

# Voorburg Group on Services

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## **Services Producer Price Indexes in the Australian National Accounts**

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## **1. Introduction**

The System of National Accounts (SNA) provides an integrated framework that facilitates the analysis and understanding of economic activity within and between economies. In order to achieve coherence each unit, product and purpose is assigned a place within the classifications and accounts of the system.

We can see from this description of the SNA that the data required for national accounts should: cover the entire economy; be produced according to the integrated framework; and be coherent across the various data sources. This is as true of services producer price indexes as it is of all other data sources.

It has been well documented that changes in the economy such as the growth of service industries and 'intangible' products have led statistical agencies to improve their coverage of the services sector - recognising that historically statistical programs have been focused on the 'old economy' of mining, agriculture, and manufacturing at the cost of services statistics.

In addition to the changes in the economy there are growing demands for economic accounts statistics - including growth accounting and productivity analysis - which are reliant on volume estimates and hence require fit for purpose price indexes.

This paper will describe: why price indexes are required in the national accounts; the general ABS approach to deriving volume estimates; the requirements for services producer price indexes; and some key issues in the provision of price indexes.

## **2. Why do we need price indexes?**

*"The System provides a framework within which an integrated set of price and volume measures can be compiled which are conceptually consistent and analytically useful. The primary objective is not simply to provide comprehensive measures of changes in prices and volumes for the main aggregates of the System but to assemble a set of interdependent measures which make it possible to carry out systematic and detailed analyses of inflation and economic growth and fluctuations."*  
Paragraph 16.1, System of National Accounts 1993

All current price aggregates in the national accounts are estimates of the sums of the values of individual transactions. Each of these transactions has two components: a price and a volume. From one period to another the quantities and prices comprising the transactions change. This means that when the current price value of an aggregate, such as GDP, in one period is compared with the current price value in another period the difference between them usually reflects both changes in quantity and changes in the price of constituent transactions.

To understand 'real' changes in production, income and wealth we need to be able to separate the changes in volume from the changes in prices. To estimate by how much the volume of GDP has changed between the two periods we need to measure the value of GDP in each period using the same unit prices. Predominately it is price indexes which enable the national accounts to be measured across time in the same (constant) prices.

The ABS began producing annually reweighted Laspeyres chain volume estimates into the national accounts in 1998. Prior to this constant price estimates, reweighted on a five yearly basis, were calculated. Annual chain volume indexes link together

year-to-year volume movements in production and expenditure calculated using current period weights.

### **3. Approaches to deriving volume estimates**

Two basic approaches are taken to deriving volume estimates at the elemental level within the Australian National Accounts: the quantity revaluation approach and the price deflation approach. Price deflation is the preferred, and the most commonly used, method.

The key benefits of using the price deflation method is the specific attention which can be given to excluding, from the price index, changes in price that are attributable to quality change, ensuring that any quality changes that do occur are reflected as volume changes.

Where an appropriate price index is not available for a particular product, a suitable proxy price index or factor price indexes (which involve weighting together price indexes for inputs such as materials, labour and capital) may be utilised. Neither of these are preferred methods for deriving volumes. The proxy price index relies on the assumption that the price of the proxy will move the same as the price of the product being proxied. While the factor price index is based on an assumption of fixed proportions between inputs so that price change due to productivity or technological change is missed.

In some situations the quantity revaluation method is used to derive the volume estimates. Under the quantity revaluation method an estimate of quantity, at the product level, in each period is multiplied by the price (or average unit value) in some base year. The method can only be applied if the product is defined narrowly enough to ensure it is homogenous in content and free from quality change over time.

The ABS has a clear preference to use price indexes based on market prices to derive volume estimates. It is these indexes which most appropriately distinguish the price and volume components in GDP movements and contribute to the production of high quality national accounts statistics. Ideally these indexes would be available for all components of the accounts.

### **Supply-Use Tables**

Supply-Use tables provide the foundation of the Australian System of National Accounts. The tables are compiled on an annual basis and provide the benchmarks for the National Accounts. For each financial year three editions (the previous three years) of supply and use tables are compiled in both current prices and in the prices of the previous year.

The balance between supply and use for each product category ensures that the volume measure of GDP is the same whether it is derived by summing final expenditures and changes to inventories plus exports less imports (use) or by summing the gross value added of each industry and taxes less subsidies on products (supply). Concepts, definitions and accounting rules for supply and use tables are the same as in the rest of the system of national accounts.

The double-deflation method is used to develop volume estimates of production in the Supply-Use tables. This method involves deriving volume estimates for value added by subtracting a volume estimate of intermediate input from a volume estimate of output.

In general the chain volume expenditure estimates are derived by deflating the current price estimates using price indexes with the exception of exports for which most of the aggregate is derived by revaluing quantity data.

Deflation is carried out at the product level as defined by the ABS' Supply-Use Product Classification. This classification was derived from the Input-Output Product Classification and has been defined in terms of characteristic products of industries and to ensure a one-to-one relationship to COICOP. Deflating at this level, in conjunction with annual re-weighting, helps to appropriately reflect any impact compositional changes may have on the chain volume indexes.

### **Quarterly and Annual GDP**

On both a quarterly and annual basis the ABS produces GDP according to three approaches - production, expenditure and income. While all three approaches set out to measure the same concept (GDP) they utilise different data sources and methodologies to do so.

Both the production and expenditure measures of GDP are measured in both current and constant prices while the income measure of GDP is expressed only in current prices.

#### Volume Estimates in the Production Approach

The production approach (also known as the value added approach) uses the output of industries to estimate GDP as follows:

Gross output at basic prices  
less intermediate inputs at purchases prices  
equals gross value added at basic prices  
plus taxes on products  
less subsidies on products  
equals Gross Domestic Product (P)

As the gross value added of an industry is defined to be the difference between the value of output and the value of intermediate inputs it is desirable to use the double deflation method to derive volume estimated of value added. It is this method which is used for the annual estimates of production GDP. Wherever possible price indexes directly relating to the output and inputs are used but in many cases such price indexes are unavailable. Factor price indexes are often used that are largely based on input prices i.e. wage cost and material price indexes. Volume estimates of wholesale and retail margins are derived on the assumption that they have the same growth rate as the sales of products they relate to.

On a quarterly basis suitable data sources required for the double deflation method exist only for the agriculture industry. In all other industries benchmarks established in the Supply-Use Tables are extrapolated using output (or input) indicators depending on data availability. The assumption underlying this method is that, in volume terms, the ratio of intermediate input to output is stable. In order to minimise departures from this assumption series at as detailed a level as practicable are weighted together using the current price estimates of gross value added from the most recent supply and use tables.

## Volume estimates in the Expenditure Approach

The expenditure approach aggregates final uses to estimate GDP as follows:

GDP (E) equals  
final consumption expenditure  
plus gross fixed capital formation  
plus change in inventories  
plus exports  
less imports

Quarterly (and annual) chain volume estimates of GDP are compiled by summing volume estimates, expressed in the prices of the previous year, of final expenditures, changes in inventories and exports less imports. The resulting changes in volume estimates of GDP in the prices of the previous year are then chained.

Final consumption expenditure is separated into household and government final consumption. Volume estimates for the household component are predominantly derived using the price deflation method with the consumer price index the key source for deflation. The volume estimation of government final consumption is based on deflating inputs - the wages paid, and the goods and services provided - or quantity revaluation method where there are output indicators available (for example student numbers). The revaluing of inputs is undertaken using the labour price index (for wages) and producer price indexes (for intermediate consumption).

Gross fixed capital formation is deflated using a combination of producer price indexes (for example construction) and import price index (for example components of machinery and equipment). Deflators in purchaser price terms should ideally be used to deflate expenditure components, as these are not available for most of gross fixed capital formation basic prices are used instead.

In the case of machinery and equipment where there are unique goods which are not homogenous over time the ABS has developed models which allow the weights of the various import and producer price indexes to vary over time. The model uses data for product imports and for products manufactured in Australia to estimate the composition of expenditures on equipment.

The calculation of volume estimates for inventories relies on a number of assumptions which are required to account for the changes in the book value of the inventories i.e. holding gains or losses. Farm inventories are quantity revalued while non-farm inventories are revalued using import and producer price indexes.

Most exports of goods are quantity revalued using customs data, volume estimates for the balance are derived using export price indexes. Volume estimates of exports of services are derived using a range of price indexes, including the consumer price index. The bulk of the volume estimates of imports of goods and services are obtained by price deflation (using components of the import price index and some indexes from other countries).

Table 1: Summary of expenditure deflation methodologies

	CPI	PPI	LPI	XMPI	Quantity Revaluation
Household Consumption	X				
Government Consumption		X	X		X
Capital Formation		X		X	
Inventories		X		X	X
Exports	X			X	X
Imports				X	

### **3. The role of services PPIs**

Section two explained how producer price indexes are used throughout the accounts, including both the expenditure and production accounts as well as within the supply-use accounts, in order to produce volume estimates.

The table below shows the contribution of each industry to the Australian economy in terms of gross value added, demonstrating the importance of the services industries to the economy.

Table 2: Percentage of gross value added at basic prices

	Jun.2006
Agriculture, forestry and fishing	3.1
Mining	7.5
Manufacturing	11.0
Electricity, gas and water supply	2.5
Construction	7.0
Wholesale trade	5.1
Retail trade	6.2
Accommodation, cafes and restaurants	2.2
Transport and storage	4.9
Communication services	2.6
Finance and insurance	7.8
Property and business services(a)	12.4
Government administration and defence	4.2
Education	4.7
Health and community services	6.7
Cultural and recreational services	1.6
Personal and other services	2.0
Ownership of dwellings	8.5
Gross value added at basic prices	100.0

In the 1990s the ABS engaged in a process of developing services producer price indexes during which time indexes for the Transport and Storage and Property and Business Services industries were established. These industries are of a significance size and importance to the economy, and as such implementation of the price indexes into the accounts significantly increased the quality of national accounts volume estimates.



This being said the biggest gains to be made in improving the quality of national accounts volume estimates still remain in the domain of services producer price indexes. From a national accounts perspective these gains can best be made in the development of price series for:

- Finance and insurance services
- Retail and wholesale trade
- International trade in services; and
- Intangible products, particularly software.

It may be noted that significant industries such as health and education have not been raised as one of the priority areas for the development of price indexes. In Australia, as in many other countries, these industries are dominated by non-market activity of Government and NPISH. As non-market producers, by definition, do not charge economically significant prices, price index deflation is not considered to be a feasible way to calculate volume estimates. Instead the focus is on developing direct volume measures.

### Finance and Insurance Services

Currently deflators for financial services are constructed within the national accounts utilising data collected from ABS financial surveys and administrative data. These deflators are not an ideal data source as we have no way of controlling for the impact of quality and compositional change. Concerns about the quality of the deflators are a concern in the measurement and analysis of the output and productivity of this fast changing industry.

The ABS has introduced estimates for financial services into the CPI, while these series are being evaluated for use in the National Accounts it is likely that scope and coverage issues will limit its usefulness. The nature of the finance and insurance industry mean that it, more than most, requires a set of coherent estimates covering the entire economy. Given the nature of Financial Intermediation Services Indirectly Measured (FISIM) and the treatment of owner-occupied dwellings in the accounts there are a number of issues to be resolved before the CPI index, covering loans and deposits for households, could be introduced.

The onus currently sits with national accounts to describe a supply and use framework of financial services in current price and volume terms covering all sectors. Once that is in place we will be able to identify the major gaps in data and work with Prices to develop the appropriate price series. Among other issues national accounts branch needs to consider- is it sensible to deflate FISIM as a separate product or should we aggregate to a component including direct fees and charges before attempting to deflate?

Insurance services provide one of the most difficult areas in which to conceptual the volume and price components of a service. For a service which is fundamentally about risk management is a change in insurance premiums, caused by a change in risk factors, a price or volume change? Further thought, by both national accounts and prices, needs to be put into the issue of defining the volume and price elements of for insurance services prior to the development of a price index suitable for deflation of national accounts.

## Retail and Wholesale

Since price indexes for retail and wholesale margins are not yet available the current price estimates for these industries in the national accounts are currently deflated using a sample of the prices of the retailed products themselves. This practice relies on the assumption that the trade margin will move in line with the basic price of the product being traded. In reality this assumption will fail unless the retailer (wholesaler) sets their margin as a fixed percentage of the price of the product.

Consequently the lack of an appropriate price index for trade margins has a detrimental effect on the quality of the volume estimates for these industries. The question over the quality of volume estimates flows through to the development, and analysis, of productivity estimates for these industries. This is of particular concern as the deregulation of the Australian economy over the past two decades has seen significant changes which would be expected to impact of the output and productivity of retail and wholesale industries.

The ABS Prices Branch has recently developed experimental series for retail margins on a limited number of products. National accounts supports this initiative and is eager to see the scope of work expand to cover more of the retail sector and wholesale. Pricing of trade margin services throws up some specific issues on which national accounts and prices need to collaborate to ensure appropriate indexes are developed. These include the valuation of cost of goods sold, and defining the nature and quantum of the output of the retail (wholesale) service.

## International Trade in Services

The ABS export and import price indexes cover only the goods component of international trade. To deflate services of imports and exports components in the accounts proxy price indexes are used, these include price indexes produced by statistical agencies in other countries.

Focus on international trade in services is increasing with interest in the nature and impact of globalisation, the analysis of free trade agreements, and study of labour mobility amongst other issues. These types of analysis require statistics on both the price and volume components of international trade.

While it is acknowledged that there are additional issues (mainly collection in nature) with developing import price indexes covering services, the development of export price indexes should simply be a subset of output producer price indexes. National accounts would encourage consideration being given to developing indexes for international trade in services in conjunction with the development of producer price indexes for services.

It is worth noting that the weakness in the data on international trade in services is not restricted to price indexes. Due to the availability of customs data the goods component of international trade activity is also better supported than that of services.

## Intangible Assets



The size of expenditure in intangibles assets such as software and databases is increasing dramatically. In the absence of fit for purpose price indexes statistical offices in different countries have adopted varying methodologies for deflating this expenditure, studies have demonstrated that the use of the various deflators has a material impact on GDP.

At the same time the SNA asset boundary is increasing to recognise more intangible assets for which deflators will be required. With the upcoming revision to SNA93 research and development expenditure will be recognised as an asset.

When expenditure on products moves from being classified as intermediate consumption to capital formation the focus on volume estimates and hence the requirement for fit for purpose price indexes (controlling for changes in quality) increases. It would be reasonable to expect the recognition of intangible assets in the SNA will continue to expand, and hence the requirement for price indexes covering these products will increase.

#### **4. The 'nature' of the price indexes required**

National accounts requirements for price indexes stem from the need to 'disentangle' price and volume components within the accounts, and to have data which are coherent and integrated within the system of national accounts framework. These requirements go to the attributes of the price indexes which are desirable in the national accounts context.

#### **Consistency and coherency of data**

To produce a consistent and coherent set of accounts it is necessary for the various source data to be consistent and coherent. This can be best achieved through the use of a consistent set of concepts, units and classifications through all source data collections.

#### Conceptual Framework

As with most countries the Australian National Accounts are based on the System of National Accounts 1993. This system sets out a framework of measuring and analysis activity across the entire economy. All source data flowing into the national accounts, including price indexes, would ideally be based on this conceptual framework.

It is recognised that different purposes and user needs can lead to varying data requirements (i.e. inflation measurement versus deflation of national accounts). However it is felt that these needs can be met through different aggregation methods while maintaining the consistent conceptual basis.

The recent development of the Producer Price Index Manual with its emphasis on national accounts concepts and the SNA has been appreciated as an appropriate direction in ensuring consistency.

#### Units

It is important for the various source collections providing data to the national accounts to derive their sample from a common population with commonly agreed unit rules. This is best achieved through the use of a single frame, covering the target population, across all collections. The issue becomes particularly important when considering secondary production where it is important that any significant secondary production is identified and separate unit established for that production and surveyed consistently throughout economic collections as such.

The ABS is in the fortunate position of having the overwhelming majority of data sourced from internally run collections. This means that we are in a position to ensure most collections are run from a single consistent population and that we can work collectively on unit issues including unit splitting. Unfortunately data collection for price indexes is not as strongly tied to the frame as other economic collections, a situation which may lead to consistency issues.

### Classifications

A common set of classifications is also necessary in ensuring consistency and coherency. The ABS has invested a significant amount of resource into the industry classification which is used consistently through all ABS. However the classification of products has not received such attention and as a result there is not the same level of consistency for product classifications in ABS and economic accounts.

Achieving consistency of product classification across price indexes, activity surveys, and national accounts would be a valuable outcome, and one which national accounts is keen on exploring.

### **Pure Price Indexes - Quality Adjustment**

A change in the quality of a product is a change in volume. To accurately separate price and volume components within the accounts price indexes, adjusted to account for quality change, are required. While this is well recognised there remain sizeable challenges to overcome. Two issues will be highlighted from a national accounts perspective here – defining the volume quantum and the consistency of quality adjustment.

#### Defining the volume element

Relative to goods, where a change in volume is typically physically embodied, it is more difficult to identify changes of volume in services, where changes in volume are not physically embodied. This is particularly true of quality changes in a service product.

For example how do we define the volume output of a retailer? Is it simply the number, or value, of transactions they facilitate? Or do we expand the definition to include length of opening hours, level of service provided etc? These are not just questions for price statisticians to consider in isolation. They get to the heart of studies of productivity (particularly at the industry level) and the analysis of the impact of changes in industry regulation and policy for example.

It is our view that more effort needs to be put into defining the nature of the volume of services output, particularly in industries such as trade and financial services. And that this effort needs to be a collaborative process between the producers of price indexes, activity data and national accounts.

### Consistency of quality adjustment

To calculate appropriate price and volume measures within the National Accounts we need to isolate the change in the price of an item which is due to any change in quality. However as this price is 'bundled' with the price of the product common to both periods it is typically not possible to directly collect the price of the quality (volume) change. Various techniques have been developed to produce pure price indexes and enable price and volume components to be isolated.

International prices manuals recommend different methodology for estimating the change in price due to the change in quality depending on the type of price index being calculated. Price indexes are calculated under a set of restrictive assumptions on economic behaviour which 'fix' demand or supply depending on the index being produced. These assumptions in turn determine the recommended quality change methodology:

An index such as the PPI output index is based on economic theory of a producer who is assumed to be a revenue maximiser operating with fixed technology and fixed inputs. These assumptions constrain the producers supply curve and lead to the resource cost approach being commonly used and recommended by international manuals - this approach values the quality change at the price it costs the producer to provide.

An index such as the CPI is based on assumptions of a utility maximiser with fixed tastes and fixed budget. These assumptions constrain the consumers demand curve and lead to the user value approach being commonly used and recommended - this approach values the quality change at the consumer's perceived value of the quality change.

For example in a case where an updated model of motor vehicle - now with airbags - is released to the market, a common practice may be to value the airbag at resource cost (say \$500) for the PPI output index and at user value (say \$1500) for the CPI. All other things being equal (laying aside the issue of taxes and margins) this means that the two indexes will show a different price change for the same product.

Within the system of national accounts the volume of supply (or production) is generally calculated using output indexes while the volume of use (or expenditure) is generally calculated using input indexes. Different estimates of the same quality change will lead to an imbalance between supply and use volumes.

The key weakness of both the resource cost and user value approach is that they seek to establish a price under a set of restrictive assumptions that considers the behaviour of only one of the economic agents (the producer or consumer) and ignores the other party in the transaction. As such neither approach seeks to measure the market price which forms the basis of measurement in the SNA.

The reality is that for a transaction to occur the two agents must come to common agreement on the price for an item - the market price. Logically the two quality adjustment methods (resource cost and user value) can be seen to provide estimates which form the outer bounds for the 'market price' of the quality change - the user value as the maximum purchaser is prepared to pay for the quality change and the

resource cost approach as the minimum price the producer requires to provide the change.

If we are to produce a consistent and coherent set of accounts a single transaction of a product can not involve two different volumes transacted dependant on whether one takes a producer or consumer perspective - there must be a common agreement on the transaction for it to take place.

## **5. Conclusion**

This paper has explained the need for price indexes in order to separate transactions into their price and volume components in order to provide 'real' measures of change. That producer price indexes at the product level and covering the entire economy are needed for both the expenditure and production measures of GDP as well as in the supply and use tables.

It has been acknowledged that, while there has been an expansion in the availability of indexes covering services, this remains the domain in which the most significant gains in the quality of volume estimates could be obtained. Particularly in the provision of indexes for trade margins, financial services, international trade in services, and intangible assets. In order to support appropriate quality adjustment, further collaborative work needs to be undertaken to define the volume and price elements of the output of service indexes.

Finally it was established that the key requirements for price indexes is that they are consistent in terms of underlying concepts, frame, and classification with other data sources, particularly the activity data which is to be deflated. And that price indexes should also be coherent across economic accounts, specifically indexes measuring price change from different perspectives should provide a coherent view of any set of transactions.