5258.0

Australian Bureau of Statistics

Research Paper

A Supply and Use Model for Editing the Quarterly National Accounts

Australia

2006

www.abs.gov.au

Research Paper

A Supply and Use Model for Editing the Quarterly National Accounts

Australia

2006

Philip Lichtwark
National Accounts

AUSTRALIAN BUREAU OF STATISTICS

EMBARGO: 11.30AM (CANBERRA TIME) FRI 1 DEC 2006

ABS Catalogue No. 5258.0

ISBN 0 642 48260 8

Produced by the Australian Bureau of Statistics

INQUIRIES

- For further information about these and related statistics, contact the National Information and Referral Service on 1300 135 070 or Philip Lichtwark on Canberra (02) 6252 6196.

CONTENTS

ABBREVIATIONS

ANZSIC	Australian and New Zealand Standard Industrial Classification
ASNA	Australian System of National Accounts
COICOP	Classification of Individual Consumption by Purpose
GDP	gross domestic product
GDP(E)	expenditure approach to measuring GDP
GDP(I)	income approach to measuring GDP
GDP(P)	production approach to measuring GDP
GFCE	government final consumption expenditure
GFCF	gross fixed capital formation
GNE	gross national expenditure
GVA	gross value added
HFCE	household final consumption expenditure
QBIS	Quarterly Business Indicators Survey
QNA	quarterly national accounts
QSU	quarterly supply and use
SNA93	System of National Accounts 1993
SUPC	supply and use product classification

The ABS has an ongoing program of monitoring and improving the quality of its national accounts estimates. A wide range of source data are used to compile the accounts, and the various data sources must be continually confronted and tested to ensure accuracy and consistency. The ABS introduced annual supply and use table benchmarking in 1998 as a means of integrating and resolving discrepancies in the source data used to compile the annual national accounts. This ensures that the three approaches to measuring gross domestic product (GDP) – production, income and expenditure – have equal annual values. However, the quarterly national accounts are not compiled in a balanced supply and use framework. This means that inconsistencies, reflected as 'statistical discrepancies', remain between the three approaches to measuring quarterly GDP as they are compiled independently of each other. However, the sum of the four quarters of each year are benchmarked to the latest balanced annual estimates.

The ABS has developed, and is experimenting with, the use of a quarterly supply and use (QSU) model as a data editing tool to enhance the quality of its quarterly national accounts. It utilises the existing quarterly national accounts data and models the remaining data that are required in a supply and use approach. Because of the substantial component of modelled data it has not been used to compile the quarterly national accounts, but is used instead as an editing tool in the compilation process. The intelligence provided can aid the compilers of the national accounts to best direct their investigations of the data prior to finalising the estimates. It also helps in establishing the priorities for longer term investigations aimed at improving the accounts.

The average magnitude of the discrepancies between the supply and use of a number of product groups have been substantially reduced since the QSU model was incorporated into the national accounts data editing process. In other cases, while the model has proved useful in indicating underlying data problems, it has not yet been possible to come to a resolution. In these instances, further investigative work is required to understand the problems and to confirm the robustness of the model assumptions for those products. The QSU system remains a 'work-in-progress' and investigations to explain anomalies between supply and use are ongoing.

A supply and use approach to compiling the quarterly national accounts has been used effectively by the Netherlands Central Bureau of Statistics (CBS) for many years. The ABS QSU model draws from the work of the CBS but with adaptations to suit the different ABS objectives, data environment and priorities. A number of statistical agencies in other countries are also exploring the possibilities of using a supply and use approach to assist in the compilation of the quarterly national accounts.

This paper describes the underlying framework of the QSU model, its overall structure and how it is being used to aid the editing of quarterly Australian national accounts data. Comments from users of the national accounts or from other statistical agencies who have experience with QSU models or are interested in developing such an approach are welcome. Comments should be directed to Philip Lichtwark (Canberra (02) 6252 6196, philip.lichtwark@abs.gov.au).

THE CALCULATION OF GDP

To understand the role the QSU model can play in improving the coherence of the components of GDP it is important to understand what GDP is intended to measure and how it is defined. GDP is an aggregate measure of the value of economic production in the domestic territory in a given period. It can be estimated using three different approaches, namely:

- the production approach, GDP(P) i.e. summing the gross value added of each industry plus taxes less subsidies on products
- the income approach, GDP(I) i.e. summing factor incomes plus taxes less subsidies on production and imports
- the expenditure approach, GDP(E) i.e. summing final expenditures less imports.

Conceptually, the three approaches yield identical values of GDP. In practice, because they are estimated using different data sources, statistical discrepancies generally occur between the different measures.

In 1998, as part of its implementation of SNA93, the ABS introduced balanced annual estimates of GDP in both current prices and volume terms. Balanced estimates are available from 1994-95 up to the year prior to the latest complete financial year. A balanced estimate of GDP implies there are no statistical discrepancies between the three approaches.

To achieve a balanced GDP estimate, the annual estimates are compiled in supply and use tables by a process of confronting and balancing the supply and use of goods and services. This ensures that final domestic expenditure, intermediate use and exports are consistent with the supply of products from domestic output and imports. It also ensures that the incomes and gross value added of each industry are the same. In turn, this ensures that the three approaches to measuring GDP will produce estimates of equal value as they are drawn from aggregates in the supply and use table. (The supply and use framework is described in more detail in the following section.)

As quarterly estimates of GDP are not compiled in a supply and use framework, different estimates for the three measures of GDP result. A single headline measure of quarterly GDP in Australia is obtained by averaging the three measures.

A large variety of survey and administrative data are used to compile the quarterly national accounts (QNA). The national accounts compilation process incorporates a review process designed to highlight inconsistencies and improbable data movements. Problems are identified, investigated and resolved in an iterative manner in the process of finalising the estimates of GDP. Any inconsistencies or gaps remaining in the data are ultimately reflected as aggregate statistical discrepancies which are shown explicitly in the published tables.

THE QSU MODEL

The QSU model has been developed to provide an indication of the source of inconsistencies between the different measures of GDP so that the review process can be better directed. It has been designed for use with seasonally adjusted volume estimates of GDP for the production and expenditure approaches, although in principle it could also be used with current price data and using original or trend data. Volume estimates are used because supply and use relationships are more stable over time in volume

THE QSU MODEL *continued*

terms than in current price terms as volumes are not directly affected by changes in relative prices. Therefore, the assumptions underlying the supply and use methodology are likely to be more robust in volume terms.

The rest of this paper describes the supply and use methodology, the structure of the QSU model and how it is used in editing the quarterly national accounts.

THE UNDERLYING FRAMEWORK

The supply and use methodology is based on the fundamental economic identity that the supply of products equals their use. When this identity holds, GDP calculated by the production approach is equal to GDP calculated by the income and expenditure approaches. GDP calculated by the production approach is equal to the value of goods and services produced by industries (output) less the cost of goods and services used up in the production process (intermediate consumption). Output is measured in basic prices and taxes less subsidies on products must be added to obtain GDP at purchasers' prices. This adjustment is necessary to give conceptual equivalence to the valuation used in the expenditure approach which is measured in what economic agents pay for goods and services (purchasers' prices). GDP as estimated by the expenditure approach is equal to the sum of all final expenditures, changes in inventories and exports less the value of imports of goods and services.

Supply and use tables are conventionally presented as two tables, a supply table showing the supply of products by industry of origin, and a use table showing the intermediate use of products by industry and final use by type of expenditure. A complete use table also includes the primary inputs to production, namely compensation of employees, operating surplus and other taxes less subsidies on production. This rests on the identity that, for each industry, output is equal to the sum of inputs, including payments to the factors of production. The income based measure of GDP is drawn from the primary inputs part of the use table. Tables 1 and 2 below illustrate the basic structure of supply and use tables.

TABLE 1. SUPPLY OF PRODUCTS, at basic prices

	Output of industries at basic prices (1)			Imports (2)	Total supply at basic prices (3)=(1)+(2)	Trade and transport margins (4)	Taxes less subsidies on products (5)	Total supply at purchasers' prices (6)=(3)+(4)+(5)
	Industry A	Industry B	Industry C					
Product A								
Product B								
Product C								
Product D								
Total supply								

TABLE 2. USE OF PRODUCTS, at purchasers' prices

	Intermediate use by industries				Final expenditure	Exports	Change in inventories	Total use of products at purchasers' prices
	Industry A	Industry B	Industry C	Total industries				
Product A								
Product B								
Product C								
Product D								
Total use at purchasers' prices								
Compensation of employees								
Gross operating surplus								
Other taxes less subsidies on production								
Industry output at basic prices								

THE UNDERLYING FRAMEWORK *continued*

The conventional matrix format of supply and use tables, with one supply table and one use table for each time period, is designed for cross sectional analysis of relationships between industries and products, and it is not ideal in an environment where changes in economic activity over time are the main focus of interest. To accommodate a time dimension in the QSU model, the basic supply and use tables have been expanded to create a suite of inter-related tables with each table having a time dimension covering the total estimation period.

ANNUAL SUPPLY AND USE TABLES AND THE QSU MODEL

The supply and use framework described in Chapter 2 is generally applied to annual data because the required detailed data sets are usually only available on an annual or less frequent basis. National statistical systems do not provide all the data required on a sub-annual basis. In order to apply the supply and use approach to sub-annual periods the available data must be augmented with modelled data derived from economic relationships established in annual supply and use tables. The QSU model uses the relationships in the annual tables to expand the level of detail available quarterly to better articulate the relationships between the different measures of GDP and thus assist in the identification of possible inconsistencies.

The QSU model uses the economic relationships between variables in the latest available annual supply and use tables (referred to as the reference year tables) to generate the additional product detail required to complete the quarterly supply and use tables. The fundamental assumption underlying the model is that the economic relationships that apply in the reference year tables remain the same during the subsequent quarterly estimation periods.

Tables 3 to 10 illustrate the links between the annual reference year supply and use tables and the QSU tables. They show how data on the supply and use of products by industries in the reference year are used to expand the more limited quarterly data set to complete the QSU tables. Primary inputs to production have been excluded as the QSU model does not include income based estimates of GDP at this stage.

As in tables 1 and 2, the following tables show the production of four products by three industries and the use of those products for intermediate use and final demand. The output of industries is expressed in basic prices, which is equal to the amount receivable by the producer minus any tax payable plus any subsidy receivable on the product. The final columns of both the supply and use tables are expressed in purchasers' prices, which include taxes less subsidies on products and the value of margins.

Trade and transport margins are represented by product D, which is produced by industry C. In order to convert the output of industries from basic prices to purchasers' prices, margins are allocated to the products incurring them. This is done in the margins column of Table 3 where margins (1200 units of product D) are distributed among products A, B and C and an off-setting amount is deducted from product D. The final columns of both the supply and use tables are expressed in purchasers' prices and margins are no longer identifiable as a separate product group.

TABLE 3. SUPPLY TABLE, reference year

	Domestic output				Imports	Margins	Taxes less subsidies on products	Total supply
	Industry A	Industry B	Industry C	Total industries				
Product A	1200			1200	120	350	130	1800
Product B	360	600		960	60	250	100	1370
Product C		1740		1740	80	600	180	2600
Product D			1200	1200		-1200		
Total output	1560	2340	1200	5100	260		410	5770

TABLE 4. USE TABLE, reference year

	Intermediate use				Gross national expenditure	Exports	Total use
	Industry A	Industry B	Industry C	Total industries			
Product A	240	120	120	480	920	400	1800
Product B	180	300	240	720	550	100	1370
Product C	360	360	120	840	1760		2600
Product D							
Total	780	780	480	2040	3230	500	5770
Gross value added at basic prices	780	1560	720	3060			

ANNUAL SUPPLY AND USE TABLES AND THE QSU MODEL *continued*

Using data from Tables 3 and 4, GDP in purchasers' prices can be calculated using the production and expenditure approaches as follows:

GDP(P) = Gross value added by industry + Taxes less subsidies on products
= Industry A (780) + Industry B (1560) + Industry C (720) + Taxes less subsidies on products (410)
= 3470

GDP(E) = Gross national expenditure (3230) + Exports (500) - Imports (260)
= 3470

Tables 5 to 10 demonstrate how the detailed data required to complete the quarterly supply and use tables are derived by applying relationships (in the form of coefficients) derived from the balanced annual supply and use tables (Tables 3 and 4) to the more limited data set available from the quarterly national accounts.

Tables 5 and 6 below show the coefficients for supply and intermediate use. The coefficients are derived by dividing industry output and intermediate use in the reference year tables (Tables 3 and 4) by the reference year industry output (the last row in Table 3).

TABLE 5. OUTPUT COEFFICIENTS, reference year

	Output		
	Industry A	Industry B	Industry C
Product A	0.77		
Product B	0.23	0.26	
Product C		0.74	
Product D			1.00

ANNUAL SUPPLY AND USE TABLES AND THE QSU MODEL *continued*

TABLE 6. INPUT COEFFICIENTS, reference year

	Intermediate use		
	Industry A	Industry B	Industry C
Product A	0.15	0.05	0.10
Product B	0.12	0.13	0.20
Product C	0.23	0.15	0.10
Product D			
Gross value added	0.50	0.67	0.60
Total output	1.00	1.00	1.00

Tables 7 and 8 show the data available from the regular QNA compilation process. The shaded areas in the tables show the data that must be estimated to complete the QSU tables.

TABLE 7. QNA SUPPLY DATA AVAILABLE FOR QUARTER 1

	Output			Imports	Margins	Taxes less subsidies on products	Total supply
	Industry A	Industry B	Industry C				
Product A				25			
Product B				20			
Product C				20			
Product D							
Total output Q1				65		80	

TABLE 8. QNA USE DATA AVAILABLE FOR QUARTER 1

	Intermediate use			Total intermediate use	Gross national expenditure	Exports	Total use
	Industry A	Industry B	Industry C				
Product A						80	
Product B							
Product C						75	
Product D							
Total					640	155	
Gross value added	150	300	150	600			

Industry output estimates are not published in the quarterly national accounts, however quarterly industry gross value added (GVA) estimates are compiled from source data on industry output, on the assumption that quarterly GVA is the same proportion of output as in the reference year supply and use tables. Because GVA is equal to output less intermediate consumption, this assumption implies that intermediate consumption also remains in constant proportion to output. In the quarterly supply and use system, the relationships in the annual supply and use tables are applied to GVA estimates to generate estimates of industry output and intermediate consumption by product group.

Gross domestic expenditure (GNE) is equal to domestic final demand plus changes in inventories. The aggregate components of GNE, and a limited range of product data, are published in the QNA, however GNE is not compiled in the supply and use product classification (SUPC), and the supply and use relationships in the reference year are used to estimate the product detail required to complete the QSU tables.

ANNUAL SUPPLY AND USE TABLES AND THE QSU MODEL *continued*

Tables 9 and 10 show how detailed quarterly supply and use data are derived by applying the coefficients from Tables 5 and 6 to the available quarterly estimates. First, total output (the last row in Table 9) is derived using the relationship of output to GVA (i.e. dividing the estimates of GVA in Table 8 by the corresponding GVA coefficients in Table 6). The remaining coefficients in Tables 5 and 6 are then applied to the resulting total output estimates to calculate the elements of both supply and use by product. For example, in Table 10, the use of Product C by Industry A (69 units) equals the total output of Industry A (300 units recorded in the last row in Table 9) multiplied by the corresponding input coefficient in Table 6 (0.23). Data derived in this way (and totals dependent on them) are highlighted in bold script in Tables 9 and 10.

Data on imports (Table 9) and and exports (Table 10) are obtained directly from the QNA. In Table 9 margins and taxes less subsidies by product have been derived by a similar process using the relationships in the reference year, but go through an extra balancing process. The method of allocating margins and taxes less subsidies in the QSU model is explained in detail in Chapter 4 of this paper.

TABLE 9. SUPPLY TABLE, quarter 1

	Output				**Imports**	**Margins**	**Taxes less subsidies on products**	**Total supply**
	Industry A	Industry B	Industry C	Total industries				
Product A	**231**			**231**	25	**72**	25	**353**
Product B	**69**	**115**		**185**	20	**54**	20	**279**
Product C		333		**332**	20	**124**	35	**511**
Product D			**250**	**250**		**-250**		
Total output Q1	**300**	**448**	**250**	**998**	65		80	**1143**

TABLE 10. USE TABLE, quarter 1

	Intermediate use				**Gross national expenditure**	**Exports**	**Total use**
	Industry A	Industry B	Industry C	Total industries			
Product A	**45**	**23**	**25**	**93**	**230**	80	**403**
Product B	**36**	**57**	**50**	**143**	**120**		**263**
Product C	**69**	**68**	**25**	**162**	**290**	75	**527**
Product D							
Total	**150**	**148**	**100**	**398**	640	155	**1193**
Gross value added	150	300	150	600			

Using data from Tables 9 and 10, the production and expenditure approaches to measuring GDP in purchasers' prices can be calculated as follows:

GDP(P) = Industry value added + Taxes less subsidies on products
= Industry A (150) + Industry B (300) + Industry C (150) + Taxes less subsidies on products (80)
= 680

ANNUAL SUPPLY AND USE TABLES AND THE QSU MODEL *continued*

GDP(E) = Domestic final demand (640) + Exports (155) - Imports (65)
= 730

Note that Tables 9 and 10 for quarter 1 (q1) are unbalanced. Unlike in the reference year tables, the total use of each product is not equal to the supply of each product. As a consequence, expenditure based GDP (730)) does not equal production based GDP (680). This is the difference between expenditure based GDP and production based GDP (50) that would be observed in the national accounts as a 'statistical discrepancy'. The main objective of the QSU model, as applied by the ABS, is to decompose the statistical discrepancy into discrepancies between component products.

Table 11 shows the statistical discrepancies for each product, based on the data in Tables 9 and 10. The aim of the editing process is to minimise these discrepancies.

TABLE 11. DECOMPOSITION OF THE STATISTICAL DISCREPANCY, q1

	Statistical discrepancy
Product A	-50
Product B	15
Product C	-15
Product D	
Total	-50

THE REFERENCE YEAR

The reference year plays a key role in specifying the structure of the QSU model. In the Australian System of National Accounts (ASNA), the reference year is always the year prior to the latest complete financial year. The sample table shown in appendix 2 are referenced to the annual supply and use tables for 2002–03, and the volume measures used in the QSU model are expressed in the prices of that year.

Re-referencing the QSU model involves re-specifying the level and composition of outputs and intermediate inputs for each industry to reflect the relationships in the latest reference year. The composition of expenditure aggregates is also updated. Updating the reference year ensures that changes in economic relationships are captured in the QSU model as soon as possible, although the reference year lags the QNA data by between one and two years.

In most years structural changes in the economy are relatively small, with change occurring incrementally in response to such factors as technological advances and changing consumer tastes. However, some events can have a significant impact on the cost structure of industries. For example, a severe drought is likely to change the relationship between the supply of products and the intermediate use of products for the agriculture industry.

CLASSIFICATIONS

The industry output data used in the QSU model are classified according to the Australian and New Zealand Standard Industrial Classification, 1993 (ANZSIC). ANZSIC identifies groupings of businesses that carry out similar economic activities. Each such grouping defines an industry, and similar activities that characterise the businesses concerned are referred to as activities primary to that industry. The classification used in

CLASSIFICATIONS *continued*

the QSU model is aggregated to the same level of detail published in the QNA, which includes 33 industry groups at the ANZSIC division and sub-division level.

The product classification is the supply and use product classification (SUPC), which is defined in terms of the characteristic products of industries. The product classification used in the QSU model includes 33 product groups, each representing the characteristic product of one of the 33 industry sectors already included in the QNA. The product groups are listed in Table 12.

The principles underlying an industry of origin classification are:

- Homogeneity of inputs – each product group should consist of items that have similar input structures or technology of production
- Homogeneity of disposition – each product group, having satisfied the first criterion should consist of items that have similar patterns of disposition or usage.

TABLE 12. QUARTERLY SUPPLY USE PRODUCT CLASSIFICATION

	PRODUCT GROUPS
1	Agricultural produce
2	Forestry and fishing
3	Mining
4	Services to mining
5	Manufactured food, beverages and tobacco
6	Textiles, clothing and footware
7	Wood and paper products
8	Printing, publishing etc
9	Petroleum, coal and chemical products
10	Non metallic mineral products
11	Metal products
12	Machinery and equipment
13	Other manufactered products
14	Electricity
15	Gas
16	Water supply, sewerage and drainage services
17	Construction
18	Other retail and wholesale services
19	Accommodation, cafes and restaurants
20	Road Transport
21	Air and space transport
22	Water transport
23	Rail, pipeline and other transport
24	Transport services and storage
25	Communication services
26	Financial and insurance services
27	Property and business services
28	Government administration and defence
29	Education
30	Health and community services
31	Cultural and recreational services
32	Personal and other services
33	Ownership of dwellings

CLASSIFICATIONS *continued*

Homogeneity of inputs and disposition over time are key assumptions underlying the supply and use table compilation. Higher levels of aggregation may compromise the homogeneity assumptions, and because the product groups have been compressed for use in the QSU model, the principles may not hold to the extent that is desirable, increasing the importance of the assumptions about constant relationships holding over time. This issue is discussed further in relation to the product estimates used as inputs and generated as outputs of the QSU model in Chapters 4 and 5.

In addition to the 33 product groups representing the primary output of industries, supplementary tables are compiled for the product groups comprising household final consumption expenditure. Household final consumption expenditure is classified by purpose categories in the national accounts using the Classification of Individual Consumption by Purpose (COICOP). The purpose categories used to classify household final consumption expenditure generally include the characteristic output of more than one industry, and are therefore not directly observable in the industry based product tables. The additional tables are created to facilitate cross checking and assist in identifying possible anomalies in the consumption data. Supplementary tables are generated for the COICOP categories listed in Table 13.

TABLE 13. PURPOSE CLASSIFICATION FOR HOUSEHOLD FINAL CONSUMPTION EXPENDITURE

1	Food
2	Cigarettes and tobacco
3	Alcoholic beverages
4	Clothing and footwear
5	Rent and other dwelling services
6	Electricity, gas and other fuel
7	Furnishings and household equipment
8	Health
9	Purchase of vehicles
10	Operation of vehicles
11	Transport services
12	Communications
13	Recreation and culture
14	Education services
15	Hotels, cafes and restaurants
16	Financial and insurance services
17	Other goods and services

CHAPTER 4 INPUTS AND OUTPUTS OF THE QSU MODEL

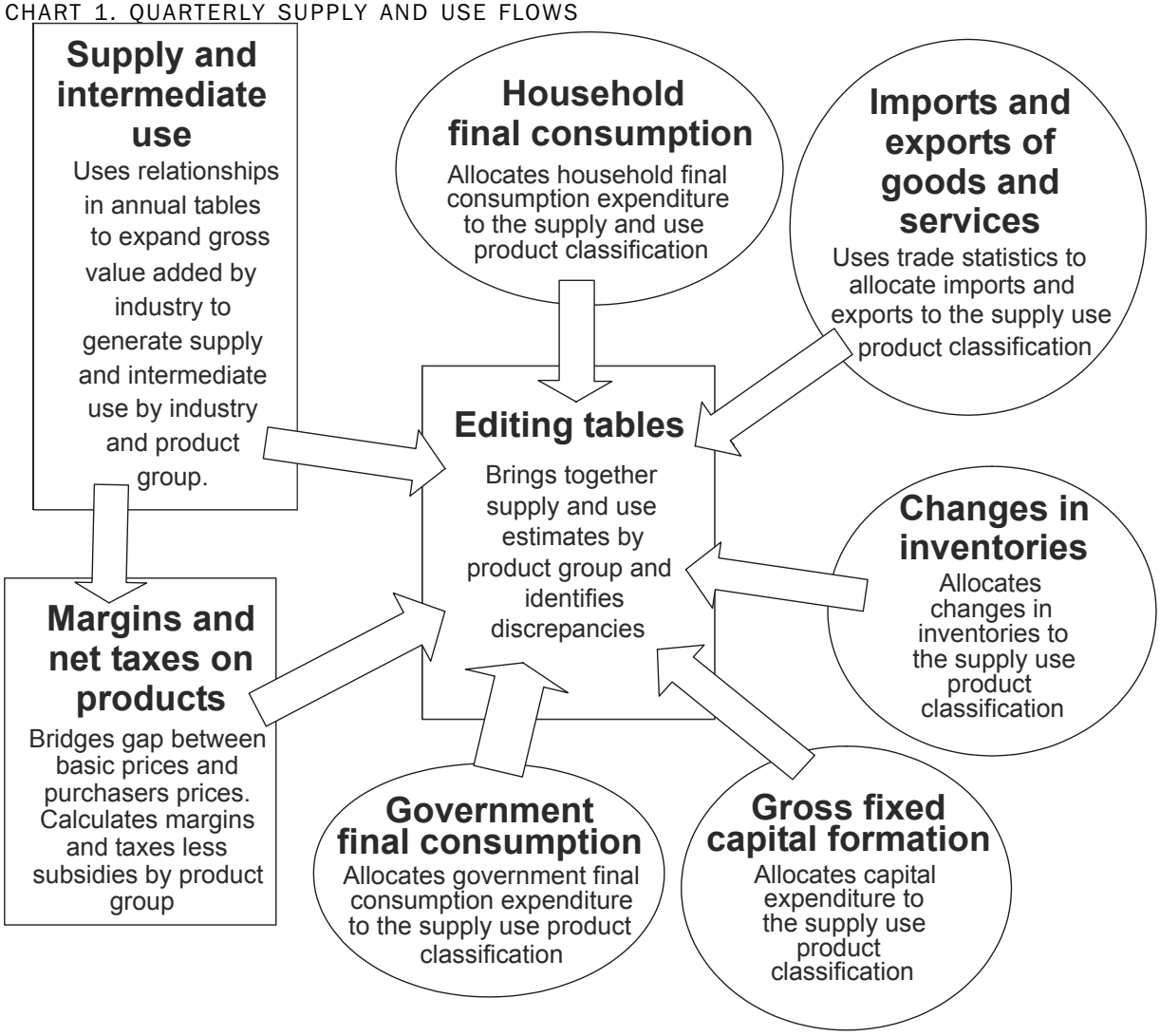
INTRODUCTION

This chapter discusses the inputs and outputs of the modules comprising the QSU model shown in Chart 1. As explained previously, the input data for the QSU model are the existing QNA data together with a limited amount of additional primary data, such as imports and exports by product. The QNA data used in the model are the components of GDP(P) and GDP(E). The model applies the relationships in the reference year tables to the input data to generate, as output, the additional detail required to complete the supply and use tables for each quarter of the estimation period.

Seasonally adjusted volume data are used as inputs rather than original data or current price data. Supply and use relationships differ according to the seasons as a result of the changing availability of some products over the course of the year. The use of seasonally adjusted data allows the cost structure in the balanced annual tables to be applied to all quarters in the estimation period. As already explained, supply and use relationships are more likely to hold over time in volume terms and are less likely to hold for current prices.

As mentioned earlier, the QSU model begins as a series of supply and use matrices that are reconfigured as a time series system for use as an editing tool. The model includes separate modules, each consisting of a time series showing the supply and/or use of products for elements of the system. These include supply and intermediate consumption of products by industry and the various final expenditure aggregates. Trade and transport margins and taxes less subsidies on products form a bridge between supply at basic prices and use at purchaser's prices and have separate modules in the model. The estimates from the various modules feed into editing tables showing total supply and use by product, and the discrepancies between the total supply and total use of each product group. Chart 1 shows the elements of the QSU model and the flows into the editing tables.

CHART 1. QUARTERLY SUPPLY AND USE FLOWS



SUPPLY AND INTERMEDIATE USE OF PRODUCTS

The supply and intermediate use module takes data on gross value added by industry from the quarterly QNA and uses the relationships in the reference year supply and use tables to generate domestic supply and intermediate use estimates, by product group, for each of the ANZSIC industry divisions and sub-divisions in the QNA (except agriculture). This transformation of gross value added by industry provides the supply of products from domestic production (at basic prices) on the supply side, and intermediate consumption of products on the use side. In the QSU model, output by industry less intermediate use by industry equals industry gross value added and total industry gross value added plus taxes less subsidies on products equals GDP(P) in the QNA.

The agriculture industry is treated differently from other industries in the QSU model (and in the QNA). The relationship between the volume of agricultural production and the volume of intermediate goods used in the production process is subject to significant cyclical changes because of differences in weather between years. Different weather from one year to the next can affect the volume of output independently of the volume of intermediate inputs. In favourable weather, the use of intermediate goods such as seed, fertiliser and fuel is relatively low as a proportion of output, while in unfavourable

SUPPLY AND INTERMEDIATE USE OF PRODUCTS *continued*

weather, such as a drought, intermediate use tends to be a higher proportion of output. Because of this characteristic it is not realistic to assume that the relationship between GVA and output in the reference year will hold over the estimation period. Consequently, data for output and intermediate use by the agriculture industry are obtained independently and GVA is calculated by deducting intermediate consumption from the value of output.

MARGINS AND TAXES LESS SUBSIDIES ON PRODUCTS

Estimates of gross product by industry in the national accounts are valued at basic prices, while expenditure estimates are valued at purchasers' prices. Trade and transport margins and taxes less subsidies on products must be added to the production estimates to bridge the gap between the two valuations. The QSU model calculates trade and transport margins in two stages. In the first stage, the percentage margins for each product group in the reference year are assumed to apply over the estimation period and an initial estimate is made on that basis. However, aggregate margins must equal the output of the trade and transport industries as reflected in the QNA estimates of value added for those industries. In the second stage any discrepancy between the initial estimates and aggregate margins is allocated pro rata to the margins at the product level.

Although the estimate of aggregate margins is considered accurate, at the product group level the model does not capture any short term changes in margins that may occur in response to changes in supply or demand conditions. The inability of the model to capture short term changes in margins by product could affect the quality of the modelled data.

Aggregate data on taxes less subsidies on products come directly from the QNA system. Taxes less subsidies for each product group are estimated in a similar way to margins. It is initially assumed that the tax rate in the reference year applies over the estimation period, then any discrepancy between estimates made on that basis and aggregate taxes less subsidies is allocated pro rata by product group. The modelled estimates for taxes less subsidies on products are considered reliable in the absence of any changes in tax rates in the estimation period.

HOUSEHOLD FINAL CONSUMPTION EXPENDITURE

The estimates of household final consumption expenditure (HFCE) available from the QNA are classified by purpose using COICOP. For the QSU industry tables, the various purpose categories are split according to the industry of origin of the components; the proportions are assumed to remain the same as in the reference year over the quarterly estimation period.

GOVERNMENT FINAL CONSUMPTION EXPENDITURE

Government final consumption expenditure (GFCE) is broken down into defence and other expenditure in the QNA. For the QSU model, the product composition of total GFCE is assumed to be the same as in the reference year. Excluding defence, major elements of GFCE are health, education and government administration. Expenditure in these areas tends to be relatively stable. GFCE is largely determined in the annual budgets of national, state and local governments. The product composition does not change significantly in the medium term in normal circumstances. However, any structural changes between the reference year and the estimation period would result in discrepancies between the estimated supply and use of the elements of GFCE. For example, an increase in health expenditure as a proportion of total GFCE in the

GOVERNMENT FINAL CONSUMPTION EXPENDITURE *continued*

estimation period would create a negative discrepancy for the product, with use exceeding supply for health services. That discrepancy would however, be offset by positive discrepancies for those product groups which fell as a proportion of GFCE.

GROSS FIXED CAPITAL FORMATION

The QSU tables include estimates of gross fixed capital formation (GFCF) for the private sector, public corporations and general government. Some product level data are also available from the QNA for private dwelling and non-dwelling construction, total private expenditure on machinery and equipment, and other fixed assets. The detailed product data required for the editing tables are generated by the QSU model using the assumption that the product composition in the reference year holds over the estimation period. In particular this involves breaking down private expenditure on machinery and equipment by product. The QNA data for GFCF by public corporations and general government are not broken down by product group in the QNA and all the product detail required for those sectors are currently generated in the QSU model.

CHANGES IN INVENTORIES

The QSU model requires data on changes in inventories at a fine level of product detail. However, the source data on changes in inventories for the QNA are collected and classified by industry, not by product group. Wholesale and retail industry inventories are assigned to product groups using relationships in the reference year. Inventories held by other industries, including manufacturing, are assumed to be mainly finished goods and work-in-progress and are assigned to the characteristic products of the respective industries. Changes in inventories are a volatile item, and changes can be positive or negative. Further, the composition of inventories may change significantly over time. Although the data on changes in inventories for industries in the QNA are believed to be of acceptable quality, change in inventories for products are particularly difficult to estimate reliably from these data. The modelled changes in inventories at the product level cannot capture short term changes and may be responsible for a significant part of discrepancies between the supply and use of some product groups generated within the QSU model.

IMPORTS AND EXPORTS OF GOODS AND SERVICES

Imports and exports of goods and services are elements of supply and use respectively. Imports and exports data for the goods component are compiled within the QNA according to the international trade classification and these data are recompiled on a supply and use product basis for input to the QSU model. Data on traded services are not available at the level of detail required by the QSU model and total services are allocated on the assumption that the composition is the same as in the reference year.

THE EDITING TABLES

The estimates calculated in the various modules of the QSU model flow into the editing tables, which are the principal output of the QSU model. The components of the final expenditure modules sum to the corresponding QNA aggregates comprising GDP(E), and the components of the supply and intermediate use module correspond to the elements of industry gross value added in the QNA.

Because of the way the model is specified, the sum of the discrepancies between supply and use of products in the QSU model must equal the discrepancy between the expenditure and production based estimates of GDP in the QNA. The editing tables show the elements of supply and use by product and the discrepancies between the supply and use of each product. The discrepancies between supply and use at the

THE EDITING TABLES *continued*

product level are, in effect, components of the total discrepancy between GDP(P) and GDP(E).

The graphs and editing tables which are produced by the QSU model are shown in Appendixes 1 and 2.

CHAPTER 5 THE USE OF THE MODEL IN COMPILING THE QNA

EDITING THE ACCOUNTS

Editing the national accounts is an iterative process, involving review of preliminary results, identification and investigation of anomalies and correction of errors. This process continues until the accounts are deemed to be at the standard required for publication. The QSU tables assist this process by confronting the supply and use of products in each round of the review. Discrepancies between the supply and use of products may indicate errors in the QNA data and this information is used to help focus investigations by the national accounts compilers. While the primary purpose is to assist with the current period QNA, the QSU tables have also proved valuable as a tool to indicate areas for longer term investigations and data development.

EFFECTS OF THE MODEL ASSUMPTIONS

Procedures for generating the inputs and outputs of the QSU model were described in the previous chapter including the possible effects of some assumptions underlying the model generated estimates. The most important assumption is that the supply and use relationships in the reference year hold for the estimation period. The assumption of stable supply and use relationships is already widely used to compile chain volume estimates of GVA in the quarterly national accounts of most countries. In principle, GVA should be calculated by deducting the value of intermediate inputs from the value of output. However, reliable quarterly data on the detailed composition of intermediate inputs (which is needed to derive accurate estimates of volumes of intermediate consumption) are not generally available, so growth in GVA is assumed to move in line with the available quarterly data for gross output. In this way, assumptions about the constant relationship between outputs and inputs for industries are already inherent in quarterly national accounts systems. The QSU model extends this practice to the products of the QNA. Any departure from that assumption will result in discrepancies between the supply and use of the product groups affected. This means that not all discrepancies between supply and use can be attributed to inconsistencies in the primary data, represented by the main QNA aggregates. Model generated errors can come from either changes in the composition of products supplied by industries or the use of products by final or intermediate users.

The composition of the supply of products at the broad level specified in the model is thought to be relatively stable as there is a close relationship between each industry and its characteristic products. Most industries undertake some construction work, and produce some services as secondary production, but secondary production comprises only a small proportion of total output. Changes in the composition of supply by industries is not thought to be a significant source of model related error, especially when using seasonally adjusted, volume data.

In normal circumstances the cost structure of industries, as represented by the relationship between an industry's output and its inputs in volume terms, is reasonably stable over the period covered by the QSU tables, which ranges from four to seven quarters beyond the reference year. Economic relationships in volume terms are dictated, in part, by technical relationships. For example a particular volume of fuel is required to transport a certain volume of cargo a given distance, or a particular number of bricks are required to construct a house. These types of relationships may change over time in response to technical advances in areas such as engine fuel economy or substitution of materials, however major structural changes would not generally be expected over the QSU estimation period.

EFFECTS OF THE MODEL ASSUMPTIONS *continued*

There is relatively more scope for changes in the composition of the use of products. Many products have a multitude of uses, and at the broad level defined in the model, some products can be used for intermediate consumption of many industries, final consumption, gross fixed capital formation, exports, or contribute to change in inventories. For this reason it is normally recommended that supply and use tables be compiled at a detailed level of the product classification to enable an accurate level of allocation to use categories. While the annual supply and use tables are compiled at a relatively detailed level, the QSU model is limited by the industry and product information available on a quarterly basis. The extra detail could be modelled, but there would be rapidly diminishing quality returns.

Some product groups originate largely from a single industry and have a limited range of uses, such as mainly for government or household final consumption expenditure or mainly for export. Examples of these products are, education and rent and dwelling services. It is relatively easy to identify any imbalances between supply and use for product groups with a limited range of uses, although it is not necessarily easy to resolve an imbalance once identified.

At the other end of the spectrum are products where supply comes from a range of sources, and which have a wide variety of uses. The diverse sources of supply and the range of product uses can make it difficult to identify the source of discrepancies for complex product groups, and to satisfactorily resolve them. In some cases structural problems are indicated which may only be resolved when more detailed data become available from the annual supply and use balancing. The assumptions required to model the data for complex product groups are more significant, so it is not possible to have complete confidence in the derived values for supply and use or the discrepancy between them. The results have to be considered as indicative and used with caution.

Machinery and equipment is an example of a complex product group. The supply of machinery and equipment comes from both domestic and imported sources and it is used for final consumption, intermediate consumption and capital expenditure. In addition, large changes in inventories of machinery and equipment may occur in response to changes in supply and demand. In terms of complexity, most product groups lie somewhere between these two extremes.

The ABS is continually gaining experience with the use and interpretation of the results of the QSU model. There are a number of product groups where the model has already been used to achieve a substantial degree of consistency between quarterly industry gross value added and the expenditure based components of quarterly GDP. However, there are still a number of areas where the model indicates substantial discrepancies that require further work to both validate the model generated estimate of the discrepancy and to resolve it in the QNA data.

CONCLUSION AND FUTURE DEVELOPMENTS

The quarterly supply and use model has made a contribution to improving coherence of the quarterly national accounts statistics by identifying possible inconsistencies between the production and expenditure based components of seasonally adjusted chain volume GDP. The ABS is still gaining experience in its use. It is no simple matter to resolve areas of apparent inconsistency in the accounts after having identified them. Arbitrary adjustments could be made to bring the components closer together, but there is a tension between doing this and letting the QNA data 'speak for itself'. The ABS has chosen not to make arbitrary balancing adjustments but to use the information to direct data editing and longer term investigations into the sources and methods of compiling the QNA.

Further work will be done to investigate the discrepancies between the supply and use of products with a view to improving the internal consistency of the QNA. For some complex products (for example machinery and equipment) it is likely to take some time for the compilers of the quarterly national accounts to verify the likely extent of data inconsistencies and to consider how best to resolve the issues.

The ABS could at some future time extend the QSU model to encompass current price estimates. One advantage of doing this would be to incorporate the income based measure of GDP so that data for all three approaches to measuring GDP can be confronted. While this has obvious attractions, the assumptions behind the existing model are less likely to be valid in current price terms. More comprehensive data on business income and expenses have recently become available from the Quarterly Business Indicators Survey and these could eventually be used as primary data for production and income measures in current price terms.

In summary, the development of the QSU model has facilitated the examination of supply and use relationships as part of the data confrontation process. By identifying inconsistencies between the various data sets used to compile the quarterly national accounts, the model has been able to improve their overall coherence resulting in improvements to the quality of the estimates.

REFERENCES

The Methodology of the Dutch system of Quarterly Accounts, Ronald J. A. Janssen and Simon Algera, Netherlands Central Bureau of Statistics, Occasional Paper Nr. NA-025, 1988

Australian and New Zealand Standard Industrial Classification 1993

APPENDIX 1 PRODUCT SUPPLY AND USE GRAPHS

INTRODUCTION

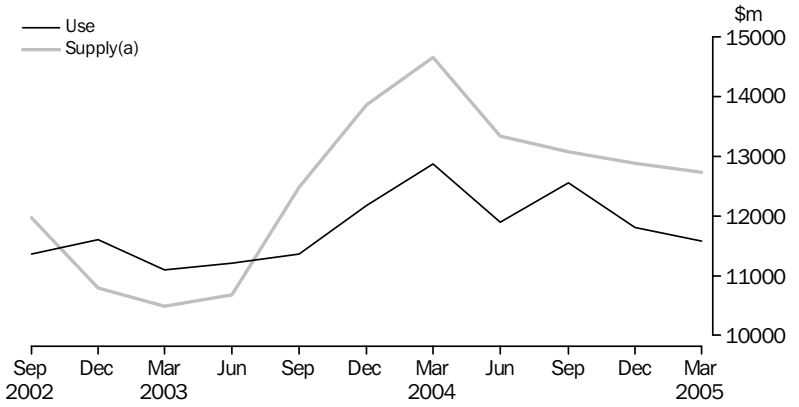
The following graphs show the supply and use of the 33 product groups identified in the QSU model as at the time of the compilation of the March 2005 quarterly national accounts. The product groups differ in complexity and the problems they present for data editing. In general, goods present more complex problems than services because they can be held as inventories and are subject to trade and transport margins. Data on inventories are not readily available at the product level, and margins must be estimated using reference year relationships and the aggregate output of the trade and transport industries.

The complexity of a product group in terms of the amount of data used to compile supply and use series does not always indicate the difficulty of balancing supply and use for that group. The quality of the data available quarterly is also a factor. The supply and use of complex product groups can be closely correlated if good quality data are available for all components, while relatively simple product groups can be difficult to balance if reliable data are not available.

The relative significance of each product group in terms of its contribution to total supply is shown as a footnote to each graph. The percentage of total supply of each product group in the reference year gives an indication of the contribution of that product group to GDP. The contribution to GVA would be preferred, but it is only available for industries, not products. It should be noted that different scales have been used on the graphs, so care should be taken in assessing the significance of supply and use discrepancies for the whole economy.

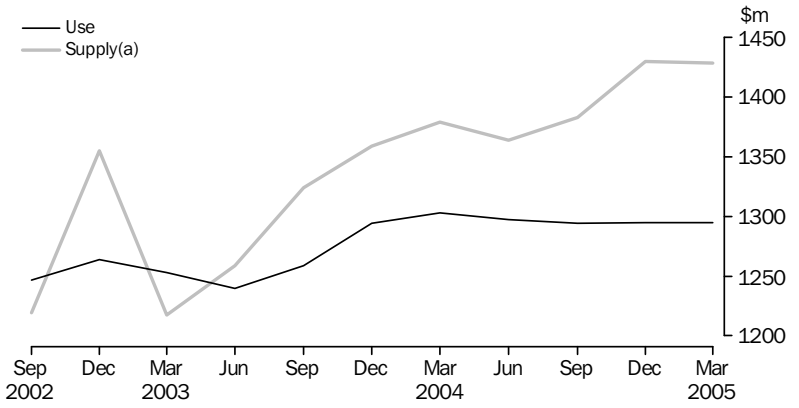
GRAPHS

AGRICULTURAL PRODUCTS



(a) Represents 4.0% of total supply in reference year, 2002–03.

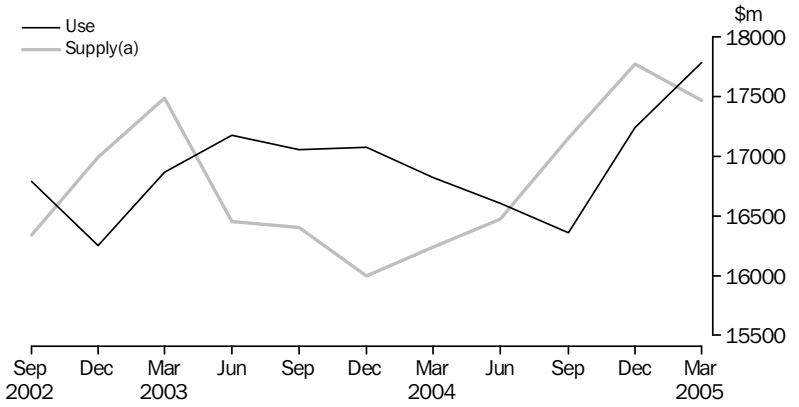
FORESTRY & FISHING



(a) Represents 0.4% of total supply in reference year, 2002–03.

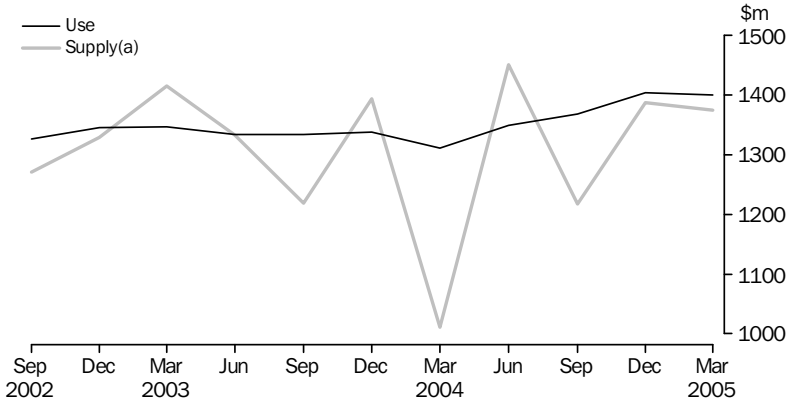
GRAPHS *continued*

MINING PRODUCTS



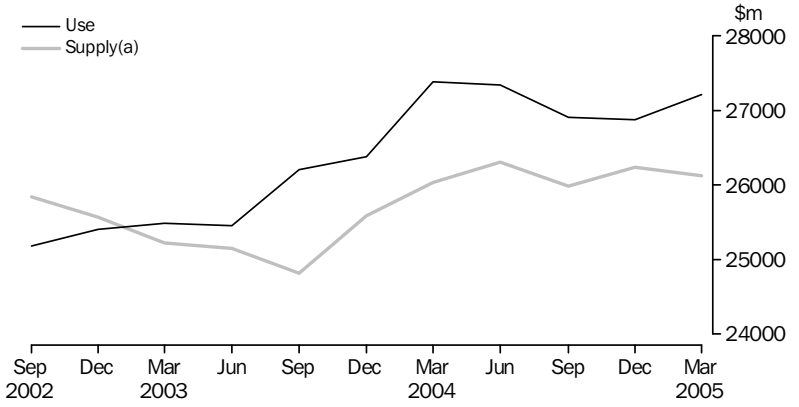
(a) Represents 5.2% of total supply in reference year, 2002–03

SERVICES TO MINING



(a) Represents 0.4% of total supply in reference year, 2002–03.

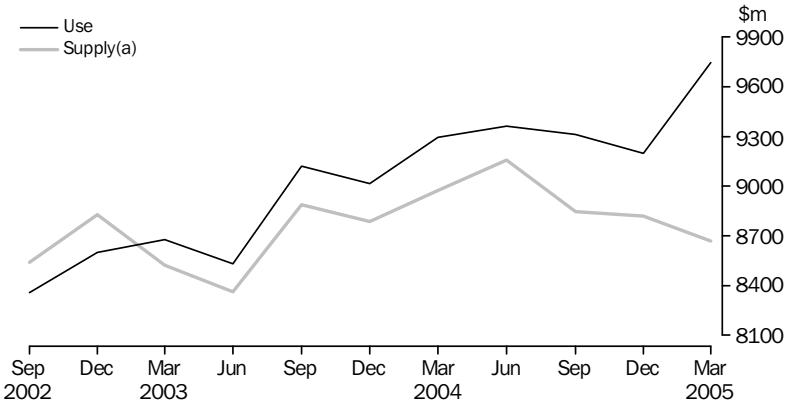
MANUFACTURED FOOD, BEVERAGES & TOBACCO



(a) Represents 7.8% of total supply in reference year, 2002–03.

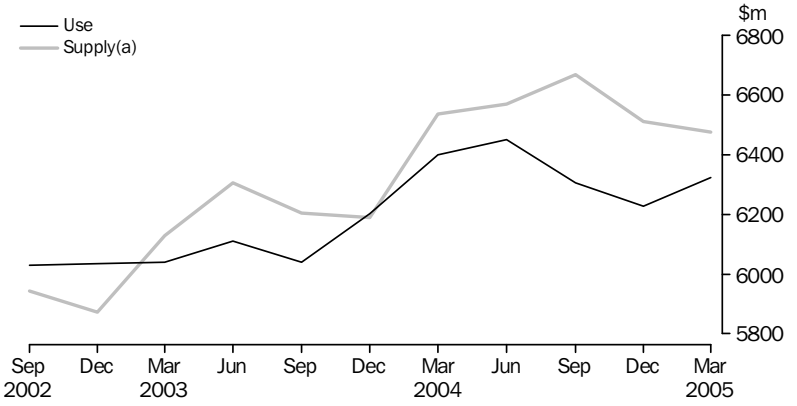
GRAPHS *continued*

TEXTILES, CLOTHING & FOOTWEAR



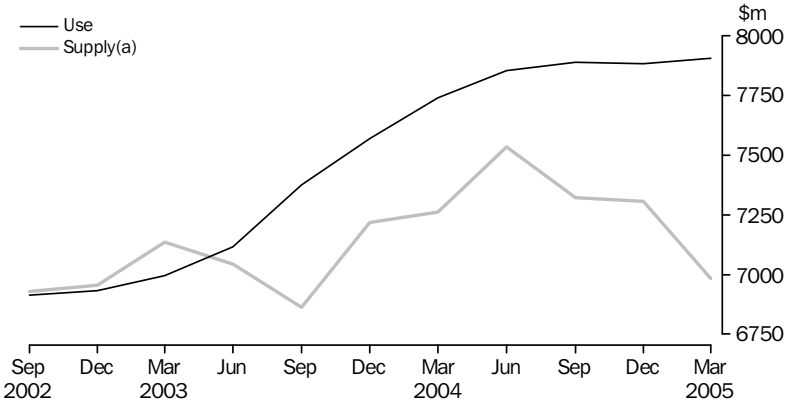
(a) Represents 2.7% of total supply in reference year, 2002–03.

WOOD & PAPER PRODUCTS



(a) Represents 1.9% of total supply in reference year, 2002–03.

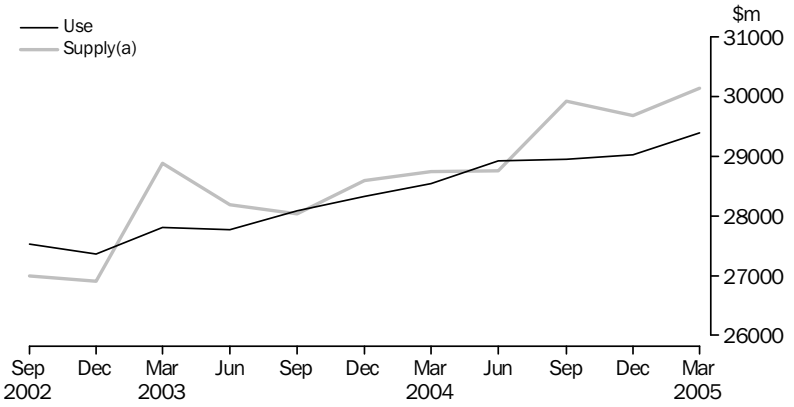
PRINTING & PUBLISHING PRODUCTS



(a) Represents 2.2% of total supply in reference year, 2002–03.

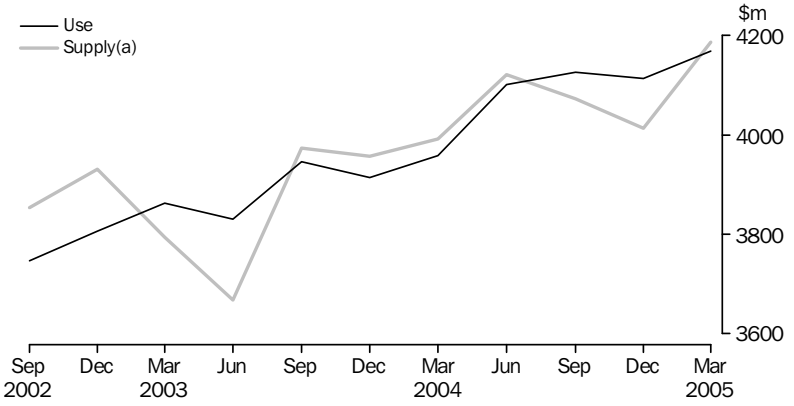
GRAPHS *continued*

PETROLEUM, COAL & CHEMICAL PRODUCTS



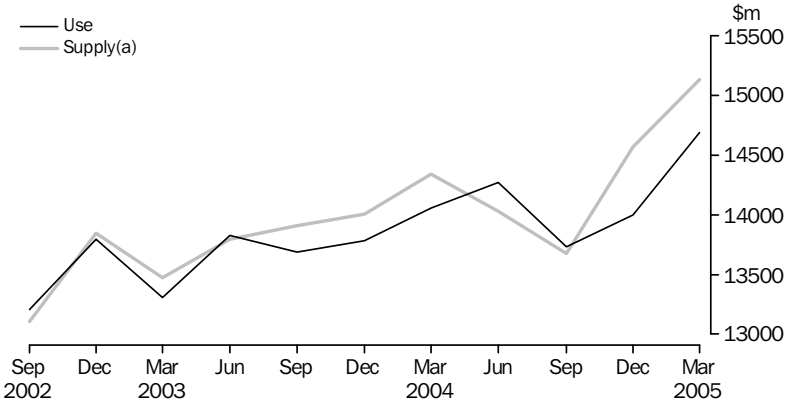
(a) Represents 8.6% of total supply in reference year, 2002–03.

NON-METALLIC MINERAL PRODUCTS



(a) Represents 1.2% of total supply in reference year, 2002–03.

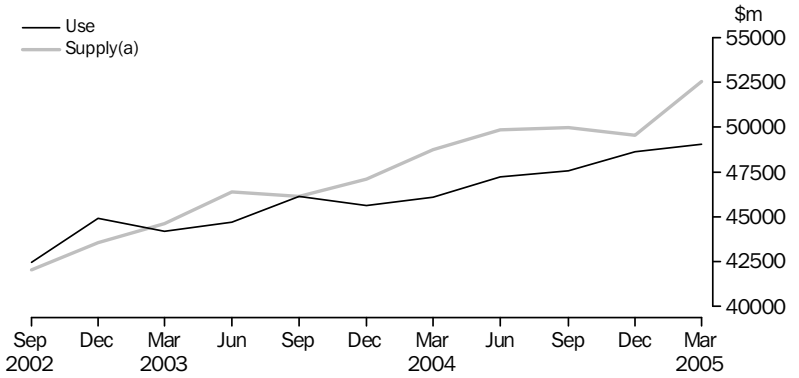
METAL PRODUCTS



(a) Represents 4.2% of total supply in reference year, 2002–03.

GRAPHS *continued*

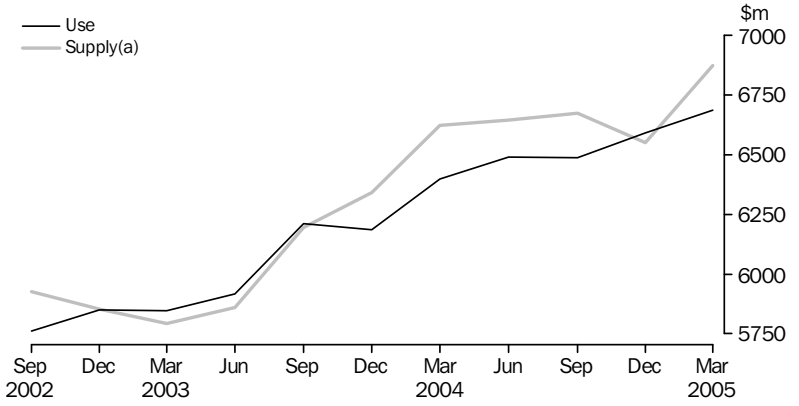
MACHINERY & EQUIPMENT



(a) Represents 13.7% of total supply in reference year, 2002–03.

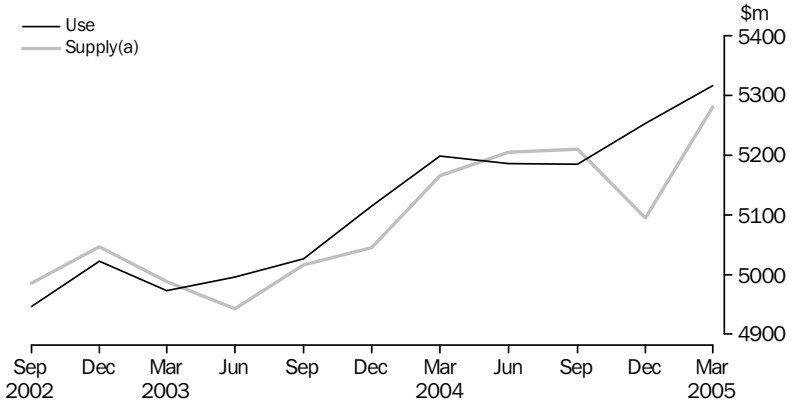
Note: .

OTHER MANUFACTURED PRODUCTS



(a) Represents 1.8% of total supply in reference year, 2002–03

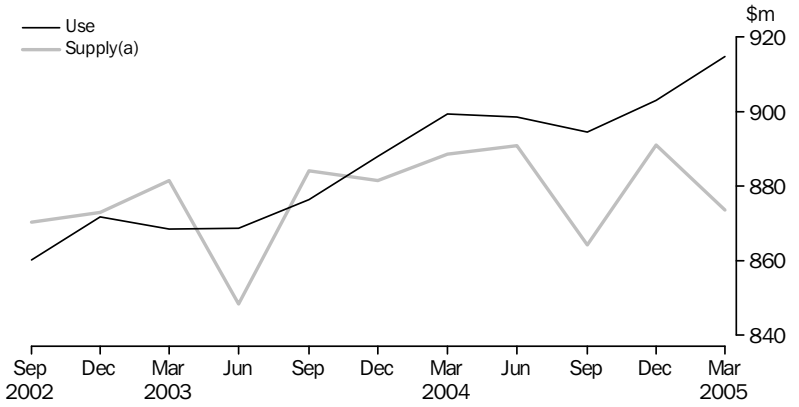
ELECTRICITY



(a) Represents 1.6% of total supply in reference year, 2002–03.

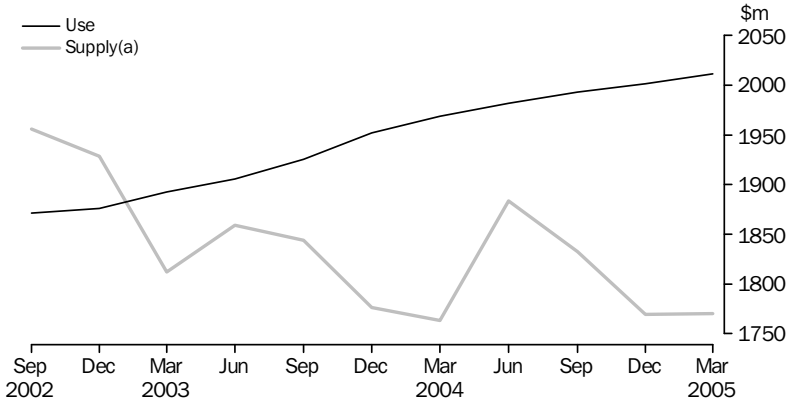
GRAPHS *continued*

GAS



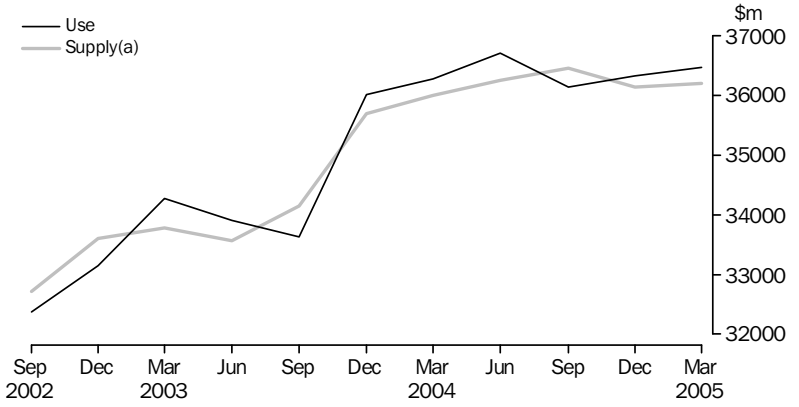
(a) Represents 0.3% of total supply in reference year, 2002–03.

WATER SUPPLY, SEWERAGE & DRAINAGE SERVICES



(a) Represents 0.6% of total supply in reference year, 2002–03.

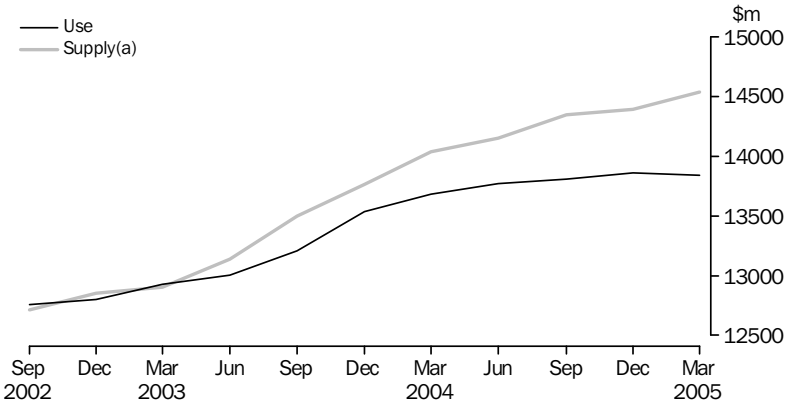
CONSTRUCTION



(a) Represents 4.0% of total supply in reference year, 2002–03.

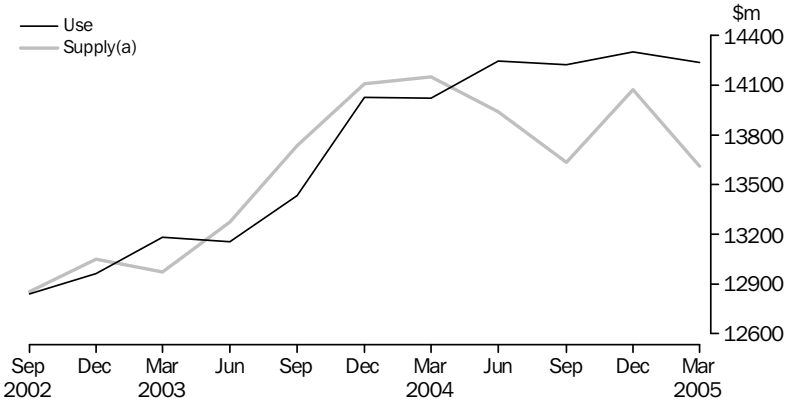
GRAPHS *continued*

OTHER RETAIL & WHOLESALE SERVICES



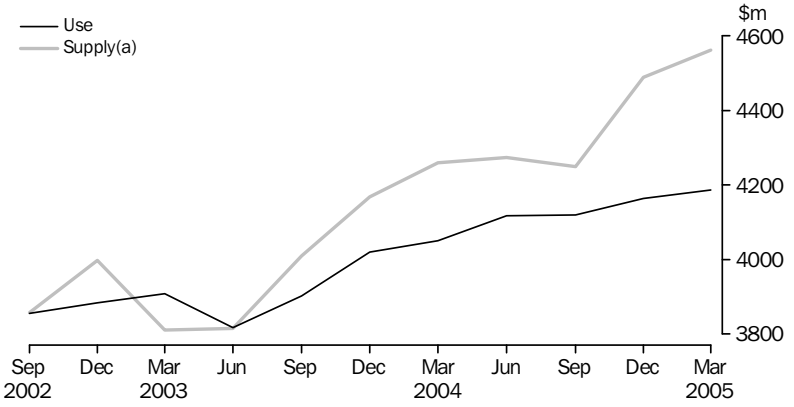
(a) Represents 4.0% of total supply in reference year, 2002–03.

ACCOMMODATION, CAFES & RESTAURANTS



(a) Represents 4.1% of total supply in reference year, 2002–03.

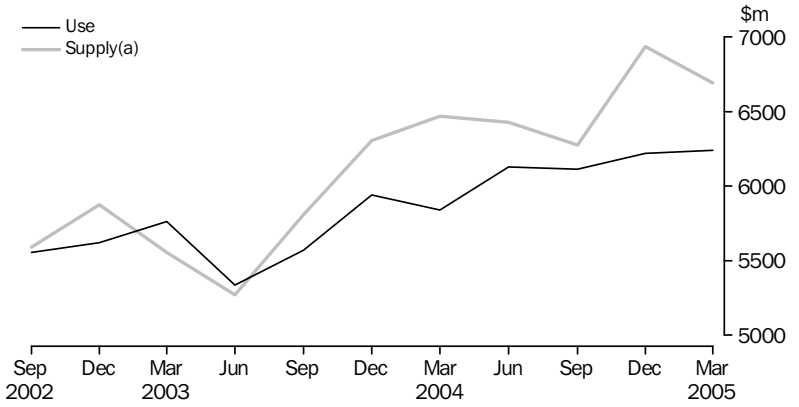
ROAD TRANSPORT



(a) Represents 1.2% of total supply in reference year, 2002–03

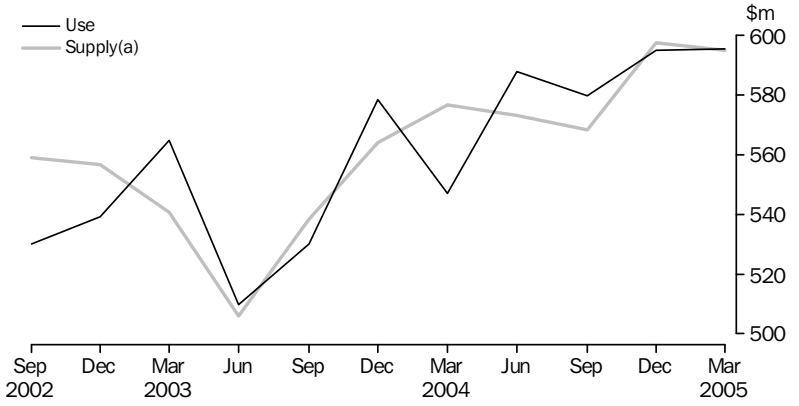
GRAPHS *continued*

AIR & SPACE TRANSPORT



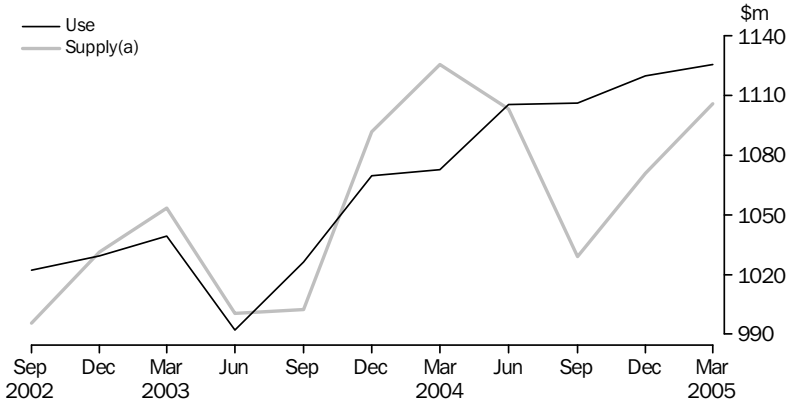
(a) Represents 0.2% of total supply in reference year, 2002–03.

WATER TRANSPORT



(a) Represents 0.2% of total supply in reference year, 2002–03.

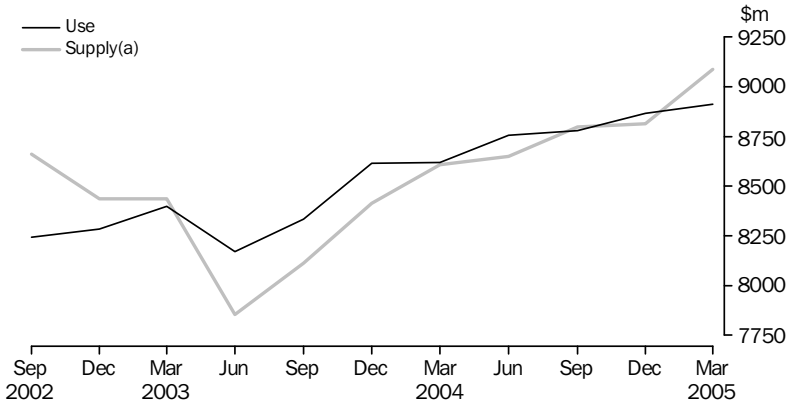
RAIL, PIPELINE & OTHER TRANSPORT



(a) Represents 0.3% of total supply in reference year, 2002–03.

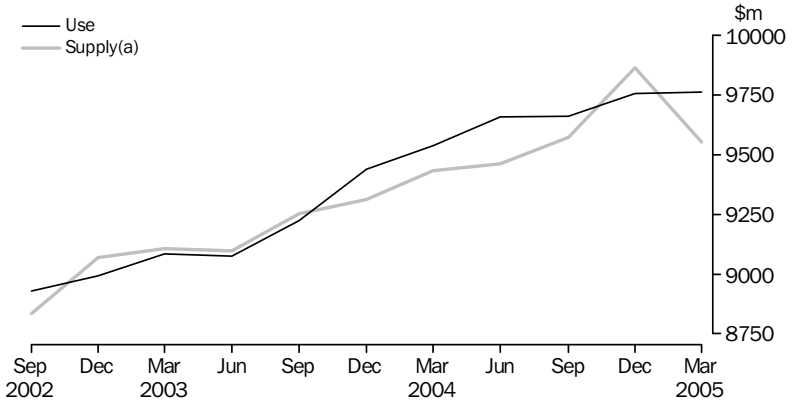
GRAPHS *continued*

TRANSPORT SERVICES & STORAGE



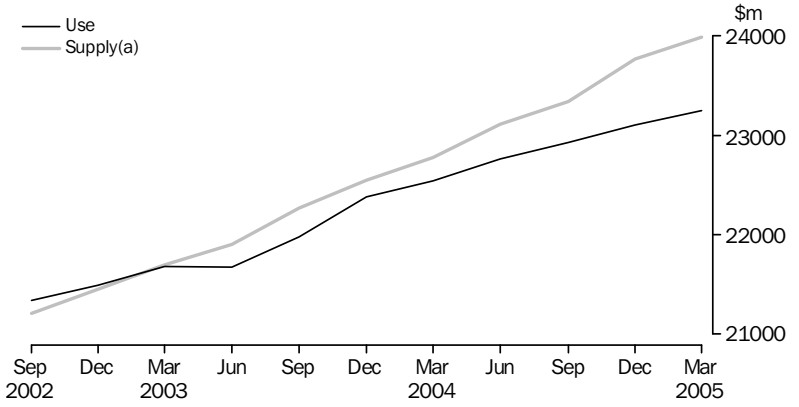
(a) Represents 2.6% of total supply in reference year, 2002–03.

COMMUNICATION SERVICES



(a) Represents 2.8% of total supply in reference year, 2002–03.

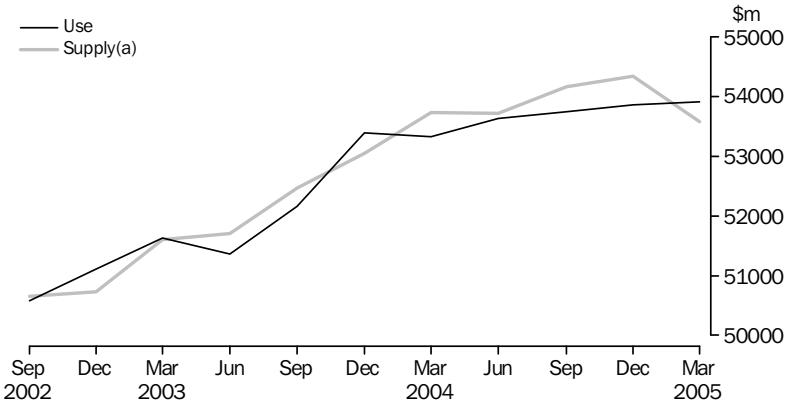
FINANCIAL & INSURANCE SERVICES



(a) Represents 6.7% of total supply in reference year, 2002–03.

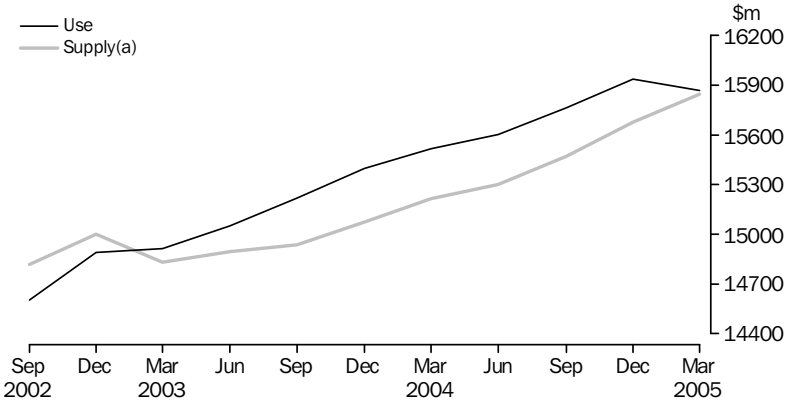
GRAPHS *continued*

PROPERTY & BUSINESS SERVICES



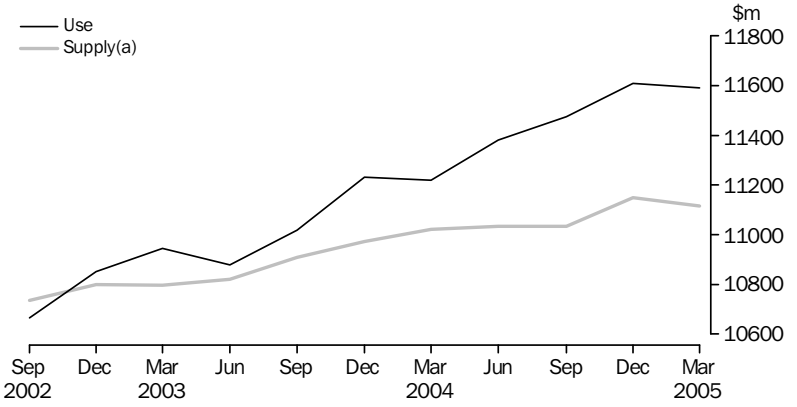
(a) Represents 15.9% of total supply in reference year, 2002–03.

GOVERNMENT ADMINISTRATION & DEFENCE



(a) Represents 4.6% of total supply in reference year, 2002–03.

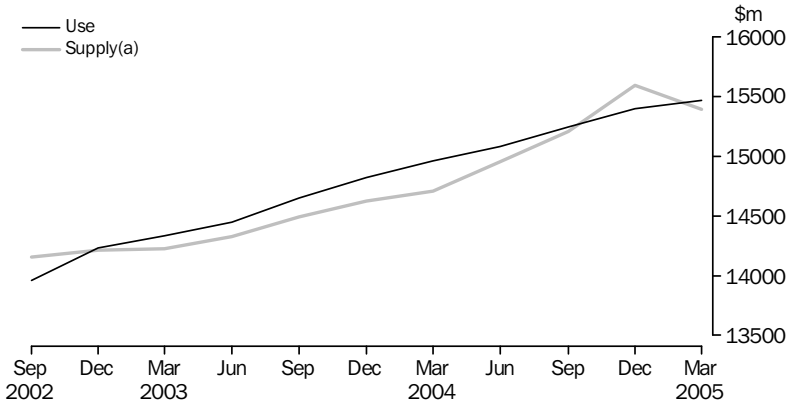
EDUCATION



(a) Represents 3.4% of total supply in reference year, 2002–03.

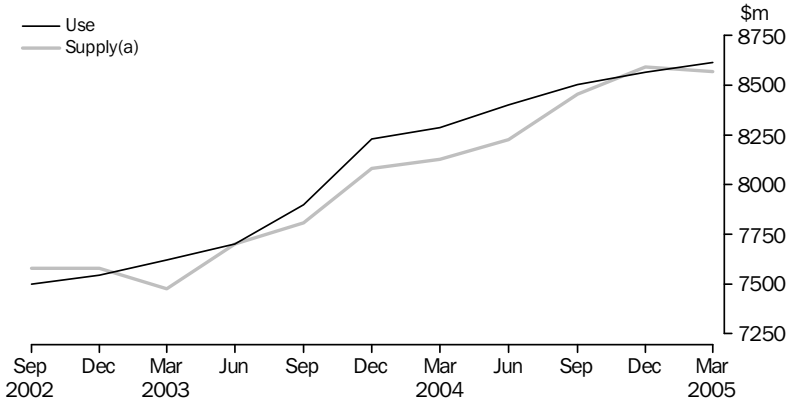
GRAPHS *continued*

HEALTH & COMMUNITY SERVICES



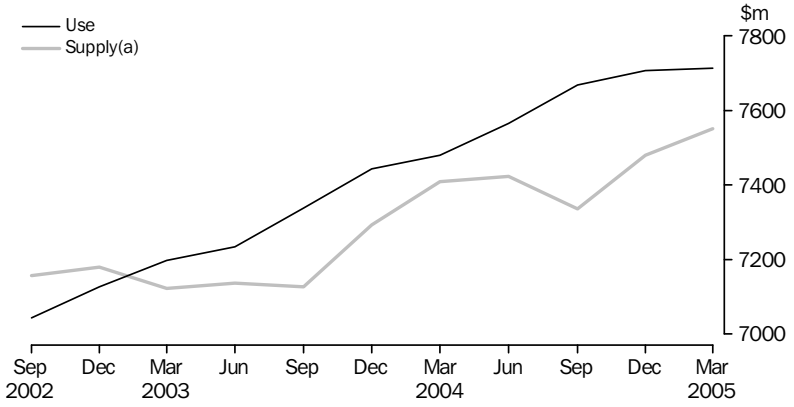
(a) Represents 4.3% of total supply in reference year, 2002–03.

CULTURAL & RECREATIONAL SERVICES



(a) Represents 2.4% of total supply in reference year, 2002–03.

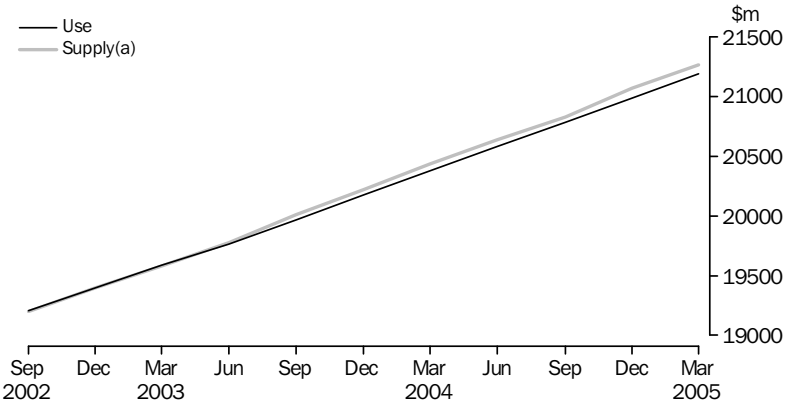
PERSONAL & OTHER SERVICES



(a) Represents 2.2% of total supply in reference year, 2002–03.

GRAPHS *continued*

OWNERSHIP OF DWELLINGS



(a) Represents 6.1% of total supply in reference year, 2002–03.

APPENDIX 2 SAMPLE SUPPLY AND USE PRODUCT TABLE

SUPPLY AND USE TABLE FOR MINING PRODUCTS

The table below, from the quarterly supply and use system, illustrates the elements of supply and use for mining products in volume terms.

MINING PRODUCTS

	2002–03	*Sep 03*	*Dec 03*	*Mar 04*	*Jun 04*	*Sep 04*	*Dec 04*	*Mar 05*
Use								
Intermediate use	26 513	6 609	6 693	6 635	6 612	6 635	6 609	6 687
Household final consumption expenditure	1 093	274	279	288	285	286	294	299
Government final consumption expenditure	—	—	—	—	—	—	—	—
Private gross fixed capital formation	—	—	—	—	—	—	—	—
Public gross fixed capital formation	—	—	—	—	—	—	—	—
General government gross fixed capital formation	—	—	—	—	—	—	—	—
Change in inventories	–393	108	195	–55	–53	–171	–152	8
Exports	40 043	10 068	9 909	9 951	9 763	9 610	10 490	10 791
Total use	**67 256**	**17 059**	**17 077**	**16 820**	**16 607**	**16 360**	**17 241**	**17 785**
Supply								
Domestic supply	51 442	12 694	12 547	12 243	12 332	12 529	12 870	12 807
Imports	11 722	2 697	2 460	2 993	3 127	3 567	3 783	3 588
Margins	3 986	990	963	980	987	1 033	1 091	1 044
Taxes less subsidies	106	26	25	25	25	27	28	27
Total supply	**67 256**	**16 406**	**15 994**	**16 241**	**16 471**	**17 155**	**17 771**	**17 466**
Discrepancy	—	–653	–1 082	–579	–136	795	530	–319
Discrepancy (percent of total supply)	—	–4.0	–6.8	–3.6	–0.8	4.6	3.0	–1.8

— nil or rounded to zero (including null cells)

FOR MORE INFORMATION . . .

INTERNET	**www.abs.gov.au** the ABS web site is the best place for data from our publications and information about the ABS.
LIBRARY	A range of ABS publications are available from public and tertiary libraries Australia wide. Contact your nearest library to determine whether it has the ABS statistics you require, or visit our web site for a list of libraries.

INFORMATION AND REFERRAL SERVICE

Our consultants can help you access the full range of information published by the ABS that is available free of charge from our web site, or purchase a hard copy publication. Information tailored to your needs can also be requested as a 'user pays' service. Specialists are on hand to help you with analytical or methodological advice.

PHONE	1300 135 070
EMAIL	client.services@abs.gov.au
FAX	1300 135 211
POST	Client Services, ABS, GPO Box 796, Sydney NSW 2001

FREE ACCESS TO STATISTICS

All ABS statistics can be downloaded free of charge from the ABS web site.

WEB ADDRESS	www.abs.gov.au

2525800013053

RRP $11.00