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QUALITY ASSESSMENT OF MACROECONOMIC FIGURES: THE DUTCH QUARTERLY FLASH*)

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*) This paper was presented at the annual meeting of Dutch economists (ECOZOEK-dag), Rotterdam, 3 June 1992.

Nr. NA-049
1992

Abstract

Since 1989-IV, the Dutch Central Bureau of Statistics has made preliminary estimates of quarterly macroeconomic figures at about eight weeks after the end of the reference quarter. Since 1991-II, a preliminary or "Flash" estimate of GDP has been published. The decision to do so was based on a study comparing the Flash estimates and the regular Quarterly Accounts figures, which have a 17-week delay. This paper reports on a similar study with figures through 1991-III.

Contents

1. Introduction

The value of statistical information depends to a large extent on its timeliness. The reliability of statistics, on the other hand, is inversely related to their timeliness. In National Accounting this trade-off is a well known problem. The more time elapses between the reference period and the completion of the accounts, the more basic statistics are available. Until recently the most timely fully integrated Dutch National Account figures were those of the Quarterly Accounts (QA). These are published about 17 weeks after the end of the reference quarter, because only then the basic monthly and quarterly data used in the balancing process of the QA system are available.

This delay, however, is quite large. Several users of the Quarterly Accounts have requested more timely macroeconomic figures. Moreover, a delay of 17 weeks is large compared to several other countries. This is due to more timeliness of basic statistics in these countries and to a less elaborate balancing procedure. For the Dutch Central Bureau of Statistics (CBS), this relative lack of timeliness led to a reconsideration of the QA's methodology. The QA are based on a fully balanced quarterly input-output table, compiled by extrapolating the input-output table of the same quarter of the previous year. This basic table determines the structure of production and demand. The extrapolation process for each sector in the table consists of applying four-quarter growth rates of values, volumes and prices ("trend indicators"), derived from basic statistical information. Moreover, "autonomous information" is incorporated. The assumptions on the system's structure, the trend indicators and the autonomous information are submitted to a balancing process, in which differences between "supply" and "demand" are reconciled.[1)]

A research project was started aiming at a more timely publication without giving in too much in terms of quality. The compilation process of these fast quarterly estimates, called Quarterly Flash (QF), should be exactly the same as that of the QA. It is clear, however, that the QF has to cope with a lack of basic statistical data. Therefore the QF project aims at providing trend indicators based on the available short-term indicators and econometric techniques, e.g. time series analysis. All in all, a timeliness of about 8 weeks for the fast estimate seemed possible.[2)]

Experimentally, the QF has been compiled since 1989-IV. Fast estimates have been made of four-quarter changes in volumes, prices, and values of seven macroeconomic aggregates, namely: Gross Domestic Product, Imports of goods and services, Consumption expenditure by households, Consumption expenditure by government, Gross fixed capital formation by enterprises, Gross fixed capital formation by government, and Exports of goods and services. In this paper only the estimates of four-quarter volume changes are considered.

A tentative conclusion of an internal study after 5 Flash estimates was that the estimates of Gross Domestic Product and of Consumption were quite reliable predictors of the regular Quarterly Accounts figures. Till now, eight Flash estimates have been made. In the second section of this study the results of these estimates are compared to those of the regular QA. The most important question to be answered for each of the variables is how **reliable** the Flash estimates are. This can be investigated by answering four related questions:

1. *how large are the differences* between the Flash estimates and the regular QA figures (called the errors)?;
2. does the QF *systematically overestimate or underestimate* the QA?;
3. is the QF *better than some other technique*, viz. ARIMA modelling?;
4. what are the *tail probabilities*, i.e. the probabilities that the errors exceed certain standards?

The answers to these questions can be found in section 2 of this paper. Mean absolute errors are calculated to show the magnitude of the errors. In addition, root mean square errors serve to indicate the error variance. To answer the question of over- or underestimating, mean errors are calculated and a t-test is run. The comparison to ARIMA-models is made by compiling inequality coefficients. As at the beginning of the QF project maximum acceptable errors were set, also called "standards", these were used as benchmarks to calculate tail probabilities.

In the final section of this paper some conclusions are drawn concerning the quality of the Flash estimates.

2. Preliminary Results of the Dutch Quarterly Flash Estimates

Section 2.1 contains the Mean Absolute Errors and the Root Mean Square Errors. In section 2.2 the Mean Errors are shown. The Inequality Coefficients are calculated in the third section, the tail probabilities in 2.4. The figures of the QA and the QF and the graphs can be found in the appendix.

2.1. Mean Absolute Error and Root Mean Square Error

The **Mean Absolute Error** (MAE) is defined as:

$$MAE = \frac{\Sigma \mid (QF - QA) \mid}{n}.$$

The MAE is used to indicate to what extent the QF estimates meet some preset standards (i.e. maximum acceptable errors), which were determined in the early stages of the project. These standards are: the mean absolute error should not exceed 0.5%-point for GDP and 1.0%-point for the other macro-economic variables.

The MAE offers no information on the variance of the errors. It is to be expected, however, that users of the Quarterly Flash figures will prefer not only a low mean absolute error but also a low variance of the errors. To check whether this demand can be met, **Root Mean Square Errors** (RMSE) are calculated.[3)] This statistic is defined as:

$$RMSE = \frac{\sqrt{\Sigma (QF - QA)^2}}{n}.$$

The RMSE is equal to the MAE only if the variance of the MAE is zero, otherwise the RMSE is larger than the MAE. So the RMSE contains information about both the level and the variance of the errors. In table 1 the mean absolute errors and the root mean square errors are shown.

Table 1. Mean Absolute Error and Root Mean Square Error of Quarterly Flash estimates compared to Quarterly Accounts figures, 89-IV - 91-III

macro-economic variable	MAE	RMSE
	%-points	
Gross domestic product	0.30	0.33
Imports of goods and services	1.13	1.65
Consumption by households	0.34	0.37
Consumption by government	0.49	0.55
Gross fixed capital formation by enterprises	1.24	1.49
Gross fixed capital formation by government	2.25	2.72
Exports of goods and services	0.71	1.07

The MAEs are relatively small for GDP and for both consumption categories. Moreover, the differences between the MAEs and the RMSEs are small, so the variances of the differences appear to be relatively small. As will be shown in table 2, the ME for these variables is small too. This justifies the conclusion that the QF estimates of GDP and consumption expenditure were quite satisfactory. The other macro-economic variables showed larger mean absolute errors and larger differences between the mean absolute errors and the root mean square errors. The MAEs of the estimates of Imports of goods and services, Gross fixed capital formation by enterprises, and Gross fixed capital formation by government all exceed the maximum acceptable error of 1%-point. Moreover, their error variance is quite large.

2.2. Mean Error

The **Mean Error** (ME) is defined as:

$$ME = \frac{\Sigma (QF - QA)}{n}, \text{ where}$$

n = the number of estimates.

The ME indicates systematic underestimation if it is negative and systematic overestimation if it is positive. It is a very imperfect measure for the quality of the Flash estimates because it only contains information about the central tendency of the distribution of the errors and no information about the variance of the errors. Moreover, because of the small number of observations in this case, it can be considerably influenced by outliers. Futhermore, negative and positive estimation errors cancel out. Therefore the

ME can only give a first impression. By estimating the Mean Error with Ordinary Least Squares, however, a t-test can be run on the statistical significance of systematic underestimation or overestimation of the regular Quarterly Accounts figures.[4] Implicit information about the variance of the errors is thus obtained.

Table 2. Mean Error of Quarterly Flash estimates compared to Quarterly Accounts figures, 89-IV - 91-III

macro-economic variable	Mean Error	t-value[a]
	%-points	
Gross Domestic Product	-0.23	(-2.44)
Imports of Goods and Services	0.83	(1.53)
Consumption by Households	-0.09	(-0.65)
Consumption by Government	0.04	(0.18)
Gross Fixed Capital Formation By Enterprises	0.41	(0.76)
Gross Fixed Capital Formation by Government	-0.08	(-0.07)
Exports of Goods and Services	-0.09	(-0.22)

[a] The critical t-value at the 5%-level is 2.365.

The t-values show that, except for Gross Domestic Product, none of the Mean Errors differs significantly from zero on the 5%-level. This means that, according to this measure, none of these macroeconomic aggregates is systematically underestimated or overestimated. GDP, however, seems to be underestimated systematically by the QF. Fortunately, as is shown before, the mean absolute error of GDP is quite small.

2.3. Inequality Coefficient

The **Inequality Coefficient** (IC) compares the estimation errors of a certain method to those of a different, often naïve, method. It is defined as:

$$IC = \frac{\sqrt{\Sigma (QF - QA)^2}}{\sqrt{\Sigma (A - QA)^2}}, \text{ where}$$

A = an alternative estimate.

The IC is commonly used to judge the quality of forecasts. If the IC is smaller than one, the alternative performs worse than the proposed method. In Theil's U-statistic the alternative is the "no change" forecast.[5] Here, the benchmarks are drawn from univariate ARIMA-models, which does more justice to the differences in variability of the different macroeconomic series.

Table 3. Inequality Coefficients of Quarterly Flash estimates compared to Quarterly Accounts figures, using univariate ARIMA models estimates as alternative, 89-IV - 91-III

macro-economic variable	Inequality Coefficient
Gross domestic product	0.43
Imports of goods and services	0.72
Consumption by households	0.50
Consumption by government	0.59
Gross fixed capital formation by enterprises	0.30
Gross fixed capital formation by government	0.28
Exports of goods and services	0.71
Mean inequality coefficient[a)]	0.53

a) The Mean inequality coefficient = $[\ 1/n\ \Sigma\ (IC)^2\ ]^{\frac{1}{2}}$

Table 3 shows that for all variables the QF estimates provide better (more reliable) forecasts than the (simple) ARIMA alternatives. Surprisingly this applies particularly to the investment estimates which were by no means among the firmest. However, it seems that a simpler alternative would have led to even worse results.

2.4. Tail probability

The last indicator presented here to assess the QF estimates' quality is the probability that an error is larger than its preset standard (see also section 2.1). This is called the tail probability. Since the number of observations in our case is very small the tail probabilities can provide no more than a rough indication.

To estimate the tail probabilities it is assumed that the observed differences between the Flash and the regular quarterly figures were sampled from a normal distribution.[6)] For each normal distribution, the μ is drawn from table 1, and the σ is estimated by applying Ordinary Least Squares.[7)] In table 4 the results are shown. The left-hand (right-hand) tail probability indicates the probability of an underestimation (overestimation) of the Quarterly Accounts figures by the Flash estimate by more than the standard.

Table 4. Tail probabilities of |QF - QA| being larger than the standard[a)]

macro-economic variable	Tail probability left -hand	right -hand	total
	%		
Gross domestic product	10.9	0.1	11.0
Imports of goods and services	10.8	44.4	55.2
Consumption by households	0.6	0.1	0.7
Consumption by government	3.2	4.4	7.6
Gross fixed capital formation by enterprises	17.1	33.7	50.8
Gross fixed capital formation by government	37.1	34.8	71.9
Exports of goods and services	20.0	15.9	35.9

a) The standard is 0.5%-point for GDP and 1.0%-point for the other variables.

From table 4 it is clear that the total tail probability of underestimating or overestimating by more than the agreed standards is relatively small for GDP and both consumption categories. However, for the remaining macroeconomic aggregates, the probability that the errors exceed the standards is considerable.

The standards used to calculate the tail probabilities are only preliminary. Users of the Quarterly Accounts may well prefer more timely statistical information at the cost of some accuracy. Moreover, it can be expected that users will consider a deviation of 1%-point for a variable that varies relatively little (like consumption of households) more troublesome than the same deviation for a more volatile series. Therefore, it is still under discussion what the maximum acceptable errors should be.[8)]

3. Conclusions

The main conclusion is that the quality loss of the Flash estimate compared to the regular Quarterly Accounts is very limited for GDP (which shows only a small, although systematic underestimation) and consumption expenditure of households and government. The quality loss for the other macroeconomic variables is larger. It is shown, however, that the QF appears to be more reliable than straightforward ARIMA estimates of the same variables.

It is expected that a simultaneous use of several estimation methods - e.g. an input-output table applied to the balancing of available basic statistics, the use of tendency surveys, and the use of time series analysis to obtain estimates for missing statistical information - will lead to a further improvement of the results.[9)]

Notes

1. For a detailed description of the QA's methodology, see Janssen and Algera (1988).

2. The methodology of the Quarterly Flash is described in Ouddeken and Zijlmans (1991).

3. In fact, the RMSE only gives a fair indication of the variance if the variance of the errors is constant over time, see e.g. Lefrançois (1989). The small number of observations does not allow conclusive testing wether this assumption is violated or not.

4. The proper regression to run is ME = constant.

5. Theil's U-statistic is defined as (see e.g. Fair (1986)):

$$IC = \frac{\sqrt{\Sigma\,(QF - QA)^2}}{\sqrt{\Sigma\,QA^2}}$$

6. In fact, the Skewnesses of the error distributions deviate from zero and the Kurtosises point to thick tails in some cases. However, as e.g. Rothenberg (1984) states, it is common small sample practice to use the normal distribution as an approximation of the "real" distribution.

7. Of course one could maintain that, with regard to the available statistical information and the additional use of tendency surveys and (model-)estimates, a Flash estimate is an unbiased estimate of the regular QA figure. This would imply à priori that the mean of the normal distribution equals zero, which is indeed indicated by table 1, and that σ is the only parameter to be estimated. This procedure leads to total tail probabilities that are very similar to those shown in table 4. (See Janssen et al. (1991)).

8. The standards were defined in terms of absolute differences between the QA and the QF growth rates. In the light of the discussion here, however, it might be more appropriate to define maximum relative errors. In that case it is better to work with relative mean absolute errors, as e.g. Young (1987) does.

9. E.g. Zarnowitz and Braun (1991) report on the improvement of macroeconomic forecast results when different forecast methods are combined.

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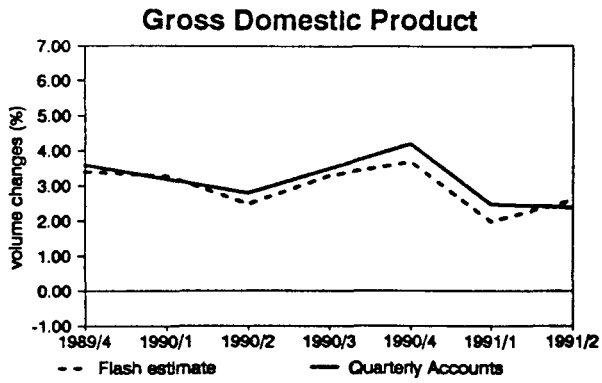
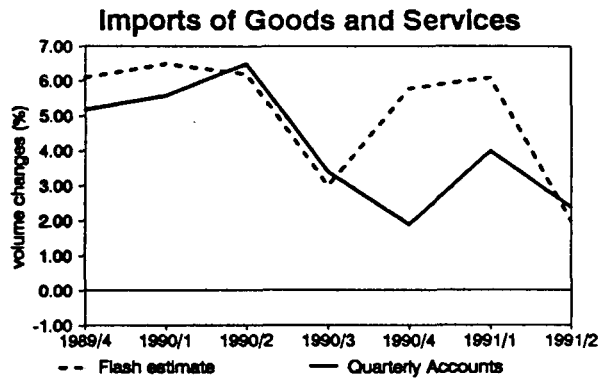
Appendix

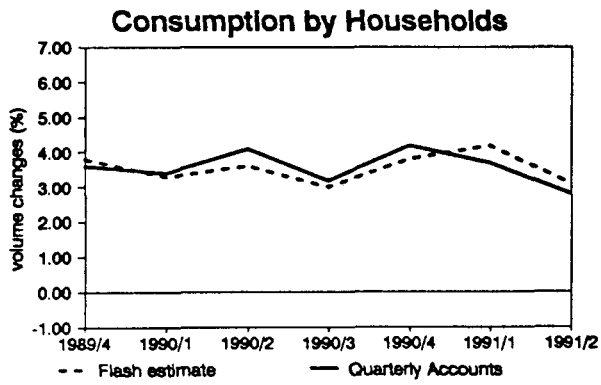
Quarterly Accounts Growth Rates and Flash Estimates

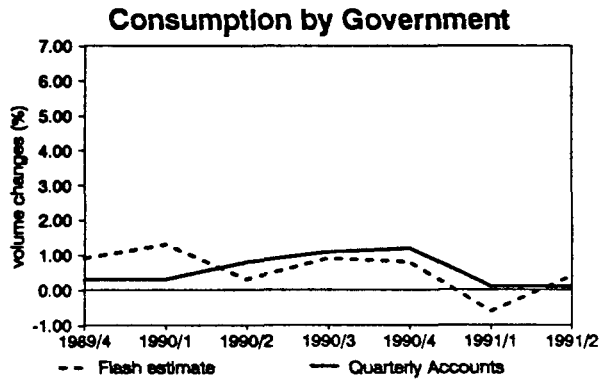
Table 1. Quarterly Flash estimates (QF) and Quarterly Accounts figures (QA), 1989-IV - 1991-III
(%-volume changes compared to the same quarter a year before)

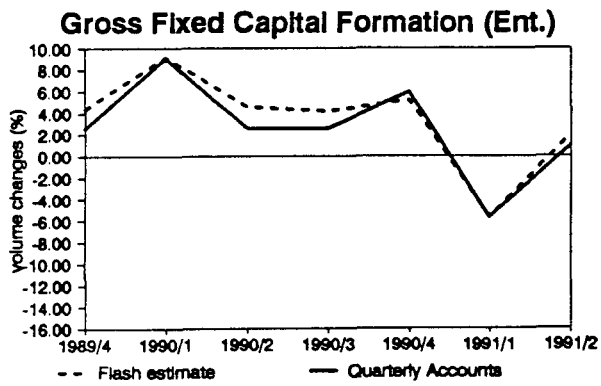
quarter		Gross Domestic Product %	Imports Goods & Services	House-hold Consump.	Governm. Consump.	Gross Fix. Cap. Form. Enterpr.	Gross Fix. Cap. Form. Government	Exports Goods & Services
1989								
-IV	QF	3.4	6.1	3.8	0.9	4.4	2.5	5.0
	QA	**3.6**	**5.2**	**3.6**	**0.3**	**2.6**	**4.4**	**5.8**
1990								
-I	QF	3.3	6.5	3.3	1.3	9.2	4.9	4.6
	QA	**3.2**	**5.6**	**3.4**	**0.3**	**9.1**	**3.8**	**4.6**
-II	QF	2.5	6.2	3.6	0.3	4.6	6.6	2.5
	QA	**2.8**	**6.5**	**4.1**	**0.8**	**2.6**	**4.8**	**3.2**
-III	QF	3.3	3.0	3.0	0.9	4.2	4.7	4.1
	QA	**3.5**	**3.4**	**3.2**	**1.1**	**2.6**	**0.1**	**5.4**
-IV	QF	3.7	5.8	3.8	0.8	5.2	2.1	5.9
	QA	**4.2**	**1.9**	**4.2**	**1.2**	**6.0**	**6.7**	**3.4**
1991								
-I	QF	2.0	6.1	4.2	-0.6	-5.6	-13.0	3.9
	QA	**2.5**	**4.0**	**3.7**	**0.1**	**-5.7**	**-10.3**	**4.2**
-II	QF	2.6	2.0	3.1	0.4	2.0	3.0	4.1
	QA	**2.4**	**2.4**	**2.8**	**0.1**	**1.0**	**3.1**	**4.2**
-III	QF	2.1	3.8	2.3	-0.5	1.1	5.1	4.6
	QA	**2.5**	**3.9**	**2.8**	**-0.7**	**3.6**	**3.9**	**4.6**

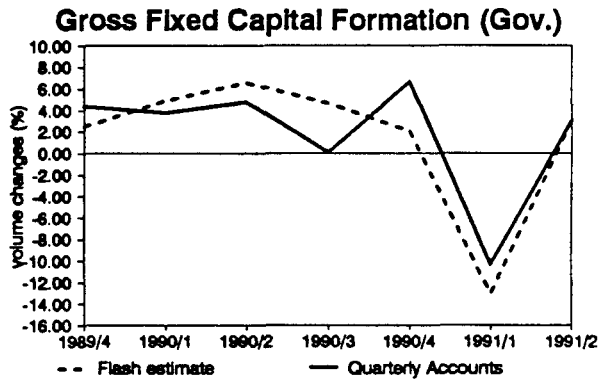

Gross Domestic Product
volume changes (%)
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
-1.00
1989/4 1990/1 1990/2 1990/3 1990/4 1991/1 1991/2
Flash estimate
Quarterly Accounts

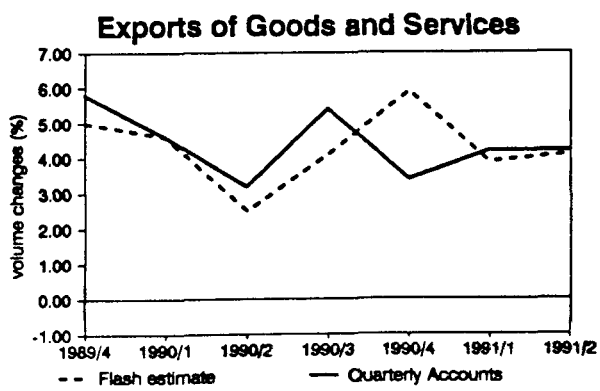

Imports of Goods and Services
volume changes (%)
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
-1.00
1989/4 1990/1 1990/2 1990/3 1990/4 1991/1 1991/2
Flash estimate
Quarterly Accounts


Consumption by Households
volume changes (%)
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
-1.00
1989/4 1990/1 1990/2 1990/3 1990/4 1991/1 1991/2
Flash estimate
Quarterly Accounts


Consumption by Government
volume changes (%)
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
-1.00
1989/4 1990/1 1990/2 1990/3 1990/4 1991/1 1991/2
Flash estimate
Quarterly Accounts


Gross Fixed Capital Formation (Ent.)
volume changes (%)
10.00
8.00
6.00
4.00
2.00
0.00
-2.00
-4.00
-6.00
-8.00
-10.00
-12.00
-14.00
-16.00
1989/4 1990/1 1990/2 1990/3 1990/4 1991/1 1991/2
Flash estimate
Quarterly Accounts


Gross Fixed Capital Formation (Gov.)
volume changes (%)
10.00
8.00
6.00
4.00
2.00
0.00
-2.00
-4.00
-6.00
-8.00
-10.00
-12.00
-14.00
-16.00
1989/4 1990/1 1990/2 1990/3 1990/4 1991/1 1991/2
Flash estimate
Quarterly Accounts


Exports of Goods and Services
volume changes (%)
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
-1.00
1989/4 1990/1 1990/2 1990/3 1990/4 1991/1 1991/2
Flash estimate
Quarterly Accounts

National Accounts Occasional Papers

NA/01 **Flexibility in the system of National Accounts**, Van Eck, R., C.N. Gorter and H.K. van Tuinen (1983).
This paper sets out some of the main ideas of what gradually developed into the Dutch view on the fourth revision of the SNA. In particular it focuses on the validity and even desirability of the inclusion of a number of carefully chosen alternative definitions in the "Blue Book", and the organization of a flexible system starting from a core that is easier to understand than the 1968 SNA.

NA/02 **The unobserved economy and the National Accounts in the Netherlands, a sensitivity analysis**, Broesterhuizen, G.A.A.M. (1983).
This paper studies the influence of fraud on macro-economic statistics, especially GDP. The term "fraud" is used as meaning unreporting or underreporting income (e.g. to the tax authorities). The conclusion of the analysis of growth figures is that a bias in the growth of GDP of more than 0.5% is very unlikely.

NA/03 **Secondary activities and the National Accounts: Aspects of the Dutch measurement practice and its effects on the unofficial economy**, Van Eck, R. (1985).
In the process of estimating national product and other variables in the National Accounts a number of methods is used to obtain initial estimates for each economic activity. These methods are described and for each method various possibilities for distortion are considered.

NA/04 **Comparability of input-output tables in time**, Al, P.G. and G.A.A.M. Broesterhuizen (1985).
It is argued that the comparability in time of statistics, and input-output tables in particular, can be filled in in various ways. The way in which it is filled depends on the structure and object of the statistics concerned. In this respect it is important to differentiate between coordinated input-output tables, in which groups of units (industries) are divided into rows and columns, and analytical input-output tables, in which the rows and columns refer to homogeneous activities.

NA/05 **The use of chain indices for deflating the National Accounts**, Al, P.G., B.M. Balk, S. de Boer and G.P. den Bakker (1985).
This paper is devoted to the problem of deflating National Accounts and input-output tables. This problem is approached from the theoretical as well as from the practical side. Although the theoretical argument favors the use of chained Vartia-I indices, the current practice of compilating National Accounts restricts to using chained Paasche and Laspeyres indices. Various possible objections to the use of chained indices are discussed and rejected.

NA/06 **Revision of the system of National Accounts: the case for flexibility**, Van Bochove, C.A. and H.K. van Tuinen (1985).
It is argued that the structure of the SNA should be made more flexible. This can be achieved by means of a system of a general purpose core supplemented with special modules. This core is a fully fledged, detailed system of National Accounts with a greater institutional content than the present SNA and a more elaborate description of the economy at the meso-level. The modules are more analytic and reflect special purposes and specific theoretical views.

NA/07 **Integration of input-output tables and sector accounts; a possible solution**, Van den Bos, C. (1985).
The establishment-enterprise problem is tackled by taking the institutional sectors to which the establishments belong into account during the construction of input-output tables. The extra burden on the construction of input-output tables resulting from this approach is examined for the Dutch situation. An adapted sectoring of institutional units is proposed for the construction of input-output tables.

NA/08 **A note on Dutch National Accounting data 1900-1984**, Van Bochove, C.A. (1985).
This note provides a brief survey of Dutch national accounting data for 1900-1984, concentrating on national income. It indicates where these data can be found and what the major discontinuities are. The note concludes that estimates of the level of national income may contain inaccuracies; that its growth rate is measured accurately for the period since 1948; and that the real income growth rate series for 1900-1984 may contain a systematic bias.

NA/09 **The structure of the next SNA: review of the basic options**, Van Bochove, C.A. and A.M. Bloem (1985).
There are two basic issues with respect to the structure of the next version of the UN System of National Accounts. The first is its 'size': reviewing this issue, it can be concluded that the next SNA should contain an integrated meso-economic statistical system. It is essential that the next SNA contains an institutional system without the imputations and attributions that pollute the present SNA. This can be achieved by distinguishing, in the central system of the next SNA, a core (the institutional system), a standard module for non-market production and a standard module describing attributed income and consumption of the household sector.

NA/10 **Dual sectoring in National Accounts**, Al, P.G. (1985).
Following a conceptual explanation of dual sectoring, an outline is given of a statistical system with complete dual sectoring in which the linkages are also defined and worked out. It is shown that the SNA 1968 is incomplete and obscure with respect to the links between the two sub-processes.

NA/11 **Backward and forward linkages with an application to the Dutch agro-industrial complex**, Harthoorn, R. (1985).
Some industries induce production in other industries. An elegant method is developed for calculating forward and backward linkages avoiding double counting. For 1981 these methods have been applied to determine the influence of Dutch agriculture in the Dutch economy in terms of value added and labour force.

NA/12 **Production chains**, Harthoorn, R. (1986).
This paper introduces the notion of production chains as a measure of the hierarchy of industries in the production process. Production chains are sequences of transformation of products by successive industries. It is possible to calculate forward transformations as well as backward ones.

NA/13 **The simultaneous compilation of current price and deflated input-output tables**, De Boer, S. and G.A.A.M. Broesterhuizen (1986).
A few years ago the method of compiling input-output tables underwent in the Netherlands an essential revision. The most significant improvement is that during the entire statistical process, from the processing and analysis of the basic data up to and including the phase of balancing the tables, data in current prices and deflated data are obtained simultaneously and in consistency with each other.

NA/14 **A proposal for the synoptic structure of the next SNA**, Al, P.G. and C.A. van Bochove (1986).

NA/15 **Features of the hidden economy in the Netherlands**, Van Eck, R. and B. Kazemier (1986).
This paper presents survey results on the size and structure of the hidden labour market in the Netherlands.

NA/16 **Uncovering hidden income distributions: the Dutch approach**, Van Bochove, C.A. (1987).

NA/17 **Main national accounting series 1900-1986**, Van Bochove, C.A. and T.A. Huitker (1987).
The main national accounting series for the Netherlands, 1900-1986, are provided, along with a brief explanation.

NA/18 **The Dutch economy, 1921-1939 and 1969-1985. A comparison based on revised macro-economic data for the interwar period**, Den Bakker, G.P., T.A. Huitker and C.A. van Bochove (1987).
A set of macro-economic time series for the Netherlands 1921-1939 is presented. The new series differ considerably from the data that had been published before. They are also more comprehensive, more detailed, and conceptually consistent with the modern National Accounts. The macro-economic developments that are shown by the new series are discussed. It turns out that the traditional economic-historical view of the Dutch economy has to be reversed.

NA/19 **Constant wealth national income: accounting for war damage with an application to the Netherlands, 1940-1945**, Van Bochove, C.A. and W. van Sorge (1987).

NA/20 **The micro-meso-macro linkage for business in an SNA-compatible system of economic statistics**, Van Bochove, C.A. (1987).

NA/21 **Micro-macro link for government**, Bloem, A.M. (1987).
This paper describes the way the link between the statistics on government finance and national accounts is provided for in the Dutch government finance statistics.

NA/22 **Some extensions of the static open Leontief model**, Harthoorn, R.(1987).
The results of input-output analysis are invariant for a transformation of the system of units. Such transformation can be used to derive the Leontief price model, for forecasting input-output tables and for the calculation of cumulative factor costs. Finally the series expansion of the Leontief inverse is used to describe how certain economic processes are spread out over time.

NA/23 **Compilation of household sector accounts in the Netherlands National Accounts**, Van der Laan, P. (1987).
This paper provides a concise description of the way in which household sector accounts are compiled within the Netherlands National Accounts. Special attention is paid to differences with the recommendations in the United Nations System of National Accounts (SNA).

NA/24 **On the adjustment of tables with Lagrange multipliers**, Harthoorn, R. and J. van Dalen (1987).
An efficient variant of the Lagrange method is given, which uses no more computer time and central memory then the widely used RAS method. Also some special cases are discussed: the adjustment of row sums and column sums, additional restraints, mutual connections between tables and three dimensional tables.

NA/25 **The methodology of the Dutch system of quarterly accounts**, Janssen, R.J.A. and S.B. Algera (1988).
In this paper a description is given of the Dutch system of quarterly national accounts. The backbone of the method is the compilation of a quarterly input-output table by integrating short-term economic statistics.

NA/26 **Imputations and re-routeings in the National Accounts**, Gorter, Cor N. (1988).
Starting out from a definition of 'actual' transactions an inventory of all imputations and re-routeings in the SNA is made. It is discussed which of those should be retained in the core of a flexible system of National Accounts. Conceptual and practical questions of presentation are brought up. Numerical examples are given.

NA/27 **Registration of trade in services and market valuation of imports and exports in the National Accounts**, Bos, Frits (1988).
The registration of external trade transactions in the main tables of the National Accounts should be based on invoice value; this is not only conceptually very attractive, but also suitable for data collection purposes.

NA/28 **The institutional sector classification**, Van den Bos, C. (1988).
A background paper on the conceptual side of the grouping of financing units. A limited number of criteria are formulated.

NA/29 **The concept of (transactor-)units in the National Accounts and in the basic system of economic statistics**, Bloem, Adriaan M. (1989).
Units in legal-administrative reality are often not suitable as statistical units in describing economic processes. Some transformation of legal-administrative units into economic statistical units is needed. This paper examines this transformation and furnishes definitions of economic statistical units. Proper definitions are especially important because of the forthcoming revision of the SNA.

NA/30 **Regional income concepts**, Bloem, Adriaan M. and Bas De Vet (1989).
In this paper, the conceptual and statistical problems involved in the regionalization of national accounting variables are discussed. Examples are the regionalization of Gross Domestic Product, Gross National Income, Disposable National Income and Total Income of the Population.

NA/31 **The use of tendency surveys in extrapolating National Accounts**, Oudde-ken, Frank and Gerrit Zijlmans (1989).
This paper discusses the feasibility of the use of tendency survey data in the compilation of very timely Quarterly Accounts. Some preliminary estimates of relations between tendency survey data and regular Quarterly Accounts-indicators are also presented.

NA/32 **An economic core system and the socio-economic accounts module for the Netherlands**, Gorter, Cor N. and Paul van der Laan (1989).
A discussion of the core and various types of modules in an overall system of economy related statistics. Special attention is paid to the Dutch Socio-economic Accounts. Tables and figures for the Netherlands are added.

NA/33 **A systems view on concepts of income in the National Accounts**, Bos, Frits (1989).
In this paper, concepts of income are explicitly linked to the purposes of use and to actual circumstances. Main choices in defining income are presented in a general system. The National Accounts is a multi-purpose framework. It should therefore contain several concepts of income, e.g. differing with respect to the production boundary. Furthermore, concepts of national income do not necessarily constitute an aggregation of income at a micro-level.

NA/34 **How to treat borrowing and leasing in the next SNA**, Keuning, Steven J. (1990).
The use of services related to borrowing money, leasing capital goods, and renting land should not be considered as intermediate inputs into specific production processes. It is argued that the way of recording the use of financial services in the present SNA should remain largely intact.

NA/35 **A summary description of sources and methods used in compiling the final estimates of Dutch National Income 1986**, Gorter, Cor N. and others (1990).
Translation of the inventory report submitted to the GNP Management Committee of the European Communities.

NA/36 **The registration of processing in make and use tables and input-output tables**, Bloem, Adriaan M., Sake De Boer and Pieter Wind (1990, forthcoming).
The registration of processing is discussed primarily with regard to its effects on input-output-type tables and input-output quotes. Links between National Accounts and basic statistics, user demands and international guidelines are examined.

NA/37 **A proposal for a SAM which fits into the next System of National Accounts**, Keuning, Steven J. (1990).
This paper shows that all flow accounts which may become part of the next System of National Accounts can be embedded easily in a Social Accounting Matrix (SAM). In fact, for many purposes a SAM format may be preferred to the traditional T-accounts for the institutional sectors, since it allows for more flexibility in selecting relevant classifications and valuation principles.

NA/38 **Net versus gross National Income**, Bos, Frits (1990).
In practice, gross figures of Domestic Product, National Product and National Income are most often preferred to net figures. In this paper, this practice is challenged. Conceptual issues and the reliability of capital consumption estimates are discussed.

NA/39 **Concealed interest income of households in the Netherlands; 1977, 1979 and 1981**, Kazemier, Brugt (1990).
The major problem in estimating the size of hidden income is that total income, reported plus unreported, is unknown. However, this is not the case with total interest income of households in the Netherlands. This makes it possible to estimate at least the order of magnitude of this part of hidden income. In this paper it will be shown that in 1977, 1979 and 1981 almost 50% of total interest received by households was concealed.

NA/40 **Who came off worst: Structural change of Dutch value added and employ-- ment during the interwar period**, Den Bakker, Gert P. and Jan de Gijt (1990).
In this paper new data for the interwar period are presented. The distribution of value added over industries and a break-down of value added into components is given. Employment by industry is estimated as well. Moreover, structural changes during the interwar years and in the more recent past are juxtaposed.

NA/41 **The supply of hidden labour in the Netherlands: a model**, Kazemier, Brugt and Rob van Eck (1990).
This paper presents a model of the supply of hidden labour in the Netherlands. Model simulations show that the supply of hidden labour is not very sensitive to cyclical fluctuations. A tax exempt of 1500 guilders for second jobs and a higher probability of detection, however, may substantially decrease the magnitude of the hidden labour market.

NA/42 **Benefits from productivity growth and the distribution of income**, Keuning, Steven J. (1990).
This paper contains a discussion on the measurement of multifactor productivity and sketches a framework for analyzing the relation between productivity changes and changes in the average factor remuneration rate by industry. Subsequently, the effects on the average wage rate by labour category and the household primary income distribution are studied.

NA/43 **Valuation principles in supply and use tables and in the sectoral accounts**, Keuning, Steven J. (1991).
In many instances, the valuation of transactions in goods and services in the national accounts poses a problem. The main reason is that the price paid by the purchaser deviates from the price received by the producers. The paper discusses these problems and demonstrates that different valuations should be used in the supply and use tables and in the sectoral accounts.

NA/44 **The choice of index number formulae and weights in the National Accounts. A sensitivity analysis based on macro-economic data for the interwar period**, Bakker, Gert P. den (1991).
The sensitivity of growth estimates to variations in index number formulae and weighting procedures is discussed. The calculations concern the macro-economic variables for the interwar period in the Netherlands. It appears, that the use of different formulae and weights yields large differences in growth rates. Comparisons of Gross Domestic Product growth rates among countries are presently obscured by the use of different deflation methods. There exists an urgent need for standardization of deflation methods at the international level.

NA/45 **Volume measurement of government output in the Netherlands; some alternatives**, Kazemier, Brugt (1991).
This paper discusses three alternative methods for the measurement of the production volume of government. All methods yield almost similar results: the average annual increase in the last two decades of government labour productivity is about 0.7 percent per full-time worker equivalent. The implementation of either one of these methods would have led to circa 0.1 percentage points higher estimates of economic growth in the Netherlands.

NA/46 **An environmental module and the complete system of national accounts**, Boo, Abram J. De, Peter R. Bosch, Cor N. Gorter and Steven J. Keuning (1991).
A linkage between environmental data and the National Accounts is often limited to the production accounts. This paper argues that the consequences of economic actions on ecosystems and vice versa should be considered in terms of the complete System of National Accounts (SNA). One should begin with relating volume flows of environmental matter to the standard economic accounts. For this purpose, a so-called National Accounting Matrix including Environmental Accounts (NAMEA) is proposed. This is illustrated with an example.

NA/47 **Deregulation and economic statistics: Europe 1992**, Bos, Frits (1992).
The consequences of deregulation for economic statistics are discussed with a view to Europe 1992. In particular, the effects of the introduction of the Intrastat-system for statistics on international trade are investigated. It is argued that if the Statistical Offices of the EC-countries do not respond adequately, Europe 1992 will lead to a deterioration of economic statistics: they will become less reliable, less cost effective and less balanced.

NA/48 **The history of national accounting**, Bos, Frits (1992).
At present, the national accounts in most countries are compiled on the basis of concepts and classifications recommended in the 1968-UN-guidelines. In this paper, we trace the roots of these guidelines, compare the subsequent guidelines and discuss also alternative accounting systems like extended accounts and SAMs.

NA/49 **Quality assessment of macroeconomic figures: The Dutch Quarterly Flash**, Reininga, Ted, Gerrit Zijlmans and Ron Janssen (1992).
Since 1989-IV, the Dutch Central Bureau of Statistics has made preliminary estimates of quarterly macroeconomic figures at about 8 weeks after the end of the reference quarter. Since 1991-II, a preliminary or "Flash" estimate of GDP has been published. The decision to do so was based on a study comparing the Flash estimates and the regular Quarterly Accounts figures, which have a 17-week delay. This paper reports on a similar study with figures through 1991-III.

NA/50 **Quality improvement of the Dutch Quarterly Flash: A Time Series Analysis of some Service Industries**, Reininga, Ted and Gerrit Zijlmans (1992).
The Dutch Quarterly Flash (QF) is, just like the regular Quarterly Accounts (QA), a fully integrated statistic based on a quarterly updated input-output table. Not all short term statistics used to update the QA's IO-table are timely enough to be of use for the QF, so other sources have to be found or forecasts have to be made. In large parts of the service industry the latter is the only possibility. This paper reports on the use of econometric techniques (viz. series decomposition and ARIMA modelling) to improve the quality of the forecasts in five parts of the service industry.

NA/51 **A Research and Development Module supplementing the National Accounts**, Bos, Frits, Hugo Hollanders and Steven Keuning (1992).
This paper presents a modified national accounting system tailored to a description of the role of Research and Development (R&D) in the national economy. The main differences with the standard National Accounts are some changes in basic concepts (e.g. own-account production of R&D is considered as capital formation) and the introducton of additional, more detailed, classifications (e.g. new subsectors).

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