Measuring Gross Value Added in constant prices

Effects of double deflation

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Content

1. Introduction

In last year's paper presented to the Voorburg Group, I introduced a significant methodological advancement in Sweden's short-term economic statistics: the ability to measure both gross output and intermediate consumption on a quarterly basis. This development enables us to observe gross value added (GVA) directly, rather than relying on assumptions about input-output ratios. As GVA in volume terms—i.e., at constant prices—is the key target variable when analyzing economic growth, this shift represents a major step forward in capturing real economic dynamics.

Building on that foundation, this paper focuses on the methodological framework required to estimate GVA in volume terms. Since both output and input are now measured independently, each must be deflated separately using appropriate price indices—a process known as double deflation. This approach allows us to isolate real changes in production and consumption from nominal price effects, thereby improving the accuracy of short-term growth estimates and the identification of turning points in the business cycle.

The focus of the Voorburg Group is to develop concepts, methods, and best practices in the area of services. In line with this mission, this work contributes to the refinement of volume measurement in service-producing industries, where price dynamics and cost structures often differ significantly from those in goods-producing sectors. In particular, I address the challenges of constructing industry-specific deflators by linking product-level price indices classified according to SPIN (Swedish Product Classification by Industry) with industry classifications based on SNI (Swedish Standard industrial Classification).

This paper will outline the methodological process—from price index aggregation and weighting to the construction of output and input deflators. Additionally, I will present Statistics Sweden's approach to quality assurance and provide insights into how we analyze price effects on value measures. These components are essential for ensuring that the resulting volume estimates are both reliable and analytically meaningful.

2. Gross value added

2.1 Gross production and intermediate consumption

Economic growth is typically defined as the rate of change in a country's Gross Domestic Product (GDP), which measures the monetary value of all final goods and services produced within an economy. By comparing short-term GDP growth to a calculated long-term sustainable growth rate, it is possible to determine the position of the economy within the business cycle. If the economy is growing faster than the sustainable rate, it indicates an expansionary phase, and vice versa.

Historically, Statistics Sweden has only been able to fully compile quarterly GDP using the expenditure approach. With the development of the new statistic on gross output and intermediate consumption, it is now possible to directly calculate quarterly GDP using the production approach as well. In the production approach, the key variable is Gross Value Added (GVA), which represents the value created

in the production process. GVA is calculated as the value of output minus the value of intermediate consumption—i.e., the goods and services used up in the production process.

Prior to the development of this new statistic, only output was measured, and intermediate consumption was assumed to follow the same growth pattern. This meant that changes in output were used as a proxy for changes in GVA, effectively assuming a constant input/output ratio. In practice, this implied that the cost of intermediate goods and services was fully adaptable to changes in production.

Empirical studies conducted by Statistics Sweden show that this assumption holds reasonably well during periods of economic stability. However, it breaks down during periods of rapid change—so-called turning points in economic activity. Since GVA is relatively small compared to total output, even minor discrepancies between the growth rates of output and intermediate consumption can significantly affect GVA. For example, under the assumption of a fixed input/output ratio, GDP might appear to grow by 3 percent, whereas actual measurements of both output and intermediate consumption show that GVA remains unchanged.

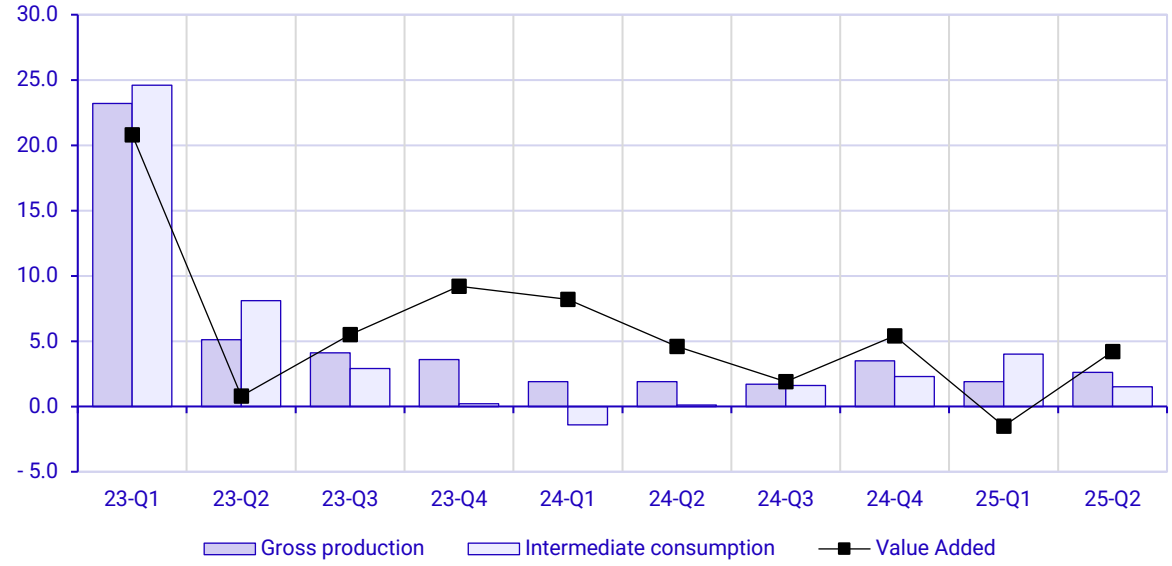
The assumption of a constant input/output ratio is particularly weak when the cost structure includes a high proportion of fixed costs. In such cases, rapid changes in output are not matched by proportional changes in costs, leading to exaggerated movements in GVA. Statistics Sweden's studies indicate that fixed costs account for more than 40 percent of the private sector's cost base—approximately 30 percent for goods producers and nearly 60 percent for service producers.
In summary, accurately measuring both output and intermediate consumption on a quarterly basis is crucial for identifying turning points in the economy. The new framework enables this and thereby serves as a vital tool for economic analysis and policy formulation.

2.3 Value and volume estimates

The changing input share described in the section above reflects the value-based development of what has been produced versus what has been consumed. While such changes in value naturally affect firms' profitability, they do not necessarily imply that the actual production volume or the volume of consumed goods has changed. In other words, the shift in the input share may be purely a price effect.

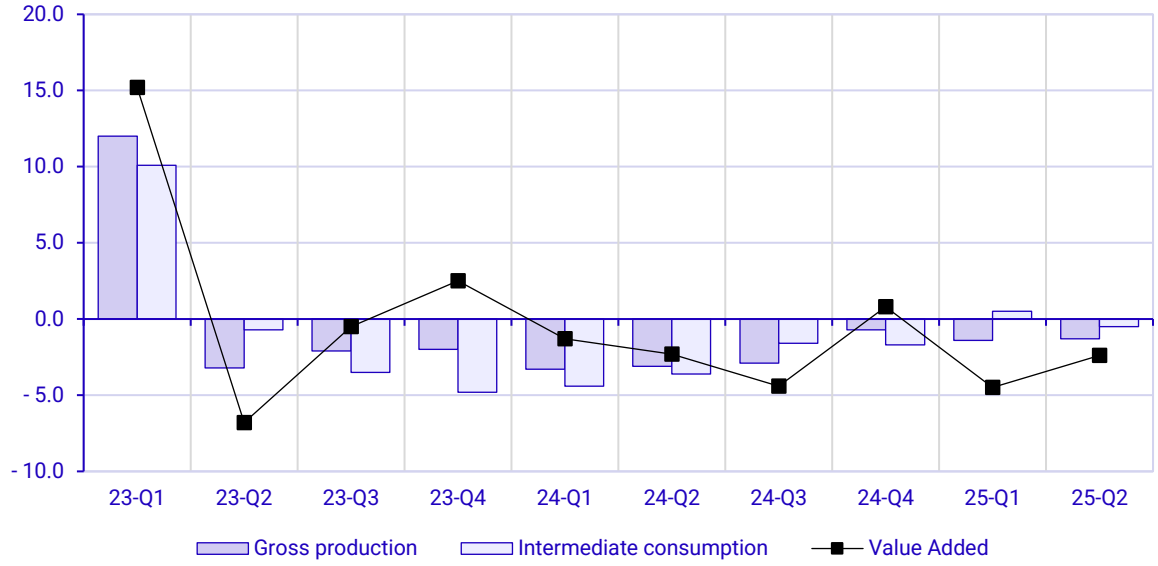
To obtain a broader and more accurate picture of cyclical developments, it is necessary to estimate the impact of price changes on the goods and services that have been produced and consumed. By doing so, the values of output and intermediate consumption can be adjusted for price movements, thereby revealing the underlying volume changes. For example, an incline in production measured at current prices may be entirely explained by rising sales prices, which in practice would be consistent with an unchanged production volume.

Value estimates
Production, Intermediate consumption and Value added, yearly percentage change, current prices



Source: Quarterly economic statistics, Statistics Sweden

Volume estimates
Production, Intermediate consumption and Value added, yearly percentage change, constant prices



Source: Quarterly economic statistics, Statistics Sweden

The following section outlines the methodology employed by Statistics Sweden (SCB) to estimate gross output and intermediate consumption at constant prices, which ultimately results in a volume-based assessment of gross value added.

3. Measuring Gross value added in constant prices

3.1 Double deflation

In economic analysis, it is essential to distinguish between nominal and real changes. The real development of gross value added—i.e., volume growth—is the central variable when discussing economic growth. As demonstrated in previous examples, the evolution of what firms produce and what they consume as inputs may diverge. This divergence can be attributed to structural changes such as increasing or decreasing productivity, but in many cases, it is simply due to differences in the development of sales prices compared to the prices of input goods and services.

A method that enables systematic and reliable handling of this issue is double deflation, which involves deflating both the output and the input of the production process separately using relevant price indices. By adjusting both sides of the production equation for inflation or other price movements, it becomes possible to estimate real gross output and real intermediate consumption, and thereby observe the real gross value added as a residual.

3.2 Sectoral deflators

Double deflation places high demands on the availability of detailed and reliable price indices for both input and output. In addition, a precise matching between volume data and price data is required to avoid distortions. The final product—namely, the industry deflators—is categorized according to the sectors in which the calculations of output and input are performed.

In the process of constructing industry-specific deflators based on price indices, price data classified according to SPIN (Swedish Product Classification by Industry) are linked to industry classifications based on SNI (Swedish Standard industrial Classification). The process begins with the collection of price indices at the product level. With some exceptions, these indices are sourced from the Producer Price Index and the Price Index for Domestic Supply, depending on the type of good or service in question. Each price index is associated with a SPIN code, which enables a detailed breakdown of price developments at the product level.

Product prices
Example from NACE I55-56: Hotels and restaurants

Period	Product (NA)	Transaction	Source	Transaction
2025-Q2	I561_56291_563	Restaurants, staff canteens, and bars	Producer Price Index	Gross production
2025-Q2	I551	Hotel services	Producer Price Index	Gross production
2025-Q2	I552T559	Cabin villages, hostels, and camping	Producer Price Index	Gross production
2025-Q2	L68202T68209	Property rental and management	Price Index for Domestic Supply	Intermediate consumption
2025-Q2	N78	Staffing and other human resource services	Price Index for Domestic Supply	Intermediate consumption
2025-Q2	C1011	Prepared and treated meat	Price Index for Domestic Supply	Intermediate consumption
...	...	...	...	...

The next step involves linking the SPIN codes to their corresponding NACE codes. Since SPIN is product-based and NACE is industry-based, a classification key is required to map products to their

respective industries. This linkage is often complex, as multiple SPIN codes may correspond to a single NACE code and a single SPIN code may correspond to several NACE codes, necessitating aggregation. To construct a consolidated price index at the industry level, a multi-step weighting process is applied. In order to establish a common denominator between price indices and output/input data, the indices are aggregated to product groups used in the national accounts. These product groups often resemble SPIN classifications but are typically more aggregated.

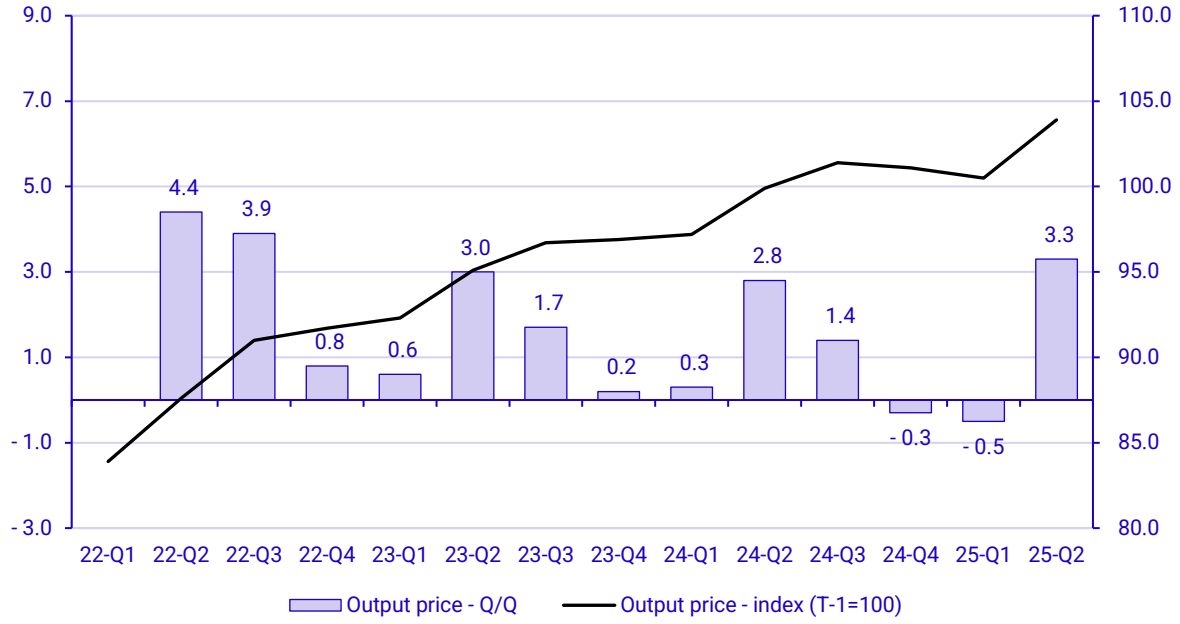
For each corresponding product group, weighting matrices are retrieved from the annual production and intermediate consumption estimates. These matrices indicate the share of each product within a given industry. In other words, one weighting matrix is linked to output, showing what has been produced, and another is linked to intermediate consumption, showing what has been used. These weights reflect the relative importance of each product within its respective industry and are crucial for ensuring that the resulting industry deflator is representative.

Product weight matrix for year T-2
Example from NACE I55-56: Hotels and restaurants

Period	Sector (NACE)	Product (SPIN)	Product name	Transaction
2023	I55-56	I561_56291_563	Restaurants, staff canteens, and bars	Gross production
2023	I55-56	I551	Hotel services	Gross production
2023	I55-56	I552T559	Cabin villages, hostels, and camping	Gross production
2023	I55-56	L68202T68209	Property rental and management	Intermediate consumption
2023	I55-56	N78	Staffing and other human resource services	Intermediate consumption
2023	I55-56	C1011	Prepared and treated meat	Intermediate consumption
...	...	...	...	...

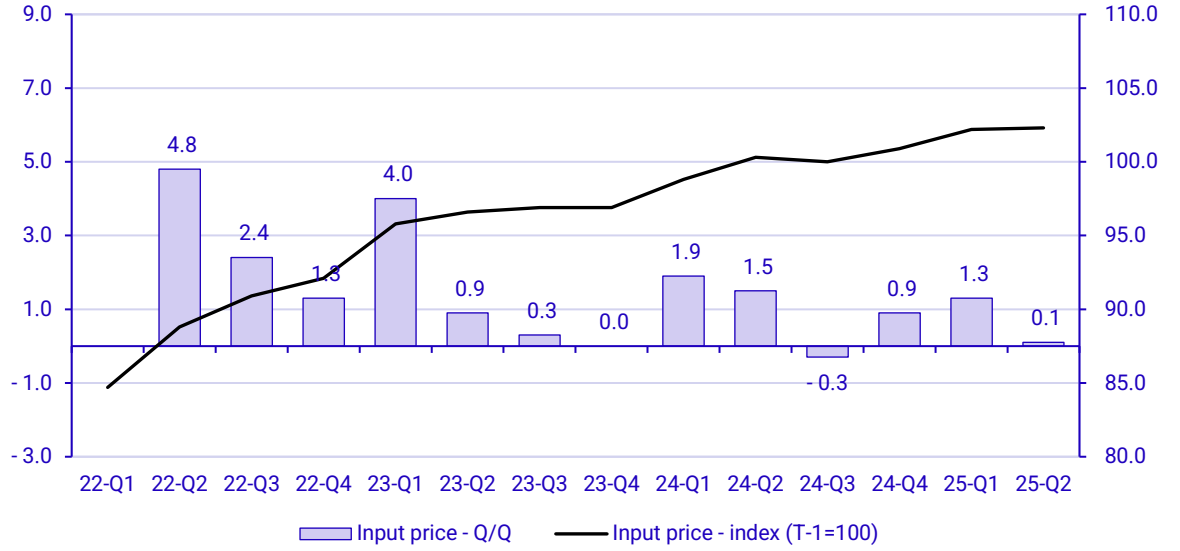
Finally, the weighted price indices are aggregated into two composite indices for each NACE industry: one output deflator and one input deflator. The result is a set of industry-specific deflators that can be used to convert nominal values into real values within each respective industry. This methodology enables a more accurate analysis of real economic developments.

Sectoral deflator for production
Example from NACE I55-56: Hotels and restaurants



Source: Quarterly economic statistics, Statistics Sweden

Sectoral deflator for intermediate consumption
Example from NACE I55-56: Hotels and restaurants



Source: Quarterly economic statistics, Statistics Sweden

3.3 General limitations

As previously noted, the weighting matrix is based on the most recent annual production and intermediate consumption estimates. Naturally, since these data are derived from annual financial statements, they are subject to a considerable time lag. The assumption that firms' production and intermediate consumption remain unchanged over time is, in certain periods, a weak assumption. This is particularly true during times of rapid economic change, when the relative importance of different products may shift—an effect that cannot be fully captured in quarterly statistics. As a result, this may lead to revisions when annual calculations are performed.

4. Quality assurance in the deflation process

Historically, the step from price indices to industry-specific deflators has represented a methodological grey area within Statistics Sweden's production system. The process has lacked a clear organizational ownership, resulting in insufficient documentation, limited knowledge transfer, and several production errors in recent years. This situation has made it difficult to conduct systematic analyses of price effects and to identify the drivers behind volume developments across industries. In particular, the absence of effective visualization tools has constrained the ability to understand how individual product prices influence sectoral deflators.

A key challenge has been the lack of structured collaboration between price statisticians and economists. This has hindered the development of robust workflows that integrate methodological expertise with domain-specific economic knowledge, which is essential for ensuring the quality of the deflation process.

4.1 A harmonized framework for deflation

To address these challenges, Statistics Sweden has initiated a project aimed at strengthening quality assurance in deflation-related work. The outcome is a harmonized framework encompassing training, documentation, and cross-departmental collaboration.

A central component is a training package designed for all staff involved in the deflation process—whether working in price statistics, structural business statistics, short-term indicators, foreign trade, or national accounts. The training aims to establish a shared understanding of the methodology and its application, thereby reducing the risk of incorrect assumptions or inconsistent data handling.

In addition to the training, a standardized template for work procedure descriptions and documentation has been developed, enabling a more transparent and reproducible process. Quarterly deflation meetings have also been introduced, bringing together representatives from relevant statistical domains to discuss methodological issues, review results, and identify areas for improvement.

4.2 Assessment and analysis of price effects

As part of efforts to improve analytical capabilities, Statistics Sweden has developed an interactive reporting tool in SAS Visual Analytics. The tool enables drill-down analysis from sectoral output and input series to the underlying price effects, and further to the specific product price indices contributing to the development. This provides analysts and statisticians with a powerful means of identifying and understanding price-driving factors within different industries, and of assessing the plausibility of volume estimates generated through the deflation process.

The tool will be demonstrated at this year's conference and represents an important step toward a more transparent and analytically robust handling of price data.