Commodity flow analysis in quarterly balancing of GDP

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Introduction

The ONS aims to provide a comprehensive picture of the level, growth and pattern of economic activity by producing National Accounts covering measures of output, income and expenditure (including GDP and GNP) and their components as well as short-term indicators of output.

The basic principal used in compiling these accounts is that total output of each commodity is equal to total uses of that output. If intermediate consumption, or the goods and services used up in producing output, is deducted from each side of the balance, we have on one side the total value added available to owners of labour and capital as income from production and on the other the total of all uses *other* than intermediate consumption. Total value added can be seen as either the sum of; the *output* less intermediate consumption of each industry, or the different sorts of *income* derived from production, or the *expenditure* made for each use of commodities other than intermediate consumption.

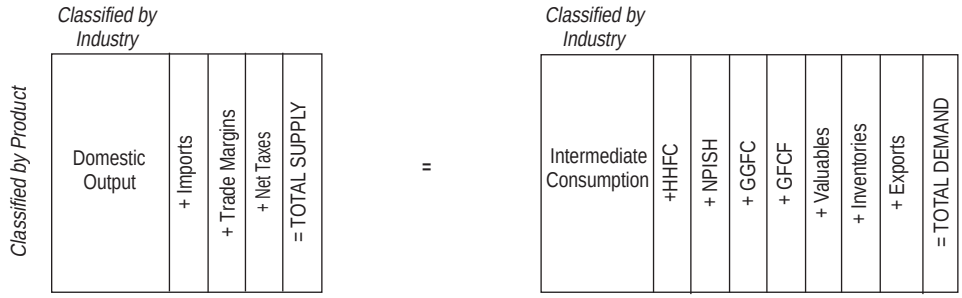
Although the actual values are equal, the sums of the estimates of value added for each industry, income for each income type, and expenditure for each expenditure type are not the same. The process by which statisticians examine the gap between the estimates, and make adjustments based on past behaviour of the series, indicators from outside the ONS and their own judgement to arrive at a definitive estimate of value added is referred to as *balancing*. Balancing can be done for annual or quarterly accounts, for accounts at current or constant prices, and for levels of activity or their growth rates. Also, the balance between the output of each commodity and its uses can be made for all commodities together, or for each commodity on its own. This detailed analysis for each commodity is referred to as *commodity flow* analysis.

Towards the end of 1999, the ONS decided to re-emphasise the role of commodity flow analysis in balancing the quarterly growth of GDP at constant 1995 prices. The ONS currently balances levels and growth rates of quarterly GDP in current and constant prices at the level of the whole economy (see Quarterly GDP - Process and Issues, Caplan and Lambert (Oct 95)). However, more detailed data are available for some areas of the accounts. The commodity flow model uses this data to inform the overall balance. The next section describes the commodity flow model. This section is followed by a review of experience in using this model for the past five quarters. Finally, there is a brief section on the future development of the model.

The Commodity Flow Model

The shape of the model is determined by the annual supply and use tables which have been produced for 1989–98 (for additional information see *UK Input-Output Balances: Methodological Guide* (1997)). These tables balance the supply and use of 123 different commodities at current prices. The structure of the tables is shown in Figure 1.

Figure 1 *Structure of Supply and Use Table*



Constant price data are gathered or estimated for each component of supply and demand. The methods used are as follows:

Supply

Domestic Output

Estimates of domestic output by industry in 1995 prices, produced by the Index of Production and GDP (O) branches, are transformed to produce estimates by commodity using the assumption that the output of each industry is split between the 123 commodities in the same proportions as in 1995.

Imports

Estimates of imports of goods in 1995 prices are produced by the Trade in Goods branch. The Trade in Services branch provides estimates of imports of 13 different services. Each of these 13 services is split between the 123 commodities using the proportions used in compiling the 1995 Supply and Use tables.

Trade Margins

It is assumed that the trade margin, on the consumption of each commodity by each type of user, represents the same proportion of the use of that commodity by each type of user as in 1995. For example, if the users of agricultural products for intermediate consumption paid a trade margin of 10 per cent to wholesalers and retailers in 1995, it is assumed that they paid the same margin in the current quarter. The total margin for each commodity is found by adding the margin paid by each different type of user.

Taxes less Subsidies on Products

It is assumed that the effective rates of taxes and subsidies on domestic output and imports are the same as those prevailing in 1995.

Demand

Intermediate Consumption

It is assumed that the ratio of intermediate consumption of each product by each industry to the output of that industry is the same as in 1995. If for example the intermediate consumption of Wood and Wood Products by the Motor Vehicles industry was 1 per cent of the output of the Motor Vehicles industry in 1995, it is assumed that it bears the same relation to the output of that industry in the current quarter. The same assumption is used in compiling the GDP output measure.

Household Final Consumption (HHFC)

Constant price estimates of 134 different categories of household expenditure are provided by the Household Expenditure branch. Each of these 134 expenditure categories is split between the 123 commodities using the proportions used in compiling the 1995 Supply and Use tables.

Final Consumption of Non-Profit Institutions Serving Households (NPISH)

The Personal Sector and Charities Survey branch provides an estimate of total final consumption expenditure of non-profit institutions serving households at 1995 prices. This is split between the 123 commodities using the proportions used in compiling the 1995 Supply and Use tables.

General Government Final Consumption (GGFC)

Constant price estimates of output of health and education by General Government are provided by the Public Sector Accounts branch. The same branch also provides a constant price estimate of General Government final consumption expenditure. Government final consumption expenditure on social work, sewage and sanitary services, and recreational services is calculated by taking 1995 figures and increasing them by the growth in total GGFC. Government final consumption expenditure on health and education is calculated by taking 1995 figures and increasing them by the growth in the output of health and education respectively. Government final consumption expenditure on public administration and defence is constrained so that total GGFC is equal to the figure provided.

Gross Fixed Capital Formation (GFCF)

It is assumed that the proportion of the domestically available supply of each commodity (defined as domestic output plus imports minus exports) used in Gross Fixed Capital Formation is the same as in the 1995 Supply and Use tables.

Expenditure on Valuables

The Gross Capital Formation branch provides an estimate of total net expenditure on valuables at 1995 prices. This is

split between the 123 commodities using the proportions used in compiling the 1995 Supply and Use tables.

Change in Inventories

Constant price estimates of change in inventories split into 25 different categories are provided by the Gross Capital Formation branch. Each of these 25 categories is split between the 123 commodities using the proportions used in compiling the 1995 Supply and Use tables.

Exports

Estimates of exports of goods in 1995 prices are produced by the Trade in Goods branch. The Trade in Services branch provides estimates of exports of 13 different services. Each of these 13 services is split between the 123 commodities using the proportions used in compiling the 1995 Supply and Use tables.

The resulting tables show gaps between supply and demand for each commodity, and the data used are consistent with that used for estimating output and expenditure. An increase in the gap between supply and use of a particular commodity in the model gives an indication of the areas that should be investigated and possibly adjusted in order to balance quarterly GDP.

The change in the supply-demand gap also gives an indication of the size of adjustment necessary for each commodity. This adjustment can be allocated to different categories of supply or use by examining the absolute size of that category for that commodity in the model in recent quarters, and the change in the value of that category for that commodity in the model between the current and the last quarter. An example of this is shown in Box 1.

This example shows a simplified version of the commodity flow process with three industries and three products. Imports, trade margins and taxes have been omitted and all the categories of final demand from household final consumption to exports are aggregated. The calculations are also simplified by the assumption that the domestic output matrix is diagonal, i.e. each industry produces one product and all of that product is produced by that industry. All calculations are shown to the nearest whole number.

We assume the base period Supply Use tables are as follows:

Supply

		Industry A	Industry B	Industry C	Total Supply
Products	A	100	-	-	100
	B	-	200	-	200
	C	-	-	100	100
Total output		100	200	100	

Use

		Industry A	Industry B	Industry C	Total IC	Final Demand	Total Demand
Products	A	-	5	30	35	65	100
	B	50	40	40	130	70	200
	C	20	5	10	35	65	100
						= 200	GDP(E)
Value added		30	150	20		= 200	GDP(O)
Total input		100	200	100			

Suppose the growth rates in the output of industries A, B and C between the base period and the present are: 3 per cent, 20 per cent and 3 per cent respectively, and growth in the demand for products A, B and C: 2 per cent, 20 per cent and 2 per cent respectively. If the model assumptions apply the supply-use tables for the present period will be as shown below:

Supply

		Industry A	Industry B	Industry C	Total Supply
Products	A	103	-	-	103
	B	-	240	-	240
	C	-	-	103	103
Total output		103	240	103	

Use

		Industry A	Industry B	Industry C	Total IC	Final Demand	Total Demand
Products	A	-	6	31	37	66	103
	B	52	48	41	141	84	225
	C	21	6	10	37	66	103
						= 217	GDP(E)
Value added		31	180	21		= 232	GDP(O)
Total input		103	240	103			

Products A and C are already balanced but for product B there is a supply-demand gap of 15. (240–225). This is the same as the difference between GDP(O) and GDP(E).

To decide which category of supply or demand to recommend for adjustment we examine the growth rates and absolute sizes of each category:

Supply

		Industry A	Industry B	Industry C	Total Supply
Products	A	3%	-	-	3%
	B	-	20%	-	20%
	C	-	-	3%	3%
Total output		3%	20%	3%	

Use

		Industry A	Industry B	Industry C	Total IC	Final Demand	Total Demand
Products	A	-	20%	3%	6%	2%	3%
	B	3%	20%	3%	8%	20%	13%
	C	3%	20%	3%	6%	2%	3%
						=	
						8%	GDP(E)
Value added		3%	20%	3%	=	16%	GDP(O)
Total input		3%	20%	3%			

Several options are available. We could reduce GDP(O) by increasing intermediate consumption of product B by industries A, B or C. Another approach would be to lower GDP(O) by reducing the output of industry B. Alternatively, we could increase GDP(E) by raising final demand for product B.

In this case, we believe that the most sensible option would be to increase intermediate consumption of product B by industries A and C. This brings the growth in the use of product B for intermediate consumption closer to the growth in the use of product B for final demand. The fact that final demand and output of product B are both growing at the same rate, increases the credibility of the two measures and makes us reluctant to alter either.

The new Supply Demand tables are shown below:

Supply

		Industry A	Industry B	Industry C	Total Supply
Products	A	103	-	-	103
	B	-	240	-	240
	C	-	-	103	103
Total output		103	240	103	

Use

		Industry A	Industry B	Industry C	Total IC	Final Demand	Total Demand
Products	A	-	6	31	37	66	103
	B	60	48	48	156	84	240
	C	21	6	10	37	66	103
						=	
						217	GDP(E)
Value added		23	180	14	=	217	GDP(O)
Total input		103	240	103			

In this stylised example, value-added to output ratios in A and C have changed significantly . A solution like this would not be adopted in practice, unless there was anecdotal evidence to suggest that such changes were plausible.

Use of the model in quarterly balancing

The commodity flow model has become increasingly influential in quarterly balancing over the last four quarters. In 1999 Q3 the previous model was revised to be compatible with the new European System of Accounts 1995 (ESA95) and data sources were updated. The model is now run using data that are delivered for the Quarterly National Accounts first release, approximately eight weeks after the end of the quarter being estimated. Imbalances and inconsistencies shown by the model are investigated and possible areas for adjustment to close the supply-demand gap are identified.

After the 2000 Q1 round, a version of the model was produced which uses the data that are delivered for the UK Output, Income and Expenditure first release, approximately six weeks after the end of the quarter.

Two particular areas, where the model has influenced the adjustments made to the unbalanced data are computer services, and post and telecommunications. The charts below show a picture of supply growing faster than use. However, the estimates of use as intermediate consumption of computer services, and post and telecommunications are based on the assumption that consumption

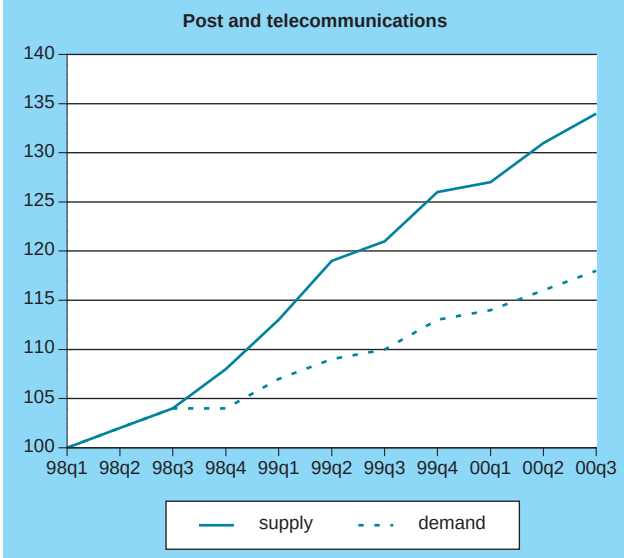
of these products by each industry grows at the same rate as in output of that industry.

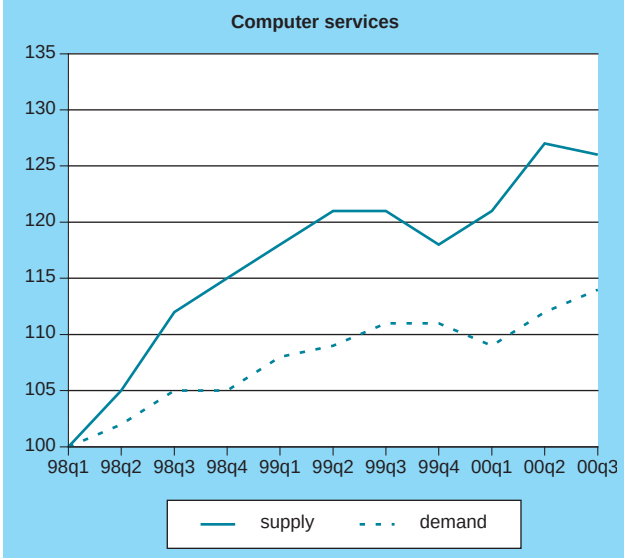
In fact, there is good reason to believe that the intermediate consumption of computer services, and post and telecommunications products by many industries has grown, and continues to grow at a faster rate than the output of those industries, in other words the value-added to output ratios are falling in many industries. The effect of this in the accounts would be that strong growth in the output of these two industries was offset by slower growth in the value-added of the industries which consume their products.

This effect was especially marked in the 1998 data, possibly as a result of Millennium Bug preparation work.

Chart **1**

Significant Supply - Demand Gaps in the Commodity Flow Model (1998Q1 = 100)





Future Developments

At the moment Supply and Use tables in current prices are produced annually, with an eighteen-month lag, but constant price estimates and the ratios used in the model are based on the weights from the 1995 tables. This is a major cause of the large supply-use gaps in the model. When the National Accounts are produced on a chain linked basis, i.e. measured in the prices of the previous year, the absolute value of the supply-use gaps will be both smaller and more informative, as the weights used in the system will be more up to date.

It is also intended to extend the model to produce current price tables using the available current price versions of National Accounts aggregates supplemented by reflated constant price figures where necessary. We will then be able to compare current and constant price imbalances and consider the plausibility of the implied deflators.

References

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