STATISTICS SWEDEN

INVENTORIES OF SOURCES AND METHODS FOR PRICE AND VOLUME MEASURES IN NATIONAL ACCOUNTS

Chapter 1 General procedures

1.1 Introduction

The widespread international use of national accounts data has led to an extensive set of international definitions and guidelines. The SNA93[1] contains the world-wide applications, and the ESA95[2] is the EU version. Most of the harmonisation work done so far, however, has focused on current price data, such as the level of GDP, while the volume growth of GDP, which is one of the most used national accounts figures, has not been focused on to the same extent. However, an increased demand for more harmonised price and volume data has put focus on the methods used in different countries for volume calculations. Member States of the EU have therefore been asked to provide an inventory of their respective methods for constant price calculations within the national accounts. A handbook on these items was also published by Eurostat in 2001.

With a focus on the measurement of the volume growth of GDP an intertemporal price and volume measurement has to be performed. Constant prices describe a fictitious situation of a certain year in the prices of another year. In reality the transactions of the current year could not take place in an identical manner at the prices of another year. The aim of these calculations is therefore to analyse which changes in aggregates are due to price movements and which are due to volume changes. A transaction's value in a current price can consequently be broken down into a price and a volume component. The price component should then only include the changes arising from real price changes. The volume component should take care of all other changes, e.g. quantity, quality and composition.

Through following the principles on which the national accounts system is based it is possible to obtain a direct measurement of GDP in constant prices from the output side or from the expenditure side.[3] According to the output approach, GDP at market prices is equal to Output at basic prices minus intermediate consumption at purchasers' prices plus the sum of taxes/subsidies on products. Following the expenditure approach GDP can be obtained as Final consumption expenditure by households, by government, by NPISH[4] plus gross fixed capital formation, changes in inventories, acquisitions less disposals of valuables and exports minus imports.

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[1] System of National Accounts 1993
[2] European System of National Accounts 1995
[3] The income approach cannot be used to measure GDP volume as the operating surplus cannot be measured directly at constant prices.
[4] Non Profit Institutions Serving Households

1.2 The expenditure side is the main approach in the Swedish national accounts

In order to provide an insight into how constant prices are presented in the national accounts system, a summary description is given here of the calculation procedure.

GDP as measured from the production side and use side is calculated, compiled and balanced in the product accounts section of the national accounts system.[5] The annual calculation of the product accounts is balanced in a system of supply and use tables (SUTs). Balancing is carried out over 400 product groups for 134 industries. Services are classified according to 120 product groups, with goods accounting for the rest. The 140 purposes of household consumption according to COICOP[6] are broken down further into 258 product groups. Consumption expenditure of departments and agencies of government is broken down partly by sector and partly by purpose according to COFOG[7]. Investment breaks down over 55 product groups in around 75 industries and 10 purposes within the sectors of general government. SUTs are based on the principle that supply must balance with use for each product group. This means that Swedish output + imports (supply) must be equal to intermediate consumption + final consumption + investment + exports (use).

First of all, all output, imports, customs duties and exports, together with sales by departments and agencies of government and non-profit institutions (NPIs) at basic prices are entered into a database. All values are calculated at both current and constant, prior-year (t-1) prices. The degree of detail varies, and both industry output and foreign trade in goods are calculated at 8-digit CN[8] level. The price indices used for conversion from current to constant prices are the producer, export and import price indices, as well as the unit value index. This is followed by aggregation to the product groups listed in Annex 1. Output of services is broken down directly over around 120 product groups. Chapter 3 deals with the deflators used.

Certain sub-components from the use side are calculated in the same way in a number of different sub-systems. Values in both current and constant prices are entered for the respective product group. For household consumption, for example, various sub-indices of the consumer price index are used. For some areas such as energy products, for example, constant price calculations are made with the aid of volume changes, and current prices are obtained by means of reflating.

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[5] Where GDP has been calculated in the product accounts, a compilation of GDP from the income side is carried out, but operating surplus is calculated as a residual.
[6] Classification of Individual Consumption by Purpose
[7] Classification of Functions of Government
[8] Combined Nomenclature for classification of trade of goods between member countries

For intermediate consumption and investment in machinery and equipment, it is most often the case that only totals for industries and purposes are available in current prices from the annual primary statistics. Intermediate inquiries are carried out for certain sub-sectors, however. Where data on the precise product breakdown are missing, a breakdown is first made according to the previous year's structure.

Where the new structure is set up in current prices, a reconciliation is carried out with the totals in the source material. The differentials which arise are distributed proportionally over various products. For certain product groups, detailed data are available, and for some areas such as energy products, construction activity and software produced on own account, complete balances are produced for supply and use at both current and t-1 prices. These product groups are treated thereafter as known values and remain unaffected by general balancing corrections. In principle, household consumption and exports, which are calculated directly at both current and constant prices, are also treated as known values.

Weighted price indices –IHT (*inhemsk tillgång*) for domestic supply (total of output + sales by general government and NPISHs + imports and customs duties – exports) is subsequently calculated for all product groups used in the annual calculation system, but the IHT index does not cover changes in taxes and subsidies on products. These are taken into account at a later stage, however, with direct corrections. Such changes affect use at purchasers' prices and thus mean that the IHT index is adjusted for the product groups affected.

Linked to each product group and use is a trading margin rate and the VAT rate applicable. Margins and taxes and subsidies on products are thus allocated to use. The product groups must balance with purchasers' price in accordance with Table 1.1.

Table 1.1 Product group 33500

Current prices

Supply	Industry (SNI)	Basic price	Trad. marg.	VAT	Purch.-Price	Deflator
Sw. outp.	3110	1				PPI
Sw. outp.	3120	10				PPI
Sw. outp.	3349	149				PPI
Sw outp.	3900	1				PPI
Imports	33500	867				IMPI
Cust. dut.		10				IMPI
		1038	266	137	1441	

Use

Intermediate consumption for market producers/producers for own final use

Dom. apps	11_38220	31	2	0	33	IHT
Opt instr	11_38620	35	3	0	38	IHT
Mot. Veh. Ind	11_38711	49	6	0	55	IHT
Electricity	11_41100	92	9	0	101	IHT
Distr. trades	11_61200	18	2	0	20	IHT
Hotel rest	11_62000	28	2	0	30	IHT
Other land tr	11_72312	35	1	0	36	IHT
Recr,cult	11_92230	46	2	0	48	IHT

Public sector consumption

Transp	124_04C	49	6	14	69	IHT

Household consumption

Kitch. equip	23_0540	6	3	2	11	KPI
Clocks	23_12311	223	185	102	510	KPI

Investment

Electricity	310_41100	97	10	0	107	IHT
Other land tr	310_72312	47	5	0	52	IHT
Transp	324_04C	70	6	19	95	IHT
Exports	6	211	24	0	235	EXPI
Inventories					0	PPI
Total		1037	266	137	1440	
Residual		1	0	0	1	
Total		1038			1441	

The advantage of working with a system of SUTs is that it adds a further dimension to the balancing process. Every supply and use breaks down into products, and information on supply and use is found at the product level. This provides broad scope for plausibility checks and balancing, which is not to be found when working at a more aggregated level with no product breakdown. However, this method of working makes highly exacting demands in terms of quality and the degree of detail of data entry and coherent classification of data input.

All parts of the system are calculated individually at constant prices using mutually consistent price indices at product level. By simultaneously reconciling current and constant prices in the same process, maximum use is made of the calculation system. Changes in prices and volumes are analysed in the same process and the material can be properly assessed and checked. Price index changes from different sources can be compared, as can volume changes for different aggregates in the same product group. And time series analyses are carried out in accordance with Table 1.2.

Table 1.2 Basis for time-series analysis
Year Product group XXX

		Shown on supply side for every product group
1999	Current price	Output at basic price
2000	Current price	Sales by general government
2001	Current price	Imports
		Customs duties
1999	Constant price	Trading margins
2000	Constant price	Taxes on products
2001	Constant price	Subsidies on products
		VAT
1999	Price change	Total domestic supply
2000	Price change	
2001	Price change	**Shown on the use side for each product group**
		Industry input
1999	Volume change	of which known input
2000	Volume change	General government consumption (input)
2001	Volume change	NPISH consumption
		General government consumption
		Household consumption
		NPISH consumption
		Investment

Inventories

Exports

Total use

Apart from tables by product, tables by industry are also produced for production and income calculation accounts. These give total output, intermediate consumption, added value, other production taxes and subsidies, compensation of employees, social contributions and operating surplus. Employment calculations are also included, with average numbers of employees and hours worked, broken down by employees and self employed persons. This makes it possible to calculate some key figures, such as trends in earnings and productivity, for analysis purposes.

The Swedish statistical system is overdetermined in the sense that there are statistics allowing the calculation of the complete output side as well as the complete use side. On the whole, the underlying statistics have long been well developed and detailed.

In the balancing process, all variables may, in principle, be affected. However, it is only in exceptional cases that the variables included in general government consumption at current prices are changed. Product allocation may be adjusted, but total intermediate consumption or production is seldom corrected. Clearly, the balancing work may lead to the detection and correction of errors or anomalies in the basic material. But the calculations are based on comprehensive and detailed material which can hardly be called into question. The material for the general government sectors is also complete, covering total transactions for the sectors and providing the basis on which to calculate net lending/net borrowing.

The general approach followed in the calculations is to adhere as far as possible to the underlying statistics and basic models. However, it always proves necessary to make certain adjustments to the original calculations. Broadly speaking, it never happens that calculations give a "satisfactory match" *a priori*, i.e. that GDP calculated from the production side directly gives the same result as GDP calculated from the use side.
Output calculations are generally more difficult to verify as regards both coverage and definitions. Much of the output statistics is based on data from company accounting. Clearly, there are a number of reasons why such data can be misleading. Companies, at least the smaller ones, may have reason to under-report their output. On the other hand, they may have an interest in over-reporting consumption of goods and services. It can sometimes also be difficult to make the definitional adjustments which are necessary in order to comply with the national accounts definitions. The main approach pursued in the GDP calculations is thus geared to the use side.

The end result is that, when all other checks, plausibility assessments and corrections have been made, the final reconcilations involve an adjustment of intermediate consumption in the various industries.

1.3 Chain price indices are used

1.3.1 Annual chaining.

In the production cycle for Sweden's annual national accounts, first preliminary figures are based on the sum of four quarters. These figures are calculated in March t+1. In November t+1 the first annual calculation is published and in November t+2 final figures based on more comprehensive material are published.

In 1999 when the calculation methods for constant prices were changed, it was discussed whether the actual periods should be calculated with weights from t-2 (last final year) or whether the t-1 (preliminary annual calculation) with less "final" values were sufficient for the first preliminary data based on the sum of the four quarters. It was finally decided to use the latest year as base-year for chaining. Even if figures for t-2 could be expected to be more reliable, one had to admit that t-1 figures were the best estimate for the weights that should be used at the end. Another advantage is that one does not have to use indices with t-1 and t-2 in the same system. Having constant prices always in last year's prices also turned out to be an advantage when having to change reference year for publication purposes.

In practice, values are stored in current prices (t prices) and in t-1 prices so that it is possible to add figures at detailed levels to aggregates. Three formulas are used for chaining. In the examples below, the reference year is 1995 = COP95.

$$(1)$$

For reference year $\quad 95_{COP95}=95_t$

$$(2)$$

For later years $\quad 96_{COP95}= 95_{COP95}*96_{t-1}/95_t$

$\quad\quad\quad\quad\quad\quad 97_{COP95}= 96_{COP95}*97_{t-1}/96_t$

$$(3)$$

For earlier years $\quad 94_{COP95}=95_{COP95}*94_t/95_{t-1}$

$\quad\quad\quad\quad\quad\quad 93_{COP95}=94_{COP95}*93_t/94_{t-1}$

These formulas are used on transactions and aggregates with constant positive or negative signs. For items that change signs over time, other methods have to be used.

As changes in inventories cannot be calculated in a "normal" way, other alternatives had to be found. It was decided to present inventories in reference year prices with the same share of GDP as in t-1 prices.

For external balance of goods and services both exports and imports are presented in reference year prices and the net amount can be subtracted.

The item trading gains or losses is more difficult, so no value is presented in reference year prices at all. However, the effect of trading gains or losses is of course included in the chaining of GNI. Another item where reference year prices are not presented is the residual between GDP by the expenditure approach and by the production approach.

1.3.2 Quarterly chaining.

Comparison of quarterly growth rates in Sweden has by tradition mostly been the annual link between a quarter and the equivalent quarter the year before. If these periods are to be compared, they need to be expressed at the same price-level. After calculation of the fourth quarter we recalculate t prices for the quarters from t-1 prices by using the current prices over the year divided by t-1 prices over the year.

$$95Q1_t = 95Q1_{t-1} * Sum95Qn_{CUP}/SumQn_{t-1}$$

The annual value in current prices and in t prices is the same and any discrepancies due to rounding are added to the fourth quarter.

This means that for every period a value is expressed at four price levels: Current prices; t prices; t-1 prices and reference prices. The reference prices are then calculated the same way as the annual series and any discrepancies due to rounding between the annual figure and the sum of quarterly reference prices is added to the fourth quarter.

In the 3 examples below, the reference year is 1995 = COP95.

$$(1)$$

For reference year $95Q1_{COP95} = 95Q1_t$

$$(2)$$

For later years $\qquad$ $96Q1_{cop95}= 95Q1_{COP95}*96Q1_{t\text{-}1}/95Q1_t$

$97Q1_{cop95}= 96Q1_{COP95}*97Q1_{t\text{-}1}/96Q1_t$

(3)

For earlier years $\qquad$ $94Q1_{COP95}=95Q1_{COP95}*94Q1_t/95Q1_{t\text{-}1}$

$93Q1_{COP95}=94Q1_{COP95}*93Q1_t/94Q1_{t\text{-}1}$

The same exceptions to this rule occur for quarterly reference prices as for annual prices. They are inventories, trading gains or loss, residuals and other net amounts.

1. 4 Time series are published at reference year prices

1.4.1 Publishing of the Swedish national accounts

Over the years, constant prices have been presented in Sweden by publishing values at fixed base-year prices. often together with percentage growth-rates. In order to make the introduction of chain-linking as smooth as possible for users, series were published that were as similar to the old ones as possible. It was then decided to use as the reference year the same year as requested in the report to Eurostat, which was 1995. In connection with the publication in November 2003, the reference year was changed to 2000.

Most economists in Sweden seem to use the previous year as the reference year and they use the reference year as a fixed base year in their forecasts. The system is also designed to serve users with any reference year if that is more suitable. For example the National Institute for Economic Research obtains data from the NA's databases at all 4 price-levels, so they can do their own chain-linking. Another approach for users is to take the same approach as the Central Bank, which uses aggregated time series with the previous year as the reference year and basis for their analyses and forecasts.

National accounts publications are available on the Statistics Sweden website and in the open databases free of charge. Series are expressed in current prices, reference year prices and often with volume changes in percentages. Special requests can be extracted from our internal databases both concerning level of aggregates and reference year.

1.4.2 Education of users and their response to the change.

Before the introduction of chain-linked time series, the Advisory Board for Economic Statistics, on which the main users are represented, was informed

about how data should be presented, and about solutions and shortcomings in the new method. When new definitions according to ESA95 and chain-linked constant prices where first published, a seminar was held for the press and users at which the innovations were presented. The paper publications and the website provide information about constant price presentations and name contact persons who can give more information about chaining and answer other questions in the area of national accounts.

The change has been well received and there have been hardly any complaints. However, people still ask questions and are surprised about the fact that data is not additive for actual constant prices and seasonally adjusted series. After being informed about the reasons for chain-linking they accept the new situation. The introduction has been easier than expected among staff and users alike. However, after some time it has become obvious that some users have not understood the chain-linked method completely. Values in reference year prices have been used as base year values. Therefore, after four years the question has been raised on what data should be published.

1.5 General methods for implementation of new products and quality control

1.5.1 New products

Continuous discussions are held regarding the collection of price information for new products. The price section within Statistics Sweden receive new values from the national accounts on household expenditure and values from household budget statistics every year as a basis for recalculating the weights in CPI. A forecast for household expenditure in the fourth quarter is made in December every year so that the weights for household expenditure in year t is based on the preliminary information on household expenditure values for the year t-1.

The price section also receive new information every year from the production of goods in manufacturing on a detailed level of classification and from international trade statistics on CN-numbers. The price section checks the values reported at the detailed level. If the value for a group has risen or fallen, checks are made in order to find out why. Maybe a new product has been included within the group, and then the contents of the group is analysed and the new product added. Regarding PPI, however, the weights are based on t-2 figures as the detailed information is not available earlier.

1.5.2 The following general methods are used in order to take quality changes into account:

a. No adjustment = pure price effect
b. Automatic chaining = pure quality difference
c. Option prices, e.g. you know what has been changed and also the market prices for these changes
d. Production costs, does not take the user's valuation into account
e. Expert valuation
f. Hedonic models
g. Overlap
h. New sample, aggregated overlap, especially MCR, Multiple chaining and resampling
i. Imputation from a higher level to a lower level