Compiling the national accounts demystified

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Explanation of symbols

.	= data not available
*	= provisional figure
x	= publication prohibited (confidential figure)
–	= nil or less than half of unit concerned
0 (0,0)	= less than half of unit concerned
–	= (between two figures) inclusive
blank	= not applicable
2005?2006	= 2005 to 2006 inclusive
2005/2006	= average of 2005 up to and including 2006
2005/'06	= crop year, financial year, school year etc. beginning in 2005 and ending in 2006
2003/'04–2005/'06	= crop year, financial year, etc. 2003/'04 to 2005/'06 inclusive

Due to rounding, some totals may not correspond with the sum of the separate figures.

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Abstract

National accounts statistics are not facts. They are estimates of a universal accounting model (SNA93) for describing, analyzing and managing national economies. The operational versions of the universal model decide what is actually estimated. They are estimated by expanding and transforming the available data with accounting identities, tested and untested assumptions and previous estimates. The estimates reflect skills, resources and compilation policy. The resulting differences in the reliability of the national accounts statistics are to a great extent the price to be paid for a miracle come true: all over the world, very incomplete, imperfect, heterogeneous and partly outdated data are to be transformed into complete, consistent, internationally standardized and up-to-date overviews of the national economies and their major components. Nevertheless, compiling the national accounts can be improved in various ways, but this requires an international long-term strategy.

Keywords: national accounts, data compilation, reliability of national accounts statistics, measurement in economics

Contents

1. Introduction

In this paper, the national measurement process underlying national accounts statistics is described and discussed (for a general overview on national accounting, see Bos, 2003). For non-national accountants, the compilation of national accounts statistics is usually a mystic and incomprehensible process. Sections 2 and 3 provide therefore a look behind the scenes.
Section 2 is devoted to the role of the national operational models, i.e. the national operational versions of the universal accounting model SNA93. The national operational model decides what is actually to be estimated. Furthermore, differences between national operational models affect the international comparability of national accounts statistics.
Section 3 explains the compilation process. It describes the roles played by data, the three compilation tools (accounting identities, assumptions and plausibility checks) and environmental factors (skills, resources and policy). In this way, the logic underlying the compilation process is revealed. Furthermore, it completes the description of the relationship between national accounts statistics and the real world.
The reliability of national accounts statistics is a major outcome of the compilation process. For data users, it is important to know how reliable official national accounts statistics are in absolute terms and in comparison to other data sources. This is the topic of section 4.
Compiling the national accounts can be improved in various ways. Proposals are put forward in section 5.
A summary is provided by section 6.

The literature on national accounts compilation methods and the reliability of national accounts statistics is very limited.[1)] The value added of this paper in view of current literature is therefore manifold:
- It demonstrates the importance of the operational model.
- It provides a systematic account of the various steps in compiling national accounts statistics.
- It clarifies the role of accounting identities, assumptions and plausibility checks.
- It discusses the role of environmental factors like skills, resources and policy.
- It puts the issue of the reliability of national accounts statistics in a general context, stresses the importance of sensitivity analysis and downplays the importance of indicators for margins of error.
- Concrete proposals for improving compiling the national accounts are put forward.

[1)] On compilation methods see in particular Séruzier (1996; on compiling national accounts in general), Bos and Gorter (1993; a concise but partly outdated overview on the Dutch estimates of gross national roduct), Statistics Netherlands (2004; the most recent, much more elaborate, description of the Dutch estimates of gross national income), Takema (2000; on compiling input-output tables), UN (2000; on the link between business accounts and national accounts) and Magnus et al. (2000; on bayesian methods). On the reliability of national accounts statistics, see Novak (1975), Weale (1988), Wroe et al (1998), Young (1987) and Vanoli (2005, chapter 5).

2. The operational model

The universal model can not be estimated directly. It should first be translated into an operational model for a specific country at a specific moment in time. The specification of the operational model involves four steps:

1. Specification of the desired scope and detail.
2. Interpretation of the universal concepts.
3. Specification of the universal concepts.
4. Application to the national economy for a specific period.

Step 1: Specification of scope and detail

The first step in the specification of the operational model is the specification of the scope and detail of the national accounts statistic. The universal model is very encompassing. The specification of the scope therefore generally involves the selection of parts of the universal model, e.g. a simple set of sector accounts excluding balance sheets and other changes in assets accounts. The universal model contains also a lot of detail, e.g. detail at very levels of aggregation in the classification by industry and the classification of flows and stocks. Due to trade-offs, scope and detail generally also depend on the frequency and timeliness of the national accounts statistics, e.g. a trade-off between detail and timeliness. The desired detail can also depend on national demands for specific detail, the available detail in national data sources or on requirements of reliability, e.g. price measurement is influenced by the level of desegregation used. Differences in level of desegregation can therefore also influence the reliability and comparability of national accounts statistics.

Step 2: Interpretation of the universal concepts

The second step in the specification of the operational model is the interpretation of the universal concepts. This step is in fact an intermediary step, i.e. intermediary in the further specification and application of the universal concepts. Interpretation of the universal concepts is not always simple and straightforward. Concepts can be formulated in vague or even misleading terms; literal reading of the definitions of these concepts can then lead astray. Furthermore, related concepts can also be defined in different and sometimes contradictory terminology. Finally, the definitions of some concepts may even conflict with the general accounting principles. Two examples can illustrate such problems of interpretation.

The first example pertains to the *services of owner-occupied dwellings*. Does this also include imputing services and income for free standing garages and holidays homes abroad? According to the general accounting logic, such imputations should indeed be made. However, the old guidelines and the SNA93 are not explicit about this and created thus differences in interpretation. The ESA95 contains therefore some explicit statements that such imputations should indeed be made.

The second example pertains to *valuables*. The general definition of valuables is ‘valuables are non-financial goods that are … acquired and held primarily as stores of value’. Furthermore, changes in inventories are defined to include goods for resale. Literally following these definitions, the acquisition and disposal of paintings by art dealers should be recorded as changes in inventories, while the acquisition and disposal of paintings by households should be recorded as net acquisitions of valuables. This interpretation was not intended in drafting the SNA93. The ESA95 therefore includes a supplementary convention treating also the purchases and sales of the art dealers as net acquisitions of valuables (ESA95, paragraph 3.126).

Step 3: Further specification of the universal concepts

The third step in the specification of the operational model is the further specification of the universal concepts at a national level. This step is required for universal concepts defined in too general terms. Four examples may illustrate this: volumes and prices, market and other non-market producers, financial derivatives and the subsectors of the general government.

In the standard national accounts, the *volumes and prices of the supply and use of goods and services* are defined in a not very specific way. Some examples may illustrate this:

– The volume of banking and insurance services is not at all defined.
– The volume of education services may be measured in terms of outputs (e.g. the number of pupils) but also in terms of inputs (e.g. the number of teachers).
– The quality change of computers may be measured by a hedonic method but also by alternative methods.
– Fisher indices are preferred but Laspeyres and Paasche indices are acceptable (in combination with chain linking).
– No clear guidelines are given about how to incorporate new products into price-indices.

Operational definitions of prices, volumes, economic growth, productivity and real income differ therefore substantially all over the world. The direct consequence is that the national accounts statistics on these major variables are not very comparable. This has induced the European Union to start a programme for drastically improving the comparability of the European economic growth figures (see section 4.3). Furthermore, without any information on the operational definitions employed, data users may have a wrong impression about what is actually being measured.

The *distinction between market and other non-market producers* is in two respects very important in the national accounts. Firstly, it determines the delimitation of the sectors government and non-profit institutions serving households vis-à-vis the other sectors. It therefore also determines the delimitation of government revenue, expenditure and deficit. Secondly, it determines the valuation of output and therefore value added and domestic product. In the new universal guidelines (SNA93), this important distinction is couched in vague and partly misleading definitions.[2)] In the new European guidelines (ESA95), this distinction is much more and better defined. For example, by introducing a 50% criterion it is decided that non-profit institutions with sales normally less than half of their production costs should be treated as other non-market producers; the other non-profit institutions should be regarded as market producers. However, this further specification is not acknowledged as a universal convention. As a consequence, operational definitions of the sector government may differ substantially among non-European countries and between European countries and non-European countries. Different notions of the sector government and different principles of valuation are then underlying the official national accounts statistics.

The previous set of international guidelines was not explicit about the recording of financial derivatives, like deep-discounted bonds. In the new guidelines, the recording of these new financial instruments is explicitly described.

The SNA93 allows two types of sub-sectoring of the general government: the social security funds may be recorded as a separate sub-sector or can be recorded as part of the central government.

These examples illustrate that universal concepts can be defined in too general terms for many different reasons. Prices and volumes are still defined in rather general terms, because no agreement could yet be reached on some of the general principles. Market and other non-market producers are defined in general terms in the SNA93, equally because no agreement could be reached about one specific definition or because such a definition was not deemed to be necessary or wanted. The recording of financial derivatives was not defined in the old guidelines because they are a relatively new phenomenon. The two types of sub-sectoring of the general government reflect a philosophy of flexibility: for some purposes/countries one treatment can be preferred and for others the alternative is more meaningful.

[2)] An economist reading the definition of market output in SNA93 may even think that the distinction between market output and other non-market output has a relationship with the concept of price-elasticity: 'market output is output that is sold at prices that are economically significant… Prices are said to be economically significant when they have a significant influence on the amounts the producers are willing to supply and on the amounts purchasers wish to buy (SNA93, paragraph 6.45, p. 128). However, this would be clearly a non-sense and unintended definition. Addictive products like tobacco and alcohol have generally very low price elasticity. However, they should not be regarded as other non-market output like defence and general public services.

Step 4: Application to the national economy for a specific period
The fourth step is the application of the universal model to the national economy and its institutional arrangements for a specific period. For example, for compiling Dutch national accounts figures on 2005, it should be investigated and decided, e.g.:
– Which establishments, corporations and institutions exist in the Netherlands in 2005 and what is their industry and sector.
– What revenues from the Dutch central and local government are taxes and what are sales by the general government.
– What payments by employers are social insurance contributions and what are wages.

The universal model is also flexible in view of specific economic circumstances, e.g. in case of hyper-inflation inflation accounting is recommended.
The application of the universal model is not straightforward. It requires knowledge and interpretation of the guidelines, knowledge and interpretation of the specific situation to be described, a judgement on what is feasible and efficient from a data compilation point of view and a judgement on what is relevant for data users.
Application of the universal model may in practice involve some clear and deliberate *deviations from the universal model*. A common deviation pertains to the statistical unit employed. In the universal model industries are defined in terms of establishments and not in terms of institutional units. However, in most countries, even in Europe, data on industries are actually based on institutional units. This is even explicit in the European regulation on manufacturing statistics: this regulation refers only to institutional units. The consequence of this common deviation is that the output and production processes of industries measured by national accounts statistics is much more heterogeneous and incomparable than suggested by the universal model.
For example, the output of shoe-producers recorded in the national accounts statistics as part of the industry manufacturing may also include retail-activities organised and administered completely separately from the shoe-producing activities. Similarly, the output, wages and employment of public administration in the national accounts statistics may also include those of units of the state government, provinces and municipalities with respect to garbage disposal, cultural services (e.g. museums and libraries), social services, health care services (e.g. preventive health care like vaccinations and health surveys) and manufacturing by workplaces for disabled people.
In the Netherlands, the revision of the national accounts in 1998 (see Buiten et al, 1999) amounted to an increase of 10% of the size of the sector general government. This increase was mainly due to a stricter adherence to the international guidelines; it was only too very limited extent causes by changes in the international concepts.
Application of the universal model may also be *affected by non-statistical uses of the operational model*. For example, in Germany the classification of individual companies by industry in the statistical business register is also used to decide which collective wage-agreement is relevant for a company. Therefore, there may be a tendency to incorporate changes only with some delays or not at all. Similarly, in some countries the industry defence should for political reasons reflect the responsibilities of the Ministry of Defence. When the Ministry of Defence owns, supervises and exploits machine producing plants, these are therefore included in the national accounts statistics on the industry defence.

These four steps demonstrate that the operational model can have a big impact on what is actually measured by official national accounts statistics. Differences in operational models can also substantially affect the international comparability of official national accounts statistics.
When compiling national accounts statistics for the first time or when implementing new universal concepts, defining the operational model involves a lot of work. When compiling national accounts figures annually, annual updating of the operational model is required. For example, companies can merge, change their major product (e.g. from mining to chemical products or from forestry to environmental protection) or go bankrupt and the government can deregulate or privatise its tasks, start special employment projects or reorganise social security. Without updating and an excellent communication of the updates, the national accounts figures will not be able to describe these developments.

3. The compilation process

Major characteristics

The major characteristics of the data, the compilation process and environmental factors can be summarised as follows.

The *available data are very heterogeneous* in all respects, e.g. scope, concepts, detail, reliability, time of availability and frequency. The available data will always be incomplete in terms of scope and detail. As a consequence, many estimates can not directly be based on the available data. For reliable estimates a good frame of reference, e.g. a business register, is essential. The frame of reference helps in completing and combining surveys and administrative data, in updating former estimates and in making estimates for parts of the economy on which hardly any information is available.

The compilation process is based on three estimation tools:

– Accounting identities.
– Assumptions for completing.
– Plausibility checks.

Compiling national accounts statistics amounts to exploiting as best as possible the many *accounting identities*. Examples are: supply is equal to demand (both in current and constant prices), the three basic ways to estimate GDP, taxes paid should be equal to taxes received and the changes in stocks are equal to the sum of the flows. Accounting identities are friends and foes of national accounts statistics. They ensure consistency, can act as plausibility check and allow residual estimates. However, they can also enforce to modify best estimates for the sake of consistency. Furthermore, all residual estimates are likely to be very unreliable, as they serve as the garbage bag for errors in all the other estimates.

Assumptions are essential in combining and completing the basic set of data. Many types of assumptions are used, e.g.:

– Grossing up of a survey on the basis of a frame of reference.
– The use of strong institutional, technical or economic relationships.
– The use of fixed ratios, transition schemes and life times.
– The use of specific conventions, e.g. the productivity increase of government output is 0.5% per year.
– Assumptions based on fragmentary qualitative information, expert opinions, historical trends and ratios, analogies and anecdotes.

The more encompassing, up-to-date, detailed, reliable and conceptually close the basic data set, the smaller the role played by assumptions can be. Plausible assumptions can remedy to a substantial extent the absence of data and are to be preferred to implausible data. However, when for substantial parts of the national economy no plausible data or assumptions are available, national accounts statistics transform into guesswork.

Plausibility checks are very important for the reliability of national accounts statistics. Three types of plausibility checks can be distinguished:

– Comparison of different data/estimates.
– Investigation of all ‘strange’ developments and ratios (numerically, conceptually, institutionally, economically) by looking for a plausible explanation.
– Investigation of the data on the presence of expected developments; in case of absence look for a plausible explanation.

Plausibility checks can weed out erratic developments in data sources (e.g. due to conceptual changes), can help in detecting all sorts of compilation errors and are important in making estimates during all various stages of the compilation process. What is regarded as plausible is ultimately decided by the compilers’ skills in inventing plausibility checks, by the compilers’ skills in finding plausible answers and by the compilers’ personal knowledge and model of the national economy.

The estimation process is influenced by *environmental factors like skills* (e.g. skills in combining data and making plausible assumptions), *resources* (e.g. resources for compiling good price-statistics, for maintaining a reliable business register or for compiling national accounts statistics) and *policy* (the strategy of continuity, preference

for prudence and stability, priorities for some parts of the national accounts and independence).

The compilation process in six steps
Compiling national accounts statistics can be summarised in six steps:
1. Specify the operational model.
2. Collect data.
3. Translate the data into the concepts of the operational model.
4. Make an incomplete set of first estimates.
5. Add supplementary estimates.
6. Balance parts and the total.

The first step, i.e. the specification of the operational model, determines what is actually to be estimated. It was already discussed in section 2. In this subsection therefore the other five steps are discussed.

Step 2: Collection of data
The second step is the collection of data and qualitative information. The major data sources are usually specific statistics, e.g. on the sales and production costs of producers, on capital formation, on employment, on wages and salaries, on household expenditure, on consumer prices, producer prices and interest rates, on imports and exports or on revenues and expenditure by government bodies.
However, raw administrative data (i.e. those that are not translated into a specific statistic) can also be very important for compiling the national accounts. This can apply to e.g. VAT-records, the business accounts of some big companies, annual reports by supervisory bodies on banking and private insurance or the annual or quarterly accounts of the central government and social insurance bodies. Furthermore, also mainly qualitative information can be important. For example, articles in newspapers or specialised magazines may provide qualitative information on developments (e.g. on sales of furniture or software) or specific events (e.g. a big direct investment project or a reorganisation of a social insurance). This information can be used to complete other data, to check the plausibility of other data or to decide on the best way of bookkeeping for specific events and developments.
The inputs collected can play a direct or indirect role in compiling the national accounts. Direct inputs are specific statistics or administrative data sources used directly in estimating national accounts statistics. Qualitative information can never be a direct input, as it should always be translated into quantitative terms before it can be used in the compilation process. Specific statistics and administrative data sources can also serve as indirect inputs. For example, in compiling national accounts figures for 2000, specific statistics can be used that refer to earlier years or to 2000. Similarly, tax data can not only be used to estimate national accounts data on taxes, but also to estimate the tax base or to check the plausibility of such an estimate.
The collection of inputs is not a passive role but requires a lot of structural and ad hoc work. This work may consist of e.g.:
– Negotiations and agreements on data delivery: which data will be delivered, which detail and frequency, when, in what format, how reliable, etc.
– The active monitoring and checking of the data delivery: do the data really arrive at the time and as complete and detailed as agreed upon or expected.
– The storage of the data in the automated systems for compiling the national accounts: this can be e.g. typing in information into spreadsheets or data bases, selecting only the for national accounts purposes relevant parts or translating data to the type of software or lay-out used by the national accountants.
– The search for other relevant quantitative and qualitative information, e.g. by reading specialised journals, newspaper articles and annual reports or by explicitly asking corporations, institutions and experts.

Step 3: Translate the data into the concepts of the operational model
The third step is to translate the input-data into the mould of the operational model. In this respect it is meaningful to distinguish two types of input-data: economic base statistics and other, generally administrative, data.

Economic base statistics generally translate administrative concepts into national accounts concepts or proxies of them. Cases in point are production statistics and government finance statistics:

– A production statistic (the results of statistical inquiry of producers) is often based on a transition scheme deriving national accounts concepts of production from the questions asked of business in the questionnaire. For example, the value of production according to the national accounts can be defined as the aggregate of sales of own-production, net change in stock of own-production, own-account capital formation, trade margin on goods and services produced by other units, sales of other goods and services (e.g. rental) and other revenues excluding royalties on subsoil assets but including revenues for overhead activities (see Bos, 1992b, pp. 14–15).
– Government finance statistics on the state government can be compiled by translation of administrative records of the state government into the national accounts concepts of government revenue and expenditure and their components. For a proper translation it is generally required to exploit additional explanations about the exact content of each budgetary chapter and article.

As a consequence, often only minor adjustments of such input-data are required to comply fully with the operational model. A major difference between economic base statistics and the national accounts is often the product breakdown. For economic statistics with very detailed product-breakdowns, like Foreign Trade statistics, translation towards the national accounts classification involves the use of a transition scheme at a rather aggregate level. However, for other economic statistics, e.g. household budget surveys or a production statistic with respect to intermediate consumption, the product-breakdown can be very limited or rather different. In such instances, product-groups in the economic statistics are to be split and re-arranged in order to derive the product-breakdown of the national accounts.

In case of the direct use of *administrative records* the translation form administrative concepts towards the operational model is to be performed by the national accountants themselves. This applies to e.g. VAT data, personal income tax data, business accounts of some very big companies, annual accounts of the biggest municipalities, supervisory reports by the Central Bank on the banking sector or social security institutions on wages, social security contributions and social security benefits. However, it should be noted that the data needs of the national accounts may have been taken explicitly into account in some administrative records, e.g. when reporting for the government budget is based on national accounting concepts.

Frames of reference

The backbones for compiling national accounts statistics are the frames of reference. Frames of references provide a listing of all the existing enterprises, institutions, persons and households and their major economic characteristics, e.g. size in terms of number of employees or sales and type of product sold. Frames of reference can be e.g. a business register based on Chamber of Commerce-registrations, a VAT-register, a population census or a count of employment. In order to obtain a complete and up-to-date frame of reference, it is generally necessary to combine the data from various data sources.

Frames of reference serve two major roles. Firstly, they are used to draw samples for surveys and to gross up surveys or administrative data for units missing, e.g. relatively small units or units exempted from registration. Secondly, they are used to combine different data sources and to transform the many partial estimates into a complete estimate about all producers, employees or consumers in the national economy.

In compilation practice, different registers may be used for different groups of producers, e.g. a VAT register, a register with government units, a register with banks and insurance companies and a register for health care institutions. This will generally imply omissions and double-counting in estimating the national economy. Furthermore, the use of registers that are not up-to-date and reliable information (e.g. with respect to the size of the different companies or about the number of households) will cause unreliable estimates about the size and developments in the national economy.

Step 4: An incomplete set of first estimates

The fourth step is to make a set of first estimates. Before actually starting to estimate, various plausibility checks on the various potential input-data are made. Examples of such plausibility checks are:

– Check on the plausibility over time of one variable in one data source. For example, detecting erratic developments in output like increases of 20% and decreases of 30% in the next year without any clear motivation. Another example is detecting that a major part of the increases in VAT-receipts was not due to increased sales but was caused by accelerated collection.
– Check on the plausibility of the level and development of ratio's between different variables in one data source, e.g. between the volume of labour and the output.
– Check on the plausibility of values and volumes in one data source, e.g. increases of output with 20% accompanied by decreases of employment with 5% is generally not very plausible.
– Check on the plausibility by comparing different data sources, e.g. a detailed production statistic are compared with more general information on the developments in one industry, with export statistics on the major product of this industry or with information on wages or employment of that industry.

For many different reasons, the first estimates are usually *based on several data sources*, e.g.:

– One data source is used for determining last year's level, while the change in level is derived from another, less reliable, data source. The reason for this mixed estimate is that the most reliable data source is not available for the current year.
– One data source is used for estimating the level of a variable, while another is used for estimating the composition (e.g. the breakdown by product-group). The reason for this mixed estimate is that the first data source does not contain (sufficiently reliable) information on the composition.
– One data source is used for estimating the level of a variable, but corrections for conceptual differences (e.g. income in kind or underreporting of sales, income and employment) are derived from other data sources. The reason for this mixed estimate is that the first data source does not fully comply with the concepts of the operational model.
– One data source is used for estimating the level of a variable, but corrections for missing units or units not to be included are derived from other data sources. This grossing up is usually done on the basis of a business register, a VAT-register, a register on the number and composition of households or a population census. The reason for this mixed estimate is that the first data source does not comply with the classification of units in the operational model.
– One data source is used for estimating the volume of a variable, while another data source is used for estimating the price. An example is the estimation of agricultural output as harvest estimates in tons per product times auction prices for agricultural products. Another case in point are the services of owner-occupied dwellings: by convention they are to be estimated as the volume of dwellings times the market rent for similar dwellings.
– One data source is used for estimating the value of a variable, while another data source is used for estimating the price or volume.

The first estimate can involve various types of *assumptions*, e.g.

– The data in the sample (e.g. a survey of households or establishments in construction) or administrative data sources are sufficiently representative for those not included.
– Unchanged composition of a total, e.g. about the commodity breakdown of intermediate consumption by industry or about the breakdown of car registration taxes paid by consumers and by producers (by industry/institutional sector).
– Similar development of a total, e.g. assuming the prices changes observed for some products are relevant for others to or that the average price change observed is a solid approximation of the average price change for the parts not observed.
– Constancy of a ratio, e.g. between sales and the number of employees of an establishment, between taxes on products and the sales of these products or between

income transfers by the government and the compensation of employees and purchases of goods and services financed by these transfers (e.g. income transfers to public schools).
– The change in the volume of government output is equal to the change in the volume of the various costs of production plus a fixed productivity increase of 1%.

Former estimates of the national accounts can also serve *as a data source*. This applies when the level of last year is extrapolated or when some breakdowns of last year are incorporated in the first estimates. The former estimate can reflect all elements of the previous compilation process, i.e. the inputs, the successive estimates and the balancing.

Step 5: Secondary estimates resulting in a complete set of estimates
The fifth step is to add secondary estimates. These secondary estimates are made starting from the set of first estimates.
These secondary estimates are often the direct consequence of applying national accounts identities. Examples are:
– In a commodity-flow approach final consumption expenditure by households can be estimated as a residual item.
– Final consumption expenditure by households can also be estimated as the sum of the first estimates of final consumption per product-group.
– Value added can be estimated as the residual of output minus intermediate consumption minus consumption of fixed capital.
– Taxes paid by the various sectors can be estimated starting from the taxes received by the government.
– Government output is defined as the sum of the various production costs. As a consequence, government output can only be estimated starting from the estimates of these costs.
– Imputed insurance services can only be recorded as final consumption expenditure, intermediate consumption or exports after the size and development of the production of these services has been determined.

However, there are also some other types of secondary estimates, e.g.
– Splitting of the first estimates. For example, the first estimate of car registration taxes is to be split into those paid by producers (i.e. taxes on production) and those paid by consumers (i.e. current taxes on income, wealth, etc.). Similarly, income in kind can be first estimated on the basis of income tax data and should then be allocated to the industries involved. Another case in point are sales via retail trade: these should be split into those bought by producers, those bought by domestic households as consumers and those bought by tourists.
– Exploiting institutional relationships, e.g. the data on excise duties on beer are used to estimate the sales of beer, the investment grants on infrastructure are used to estimate capital formation on infrastructure or the income transfers by the state government mainly financing other government units are used to estimate the size of the expenditure by the latter.
– Exploiting economic relationships, e.g. the first estimate of output in some industries is used to estimate their capital formation or their employment or the first estimate of loans by banks to non-financial corporations is used to estimate also the corresponding interest payments. Some of these estimates may also be based on regression analysis.
– Exploiting technical relationships, e.g. knowledge about chemical processes can be used to produce a plausible estimate of the composition of the inputs and outputs of chemical industry.

The fifth step includes also tertiary and even much more indirect estimates. For example, suppose capital formation for the national economy is a secondary estimate on the basis of the supply of capital goods and the exports of capital goods. Capital formation by industry is then a tertiary estimate. Estimating capital stock by industry is then the next estimate. Starting from this estimate consumption of fixed capital by industry can then be estimated. This is then a quintal estimate.
After the fifth step, a set of estimates complete in detail and scope should have been obtained. Our examples have illustrated that the *sequence of estimation is generally not*

a straight-forward bottom-up approach. It is much more likely to be a very complicated mix of bottom-up, top-down, left-right (e.g. first supply and then demand or first taxes received then taxes paid), right-left, from values to prices and volumes, from prices and volumes to values, from flows to changes in stocks and from changes in stocks to flows, etc. Only in this way the limited set of available data can be exploited in the most efficient way.

Assumptions have a leading role in completing the estimates. They are necessary to fill all major and minor gaps and imperfections in the basic data set. This implies that the more encompassing, up-to-date, detailed, reliable and conceptually close the basic data set, the smaller the role played by assumptions can be. Gaps and imperfections can first be mended by plausible assumptions (e.g. by exploiting economic and institutional relationships and by using a reliable and up-to-date frame of reference). All remaining gaps are then to be completed with more bold assumptions. For very small parts of the economy (e.g. construction companies representing about 10% of the total number of employees in the industry construction), this can be quite harmless. However, when bold assumptions about substantial parts of the national economy are necessary, national accounts statistics transform into guesswork.

Step 6: Balancing plausibility and consistency

The fifth step results in a complete set of estimates. However, this set is generally not consistent and not entirely plausible. The sixth step is therefore to balance parts and the total. [3)]

Balancing is an overall plausibility check on the economic coherence of the estimates. What is actually checked on plausibility depends on the available accounting framework and the compilers' skills in inventing and performing plausibility checks in combination with the available time. A more encompassing and detailed framework gives more opportunities for plausibility checks. For example, a supply and use framework allows a lot of plausibility checks, in particular when there is a simultaneous balancing in current and constant prices. Balancing is generally rather unimportant for compiling very timely national accounts statistics.

Balancing can also amount to enforcing consistency, i.e. preferring one estimate to another without having a clear opinion about which estimate is the best. Such enforced decisions will be more frequent and painful in case of rather well and complete sets of basic data in combination with a well developed compilation process involving numerous plausibility checks. Such enforced decisions hardly occur in case of a small set of reliable basic data and a very elementary compilation process. In the latter case, the focus will be fully on providing a complete set of estimates, i.e. step 5 is then the last step.

Balancing can involve intensive interactive balancing at desegregate levels, between different levels of aggregation and between various parts of the national accounts. Examples of such balancing can be:

- Balancing the supply and use of specific product-groups, e.g. achieving consistency and plausibility for the supply and use of textile or oil.
- Balancing the resources and uses of very specific transactions, e.g. the payment of public transport subsidies and the receipts of public transport subsidies or the payment of income transfers by the state-government to municipalities and the receipts of municipalities of income transfers by the state-government.
- Balancing the overall supply and use of goods and services while investigating the plausibility of the development of the supply and use of specific product-groups, e.g. those with respect to construction.
- Balancing simultaneously the production approach and the income approach for estimating GDP, e.g. with respect to compensation of employees by industry and operating surplus.

However, in practice it may also amount to a quite mechanical procedure. For example, GDP may be taken by convention as the average of the estimate of GDP via the production approach and that via the expenditure approach.

[3)] On balancing in a supply and use framework, see e.g. Bos and Gorter (1993, pp. 120–130) and Statistics Netherlands (2004, pp. 249–279).

Balancing as a plausibility check amounts to *finding a plausible story behind 'strange' developments*, i.e. what explains this development and which data sources and assumptions underlie these estimates. Two examples from Dutch compilation practice may illustrate this.

In the eighties the basic statistics indicated that intermediate consumption of the car and bicycle-producing industries increased rapidly, while production remained rather stable. This appeared rather implausible, but in balancing the input-output tables also a steep increase in the imports of components for car and bicycle production was noted. It was concluded that the Dutch car and bicycle producers were more and more becoming assemblers of cars and bicycles.

In 1996 and 1997 the basic statistics indicated that the labour productivity of the telecom-industry had increased by over 15%. This seemed rather implausible, but further investigation -of e.g. annual reports of the major companies involved- confirmed this development.

External experts can play an important role in finding plausible answers. For example, they can indicate that specific events have occurred like a strike or explosion in some big plant. They could also signal major changes in the concepts or compilation methods underlying the various data sources, like a change in the concept of wages in social security records or delays in recording changes in the number of unemployment benefits in one big administration.

What is regarded as plausible depends also on the compilers' personal knowledge and model of the national economy. Three anecdotes from Dutch compilation practice may illustrate this.

One compiler was in his private time an aeroplane watcher; he loved to look at planes coming and going at Schiphol and other Dutch airports. At some stage in the balancing process, the estimated use of capital goods substantially exceeded the supply of capital goods. He detected that some specific aeroplanes had been recorded as capital formation in capital formation statistics. However, on the basis of his personal knowledge as an aeroplane watcher he knew that these planes had not yet arrived in the Netherlands. He investigated the Foreign Trade Statistics, which indeed did not include the imports of these aeroplanes. This solved the inconsistency between supply and use: capital formation statistics included these aeroplanes when paid, while foreign trade statistics included these when delivered. The estimates of capital formation were adjusted, as the time of recording in the foreign trade statistics complied with the recording principles of the national accounts.

The second anecdote refers to knowledge of technical relationships. A new compiler was working on balancing the supply and use of paper and related products. In the Dutch input-output tables, part of paper was assumed to be used for wrapping cigarettes. However, he had a background in chemicals. He therefore knew that for this purpose not ordinary paper is used, but a type of paper produced by the chemical industry. The estimates were therefore adjusted on the basis of this new knowledge. So, for many years, insufficient technical knowledge had led to a wrong assumption about technical relationships. Similar errors can be made in exploiting economic and institutional relationships.

The third anecdote refers to the so-called method 'Nooteboom', a former chief in the Dutch national accounts department. He was said to have a quite personal way of checking the plausibility of the estimates by his employees. When these estimates deviated substantially from his personal impression of the developments in Leidschendam, i.e. his place of residence, they were considered to be suspicious and had to be justified by his employees. As a consequence, the estimate of the development Dutch economy was partly benchmarked and calibrated on the basis of the developments in one Dutch town.

Balancing is in practice not only important for solving complicated estimation problems. An important function of balancing is also to weed out various elementary human errors. Examples are a typing error drastically increasing output in a specific industry, a communication problem resulting in twice grossing up of a survey, and a drastic decrease of social benefits due to the thoughtless processing of social security data in which definitions or presentation have been changed.

Consistency checks are an elementary type of plausibility check: if estimates are inconsistent, there should be an error in the estimates. Inconsistency can therefore help

in tracing errors in the estimates. However, it can happen that despite a thorough reinvestigation no plausible explanation for this inconsistency is found. This can then only be solved in two ways.

The first solution is to modify the best estimates of some variables or part of the breakdown of variable (e.g. in some of the product-groups of final consumption expenditure by households). In general this will be done where it does the least harm, e.g. where the estimates have the greatest margin of uncertainty or in which data users are least interested.

The variables that are each time sacrificed serve as a sort of garbage bin. Examples of such garbage bins can be changes in inventories or the use of business services (in order to solve the supply and use by product) and net sales of land by municipalities (in order to reconcile a plausible estimate of net lending with plausible estimates of the major categories of income and expenditure).

When the standard garbage bins are full or when there are no clear garbage bins available, painful choices are to be made for the sake of consistency. This can apply e.g. to For example, a global indicator of final consumption expenditure by households, like VAT-receipts, may indicate drastic increases, while the data for none of the quantitatively important product-groups in household final consumption expenditure provide a clear explanation for this. The *choice is then between a reliable global estimate without a plausible underpinning by product-group and a not reliable global estimate with plausible estimates by product-group*.

The second solution is to *show the inconsistency explicitly*. This is an approach often adopted for the substantial and highly fluctuating differences between net lending estimated from the non-financial side and net lending estimated from the financial side. Suppose the estimate from the financial side is considered to be the best. Consistency could then be achieved by modifying the estimates of the non-financial transactions, but which are to be adjusted: output, compensation of employees, interest payments? Substantial and highly fluctuating differences lead to substantial and highly fluctuating adjustments. This puts severe strains on the plausibility of the estimates over time. Consistency could also be achieved by modifying the estimates of the financial transactions, but which are to be adjusted: are there more loans, what is the other party involved, etc. Such very difficult too reconcile differences occur generally for estimates of net lending of the sectors Rest of the World, Non-financial corporations and Households. For the sector Financial Corporations and Government such awkward inconsistencies are less likely, because the estimates of net lending for these institutions are often mainly based on rather complete and consistent sets of financial and non-financial accounts.

When one way to estimate domestic product is preferred to another (e.g. a production approach estimate is preferred to the income approach), the latter can be reconciled be showing explicitly the adjustments needed to obtain consistency. Similar explicit adjustments could be made in reconciling national accounts estimates of employment and employment statistics.

In the Netherlands, also a difference is explicitly shown between imputed Value Added Tax (VAT) and paid VAT. The imputed VAT is the VAT calculated in the context of the supply and use framework. The paid VAT is the VAT according to the government accounts and the tax administration.

Explicitly showing such differences between estimates is in particular a suitable solution when the inconsistencies are very big and not stable over time and where no relatively unimportant residual item(s) can be found. Nevertheless, very big and unstable inconsistencies, but also clear trends in the size of the inconsistencies, can still raise fundamental questions about the reliability of the estimates. For example, in the Netherlands the difference between imputed VAT and paid VAT was stable for many years, but declined then suddenly. The general revision of the Dutch national accounts was used to avoid that the paid VAT would even surpass the imputed VAT. Unfortunately, despite substantial efforts, no clear explanation for the not very plausible development of the difference between imputed and paid VAT has yet been found.

So, in compiling national accounts statistics consistency and plausibility seem to be friends but can also be foes that are difficult to reconcile. For the sake of consistency, solid estimates may have to be adjusted. The alternative is to present inconsistent set of estimates. In some cases, national accountants prefer the latter solution, i.e. prefer not to present an illusion of consistency.

A more complex picture

These six steps give in four respects a too simple picture of compilation practice: there is no strict chronology of steps, no identical compilation process each year and not one compilation process and furthermore it ignores the role of compilation policy.

No strict chronological sequence of steps

Firstly, these steps do not represent a strict chronological sequence of separate steps: in practice all these steps are intertwined, interact strongly, can occur in somewhat different chronological sequences and have recursive loops. For example, while balancing attention can be paid to the operational model, the plausibility of specific input-data and the translation into national accounts concepts.

Changing compilation processes

Secondly, a major feature of the national accounts is that the compilation process is not identical each year. This reflects that the available data sources and the national economy are not stable over time. Examples of changes in data sources are the arrival of new data sources, the disappearance or temporary absence of some data sources or changes in the scope and concepts. As a consequence of such changes, the compilation process should often be adjusted. The same may apply to changes in the national economy, e.g. a new type of subsidy, new financial instruments, drastic increased importance of specific products (ICT) or a specific big event (e.g. a flood destroying crop).

Outcome of many successive compilation processes

Thirdly, the six steps suggest that a set of national accounts statistics is the outcome of one compilation process. However, a set of national accounts statistics is generally the outcome of many successive compilation processes over a very long period of time. Firstly, for a base year or a base period of several years national accounts statistics are compiled. Secondly, starting from the base year estimates, for more recent years final estimates are compiled with some years delay. Thirdly, starting from the most recent final estimates, for the most recent years provisional estimates are compiled with some months or one or two years delay. Fourthly, starting from the base year estimates, time-series are made for years before the base year. Fifthly, several countries now and then revise all their estimates, e.g. after a period of ten years.

Compilation policy

Fourthly, the six steps are silent about the role of *compilation policy*. However, the compilation policy influences the reliability of the national accounts statistics in several ways.

– By choosing the timeliness of publication.
– By allocating the resources.
– By choosing a strategy of continuity.
– By choosing a strategy for prudence and stability of the estimates.

The more timely national accounts statistics should be published the less data sources are available. As a consequence, more timely national accounts statistics should in principle be less reliable.

By allocating the resources for estimating the different parts of the national economy, also the reliability of the estimates for these parts are influenced. For example, increasing resources for estimating the services industries and decreasing those for manufacturing and construction, will likely (ceteris paribus) change the reliability of these estimates in the same direction. Similarly, by allocating more resources to more timely estimates and less resources to the later estimates also the reliability of the estimates is influenced. However, in this case in the long run also the more timely estimate may become less reliable, as the latter is built upon the estimates of the least timely estimates.

National accounts statistics should preferably be both *up-to-date and continuous*. The former requirement means that estimates must comply with the most recent findings. Continuity means that the data from different reference periods must be mutually comparable. These two requirements come into conflict whenever definitions change, the

availability of data sources alters (e.g. a new more reliable data source becomes available) or estimation methods improve. Meeting the requirement of up-to-date estimates of levels means a permanently changing set of national accounts time-series and can be very labour-intensive. However, a never changing set implies continuous but never up-to-date estimates. Most countries adopt a compromise (a mixed strategy of continuity). In compiling the annual figures, the continuity aspect is often given priority –with the result that levels are not up-to-date in some cases. At intervals, however, the data are revised to bring the whole series into line with the updated level for a specific base year. The mixed strategy of continuity implies that the estimates do not always represent the best estimate of the level.

Prudence and stability can be other reasons for not pursuing the best estimate. When the best estimate suggests a very strong or surprising development in the national economy, a prudent estimate is a somewhat weakened, less surprising, development. *A prudent estimate can also refer to the estimation method itself, i.e. prefer a method that can be most easily explained and defended against criticism*. Examples of practical rules adhering to his principle are e.g.:

– Make prudent assumptions, e.g. take an average or take the development of last year provided it was a 'normal' year.
– Prefer the data source from the most reputed institutions.
– Prefer an explicit data source to plausible assumptions.
– Do not lightly deviate from long-established estimation methods.
– Do not include any estimate at all when no solid information is available (e.g. on underreporting of income).

In case of successive published estimates, stability of the estimates can be an argument to deviate from the best estimate. It boils in fact down to a bias for the first published estimate, i.e. only deviate substantially from such estimates in case of strong evidence.

Political pressure may also influence the reliability of national accounts statistics. This occurs in particular when national accounts statistics are compiled by government departments or a dependent national statistical institute. An independent institute taking care of compiling national accounts statistics is therefore an important requirement for reliable national accounts statistics.

4. The reliability of national accounts statistics

National accounts statistics have something miraculous, like the miracle of estimates based on a sample. The miracle of sample-estimates is that a sample suffices to make estimates about the whole population. The miracle of national accounts statistics is that a very incomplete, imperfect and partly outdated data set is transformed into a complete, consistent and up-to-date picture of a national economy. In section 3 the secrets behind this miracle have been revealed. In this section the consequences for the reliability of national accounts statistics are investigated.

The price of the ambition of the universal model

The reliability and comparability of national accounts statistics have some fundamental bounds. These bounds are the mirror-image of the ambition of the universal model.

The ambition of the universal model is to provide a relevant, complete, consistent and standard overview of national economies all over the world. This ambition has clear and inherent trade-offs with reliable and comparable estimates, because:

– For the sake of relevance various imputations are to be estimated, e.g. income in kind, consumption of fixed capital, the services of owner-occupied dwellings or reinvested earnings on direct foreign investments. However, a reliable estimate of such imputations is inherently difficult.
– Complete estimates of national economies are to be made, while in all countries for some parts no reliable data (e.g. services industries or illegal production) are available; this implies that the national accounts statistics for these parts of the national economy will be less reliable.
– One universal model is to be estimated even though available data sources, specific circumstances and resources for compiling economic statistics differ widely internationally and inter-temporally; this implies that the reliability will differ widely internationally and inter-temporally.
– Consistent estimates of national economies are to be made following standard national accounting concepts, while the concepts in data sources are often inconsistent and can deviate substantially from the national accounts concepts; this implies that necessarily imperfect modifications are to be made for conceptual differences.
– A complete set of price and volume measures is to be estimated even though perceptions on volumes and quality may differ widely or are not well specified by economic actors. This implies that reliability and comparability is in particular a problem for price and volume measures.
– The universal model can never serve as the operational model. This implies that differences in operational models will always affect international comparability.

Relatively reliable?

National accounts statistics are generally the only available estimates of the universal model. As a consequence, they are relatively reliable for the model as a whole and its major aggregates like GDP.

For specific parts or individual variables, e.g. household consumption expenditure, alternative data sources can be available, e.g. a household budget survey. There are several reasons why national accounts statistics are likely to be more reliable and comparable than such alternative data sources:

– National accounts statistics will in general incorporate all reliable data sources on specific parts of the national economy; it combines these data in a sophisticated bookkeeping system which allows various extra checks on the reliability of the data.
– National accounts statistics reflect generally a long and intensive experience with the merits and limitations of the various data sources available nationally. For example, they include various standard corrections for omissions and errors in these data sources. They will therefore be more reliable than individual data sources.
– Due to the universal model, national accounts statistics are relatively explicit about what they want to measure, e.g. which concept of capital formation is employed or which definition of wages is used.

– National accounts statistics are each year based on the same set of universal concepts;
– National accounts statistics of different countries are based on the same set of universal concepts.
– National accounts statistics will not reflect political interference when compiled by an independent institute. Some other data sources may be clearly subject to political interference.

However, national accounts statistics are not necessarily the most reliable estimate for specific parts or individual variables. Several reasons have been mentioned in section 3:
– Compilation policies of continuity, prudence and stability may require not to make the best estimates as such, e.g. the use of a new and better data source may lead to discontinuous estimates.
– A data source may arrive with too long delay (e.g. income tax data arriving with four years delay) and is therefore not incorporated in the national accounts statistics.
– The allocation of resources may amount to limited efforts for making a best estimate of some variables, some very specific detail or some part of the national economy. For example, an estimate is based on simple assumptions instead of labour-intensive compilation efforts needed for a best estimate.
– Consistency may enforce to sacrifice some of the best estimates.

International comparability
Differences in compilation methods may also affect the international comparability of national accounts statistics. So, for international comparisons for specific parts or variables it may be worthwhile to ignore national accounts statistics and to process data sources available in several countries (e.g. manufacturing statistics) in one standard way. This may result in more comparable and reliable data, e.g. of manufacturing output per employee.

Assessing reliability
For many uses of national accounts statistics, it does not suffice to know that the figures are the most reliable estimates available. For a proper use and interpretation of national accounts statistics it is also important to know how reliable they are, e.g.:
– are the EU-Member States national income estimates sufficiently reliable as a tax-basis for the European Union?
– Is the small drop in GDP growth a statistical artefact or a real economic development?
– Are the supply- and use-tables sufficiently reliable to draw conclusions about trends in the contracting out by specific industries or developments in the relative prices of some specific products?
– How reliable are the coefficients of an econometric model estimated on the basis of national accounts time series?

What is reliability?
Following Novak (1975), reliability can be defined in terms of accuracy and consistency. Accuracy is defined as the discrepancy between the observed and the ‘true’ values. Since the ‘true’ values must usually be approximated, the results of accuracy tests may themselves be subject to errors and biases. Accuracy tests can not be applied directly to national accounts statistics, but they could be applied to the basic data, like statistical surveys and administrative data records.
Consistency is defined as the discrepancy between two or more observed values, all of which could depart considerably from the ‘true’ value. Consistency between two observed values can not prove accuracy. Consistency tests provide merely methods for detecting deficiencies in accuracy. Consistency tests are very suitable for the national accounts, as they can show the sensitivity of national accounts statistics for using different data sources or estimation methods.

Sampling theory?
Sampling theory indicates how to estimate the accuracy of sample estimates. However, in the national accounts sample estimates play a minor role, e.g. many administrative data sources are used, many specific estimation methods are used and big companies

and institutions (e.g. the state government) have a disproportionate economic importance. Non-sampling errors are therefore dominant in national accounts statistics, e.g. false reporting or the use of an outdated business register. As a consequence, sampling theory has not much to offer in assessing the reliability of national accounts statistics.

Investigating the data sources, operational model and compilation methods

The reliability of national accounts statistics can also be assessed by investigating the data sources, the operational model and the compilation methods. For example, the Dutch inventory on compiling national income estimates contains a table indicating that 78% of the estimate from the production side is based on good-quality institutional data sources available annually (see table 1). These data sources can be e.g. production statistics (e.g. for manufacturing), reports from supervising bodies (e.g. on banking and insurance), government finance statistics and annual reports, e.g. of some big companies. The reliability of these data sources can be clarified further by indicating their major features, e.g. the sample size of the survey and their quantitative importance vis-à-vis the population, major conceptual differences with the national accounts and biases in the registration (e.g. underreporting, the absence of small units, inadequate coverage of new products and false reporting of values and type of product produced or sold in order to reduce tax liabilities and to evade administrative obligations). Furthermore, the reliability of national accounts statistics can be disclosed by making explicit the size and motivation of the major corrections on the basic data, the cross-checks made and the major assumptions used.

Table 1
Five groups of compilation procedures (production approach; update of table in Bos and Gorter, 1993, p. 14)

Compilation method	Industry	Value added	Good quality institutional data sources
		%	
Production statistics	Manufacturing Public utilities Construction Trade, hotels, .. Repair of consumer goods Transport and storage Part of business services	50	50
Good-quality data sources from supervising bodies	Banking, finance, insurance	6	6
Estimated (partly) functionally	Agriculture Operation of dwellings	14	0
Estimated from the costs side	General government Subsidized education Social services	15	12
Estimated (mainly) on the basis of annual reports	Mining and quarrying Communication Intramural health care	10	10
Miscellaneous	Other services	5	0
		100	100

Consistency of successive estimates

The simplest way to test consistency is to look at the national accounts statistics themselves, i.e. at differences between successive estimates and at differences within one set of estimates.

National accounts statistics are often published as a series of successive estimates. The first estimates are the most timely, but are also the least reliable. Later estimates can be based on more data sources and are therefore more reliable. Systematic investigation of the differences between these estimates can also reveal some important statistical qualities of the estimates. This is illustrated by a sample of one year from Dutch national accounts statistics (see table 2).

The Dutch national accounts contain four successive estimates, in chronological sequence: quarterly accounts for a limited set of variables, preliminary annual estimates,

semi-final annual estimates and final annual estimates. Table 2 compares the final estimates of 1998, with earlier estimates of 1998. The estimates pertain to the volume change, the price change and the level of some major aggregates, like GDP and final consumption expenditure. Furthermore, some key-ratio's are presented, e.g. national income per capita and government net lending as % of GDP. The table suggest that:

– Later estimates are generally better, i.e. closer to the final estimates.
– Volume changes may be more difficult to estimate than price changes.
– Volume changes of relatively volatile variables, like capital formation and exports, are more difficult to estimate than less volatile variables, like final consumption expenditure by the government.
– A particular category of volatile variables are balancing items, like net lending by the government, value added and net exports. They include the estimation errors of the underlying variables, e.g. the estimation error in the price of gross value added is the net result of the estimation errors in the prices of output and intermediate consumption.
– Ratio's as a percentage of GDP are not very sensitive to estimation errors.

Table 2
A comparison of successive estimates in the Dutch national accounts, 1998

	Final	Final minus semi-final	Final minus preliminary	Final minus quarterly
	% volume changes	*% point*		
GDP	4.3	0.2	0.6	0.5
Final consumption expenditure	4.4	0.3	0.5	0.5
government	3.6	0.2	0.3	1.1
households	4.8	0.4	0.7	0.3
Capital formation	4.2	0.1	–1.0	0.2
Imports	8.5	0.5	0.8	2.4
Exports	7.4	0.0	1.0	0.1
Employment	2.9	–0.1	0.2	
Average size of deviation		0.2	0.6	0.7
Average deviation		0.2	0.4	0.7
	% price changes	*% point*		
GDP	1.7	–0.3	–0.2	–0.3
Final consumption expenditure	1.7	–0.2	–0.2	–0.4
government	1.6	–0.5	–0.7	–1.3
households	1.7	–0.4	–0.1	–0.1
Capital formation	2.0	–0.1	0.3	0.4
Imports	–1.5	0.0	0.0	0.8
Exports	–1.4	–0.2	–0.2	0.2
Average size of deviation		0.2	0.2	0.5
Average deviation		–0.2	–0.2	–0.1
	1,000 euro			
NNI per capita	18.8	–0.3	–1.2	
GDP per full-time equivalent	57.4	0.2	–0.1	
	% BBP			
Government expenditure	47.3	0.14	0.00	
Government revenu	46.4	0.01	–0.05	
Government net lending	–0.8	–0.14	–0.05	
Value added by the gov.	12.7	0.0	0.0	
Imports	55.5	0.3	0.2	
Exports	61.0	–0.2	0.0	
Net exports	5.4	–0.4	–0.2	
	million full-time equivalent jobs			
Employment	6.2	–0.1	0.6	

By compiling such figures for a long range of years, important statistics about the reliability of the national accounts statistics of a country can be derived.[4] These statistics can reveal the average size of the estimation errors and the occurrence of systematic under- or overestimation in general and in specific situations, e.g. in case of substantial changes in the trade cycle. More detailed investigation can also clarify the links with the arrival of specific data sources and changes in compilation methods and policy, e.g. extra efforts to improve the reliability of the flash and preliminary estimates.
Such statistics on national accounts statistics can also be regarded as a *simulation of the effects of less data sources, less reliable data sources and less resources and time for compiling national accounts statistics*. In this way, the relatively reliable national accounts statistics of countries like the Netherlands can also give a rough impression of the reliability of national accounts statistics of countries with much less data sources.
However, for two reasons the *differences between the successive estimates give a too optimistic picture*. Firstly, in compilation practice, a major role of the final estimates is also to calibrate the more timely estimates, e.g. to reveal their systematic errors. Secondly, ratio's derived from the final estimates of last year are often used as inputs for the more timely estimates of the current year. As a consequence, the margin of error of the more timely estimates would have been substantially larger when the final estimates were not known and were not used in compiling the more timely estimates.
In many countries, national accounts statistics are once in a while revised. The changes in the estimates due to a revision (corrected for any changes in concepts) can also give an impression of the reliability of national accounts statistics. As part of the harmonisation of European national income estimates, the estimates of several countries have been revised substantially, i.e. by 5, 10 or in one case even 20%. So, the margin of error of national income of the least reliable European national accounts statistics was between 5-20%. The national income estimates of many countries outside Europe are based on a similarly weak or even weaker statistical infrastructure. Similar margins of error can therefore be expected in the national income estimates of these countries.
A common feature of the adjustments in Europe was that all the major adjustments were upward adjustments. Furthermore, most of the smaller adjustments were also upwards. This suggests that in compiling national accounts underestimation is a more serious danger than overestimation. This can reflect prudence as a compilation strategy. However, it can also reflect:

– Prudence in specific cases, e.g. in estimating parts of the economy on which data are very scarce.
– Ignorance. For example, the compilers are ignorant about the existence or scale of some economic activities and therefore do not include separate estimates on these activities.
– A lack of interest in estimating on some specific parts of the national economy, e.g. limited compilation efforts are devoted to estimating some types of services-industries.

Consistency of different estimates

One set of national accounts statistics may also show differences between different estimates. The most common is a *difference between net lending estimated from the financial side and net lending estimated from the non-financial side.* This occurs in particular for sectors where the data sources and estimation process differ substantially for both sides.[5] This will in general not apply for financial institutions and the government, but it will often for households, non-financial corporations and the rest of the World.
In the Dutch national accounts, the differences shown for 2001 are 3 billion euro for the Rest of the World, 1 billion euro for households and 2 billion euro for non-financial

[4] In the Netherlands, statistics on successive estimates are regularly published as part of general policy of quality control (see Kazemier et al., 2004). At present, this is confined to the estimates of volume changes of domestic product and its breakdown by type of final expenditure and by industry.

[5] Minor differences are easily to be reconciled by taking the estimate of one transaction as the residual item.

corporations. These differences can reflect all kinds of measurement errors in the financial and non-financial flows, e.g.:

– The 1 billion euro difference for the Rest of the World can indicate that net exports is not 26 billion euro but 23 billion euro. However, it could also indicate that the change in foreign equity is not 20 billion euro but 23 billion euro.

– The 1 billion euro difference for households can indicate that household expenditure is 219 billion euro instead of 220 billion euro. However, it could also indicate that compensation of employees received by households is 226 billion euro instead of 227 billion euro.
– The 2 billion euro difference for non-financial corporations can indicate that net operating surplus is 64 billion euro instead of 62 billion euro. However, it could also indicate that the change in liabilities is 57 billion euro instead of 59 billion euro.

The differences between the estimates of net lending can overestimate and underestimate the measurement error in individual variables. Overestimation occurs when the measurement error is not located in one variable but is spread over many. However, underestimation is also likely, because measurement errors can partly compensate each other, e.g. an underestimation of exports can be compensated by an underestimation of imports.
Substantial changes in the statistical difference from one year to another can also indicate errors in measuring the change over time of some specific variables.

Sensitivity analysis
Sensitivity analysis is a very important tool to shed light on the reliability of national accounts statistics. Five examples may illustrate this. They cover a broad range of measurement errors:
– The recording of fraud.
– Foreign trade statistics.
– Capital consumption, in particular in the life times of fixed assets.
– Price and volume measurement.
– Signalling new developments.

The first example is Broesterhuizen (1983). He investigated the reliability of Dutch GDP estimates in view of *fraud*, i.e. not reporting or underreporting of income to the tax and social security authorities or in statistical surveys. For this sensitivity-analysis, GDP estimation was distinguished into six components reflecting the Dutch data and compilation process:
1. ‘Indirect methods’, e.g. agriculture and operating of real estate are estimated by multiplying estimates of the volume of sales/output by an estimated price;
2. ‘Government’, including also many enterprises and institutions supervised by the government, like public utilities, national railway and telephone companies, banking and insurance and hospitals.
3. ‘Large firms’, i.e. with more than 100 employees and included in surveys of producers;
4. ‘Small firms’, i.e. with less than 100 employees and included in surveys of producers;
5. ‘Very small firms’, i.e. with less than 100 employees and not included in surveys of producers;
6. ‘Fiscal data’, i.e. specific groups of self-employed estimated on the basis of fiscal data.

For each component plausible ranges of distortion by fraud are indicated. In this way a plausible upper bound for the distortion of GDP by fraud is derived. The conclusion was that for GDP-levels a distortion of more than 5% is very unlikely and that for GDP-growth rates a bias of more than 0.5% is very unlikely.
The second example pertains to *measurement errors in foreign trade statistics*. The existence of such errors is evident from comparing the mirror-statistics of countries, even of those with a good statistical reputation (see van Bergeijk, 1995). For example, comparing the bilateral trade statistics of Germany and the Netherlands indicates implicit minimal measurement errors of about 1.5–3%. This can also result in quite a different view of the bilateral trade. For example, the balance of Dutch-German bilateral trade in 1987-89 turns into deficit according to German trade data, whereas the data published by the Netherlands show a persistent surplus.

What are the consequences of such measurement errors for the national accounts, e.g. the domestic product estimates? These consequences are not straightforward as they depend critically on the compilation methods used. An error in foreign trade statistics does influence domestic product when estimated from the expenditure side or when using commodity-flow methods. But such an error is irrelevant for domestic product when estimated from the production side, i.e. as the difference between output and intermediate consumption. The latter may imply that in balancing the accounts the error in foreign trade statistics is detected and corrected for in estimating imports and exports. Unfortunately it may also imply that the estimates of variables other than imports and exports are adjusted in order to balance the accounts, e.g. final consumption expenditure by households. So, errors in foreign trade statistics may spread all over the national accounts.

The third example refers to *capital consumption*. Gross domestic product is only influenced by measurement errors in capital consumption by the government (and non-profit institutions serving households). The generally more relevant concept net domestic product is only influenced by measurement errors in capital consumption by market producers. Bos (1990) investigated the sensitivity of Dutch domestic product statistics for different assumptions about the life-time of fixed assets. Taking half of the officially assumed life-times resulted in a 2.8% lower average value of net domestic product during the period 1969-1988; the growth rate of NDP decreased with 0.1%point.

The fourth example refers to *errors in price measurement*, like not taking into account quality change (e.g. by the use of naïve volume-indicators for imports and exports, like the weight of a product), the introduction of new products, the use of outdated weighting schemes or the use of sub-optimal index formulae.[6)] If prices changes and values are estimated independently, errors in price measurement end up in the estimates of the volumes. However, if values are estimated by multiplying an estimate of price by an estimate of a volume, the errors in price measurement end up in the values and do not influence volumes. Furthermore, the consequences for prices, volumes and values of domestic product depend also on the specific location of the error. For example, a measurement error in the price change of indirectly measured financial services does not influence the price of domestic product, because the use of all these services is recorded as intermediate consumption. Similarly, measurement errors in the price change of computers influences different countries differently, as some countries are major producers and exporters of computers, while others only import computers.

The fifth example refers to *signalling new developments*. By looking at the national accounts data sources and compilation methods or by looking at successive national accounts estimates the signalling quality of national accounts statistics can be revealed. For example, if no (timely) data sources are available on the employment, sales and purchases of some services industries and no qualitative information is used, national accounts statistics will not signal any major change in these services industries.

A sensitivity analysis is a very important tool for assessing the reliability of national accounts statistics. Only in this way the consequences of errors in data sources or the absence of data sources can be properly investigated. The reason is that these consequences critically depend on the bookkeeping mechanisms in the national accounts and the compilation methods actually employed. For data users with a sound understanding of national accounts, documentation of the operational model and compilation methods may be sufficient to draw qualitative inferences about the consequences of measurement errors in national accounts data sources. However, for most data users explicitly spelling out of the consequences of bookkeeping mechanisms and compilation methods and giving an estimate of the size of these consequences will be essential supplementary information.

[6)] Den Bakker (1991) is an example of a sensitivity analysis for the choice of index number formulae and weights; Sensitivity analysis of Dutch macro-economic data for the interwar period show that different formulae and weights yield large differences in growth rates.

The universal and operational concepts as approximations of the true concepts

From the point of view of a specific use of national accounts statistics, the underlying concepts could be regarded as approximations of the true concepts, i.e. of the theoretically perfect concepts for that type of use. As a consequence, conceptual imperfections could also be regarded as measurement errors. Such conceptual measurement errors can be very substantial and are also essential for assessing the reliability of national accounts statistics. Four examples may illustrate this.

Firstly, if domestic product is taken as a proxy of welfare, the measurement error is likely to be very big, e.g. because leisure time, unpaid household services and inequality are not taken into account.

Secondly, gross figures on value added, domestic product and national income are often preferred to net figures, because estimates of capital consumption are not considered to be sufficiently reliable or comparable. However, this argument overlooks the importance of the conceptual error, i.e. by preferring gross figures expenditure on capital formation are never regarded as intermediate inputs for the production process. As a consequence, productivity and income per capita of capital intensive industries and countries are overestimated vis-à-vis more labour intensive industries and countries (for a more extensive discussion, see Bos, 1992b).

Thirdly, for monitoring the solvency of European government finance, gross government debt figures are used. However, they do not give a balanced picture of the financial position of the government. Figures from the Netherlands can illustrate this. The major assets of the Dutch government are the natural gas stock, the fixed capital stock and the financial assets. If these assets are also taken into account, a totally different picture of the development of the financial position of the Dutch government is presented. During 1970-1977 gross government debt decreased with more than 10% GDP. At the same time also the value of the fixed capital stock increased with over 10% GDP. However, this is overshadowed by the decrease in the value of the natural gas stock. As a consequence, net worth of the government decreased with 7% GDP. In the period 1978-1993 the size of government debt doubled by an increase with 38% GDP. Government's net worth decreased much stronger, by a decrease in the gas stock (-26% GDP) and the financial assets (-9% GDP in the period 1990-1993). Since 1994 Dutch gross government debt decreased with 25% GDP. This substantial decrease in debt is more than compensated by a decrease in the natural gas stock and other property: net worth decreased with 16% GDP.

Fourthly, the successive revisions of the Dutch national accounts illustrate also the quantitative impact of some very specific conceptual changes. For most data users, these changes are not regarded as becoming closer or less close to the true concepts or most optimal concepts for their specific use. They are generally just regarded as modifications of earlier national accounts estimates, i.e. as if no conceptual changes were made.

In the revision of 1999, the concepts of the new international guidelines (SNA93 and ESA95) were introduced (see Bos, 1994 and Buiten et al., 1994). This implied a substantial change in basic concepts. For example, the introduction of capital consumption on infrastructure increased government final consumption expenditure, domestic product and national income with 1.4% GDP. Recording expenditure on software and data bases as capital formation increased capital formation, capital consumption, domestic product and national income with 0.8% GDP. Reinvested earnings on direct foreign investment are now included in the primary income flows with the rest of the world. As a consequence, Dutch national income increased with 1.3% GDP. A major shift occurred between final consumption expenditure by households and by the government. The latter included now also 8% GDP of social benefits in kind via market producers, like health care services financed by social security, rent allowances and free transport for students. Social security contributions were reduced with 1.2% GDP by excluding branch-specific social insurance, e.g. for civil servants.

European requirements on the harmonization of GNP-estimates also induced some substantial changes. The payments to people in social workplaces should be recorded as compensation of employees instead of social benefits. As a consequence, final consumption expenditure by the government, domestic product and national income increased with 0.6% GDP. The estimates for the imputed services of owner-occupied

dwellings were also revised. This implied a reduction of final consumption expenditure by households, domestic product and national income of 1.3% GDP.
Following new EU-guidelines, in the revision of 2004 (see Statistics Netherlands, 2004), the recording of the services of the financial intermediation services indirectly measured (FISIM), i.e. the banking services financed via the interest margin, was modified. Instead of recording the use of all these services by convention as intermediate consumption, the use of the services should now be allocated to the real users of these services following a new international method. As a consequence, final consumption expenditure by households increased with 1.2% GDP, government final consumption expenditure with 0.2% GDP and exports with 0.4% GDP. The total impact on GDP was therefore an increase of 1.8%.

5. How to improve compiling the national accounts?

Official national accounts statistics is a product which should be produced efficiently, be improved continuously in view of changing data demands and be marketed actively.
Efficient production of official national accounts statistics requires:

– Regular investments in improving the compilation techniques and the skills and knowledge of the compilers;
– Efficient relationships with data sources used as inputs for the national accounts statistics;
– An optimal balance between the efforts of processing and the relative importance of the outputs.

We will shortly explain what these requirements can imply for improving the efficiency of compiling national accounts statistics.

An international strategy

Investments in the compilation techniques and the compilers refer to further automation, critical evaluation of present compilation techniques, consideration of using alternative compilation techniques, more international sharing of knowledge on best practices, special courses for training statisticians and targeted research on specific compilation issues.
Automation, evaluation, courses and research should preferably be taken up internationally: development of international standard software for compiling national accounts statistics, audits on the efficiency of the compilation techniques by international consultants, international courses on simple as well as advanced national accounts compilation techniques and an international research programme on national accounts compilation issues. Such an international approach can exploit best all available know-how, can profit from the economies of scale involved and avoids doing double work (see also Franz, 1996).
At present, the international approach on improving compilation techniques is piece-meal and ad hoc. It is limited to some beginners' courses on compiling the national accounts (e.g. the Dutch course on compiling the national accounts in practice) and the writing of handbooks commissioned by the international organisations. Hardly any articles and books have been published about national accounts compilation techniques. As a consequence, compilation processes underlying official national accounts statistics are to a great extent based on compilation techniques developed nationally and in isolation. They are not based on a fruitful exchange between national accountants of best practices and they could not benefit from specialised research in national accounts compilation techniques. Furthermore, the compilation processes underlying non-official national accounts statistics, e.g. time series compiled by academic researchers on economic history, are often based on limited knowledge of the official compilation processes.
The current international approach depends also too much on the willingness of some statistical offices to free temporarily one or more of their experts from their normal duties. This willingness is even a clear risk for the statistical office involved: their best experts are also the backbone of the national compilation process, they are often working at the executive level and they are very difficult to replace, in particular in the short run.
The present international approach is piece-meal and should therefore be replaced by a long term strategy for improving general knowledge about national accounts compilation techniques. A major focus should be generating practical information, e.g.:

– Articles about national experience with developing new software and using standard software for compiling national accounts statistics. This can include reports about ambitious automation projects that failed,[7)] but may also cover simple routines that worked well in practice.[8)]

[7)] In the Netherlands, the automation of a balancing system for input-output tables (APS) failed in the eighties. The ambitions were too high, e.g. the system should show all kinds of margins of error of the various data and estimates at a very disaggregate level. This automation canard was the major reason for years of delay in revising the Dutch national accounts. In the end, a very simple system was developed which only contained the most essential information. This worked rather well and was later modernized and extended. This automated balancing system for input-output tables should now be regarded as one of the major compilation jewels of the Dutch national accounts.

– Articles about balancing the accounts, the assumptions and plausibility checks used and their consequences for balancing;
– Articles about practical solutions in compiling and updating time series.
– Articles about compilation strategies, e.g. about continuity and prudence.
– Overviews of common errors in interpreting and applying the guidelines. For example, taxes on products are in compilation practice sometimes also allocated to non-market output. However, they can by convention not be levied on non-market output. Similarly, abolishing the exemption of VAT for specific products/producers may actually be regarded as no change in the VAT-rate. However, it implies an increase in the average VAT-rate. A wrong interpretation will imply wrong measures of price en volume change. An other case in point are the rents of dwellings and individual rent allowances. Changes in the average individual rent allowances seem to be irrelevant for recording household final consumption expenditure. However, increases in the average individual rent allowance should be regarded as an increase in the price of social assistance benefits in kind and government final consumption expenditure and as a decrease in the price of household final consumption expenditure.

This international approach can also be partly run on a commercial basis, i.e. by companies or national statistical offices selling their software, audits and courses to statistical offices and other compilers of national accounts statistics.

Relationships with data sources

The building-bricks for constructing national accounts statistics are various other statistics and administrative data sources. The second requirement for efficient compilation is therefore an efficient relationship with these data sources. This relationship is not a one-way relationship, as the national accounts and its input-statistics share a lot of common interests. For the national accounts, an input-statistic is often not only an input but reflects also a user-group for the national accounts statistics. For the input-statistic and its data-users, the national accounts is not only a data-user but also a frame of reference to put the statistic in a national perspective, e.g. to express value added in construction as a percentage of GDP. In fact, both the input-statistic and the national accounts statistics may have common users.

To profit optimally from the joint interests, good communication and co-ordination are required on concepts, classifications, timing, formats of transferring data, etc. National accountants should clarify why and how they transform the data from the input-statistic into national accounts data. The processing of the data should also be co-ordinated, because some checks can best be done in compiling the input-statistic and some others in compiling the national accounts. Furthermore, national accountants may perform some plausibility-checks that have already been done or they may assume that some checks have been made that in fact have not. For most common input-statistics (e.g. Labour Force Survey, Family Expenditure Survey, Industry statistics), *international quality standards* that are regularly monitored seem to be an efficient solution.

Joint statistical products could also be developed, e.g. in the form of a module or satellite account. Examples of these are a module linking national accounts statistics and environmental statistics, a health care module, a Research and Development module or

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[8] Old routines, like compilation sheets developed in the paper and pencil-era, may well stand the test of the time. An example from Dutch compilation practice may illustrate this. Compilation sheets for the estimation of government accounts were developed in the sixties or seventies. These sheets showed in a matrix format for each transaction the specific layer of government (State, municipalities, provinces, social security funds, private subsidised schools, etc.) involved and a further specification, e.g.:

– a breakdown of capital formation by type of asset;
– a breakdown of final consumption expenditure into the various costs of production (e.g. compensation of employees, consumption of fixed capital and intermediate consumption), sales and own-account capital formation;
– a complete overview of other income transfers or interest by paying and receiving sector/specific layer of the government. These sheets have of course been modified several times, e.g. in order to take into account of the substantial changes in the universal concepts with respect to the government.

These sheets are also now embedded in a modern automation system. Nevertheless, they are still the backbone of the Dutch estimates on the revenue and expenditure of the general government, as they provide a simple overview and a very strong check on consistency. These sheets should therefore still be regarded as jewels of Dutch compilation practice.

a social policy module (see Bos, 2003, pp. 149-172). The joint products can also be a simple table showing the links and differences between the national accounts statistics and the input-statistic.

Balance between compilation process and outputs

The third requirement for efficient compilation is a good balance between the efforts of processing and the outputs, i.e. the national accounts statistics and their uses. For estimating important parts of the national economy, sizeable compilation efforts are justified. However, not much compilation efforts should be put in estimating accurately a very limited part of the national economy which does not serve any special (important) data needs.

This notion can be made explicit by developing explicit quantitative standards, e.g. the half pro-mille norm the present author proposes for designing the compilation process. This norm indicates that no separate estimates should be made for parts of the economy that are smaller than half a pro-mille of domestic product. This norm reflects that many key-figures are in terms of promilles, e.g. net lending by the government as a percentage of domestic product is 2.6% or the relative size of manufacturing as a percentage of domestic product is 30.5%. The norm can also be interpreted for parts of the economy. Suppose the national economy is split into ten industries. The average size of an industry is therefore 10%. The half pro-mille norm indicates therefore that for an industry of average size no separate estimates should be made for parts that are smaller than 0.5% of the total industry. For a relatively small industry of only 1% of domestic product no separate estimates should be made for parts smaller than 5% of the total industry.

Quantitative rules of thumb to ensure balance of efforts can be applied to various stages of the compilation process. A major case in point is the business register for statistical purposes. Splitting of administrative units into several statistical units is often essential for compiling meaningful statistics, e.g. a more homogeneous classification of units by industry. However, such splitting also drastically increases the costs for properly maintaining and updating the business register. Furthermore, it can also hamper the linking of administrative and statistical data, e.g. of administrative wage records and statistical surveys on wages by industry. Splitting only serves the national accounts purposes when the advantage of more analytically useful information outweighs the negative trade-offs on obtaining complete, reliable and up-to-date information. Splitting should therefore only be allowed for units with substantial economic importance.

There is always a tendency to focus the compilation efforts on parts of the economy for which already good data sources exist and to estimate and publish for these parts statistics at a very detailed and disaggregate level. At the same time, often few efforts are spent on quantitatively or politically important parts of the economy on which solid information is relatively scarce. This practice is not efficient in view of the outputs.

Similarly, there is often a tendency to balance the efforts in view of old data needs and to forget to serve and explore new data needs. For example, disproportionate attention is often paid to compiling statistics on manufacturing compared to statistics on services. In fact, efficient compilation should be biased towards measuring changes in the economic and institutional structures: even if these changes do not represent relatively large amounts of money, they are often the messengers of bigger changes that are still to come and a proper and early signalling of changes should be a major task of national accounts statistics.

Even with extra efforts, the accuracy of national accounts statistics on parts of the economy on which quantitative information is relatively scarce and on recent changes will be relatively low compared to the accuracy for other parts. Nevertheless, the value added to users will be relatively high: it provides the best estimate that can be made and has a high news value.

Typical national accounts compilation problems have a huge correlation with important policy issues. This applies e.g. to estimates for small enterprises (how well are they doing compared to the bigger ones?, are they the source for economic growth and innovation?) and underreporting of incomes, employment and sales (all the black economy issues). These problems should not be a source of shame for national accountants, but should be regarded as a challenge with high news value. Separagraphte publications of best estimates on these issues should even be considered. Co-operation with other parties interested in this output (e.g. a Ministry, a

research institute, the tax authorities, etc.) can help financing proper estimates, can help exploiting data and know-how and can result in better and more tailor-made national accounts statistics.

Non-official efforts to compile national accounts statistics can also indicate a lack of balance between the efforts of processing and the official output. For such alternative outputs, e.g. long consistent time-series, regional accounts or balance sheets, the benefits for this specific data user exceed the substantial compilation costs involved. These non-official compilation costs are relatively high, as substantial investments in national accounting knowledge and skills are required for only one project. Furthermore, these alternative outputs are likely to have positive external effects for other data users: they may not be interested when they have to make substantial investments, but they can be interested when provided free or at low costs. The various types of official national accounts statistics are likely to have met much less demanding tests. The optimal supply of national accounts statistics can therefore be improved when serious efforts to compile non-official national accounts statistics are used to reconsider the official output-mix.

Providing information on the data sources and compilation process will also be a strong stimulus for further improving the efficiency and the international comparability. Efficiency is in particular served by demolishing the various myths and taboos surrounding the efficiency of the national compilation processes, e.g. ‘increasing the timeliness of national accounts statistics necessarily implies a loss of reliability’. However, the wonder of more timely and more reliable data can often become reality by getting rid of old inefficiencies, by being obliged to seriously investigate the existence and use of alternative data sources or by profiting from new circumstances (e.g. better automation, access to other data sources).

6. Conclusions

The universal model SNA93 can not be estimated directly. It should first be translated into an operational model for a specific country during a specific period of time. This involves interpretation of the universal model in view of the national economy and further specification of the concepts, detail and scope. The operational model decides to a substantial extent what is actually measured. Differences in national operational models are therefore a serious threat to international comparability. This applies in particular to the measurement of prices and volumes. A more specified universal model can partly solve this problem. However, even a more specified universal model can never serve as the operational model.

The operational model is estimated by combining very heterogeneous and incomplete sets of data; the latter include national accounts estimates for previous periods and frames of reference for grossing up and combining data, e.g. a business register or a population census. The major estimation tools are accounting identities, plausibility checks and assumptions.

Accounting identities are friends and foes of national accounts statistics. They ensure consistency, can act as plausibility check and allow residual estimates. However, they can also enforce to modify best estimates for the sake of consistency. Furthermore, all residual estimates are likely to be very unreliable, as they serve as the garbage bag for errors in all the other estimates.

Plausibility checks are very important for the reliability of national accounts statistics. They can weed out erratic developments in data sources (e.g. due to conceptual changes), can help in detecting all sorts of compilation errors and are important in making estimates during all various stages of the compilation process. What is regarded as plausible is ultimately decided by the compilers' skills in inventing plausibility checks, by the compilers' skills in finding plausible answers and by the compilers' personal knowledge and model of the national economy.

Assumptions are essential in combining and completing the basic set of data. The more encompassing, up-to-date, detailed, reliable and conceptually close the basic data set, the smaller the role played by assumptions can be. Plausible assumptions can remedy to a substantial extent the absence of data and are to be preferred to implausible data. However, when for substantial parts of the national economy no plausible data or assumptions are available, national accounts statistics transform into guesswork.

The estimation process is influenced by environmental factors like skills (e.g. skills in combining data and making plausible assumptions), resources (e.g. resources for compiling good price-statistics, for maintaining a reliable business register or for compiling national accounts statistics) and policy (e.g. a mixed strategy of continuity or a preference for prudence and stability).

Official national accounts statistics are generally the only and therefore the best available estimates of the multi-purpose universal model. However, their reliability can differ substantially internationally, over time and even within the same set of national accounts statistics. This is to a great extent the price to be paid for a very ambitious statistic. For example, complete estimates of national economies are to be made, while in all countries for some parts no reliable data (e.g. services industries or illegal production) are available. Furthermore, one universal model is to be estimated even though available data sources, specific circumstances and resources for compiling economic statistics differ widely internationally.

National accounts estimates are not necessarily the best available national estimate of individual variables. Reasons can be e.g. a compilation policy stressing continuity, the allocation of resources and time for making specific estimates or the need for consistent estimates.

A major drawback of official national accounts statistics is that usually no information is provided about their operational concepts and reliability. This should be remedied by:

- Production and dissemination of statistics about differences in successive estimates;
- Documentation of the operational concepts;
- Documentation of data sources and compilation methods, e.g. including a table indicating the relative importance of good-quality data sources for the estimation of domestic product, a table showing which parts of the national economy are not

covered by good-quality data sources and an overview of the assumptions, plausibility checks, balancing procedures and compilation policy.
– Sensitivity analysis about the consequences of various major types of measurement error.
– Sensitivity analysis about the consequences of alternative specifications of the operational model, e.g. the consequences of introducing hedonic prices for computers.
– Sensitivity analysis about the consequence of alternative specifications of the universal module, e.g. a welfare-oriented module on household income.

This approach has some similarity with the old habit of some statistical offices to publish margins of error. However, such margins of error are a too indirect, crude and subjective way to address the issues at stake. Furthermore, they do not explain the underlying logic and sources of errors and biases; also the –often quantitatively very important- conceptual issues are generally ignored.

The efficiency of compiling the national accounts could be improved by:
– An international long term strategy for improving national accounts compilation techniques;
– A more efficient relationships with data sources, e.g. better coordination, international quality standards for various basic statistics and joint statistical products;
– A better balance between the compilation process and the outputs, e.g. by reconsidering the output in view of non-official efforts to compile national accounts statistics (e.g. time series!) or by the use of explicit thresholds for making separate estimates or for splitting units in the business register.

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