Dif} = \frac{Dic}{Do \dfrac{Iif}{Io}} = \frac{Dic}{Iif} \times \frac{Io}{Do}$$

Dic = Customs duties in current year at current prices
Dif = Customs duties in current year at constant prices
Do = Customs duties in the base year
Iif = Import c.i.f. in current year at constant prices
Io = Import c.i.f. in the base year.

for the trade margins must be allocated to all final demand accounts. In the purchasers' value system all deliveries from the production accounts and from the import accounts are valued at purchasers' prices. Offsetting flows for the trade margins on output must therefore be shown as input on the production and import accounts. These calculations of the two sets of trade margin flows (gross production in the trade industry) are done easily by the computer simply by taking the difference between the two values in a set of cards and punching the difference in a new card for trade margins. Calculations at current and at constant prices are made simultaneously.

It then remains to make cards for the sector products which are the differences between total output and total input on each production account. This calculation is made in the same operation as the calculation of the trade margins. This operation also calculates the cards for the total aggregates: total gross domestic product, total private consumption, total exports, etc.

Our final accounts are in the form of 6,000 sector-flow cards on magnetic tape which can be listed in different ways giving the tables we want to show.

J. Capital Consumption and Income Flows

In the Norwegian national accounts separate estimates by industry are made for capital consumption at current and constant prices and at current prices only for indirect taxes, subsidies, compensation of employees, and the residual operating surplus. All these figures are punched on cards applying the same coding-system for sectors, etc. Consequently, it is possible to substitute for the cards for gross sector products at market prices in the accounts the cards for these income flows. This is done for certain analytical purposes.

K. Time Series on One Set of Cards

It has been described above how we obtain our accounts for one year in a set of punchcards.[15] The figures are given in four price systems. The capacity of our ordinary 80-column IBM punchcards are 12 fields (each of 5 columns) after allowing for necessary columns for indications of sectors, etc. We can then concentrate three years with the four price systems on one card.

However, in time series analyses we are usually only interested in one price system at a time, and we are able to include 12 years on one set of cards. We have complete national accounts on punchcards dating back to 1949 although the figures for the years prior to 1955 are not as detailed as those for that year and later. For our publication "National Accounts 1865–1960" we thus by chance happened to be able to have the last 12 years 1949–1960 in one set of cards. This was a great advantage as I shall explain later. We also found it useful to punch and store on cards all the information we had for the years prior to 1949.

15. Magnetic tape was for the first time used for the national accounts for the year 1961.

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L. *What Do We Gain by Using Computers?*

When considering what we have gained by switching from work-sheets to punchcards in our yearly national accounts, two aspects may be mentioned. The first is the advantages during the work. The second is the advantages of having the final results on punchcards.

The quality of the national accounts is in the last resort a question of the coverage and the quality of the basic statistics. The introduction of punchcards and computers as working tools in national accounting work can, of course, not change this fact.

The quality of the national accounts is, however, also a question of the quality and reliability of the work of the national accountant and his assistants. The computers themselves work more accurately than human beings and many types of human errors disappear. When the computers, from time to time, make errors, they are really big and easily discovered. On the other hand, there are human beings working with the computers and the cards, and the checking of the great mass of figures is often a tiring task with the risk of overlooking eventual errors. Many types of controls, are, however, introduced and I believe that the reliability of our national accounts figures is considerably higher now than before we introduced the punchcard.[16]

Letting the computers do the routine work following fixed instructions also reduces the effects of changed human judgments and the effects of change in staff.

A very important point for us has been the reduction in the requirements for personnel. At the same time we have been able to reduce the time of processing considerably. For the future we believe that our final detailed national accounts will be ready 3 months after the manufacturing production statistics are completed or 14 months after the end of the year covered.

I might mention three fields where we have profited (or will profit) by having the yearly accounts on punchcards. First, having 12 years on the same set of cards makes it very easy to compute value and volume indexes. Further, dividing these two indexes results in implicit price indexes. Volume indexes might easily be computed as year to year changes (previous year = 100). All kinds of relative figures and percentage distributions are calculated quickly. The results of these calculations as well as the actual figures themselves can be supplied in the form of manuscripts for printing or even in the form of "masters" to be used in off-set.[17] In this way the task of proofreading is reduced.

Secondly, transfers to other systems with other sectoring and other classifications are facilitated. The only condition is that links between the systems can be established in the form of master cards. We make alternative classifications in this way,[17] and we expect to switch to the revised SNA when that system is adopted. Further, we believe an adjustment to show our figures in the form of a revised MPS-system might be carried out by such a process.

16. Another point is that great improvements in the basic statistics during recent years have also improved the coverage and quality of our national accounts.
17. See, e.g., "National Account Classified by Fourteen and Five Industrial Sectors 1949–1961" Central Bureau of Statistics, A 116, Oslo 1965.

Thirdly, having the yearly accounts on punchcards makes it unnecessary to do the punching when the figures are to be used as the basis for quarterly accounts or in the model for forecasting. This will be discussed in the following sections of my paper.

III. QUARTERLY ACCOUNTS AND PRELIMINARY YEARLY ACCOUNTS[18]

A. *The Yearly Accounts as the Basis*

Quarterly accounts set up by the method described here have been estimated from 1959. The results have been published regularly from 1965. They are published 7–8 weeks after the end of the quarter.

No seasonal adjustments have yet been made to the quarterly figures, and the consumers are therefore referred to comparisons with the figures for the corresponding quarter in the previous year.[19] However, since we have a fairly long Easter vacation in our country and since Easter moves between the first and second quarters, we have also made accounts covering the period January through April. These estimates have not been published and are used only for internal purposes and as a basis for economic planning.

The method used for the quarterly accounts gives complete accounts with the same specification of sectors and the same sector flows as in the final yearly accounts, but commodity flows are not calculated. The estimates are to a great extent based on volume and price indexes.

The final purpose of the quarterly accounts is to give a breakdown of the figures in the final yearly accounts, both at current and constant prices. However, since it is considered important to give preliminary figures as soon as possible after the end of the quarter, preliminary quarterly accounts are calculated. For this purpose it is assumed that the input/output coefficients are unchanged from last year. Further, the volume and price indexes used show the change from the series (both at current and constant prices) in the previous year's accounts.

Preliminary yearly accounts are set up by the same method as the quarterly accounts. This is first done before the end of the year as a basis for our Economic Survey. It is later done again when new important statistical information is available on a yearly basis. Then we also adjust the quarterly accounts mechanically to that total. The quarterly accounts are again adjusted when the final yearly accounts become available.

While the final yearly accounts are first carried through in current prices, the quarterly accounts are first calculated at constant producers' prices. Then the flows in the three other price systems are estimated. The procedure is as follows.

B. *The Supply by Sectors at Constant Producers' Prices*

For most domestic sectors a production index (volume index) showing the change between the previous year and the quarter is calculated. For mining,

18. This description is based on the use of punchcards. Magnetic tape has now been introduced also for the quarterly accounts.
19. Seasonally adjusted figures (back to 1961) were published in 1966.

manufacturing, and electricity, these indexes are based on the monthly pro-
duction indexes. (The sectoring in these indexes has recently been changed in
collaboration with the National Accounts Division.) For many of the service
industries the indexes are primarily based on employment figures.

In some industries, e.g., agriculture, forestry, construction and some of
the service industries, direct estimates of the value at constant prices are calcu-
lated instead of production indexes. For agriculture most of the crops are
allocated to the harvesting quarter. The yearly production of meat is distributed
evenly over the year, and the difference between production and deliveries is
considered as change in inventories. The other agricultural products such as milk,
eggs, etc., are considered produced in the quarter when these products are
delivered and based on statistics of deliveries. The total production of whaling
is considered produced in the first quarter of the year.

For imports of goods the foreign trade statistics give detailed information
on current values and price indexes. Information on imports of services are
taken from the quarterly balance of payments statistics.

By punching the volume indexes for the domestic sectors and applying these
cards together with the punchcards for the previous year's national accounts
we get cards for the value of production at constant producers' prices this
quarter. For other domestic sectors without volume indexes we punch cards for
the value of production. For imports of goods the detailed punchcards from
the foreign trade statistics are reduced to cards showing the supply from each
import sector (account). Since the punchcards from the foreign trade statistics
also include price indexes, our programme is made to give us cards containing
values both at current and constant (c.i.f.) prices. (It should be added that the
punchcards for foreign trade statistics have been edited in co-operation with
the National Accounts Division.)

C. *Intermediate Input at Constant Producers' Prices*

For most domestic sectors it is assumed that intermediate input varies
proportionately with the volume of production of the receiving sector, that is,
we assume input/output coefficients unchanged from previous year. The most
important exceptions are the agriculture, whaling and shipping sectors. In
agriculture, for instance, all input of fertilizers is allocated to the second quarter
and of packing materials to the third quarter of the year, while the use of
foodstuffs is allocated over all four quarters according to information on sales.
All intermediate input in whaling is allocated to the fourth quarter. For Nor-
wegian shipping expenditure abroad, direct information is taken from the
quarterly balance of payments statistics. Heating and lighting expenses in the
service industries are mostly allocated to the first and the fourth quarters.

For the domestic sectors which have production indexes and where it is
considered that the input/output coefficients are constant, we apply the cards
for the production indexes together with the punchcards for the previous year's
national accounts and obtain cards for the value of the intermediate input in
the quarter. This calculation is made simultaneously with the calculation of

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production. For sectors where the value of intermediate input is calculated directly, cards are punched and added to those calculated mechanically.

D. *The Final Demand at Constant Producers' Prices*

For exports we have the same source of information as for imports. However, the punchcards from the foreign trade statistics are applied together with special cards for trade margin coefficients[20] produced from the previous year's national accounts. The resulting cards give exports classified by domestic sectors in all four price systems.

Government budgets are, like the government accounts, classified in a way which gives us the necessary information. Since 1961 the budgets have followed the calendar year and we assume that each category of government capital formation and consumption at constant prices is distributed evenly over the year. Further, we assume that goods and services are distributed among delivering sectors as in the previous year. This distribution is carried out in all four price systems and all the cards for deliveries (sector flows) to government consumption and government capital formation are punched by hand.

The yearly national accounts include one account for each of the 125 items in the classification of private consumption. For each of these accounts a volume index showing the change between the previous year and the current quarter is calculated and punched. These volume indexes are based partly on the retail sales and consumers' price indexes and partly on production and import volume indexes. Some deliveries, for instance from agriculture, and the consumption of new cars are calculated directly.

In much the same way as for private consumption, volume indexes are calculated and punched for each sector and sub-category of fixed capital formation in enterprises. These volume indexes are mostly based on import figures and production indexes of the industries producing capital goods.

As a first approximation it is assumed that the composition of each item of private consumption and of each sector/sub-category of fixed capital formation in enterprises at constant prices is the same as in the previous year. Therefore, when the volume indexes for private consumption and fixed capital formation are applied together with the punchcards from the previous year's national accounts the resulting cards give the detailed sector flows to private consumption and fixed capital formation in enterprises. This calculation is made simultaneously with the calculation of total production and intermediate input in the domestic sectors.

To sum up: Volume indexes are estimated for most of the production sectors, private consumption, and fixed capital formation sectors. These volume indexes are punched and applied together with the punchcards for the previous year's national accounts. To the resulting cards are added cards from other processes and directly punched cards for a few producing sectors and the rest of the final demand sectors.

20. The trade margin coefficients for exports are applied differently from other trade margin coefficients since exports are valued at purchasers' (f.o.b.) prices.

E. *Change in Inventories as a Residual*

We now have cards for the total supply of resources and for their use with the exception of changes in inventories. The values are expressed at constant producers' prices. Most of the cards are based on volume indexes and produced by the computers, while others are based on direct calculations of value and punched by hand. Many of the figures are only preliminary approximations.

By listing all the cards, the difference between the total supply of each domestic and import sector and what has been allocated from that sector to final demand or to intermediate input in other sectors gives a preliminary figure for changes in inventories for the sector. Now all the results have to be checked carefully and critically and in many cases the preliminary figures will be changed. Due to the methods used, the errors of calculation will result in errors in the change in inventories. Such errors will be relatively higher in the quarterly than in the yearly accounts.

F. *Accounts at Constant Purchasers' Prices and at Current Producers' and Purchasers' Prices*

Special price indexes are calculated and punched, showing for each supplying sector the price changes (for deliveries to domestic uses) from the previous year to the current quarter. These price indexes are applied together with the punchcards from previous year's national accounts, resulting in a set of punchcards showing price indexes (changes from the base year) and trade margin coefficients for all the sector flows. These cards again are applied together with the cards showing the sector flows at constant producers' prices, resulting in a corresponding set of cards in all four price systems. Then it remains only to compute the trade margins, the sector products and the main aggregates in the same way as for the yearly accounts.

G. *Later Adjustments of Quarterly Accounts*

As soon as revised national accounts figures for previous year or new information about the current year are published, we need to revise the quarterly accounts. Instead of recalculating the four quarters we have established a special mechanical programme for adjusting the figures. For each sector flow we adjust the four quarters by the same percentage so that the sum of the four quarters equals the value of the year. Then trade margins, sector products and main aggregates are recalculated.

IV. The Use of National Accounts Data in a Model for Forecasting

The Central Bureau of Statistics has developed an econometric model, MODIS I, for economic analysis and forecasting. It is essentially an input/output model with consumption relations.[21] This model is closely related to the national

21. In 1965 a more developed model, Modis II, was introduced covering also price and value relationships.

accounts. It is used for different purposes, of which the work in connection with national budgeting has been the most important.

A. *The National Budgets*

The Central Bureau of Statistics is an independent institution doing, among other statistical work, the national accounts. The setting up of the national budgets is an important part of the planning of economic policy of the Norwegian government, and the Department of Finance is responsible for this work. The Central Bureau is not involved in the political aspects of national budgeting. However, our institution performs a great number of technical services in connection with the setting up of the budget.

The yearly national budget is based on the same accounting system as the national accounts. It is submitted to the Parliament (Stortinget) in October, at the same time as the ordinary government budget for the following calendar year. When the national budget, for example for 1965, was being prepared (in the summer 1964), we had preliminary national accounts for the year 1963 and for the period January through April 1964. Taking account of the changes between these four months and the corresponding period in the previous year, a revised budget for the whole of 1964 was calculated. On the basis of this revised budget, the budget for 1965 was set up. The procedure for both these budgets is as follows:

The Finance Department makes estimates for exports by sector, fixed capital formation by categories, government consumption by categories, a few items of private consumption such as private cars, and the production in certain industries, e.g., agriculture and aluminium production. On the basis of these estimates, the national accounts for the previous year, and our econometric model, the electronic computer calculates a complete national accounting system (budget) for the year. All the figures are in prices of the last year's accounts, that is, the 1965 budget is calculated at 1963 prices.

This does not mean that this calculated budget will be accepted as the government's proposal. We have, however, used our model to show how the government's estimates look in a comprehensive system and, for example, what imports will be the result of the estimates. On this basis the government may wish to change some of their estimates. It happens often that the calculations have to be made several times based on different sets of estimates. We are not, however, consulted when the government decides how the final budget should look.

Much the same method is used in our services to the government when the long-term (four-year) programme is set up.

B. *Other Uses of MODIS I*

Like any other input/output model MODIS I has other applications. It is for example used regularly for the historical analysis of economic trends; in connection with the Bureau's yearly Economic Surveys the model is used to break down the changes in gross domestic product and imports to "explain" the reasons for the changes.

A few years ago the model was used in an attempt to calculate the implications for individual industries of price changes which could be assumed to result from changes in customs duties as a result of a possible entrance into the Common Market.

V. FUTURE PROGRESS

A. *Changes in the National Accounting System*

The main changes now proposed for the revision of the standard international system of national accounts are the inclusion of input/output tables and financial flows. The input/output tables are already included in the Norwegian national accounting system and will not cause any difficulty for us. We have started work on including financial flows. Whether these flows can be included in the system of punchcards has not yet been considered.

An important change in our treatment would be to accept the UN Secretariat proposal to show in the production accounts not sector flows but flows from sectors to commodity accounts and from commodity accounts to sectors. As I have mentioned earlier (see footnote 12) such a change can be made in our accounts now that we have access to computers with greater capacity.

We shall probably include directly in the accounts a purpose classification of government expenditure as is also proposed by the UN Secretariat. We have all the necessary information, but this classification is, at the moment, not included in the punchcard system.

We are experimenting in expanding the forecasting model. The purpose is to be able to take into consideration expected changes in prices and wages.[22]

B. *Further Co-ordination with Other Divisions*

In the Central Bureau's own five-year plan for statistical progress national accounts are considered as the co-ordinating instrument for all economic statistics. It has been considered very important to reduce the processing time. So-called PERT studies have been undertaken to investigate how the processing time of the national accounts is dependent on the sequence and the time of processing of other statistics.

It happens quite often in national accounting work that inconsistencies and errors in the basic statistics are discovered. Up to now it has been too late to change the basic statistics when we discover the errors. Shortening the processing time of national accounts or a simultaneous processing of the national accounts and the basic statistics may make it possible to correct errors before the latter are published.

While we have succeeded in co-ordinating production figures in national accounts and the different kinds of basic statistics, there is still co-ordination work to be done in the field of prices. As a first step the calculations of export and import price indexes in national accounts and foreign trade statistics have been co-ordinated through a combined data-processing system. We are, at the moment,

22. See footnote 21.

trying to combine all information on prices of imports, exports, production, wholesale and retail trade in one system. Here the punchcards play a very important role. We hope that the result will be price indexes supplied on punchcards from the other divisions, price indexes which can be used directly for the purpose of national accounts work. Such a system requires a very strict co-operation between several divisions of the Bureau, using the same sectoring, the same coding system and the same type of punchcards.

At this stage I might also mention that we are planning to elaborate further the work which has been done on printing or duplicating publications directly from punchcards.

C. Further Mechanization of the Quarterly Accounts

Cutting down the processing time is considered especially important for the quarterly accounts. As has been described the present processing goes through many programmes and checking is necessary at each stage. Since we have only recently had access to computers with greater capacity, we are, at the moment, in the process of altering the whole routine. If we succeed, the new process will be as follows:

Cards are punched for the volume (or value) and price indexes and for the different flows for which we estimate the value directly. All this information, together with the punchcards (magnetic tape) for the previous year are read into the computer. All processing, including calculation of sector products and main aggregates, is made and complete quarterly accounts emerge from the computer.[23] In this way we will have more checking at the end but the whole processing will be much quicker and less manpower will be required. We also hope that the results can be supplied in the form of texted tables supported by the necessary implicit price and volume indexes.

Finally, the National Accounts Division has recently been asked to supply preliminary quarterly figures (or forecasts) before the end of the quarter. Technically there is no problem in doing this in the same way that we make preliminary yearly accounts before the end of the year. However, the value of such estimates is entirely dependent on the degree to which we can successfully estimate the various volume and price indexes.

Les calculateurs électroniques, les cartes perforées, les bandes magnétiques sont très largement utilisées dans la préparation des comptes nationaux annuels et trimestriels de la Norvège.

L'article débute par une brève description du système norvégien de comptabilité nationale. Quatre aspects sont mis en lumière. En premier lieu les comptes sont construits dans l'optique de la production avec pour objectifs essentiels, d'une part de dégager le produit domestique brut aux prix du marché par

23. This routine was introduced in 1966. From the moment the indexes, etc., are punched the whole routine takes less than one day. After 1–2 weeks checking the adjusted flows are punched on cards. Then the adjustment routine takes two hours.

industrie d'origine, d'autre part de donner une décomposition détaillée de ses emplois. En second lieu la partie centrale du système est un tableau d'échanges interindustriels portant sur environ 1700 marchandises, 130 industries et 150 secteurs de demande finale. Ce tableau est donc complètement intégré au système de comptes nationaux. Troisièmement, la tableau d'échanges interindustriels sert à la préparation des comptes trimestriels. Enfin un modèle économétrique d'analyse et de prévision, étudié par le bureau central de statistiques norvégien, est autrement lié aux comptes nationaux.

L'article consiste essentiellement en une description de l'utilisation des ordinateurs et des cartes perforées. Il montre comment est rassemblée toute l'information disponible sur les ressources et les emplois de marchandises, sur les prix, etc. Autant que possible les cartes perforées sont reprises de l'élaboration des statistiques élémentaires pour être utilisées dans la suite du processus. Finalement chaque poste des comptes nationaux est représenté par une carte perforée.

L'article décrit les avantages obtenus par le passage du travail sur tableaux au travail sur cartes perforées en distinguant ceux qui apparaissent au cours de la préparation des comptes de ceux qui résultant de la présentation sur cartes perforées du résultat final.

La dernière partie décrit comment on utilise les cartes perforées relatives aux comptes annuels pour l'estimation provisoire des comptes trimestriels ainsi que dans le modèle prévisionnel.