

Measuring intermediate consumption on a quarterly basis

A way of finding turning points in economic activity

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1. Finding turning points in economic activity

A high-quality measure of economic growth is essential to be able to conduct accurate and efficient economic policy. That is, for the fiscal and monetary policy makers to have a clear picture of where the economy is heading, the measure of economic growth must effectively be able to find turning points in economic activity. Statistics Sweden have been doing extensive research and development on this field in recent years. The outcome is a new statistical product called Quarterly Economic Statistics (QES) which gives an enhanced picture of short-term economic growth.

Economic growth is generally defined as the rate of change in a country's Gross Domestic Product (GDP). GDP is in turn a measure of the monetary value of all final goods and services in an economy. Short-term economic growth can be used to define where in a business cycle the economy is. This can be done by putting short-term GDP growth in relation to a calculated potential long-term sustainable GDP growth. If the economy is growing in a faster pace than what is assumed to be sustainable, the business cycle is in an upward phase, and vice versa.

Information from a large number of sources is compiled in order to reach GDP. In turn, GDP can be calculated with three different approaches, each using different sources. At Statistics Sweden it has historically only been possible to fully reach quarterly GDP by the expenditure approach. The new statistical product ESQ has made it possible to also reach quarterly GDP by the output approach and the income approach. The economic implications will be presented in section 1 and the design of ESQ will be presented in section 2.

The three approaches to measuring GDP

New business statistics (red) enables GDP to be calculated with different approaches

Output approach	Expenditure approach	Income approach
+ Gross Value Added (GVA)	+ Household consumption	+ Gross Operating Surplus (GOS)
(+ Output	+ Government spending	(+ Net Operating Surplus
– Intermediate consumption)	+ Gross capital formation	– Consumption of fixed capital)
+ Taxes on production	(+ Gross fixed capital formation	+ Compensation of employees
– Subsidies on production	+ Change in inventories)	(+ Wages and salaries
	+ Net exports	+ Employer social contributions)
	(+ Exports	+ Gross mixed income
	– Imports)	+ Taxes on production
		– Subsidies on production
= GDP at market prices	= GDP at market prices	= GDP at market prices

1.1 Output and Intermediate consumption

When calculating GDP by the output approach the target variable is Gross Value Added (GVA). That is, the value created in an economy's respective production processes. GVA is in turn calculated as the production value minus the value of all intermediate products used in the production process, also known as intermediate consumption. Prior to the development of the ESQ statistics only production was measured, and intermediate consumption was assumed to develop in the exact same way. Since the GVA is calculated as the production value minus the value of intermediate consumption, the change in production value was used as a proxy for the change in GVA. This implied that the input/output-ratio was assumed to be constant, and by extension, the cost of intermediate products was assumed to be fully adaptable to changes in production.

Empirical studies made by Statistics Sweden show that the assumption of a fixed input/output-ratio performs well under calmer periods of economic activity when production is stable. However, under circumstances when production shifts rapidly, so called turning points in economic activity, the assumption is weak. Since GVA is a relatively small number in comparison to production, discrepancies between the change in production and change in intermediate consumption can have large effects on the change in GVA. The table below shows an example of how relatively small discrepancies between the growth of production and intermediate consumption affect GVA growth. Under the assumption of a fixed input/output-ratio, GDP would have increased by 10.0 percent. When both production and intermediate consumption are measured, GVA is instead unchanged.

Effects on GVA from discrepancies between output and intermediate consumption

	Time t+0	Time t+1	Growth
Production	100	110	10.0 %
Intermediate consumption	- 80	- 90	12.5 %
Gross Value Added	= 20	= 20	0.0 %

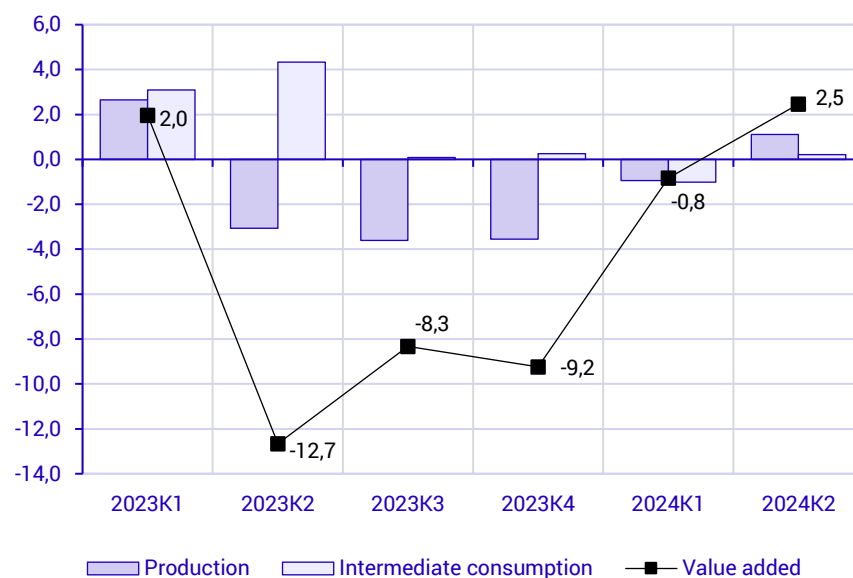
Apart from the circumstances mentioned earlier, the assumption of a fixed input/output-ratio is weak when the cost base consists of a larger share of fixed costs. That is, when production is changing rapidly but the cost base can't be fully adapted, GVA will increase or decrease more than what production does. Empirical studies made by Statistics Sweden show that the cost base of the private sector consist of more than 40 percent fixed costs. The number for the goods producers is approximately 30 percent while the number for the service producers is almost 60 percent.

1.1.1 A practical example from the Swedish services sector

To demonstrate how the measure of value added changes when incorporating both a measure of production and a measure of intermediate consumption, the recent developments in the Swedish services sector can be examined. As the figure below shows, the production value declined for four consecutive quarters starting from the second quarter of 2023. However, the companies did not have the possibility to adapt their intermediate consumption to the decline in production immediately, resulting in a sharply declining value added. If the production value was to be used as a proxy for value added, as was the case before, the value added would be heavily overestimated during the first three quarters.

The ratio between intermediate consumption and production varies over time

Production, Intermediate consumption and Value added, yearly percentage change



Source: Quarterly economic statistics, Statistics Sweden

1.2 Gross operating surplus and Compensation of employees

When calculating GDP by the income approach the value of income generated by domestically produced goods and services are summarized. The value of the generated income is in turn split up between Gross Operating Surplus (GOS) and Compensation of employees. The GOS measures the producing entities incomes before interests and fees on financial or tangible assets. The compensation of employees measures the income generated to households in the form of wages and social contributions. With the introduction of the ESQ statistics the income approach is now possible to use when calculating the quarterly GDP of Sweden. This means we could have three approaches to cross-check each quarter, which in theory should reach the exact same number.

2. Statistical method

To conduct a statistical survey as efficient as possible, regarding both internal and external costs, administrative data should be used where it is possible. In the case of measuring private sector incomes and expenditures, Statistics Sweden has designed the survey as a combination of administrative data from the Swedish Tax Authorities and survey data collected directly from the largest corporations.

In the context of GDP, the income and expenditure statistics are used to measure the target variables Gross Value Added (GVA) and Gross Operating Surplus (GOS). GVA can in return be calculated in a simplified or detailed way. A simplified GVA can be calculated based on administrative data and does not include any details of the incomes or expenditures. To reach a detailed GVA the simplified GVA must be complemented by certain details, which is the reason why survey data are collected from the largest corporations. Hence, the detailed GVA collected from surveys is closer to the actual GVA, while the simplified GVA collected from administrative data should be treated as a proxy.

Due to the economic constraints that exist when conducting a survey there is a tradeoff between survey data and administrative data. Based on empirical studies made by Statistics Sweden the number of surveys is set to approximately 400. These 400 surveys constitute about 40 percent of the total private sector production.

2.1 Calculations based on survey data

The total frame population consist of more than 1.1 million corporations, and hence the survey population of 400 corporations only constitute about 0.04 percent. However, these 400 corporations are selected based on how much they produce, which explain why they make up over 40 percent of the total production value. From internal studies it is shown that the largest corporations have a somewhat complex reporting structure to the Tax Authorities, and that the administrative data fits the actual quarterly estimates quite poorly. Together with the fact that we need detailed information about incomes and expenditures from these corporations, they are asked to each quarter submit a detailed income statement as the one shown below.

(1) Net sales

- (2) **Change in inventories**
- (3) **Work performed by the company for its own use**
- (4) **Other operating income**
 - Broken down by:*
 - (5) *Government assistance received*
 - (6) *Exchange gains on operating receivables and liabilities*
 - (7) *Capital gains on sale of tangible and intangible assets*
 - (8) *Other operating income than listed above*
- (9) **Cost of goods for resale, raw materials and consumables**
 - Broken down by:*
 - (10) *Raw materials and consumables*
 - (11) *Goods for resale*
- (12) **Other external costs**
 - Broken down by:*
 - (13) *Consumable equipment with a life of more than one year*
 - (14) *Exchange rate differences on accounts with third parties*
 - (15) *Losses on sale of tangible and intangible assets*
 - (16) *Restructuring costs*
 - (17) *Other external costs than listed above*
- (18) **Personnel costs**
 - Broken down by:*
 - (19) *Salaries and other remunerations*
 - (20) *Social security expenses (incl. pension expenses)*
 - (21) *Other personnel costs than listed above*
- (22) **Depreciation and amortization of tangible and intangible assets**
- (23) **Impairment of current assets in excess of normal impairment**
- (24) **Other operating expenses**
 - Broken down by:*
 - (25) *Exchange rate differences on accounts with third parties*
 - (26) *Losses on sale of tangible and intangible assets*
 - (27) *Restructuring costs*
 - (28) *Other operating expenses than listed above*

Where:

Operating income = 1 + 2 + 3 + 4

Operating costs = 9 + 12 + 24

Personnel costs = 18

Compensation of employees = 18 – 21

EBITDA = Operating income – Operating costs – Personnel costs

Production = 1 + 2 + 3 + 4 – (5+6+7)

Intermediate consumption = 9 + 12 – (13+14+15+16) + 18 – (19+20) + 24 – (25+26+27)

Detailed Gross Value Added = Production – Intermediate consumption

Gross Operating Surplus = Detailed Gross Value Added – Compensation of employees

2.2 Calculations based on administrative data

Based on administrative data a simplified GVA and an actual GOS can be calculated. The GVA is simplified because we miss detailed information about the incomes and expenditures presented in the table above. However, the simplified GVA is assumed to be good enough, mainly because the detailed information, such as exchange rate differences on accounts with third parties, are generally concentrated to the largest corporations, which in turn are asked to submit a detailed income statement.

As shown in the table below, the administrative data is gathered from the Swedish Tax Authorities. The income and expenditure variables are gathered from the companies Value Added Tax (VAT) declarations, while the personnel costs are gathered from the companies' employer declarations. To reach the target variables described below, the administrative data must be complemented and adjusted by several factors. These factors will be described in the following two sections.

<u>Simplified income statement</u>	<u>Data source</u>	<u>Adjustments</u>
(1) Net sales	VAT declarations	Change in <u>inventories</u>
(2) Other operating income		
(3) Cost of goods for resale, raw materials and consumables	VAT declarations	Fixed capital formation Change in <u>inventories</u>
(4) Other external costs		
(5) Other operating expenses	Employer declarations	
(6) Personnel costs		

Where:

Operating income = 1 + 2 (+ adjustments)

Operating costs = 3 + 4 + 5 (+ adjustments)

Personnel costs = 6

Compensation of employees = 6

EBITDA = Operating income – Operating costs – Personnel costs

Production = 1 + 2 (+ adjustments)

Intermediate consumption = 3 + 4 + 5 (+ adjustments)

Simplified Gross Value Added = Production – Intermediate consumption

Gross Operating Surplus = Simplified Gross Value Added – Compensation of employees

2.2.1 Operating income and production

VAT declarations constitute the base of the calculation of both operating income and production. Each company in the frame population are obliged to report their VAT declaration to the Swedish Tax Authorities, the vast majority on a quarterly basis. The VAT declarations contain information on how much the companies have paid in VAT. However, to go from VAT to actual incomes, each sold product must be written up by a specific VAT rate. The VAT rate can in

Sweden be either 6, 12 or 25 percent depending on what kind of product it is. Historical information from the structural business statistics is used to calculate a mean VAT rate for each NACE code. This mean VAT rate is then used to write up the reported VAT from the Swedish Tax Authorities.

Paid VATs are booked to the Swedish Tax Authorities regardless of if the sold product comes directly from the production plant or if it comes from products held as inventory. When the target variable is production, that is the value of all goods and services produced during the current quarter, an adjustment of the VAT incomes must be made regarding changes in inventory. Incomes stemming from a decreased inventory must be eliminated since these products were produced in an earlier period. Contrary, products that have been produced during the current period but not sold must be added to the VAT incomes. This is done by a complimentary survey measuring the changes in private sector inventories.

2.2.2 Operating costs and intermediate consumption

As with the operating income and production, VAT declarations constitute the base of the calculations of operating costs and intermediate consumption. The difference is that when measuring the companies costs of purchasing intermediate products, the received VAT is used instead of the paid VAT. The same mean VAT rates per NACE code as described above are used to write up the VAT values.

The received VAT includes, apart from the cost of intermediate products, investments in machinery and equipment and investments in buildings and constructions. In an accounting perspective this is not an issue, but when the target variable is intermediate consumption, these investments must be eliminated. The reason that the investments must be eliminated is that they will be included on the expenditure side of the GDP calculations and can hence not be included on the production side. This adjustment is done by a complementary survey measuring gross fixed capital formation in the private sector.

When the target variable is intermediate consumption, that is the value of all goods and services used in the production process during the current quarter, an adjustment of the VAT expenditures must be made regarding changes in inventories of intermediate products. The value of intermediate products that are bought during the current period but are not yet used in the production process must be eliminated from the VAT expenditures. Contrary, the value of intermediate products that are used in the production process but bought in an earlier period must be added to the VAT expenditures. This is done by the same complimentary survey as described in the earlier section.