Inflation Measurement in the UK

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Abstract: Headline inflation measures are conventionally based on consumer price index numbers. The UK has been developing a wider inflation measure that extends beyond just consumers expenditure to encompass final expenditure by all UK residents: consumers, businesses and government. This paper gives a progress report on the construction of this measure, based on the components of Total Domestic Expenditure, and also examines the conceptual and practical issues surrounding the possible construction of an additional wider inflation measure based on GDP.

1. Introduction

It is a common international convention to base headline inflation measures on CPIs relating to consumer price inflation. In the UK, the main measure of consumer price inflation is the Retail Prices Index (RPI), which measures price changes of a fixed basket of goods and services representing purchases by "index" households. It is timely (published within a month), has no revisions and excludes compositional change. There has been concern that its coverage is limited to consumers expenditure - which represents less than sixty per cent of final domestic expenditure and that its use for a multitude of purposes is an unattainable goal. Other measures are increasingly used in inflation measurement.

The Producer Price Index (PPI) measures changes in prices charged to UK customers by UK producers of manufactured goods. Like the RPI, it is timely and excludes compositional change, but it is subject to revisions (of up to five months) and its coverage is largely confined to the manufacturing sector - which represents only twenty per cent of output.

By-products of the national accounts system which are not designed specifically to measure inflation are also used as inflation indicators. These include the Gross Domestic Product (GDP) deflator, which is determined by dividing GDP at current prices by GDP at constant prices. The year-on-year change in the GDP deflator provides an estimated measure of inflation generated within the UK economy. It has economy-wide coverage but it is available only quarterly, is subject to compositional change, and also to revisions (typically over longer periods than the PPIs).

Total Domestic Expenditure (TDE) is another relevant national accounts aggregate. Unlike GDP it includes imports but excludes exports. The TDE deflator is derived by dividing TDE at current prices by TDE at constant prices. The TDE deflator can be thought of as a measure of inflation as it affects consumption expenditure by UK residents. However, as with all implied deflators derived from national accounts aggregates, it is subject to compositional change and to revisions.

[1] **This paper is a personal note by the authors and does not represent an official statement by the ONS.**

2. Wider inflation

A paper presented to the Ottawa Group in November 1995[2] described the development of wider inflation measures in the UK. This project was in response to users who had suggested that a more general price index would be a better measure of wider inflation than the RPI, which was limited to consumer items. Following extensive consultations, the ONS concluded that users were looking for an inflation measure which would cover the economy more widely than existing indices; be published monthly and be timely; be subject to minimal revisions only; exclude compositional change; and reflect directly measured prices.

The new index is called the Final Expenditure Prices Index (FEPI) and is based on the components of the national accounts concept of Total Domestic Expenditure (TDE) (excluding changes in stocks). The index reflects final purchases by UK residents (households, businesses and government). It has three components:

- the Index of Consumer Prices;
- the Index of Investment Prices (plant and machinery, vehicles, new buildings & works);
- the Index of Government Prices.

Like the RPI, the index is designed as an annually chain-linked Laspeyres-type index with the weights revised each January (although pseudo-chaining has to be used for PPI-based components in the short term).

The new index will be used in macro-economic analysis and in developing a greater understanding of the inflation process. It might also be of use to H.M.Treasury in public expenditure planning; whilst in the business sector it could be used as a "deflator" to convert *nominal* profits to *real* profits, in the index-linking of contracts and in the regulation of privatised utilities.

The new index, which has now been constructed back to 1992, is *additional* to existing indicators such as the Retail Prices Index (RPI), the RPI less mortgage interest and indirect taxes (RPIX), and the Producer Price Index (PPI). Users have stressed that they value the continuity and consistency of the RPI, and that they would not like to see its prominence diminished.

Although the new index has yet to be published, the development of the index itself has resulted in a number of benefits for ONS:

- useful inputs into national accounts balancing and improved deflators for national accounts;
- reconciliation across ONS of the methodology for imputing import prices;
- recognition of the usefulness of the TDE deflator as a measure of wider inflation;
- specific plans to introduce direct collection of import prices of capital goods;
- development of price indices for areas of consumers expenditure not previously covered;
- a new project dedicated to the development of public sector productivity measures.

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[2] **UK RPI: A Cost of Living Index or an Inflation Indicator, Marta F.Haworth, International Working Group on Price Indices, Stockholm, November 1995.**

The nature of an indicator with such wide coverage as the FEPI is that it draws on a range of different price indices. Such input price series are not always consistent in a number of respects. The problem with the time lag in the construction output price indices is described in paragraph 3.

There are also practical problems arising from earnings indices methodology incorporating smoothing and forecasting.

A few issues remain unresolved, and these are described below. Nevertheless, the ONS hopes to start publishing the new series as an experimental index during 1997. During its period of publication as an experimental index, further work will be carried out in the areas outlined below. In addition we expect useful feedback from users. The improvements in methodology and any adjustments in response to user feedback would then be incorporated into a new re-launched FEPI in January 1999.

3. Future developments

3a. Time lags

There is a time lag of 4 to 5 months in the construction output prices becoming available. The extent of the delay is because of the time it takes to collate and process information for the construction industry. Although the use of imputed prices in an index of this type is controversial, a pragmatic solution might have to involve some use of imputed price indices for the most recent months. These would be revised as and when improved estimates (and eventually a final figure) emerged.

3b. Revisions policy

Because some of the underlying indices that feed into the FEPI are subject to revision, some revisions to the FEPI itself continue to be inevitable. However, the FEPI revisions policy is not to allow extensive revisions to the FEPI series and the aim is to restrict revisions to no more than the past six months.

3c. Revisions to the FEPI structure

The revisions policy also has to address the weights used in the index, the structure of national accounts on which the index is based, and possible changes in underlying national accounts methodology. The rule for revisions in these instances is that the published FEPI series will be calculated according to the methodology and the classification considered appropriate at the time. If, subsequently, a change in methodology or structure is implemented, such a change will affect the index only from that moment on. Earlier figures will not be re-calculated to reflect the new methodology or structure - even if national accounts figures are retrospectively revised.

The structure of FEPI is adjusted, once a year, to reflect any changes that have been made to the structure of consumers expenditure, investment expenditure or government expenditure. For example, when the national accounts are re-structured to conform with the new European System of Accounts (ESA95) in 1998, significant changes will occur to some of the series. The largest will be for capital formation where a range of new asset types will be introduced into the accounts. When the new system is implemented, revisions to national accounts in all years will be made. Simultaneously the national accounts will be re-based to 1995. It could be argued that, for consistency, the entire FEPI series from January 1992 should also be re-calculated in line with the new ESA structure. However, one of the merits of the new index is that, as an operational index, it is subject to minimum revisions only. Clearly a re-calculation of FEPI back to January 1992 could lead to extensive revisions to the entire series. Subject to user views, therefore, the structure of FEPI may simply be revised to reflect the new ESA system as from the year following the first publication of the national accounts using the new ESA system, i.e. from January 1999.

3d. Chaining the PPIs

The FEPI is in principle a chain-linked index whereby all component indices are re-set to 100 each January and the indices for the following 12 months determined by combining together the new (Jan=100) index series using an updated set of weights. The UK RPI is an annually chain-linked index. The PPI series, however, is currently re-based every five years. At present, it is calculated with 1990 as its base period. Consequently the PPIs that feed into the FEPI calculation have to be amended so that they appear to have been re-set to 100 each January. This process is referred to as "pseudo-chaining". The plan is for the PPI to move to annual chain-linking within the next few years. This would ensure complete consistency with the underlying FEPI methodology.

3e. Import adjustment factors

At present, prices of imported capital goods are not directly collected. Instead, the equivalent PPIs for domestically-produced capital goods are monitored and adjusted by applying an "import adjustment factor". This factor is calculated monthly as a ratio of the import price indices (for those goods that are directly priced) divided by the domestic PPIs for the same goods. This approach is consistent with the methodology used for the Unit Value Indices for imports and exports. Direct price collection for imported capital goods is also now planned for implementation by 2002.

3f. Productivity

No measure of productivity change has yet been developed for the public sector in the UK. Consequently the Index of Government Prices is not adjusted for such changes. It is generally acknowledged, however, that such an adjustment should be applied to changes in government prices. Without it, the Index of Government Prices is seen as suffering from serious limitations.

To illustrate the need for such an adjustment, consider a situation whereby government pays 2 per cent more to its civil servants than it did a year ago. If civil servants are more productive this year than last year then an appropriate "quality-adjustment" needs to be made to reflect the fact that government is now getting more for every £102 it spends on salaries this year than it did for every £100 it spent last year.

A number of UK departments and agencies already have established performance measures of productivity, but the assumptions and methodology underlying the calculation of these measures is not always consistent. If similar measures can be established across agencies and departments, all like measures can be combined to create a single measure of government-wide productivity change. A new project has been established to take this work forward. If successful, then an estimate of government productivity will be applied to the Index of Government Prices. In addition a parallel adjustment would be made to the contribution from Government Expenditure to GDP. At present, the contribution from government to GDP is based solely on the total costs incurred by government, namely pay and procurement.

3g. GDP price index: an alternative measure of general inflation?

Having completed the construction of the Final Expenditure Prices Index (FEPI), the ONS is now responding to H.M. Treasury's request for an improved GDP inflation measure for use in public expenditure planning. At present the GDP deflator is used, but H.M.Treasury have asked ONS to investigate the feasibility of developing a "GDP price index" that is monthly, timely and subject to fewer revisions than the GDP deflator.

ONS has prepared a discussion paper which addresses the conceptual and practical aspects of constructing a GDP price index using each of the three standard approaches to estimating GDP: expenditure, output and income. An earlier version of this has been circulated within the ONS and the version at Annex A reflects some of these views. External advice has also been sought from Professor W. Erwin Diewert and further consultations are planned over the coming months.

Professor Diewert commented that a GDP price index cannot be recommended as a general measure of inflation as highly as an index based on consumers expenditure, investment expenditure and government expenditure (with imports implicitly included, i.e. not netted off) [3]. This is precisely the structure used for the FEPI. He also asked whether there is any conceptual justification in compiling a GDP price index and, if so, whether it can possibly be defined and calculated and what would be the interest in such a measure. Defining the set of transactions to which a price index would relate is difficult because GDP is essentially a difference in values. A further practical problem is presented by the paucity of information on prices of intermediate inputs, particularly for services.

[3] **Seasonal Commodities, High Inflation and Index Number Theory, W.Erwin Diewert, Discussion Paper No.DP96-06, Department of Economics, University of British Columbia, pp 29-31**

4. Conclusion

The Group is invited to comment on the needs for experience of wider inflation measurement and on the feasibility of going beyond the total domestic expenditure - based approach developed in the UK so far. Specifically, the following questions might be considered by the group:

1. Is a GDP-type index desirable and feasible?

2. Is it possible to develop an approach based on keeping "baskets" of inputs and outputs fixed when a netting concept is used?

3. What might be the conceptual and practical issues involved?

4. What would be the appropriate uses for such an index?

Annex A: Development of a GDP Price Index: a discussion paper

1. Price Indices

The ONS publishes two mainstream sets of price indices: the Retail Prices Index and the Producer Prices Index. Both the RPI and PPI are base-weighted. They differ, however, in that the weights for the PPI series remain unchanged throughout the life of the index whilst for the RPI series (and the new FEPI series) the weights are revised annually, giving rise to "chain-linked" indices. In fact, even the PPI series is effectively chain-linked; but whereas chain-linking of the RPI (and FEPI) is carried out every year, PPI chain-linking takes place only at re-basing e.g. every five years or so - though there are plans to move to annual chain-linking in 1999.

The fixing of the weights and the subsequent monitoring of price change only distinguishes pure price indices such as the RPI and PPI from the national accounts deflators, where movements in the deflator can occur because of compositional change as well as price change.
An important consideration in basing a price index on the structure of GDP is that some elements of GDP are imputed. Since a price index designed to measure inflation should relate only to real transactions, imputed items should be omitted.

2. Gross Domestic Product

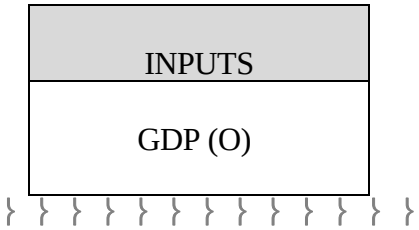
GDP (also known as "value added") is measured in three different ways: by Expenditure; by Output; and by Income.

With three alternative approaches available, one might reasonably expect at least one approach to provide a suitable basis for a GDP price index. Unfortunately, as the following (simplified) definitions show, whichever of the three approaches is chosen, something has to be netted off: imports (using the Expenditure approach); intermediate inputs (using the Output approach); and business expenditure (using the Income approach). Such netting off can lead to conceptual and practical difficulties.

- GDP(E) = Total Final Expenditure less Imports

Note that the national accounts definition of GDP(E) includes the value of changes in stocks and work-in-progress. Transactions elsewhere in the economy may have led to the changes in stocks but the changes themselves cannot be associated directly with transactions.

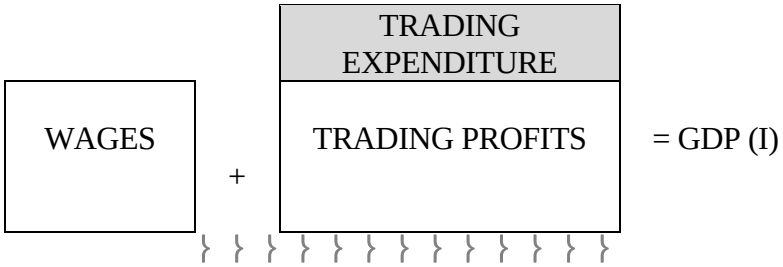
- GDP(O) = Gross Output less Intermediate Inputs



GROSS OUTPUT

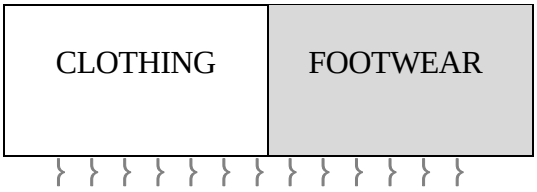
Note that whilst this, in theory, represents the derivation of GDP(O) - in practice changes in GDP(O) are measured using gross output only, the assumption being that the quantity of inputs required to produce one unit of output remains constant - at least in the short term.

- GDP(I) = Wages plus Trading Profits



GROSS TRADING INCOME

The "netting off" itself does not preclude each of the above approaches from being used as a basis for a price index. For instance, if we had an index for *Clothing & Footwear* and a separate index for *Footwear*, then - since the two components *Clothing* and *Footwear* are independent - an index for *Clothing* could easily be derived by netting off *Footwear* from *Clothing & Footwear*.



CLOTHING & FOOTWEAR

What prevents similar progress in the case of GDP is that, for all three approaches, the shaded components and the unshaded components are not independent i.e. for all three approaches, the shaded components (imports, inputs, business expenditure respectively) contribute in part to the whole. For instance, each element of "Total Final Expenditure" will reflect, to varying degrees, the effect of imports. They cannot be separated, as can clothing and footwear. Similarly each element of *Gross Output* will be affected by the impact of *Input Costs* and each element of *Trading Profit* will be affected by the impact of business expenditure.

3. Detailed examination of the structure of GDP

3.1 GDP(I) GDP(I) equals:

income from employment
plus income from self-employment
plus trading profits
plus rent
plus imputed charge for capital consumption
less stock appreciation

Conceptual considerations apart, this is unlikely to be a feasible basis for a GDP price index because there are no price indicators for "income from self-employment". Moreover, since gross trading profits cannot be factored into separate price and volume components, a price index for trading profits cannot be constructed.

3.2 GDP(E) GDP(E) equals:

total domestic expenditure
plus exports
less imports

Given that the FEPI is based on the main components of Total Domestic Expenditure (Consumers Expenditure, Investment Expenditure and Government Expenditure), and that GDP is just two steps away from Total Domestic Expenditure (exports have to be added and imports netted off) - this might appear to be the most obvious approach. However, for the reasons described above, it is not possible to construct a GDP(E) index by calculating the contributions to GDP by each component of final expenditure and then summing these contributions. This is because to do so, it would be necessary, for each component of final expenditure (and of exports), to know the values of the various imported goods and services that had contributed either directly or indirectly to final expenditure on that component item. Information at this level of detail is not available. Therefore the GDP(E) index is only feasible at the overall aggregate level because it is possible to add on an aggregate export price index to the FEPI, and then to net off an aggregate import price index.

3.3 GDP(O) GDP(O) equals:
gross output
less intermediate inputs

In the UK there are two published measures of GDP(O):

- the fully-balanced annual output measure at current prices, produced by input-output balancing approx. 18 months after the period to which it relates;

- the quarterly output estimate at constant prices, which assumes that in the short term gross to net ratios remain relatively constant.

In addition there is a quarterly current price estimate of output, used internally as an aid to balancing but not yet of publishable quality. This is based on the same simplifying assumption of constant gross to net output ratio as the quarterly constant price estimate.

Longer term developments include a constant price input-output framework and a quarterly input-output framework as a tool for balancing the quarterly accounts.

The view of some national accounts experts is that if the proposed index is to be based on GDP(O), it might suffer from the same problems as double-deflated value added i.e. be subject to measurement errors which are cumulative [see SNA 1993 section 16.68-16.69]. For that reason the SNA suggests a single indicator system as a more stable alternative. This may point to a simpler "GDP price index" which would effectively be a price index for gross output only, the implicit assumption being that movements in input prices are the same at the movements in output prices.

Nevertheless if input-output data of sufficient reliability were to become available, it should, in principle, provide the basis for a GDP(O) price index to be constructed. There remains a conceptual problem, discussed in the following section. There also some practical constraints such as the availability of only a limited range of service industries. This matter is being addressed and a more comprehensive range of service sector indices should be available by 1999.

4. Constructing a price index

To construct a base-weighted price index it is usually necessary to:
- define the components of the index;
- identify, for each component, an appropriate price indicator;
- determine the base period weights (expenditure on each component in the base period).

Most expenditure can be written in the form of: Price x Quantity. For instance, expenditure on beer = average price per litre x number of litres purchased.

As we have shown, however, value added cannot be expressed as "Price x Quantity". It is calculated simply as a residual (e.g. gross output less inputs, total final expenditure less imports, etc.) or, in the case of GDP(I), as the aggregation of several components - one of which, profits, is itself a residual, i.e. receipts less expenses.

Whilst it is certainly true that, for a specific time period t, the total value of intermediate inputs plus value added equals gross output, is this relationship also valid when the prices and quantities are for different periods? The theoretical derivation of the implied GDP deflator certainly makes this assumption:

In the UK the aggregate GDP implied deflator is derived as follows:

GDP deflator = GDP at current prices
GDP at constant prices

For the output approach this can be expanded into the following form:

$$\text{GDP(O) deflator} = \frac{\sum_{outputs} P_t Q_t - \sum_{inputs} P_t Q_t}{\sum_{outputs} P_0 Q_t - \sum_{inputs} P_0 Q_t}.$$

In the above expression it is the denominator, the estimate of GDP at constant prices, that is of interest. It is determined as the sum of the products of current quantity and base price (for each output of each industry) less the sum of the product of current quantity and base price for each industry's intermediate inputs.

Given this relationship, it may also be valid to assume that some other "measure" of GDP can be derived for base quantities valued at current prices? If such an assumption is valid, this "measure" can be interpreted as an approximation to a Laspeyres-type GDP price index.

For instance, a GDP(O) "price index" could be defined as follows:

$$I^o = \frac{\sum_{outputs} P_t Q_o - \sum_{inputs} P_t Q_o}{\sum_{outputs} P_o Q_o - \sum_{inputs} P_o Q_o}$$

This can be re-written as a base-weighted sum of prices, though unlike other price indices it includes some negative weights:

$$I^o = \sum_{outputs} w_o . P_t - \sum_{inputs} w_o . P_t$$

where $$w_o = \frac{Q_o}{\sum_{outputs} P_o.Q_o - \sum_{inputs} P_o.Q_o}$$

and P_o has been re-scaled to unity. In a similar manner a GDP(E) price index could be defined as:

$$I^e = \frac{\sum_{TFE} P_t Q_o - \sum_{imports} P_t Q_o}{\sum_{TFE} P_o Q_o - \sum_{imports} P_o Q_o}$$

$$= \sum_{TFE} w_o.P_t - \sum_{imports} w_o.P_t$$

The formulae for both I^o and I^e are ideal as price indices since all the quantities are fixed at their base period values and all that has to be monitored are the changing price levels.

An important feature of the above formula for I^e is that it can be directly calculated at the aggregate level. It does not require that the "expenditure less imports" component be determined separately for each industry and then all industries aggregated together. This has important implications. For instance, if we take the overall FEPI (based on Total Domestic Expenditure) and bolt on an export price index we get the left-hand part of the above expression: equivalent to Total Final Expenditure. If we can also identify an appropriate import price index to represent the right-hand part of the expression, and deduct it from the Total Final Expenditure Price Index (i.e. combine it using negative weights) a GDP(E) Price Index is the result.

5. Worked example

See Table 1, which illustrates a simple economy where there are three different intermediate inputs and two different outputs. The table shows the volume and price of inputs and outputs at both base period and current period.

The table shows the derivation of the GDP deflator,

$$\frac{\text{Pt.Qt (outputs) - Pt.Qt (inputs)}}{\text{Po.Qt (outputs) - Po.Qt (inputs)}} = 113.83.$$

The equivalent "GDP price index", using the above formula, is

$$\frac{\text{Pt.Qo (outputs) - Pt.Qo (inputs)}}{\text{Po.Qo (outputs) - Po.Qo (inputs)}} = 114.34.$$

6. Would two different GDP price indices be consistent?

GDP(E) includes the value of changes in stocks - which would be omitted from a price index based on GDP(E) because changes in stocks are not market transactions. However, since a price index based on GDP(O) would not involve so many omissions - different price indices based on GDP(E) and GDP(O) (if both could be derived) are likely to generate different measures of inflation.

In reality GDP has just one value - and in the UK the ONS tries to keep its three estimates of GDP as close as possible. Therefore, if a GDP price index were to be published, ONS would not want two different versions to appear.

7. **Problems with negative GDP inflation**

Concern has been expressed that a GDP price index derived as a residual could, in extreme situations, lead to negative inflation - even if the components of the residual were showing positive inflation. An example of how this might arise is illustrated in Table 2.

The situation is similar to that illustrated in Table 1: the same base period prices and quantities prevail both for inputs and outputs; and in period t the output prices and quantities are the same as in Table 1. However, in Table 2 input prices in period t are very much higher than they were in the base period.

The effect on the GDP deflator is significant. In Table 2 the GDP deflator in period t has risen to 113.8 and the GDP price index to 114.3; but in Table 3 the GDP deflator has fallen to 95.7 and the GDP price index to 92.5.

In other words the "implicit" price of domestically-generated economic activity has declined between the base period and period t, despite the fact that both input prices and output prices have risen. This is because input prices have risen much more steeply than output prices and the economy is having to absorb the rise in input prices. In practice it would do this either by reducing trade margins (and therefore profit levels) and/or by reducing wages.

Note that in both examples (Table 1 and Table 2) the GDP deflator and the GDP price index move in the same direction - but by different amounts. The likelihood that a GDP price index will ever show negative inflation may therefore be estimated on the basis of how often, historically, the GDP deflator has exhibited negative inflation.

The main issue that the possibility of negative GDP inflation raises is:

- Will it be possible to explain to users the reasons for negative GDP inflation over a period when input and output prices are both rising? (The fact that, in such a situation, the GDP deflator is also likely to be showing negative inflation may help.)

- If not - is this sufficient reason not to proceed with a GDP index along the lines outlined in this paper?

8. Two other unlikely scenarios

- General inflation rates are negative - i.e. there is price deflation and not inflation. Clearly there would be no difficulty in explaining negative GDP inflation in a situation where both input prices and output prices were also falling.

- Conversely, a reverse of the situation described in section 7 could arise whereby input prices had fallen very sharply and output prices had fallen only slightly. In such a situation GDP inflation could be positive, despite both input and output prices falling. An example of such an extreme situation is illustrated in Table 3.

Table 1. Example of the derivation of the GDP deflator for a simple economy with just three different intermediate inputs and two outputs.

Base period

		quantity (Qo)	Price (Po)	Value (PoQo)
Inputs	A	100.0	34.50	3450.00
	B	500.0	10.00	5000.00
	C	1500.0	4.25	6375.00
			Total	14825.00
Outputs	A	50	167.75	8387.50
	B	100	180.00	18000.00
			Total	26387.50

Period t

		quantity (Qt)	Price (Pt)	value (PtQt)	value (PoQt)	value (PtQo)
Inputs	A	104.6	36.00	3,765.60	3,608.70	3,600.00
	B	522.3	10.37	5,416.25	5,223.00	5,185.00
	C	1550.0	4.63	7,176.50	6,587.50	6,945.00
			Total	16,358.35	15,419.20	15,730.00
Outputs	A	54.3	173.00	9,393.90	9,108.83	8,650.00
	B	115.4	203.00	23,426.20	20,772.00	20,300.00
			Total	32,820.10	29,880.83	28,950.00

	inputs		outputs	
sum po.qo	14,825.00	a1	26,387.50	a2
sum po.qt	15,419.20	b1	29,880.83	b2
sum pt.qo	15,730.00	c1	28,950.00	c2
sum pt.qt	16,358.35	d1	32,820.10	d2

GDP = value of total outputs less value of total inputs

Base volume at base prices	po.qo	= a2-a1	=	11,562.50	A
Current volume at base prices	po.qt	= b2-b1	=	14,461.63	B
Base volume at current prices	pt. qo	= c2-c1	=	13,220.00	C
Current volume at current prices	pt. qt	= d2-d1	=	16,461.75	D

pt.qt/po.qt	113.83	D/B	GDP deflator
pt.qo/po.qo	114.34	C/A	"GDP price index"

Table 2. Example of the derivation of the GDP deflator for a simple economy with just three different intermediate inputs and two outputs. Input and output prices rising - GDP deflator and price index falling

		Base period quantity (Qo)	price (Po)	value (PoQo)
Inputs	A	100.0	34.50	3450.00
	B	500.0	10.00	5000.00
	C	1500.0	4.25	6375.00
			total	14825.00
Outputs	A	50	167.75	8387.50
	B	100	180.00	18000.00
			total	26387.50

		Period t quantity (Qt)	price (Pt)	value (PtQt)	value (PoQt)	value (PtQo)
Inputs	A	104.6	40.00	4,184.00	3,608.70	4,000.00
	B	522.3	12.00	6,267.60	5,223.00	6,000.00
	C	1550.0	5.50	8,525.00	6,587.50	8,250.00
			total	18,976.60	15,419.20	18,250.00
Outputs	A	54.3	173.00	9,393.90	9,108.83	8,650.00
	B	115.4	203.00	23,426.20	20,772.00	20,300.00
			total	32,820.10	29,880.83	28,950.00

	inputs		outputs	
sum po.qo	14,825.00	a1	26,387.50	a2
sum po.qt	15,419.20	b1	29,880.83	b2
sum pt.qo	18,250.00	c1	28,950.00	c2
sum pt.qt	18,976.60	d1	32,820.10	d2

GDP = value of total outputs less value of total inputs

Base volume at base prices	po.qo =	a2-a1 =	11,562.50	A
Current volume at base prices	po.qt =	b2-b1 =	14,461.63	B
Base volume at current prices	pt. qo =	c2-c1 =	10,700.00	C
Current volume at current prices	pt. qt =	d2-d1 =	13,843.50	D

pt.qt/po.qt	95.73	D/B	GDP deflator
pt.qo/po.qo	92.54	C/A	"GDP price index"

Table 3. Example of the derivation of the GDP deflator for a simple economy with just three different intermediate inputs and two outputs. Input and output prices falling - GDP deflator and price index rising

Base period

		quantity (Qo)	price (Po)	value (PoQo)
Inputs	A	100.0	40.00	4000.00
	B	500.0	12.00	6000.00
	C	1500.0	5.50	8250.00
			total	18250.00
Outputs	A	50	173.00	8650.00
	B	100	203.00	20300.00
			total	28950.00

Period t

		quantity (Qt)	price (Pt)	value (PtQt)	value (PoQt)	value (PtQo)
Inputs	A	104.6	34.50	3,608.70	4,184.00	3,450.00
	B	522.3	10.00	5,223.00	6,267.60	5,000.00
	C	1550.0	4.25	6,587.50	8,525.00	6,375.00
			total	15,419.20	18,976.60	14,825.00
Outputs	A	54.3	167.75	9,108.83	9,393.90	8,387.50
	B	115.4	180.00	20,772.00	23,426.20	18,000.00
			total	29,880.83	32,820.10	26,387.50

	inputs		outputs	
sum po.qo	18,250.00	a1	28,950.00	a2
sum po.qt	18,976.60	b1	32,820.10	b2
sum pt.qo	14,825.00	c1	26,387.50	c2
sum pt.qt	15,419.20	d1	29,880.83	d2

GDP = value of total outputs less value of total inputs

Base volume at base prices	po.qo	= a2-a1	=	10,700.00	A
Current volume at base prices	po.qt	= b2-b1	=	13,843.50	B
Base volume at current prices	pt. qo	= c2-c1	=	11,562.50	C
Current volume at current prices	pt. qt	= d2-d1	=	14,461.63	D

pt.qt/po.qt	104.47	D/B	GDP deflator
pt.qo/po.qo	108.06	C/A	"GDP price index"