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Information Paper

Introduction of Chain Volume Measures in the Australian National Accounts

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PREFACE

On 30 September 1997, the Australian Bureau of Statistics (ABS) published an Information Paper entitled *Implementation of Revised International Standards in the Australian National Accounts* (Cat. no. 5251.0) detailing the implementation of the *System of National Accounts 1993* (SNA93) in the Australian national accounts (ANA).

An important recommendation in SNA93 is that annually-reweighted chain volume measures should be compiled to aid the analysis of economic statistics. SNA93 argues that chain volume measures provide better indicators of volume growth than constant price estimates for most economic statistics relating to expenditure and production. The ABS will be implementing this change with the move to SNA93 as from September quarter 1998.

This information paper on chain volume measures has been produced because of the importance of the change to users, and the relatively complex issues associated with chaining and choice of the appropriate index number approach.

The ABS has undertaken extensive empirical studies which confirm that, in the past, the change to annually-reweighted, chain volume measures would have had a substantial impact on the growth in volume of some important components of expenditure on gross domestic product (GDP), most notably private gross fixed capital expenditure on equipment and imports, but because these were largely off-setting the change had little impact on the growth in volume of Australia's GDP.

Over the last eighteen months or so, the ABS has consulted international experts in index theory, conducted seminars for representatives of major user groups, including the ABS's Economic Statistics User Group, and presented discussion papers. All users consulted have supported the change.

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SUMMARY OF FINDINGS AND PROPOSED CHANGES

In general, annually linked and reweighted chain volume measures provide better indicators of movement in real output and expenditures than constant price estimates, because, unlike constant price estimates, they take account of changes to price relativities that occur from one year to the next. It is the price relativities that determine the weight given to each component of a volume index.

In practice, the advantages of annual chain volume measures depend on the variability of the price and volume relativities between the component series. In Australia's case, the most important changes in price relativities relate to the prices of computer equipment relative to the prices of other goods and services, and the aggregates most affected are the components of GDP(E) where computer equipment is prominent — private gross fixed capital expenditure on equipment and imports. However, the effects of chaining on those components that include computer equipment are largely offsetting when compiling GDP(E) because Australia's production of computer equipment is relatively small, and so the effects of chaining are not very noticeable for GDP as a whole.

Effective from the September quarter 1998 issue of *Australian National Accounts: National Income, Expenditure and Product* (Cat. no. 5206.0), the existing constant price estimates will be replaced with annually-reweighted, chain Laspeyres volume measures. All subsequent national accounts publications, and special and standard data services will contain chain volume measures rather than constant price estimates.

The annually-reweighted, chain Laspeyres volume measures are to be published in terms of dollars rather than as index numbers. The reference year will be the year prior to the latest complete financial year. This will mean that the volume measures to be released in the September quarter 1998 issue of 5206.0 will be expressed in terms of 1996–97 dollars. In the June quarter 1999 issue of 5206.0 the reference year will be changed to 1997–98, and every year thereafter the reference year will change with the release of the June quarter issue of 5206.0. This will entail revising the levels of the volume measures for their entire history every year, but re-referencing will not alter growth rates. Re-referencing the volume measures each year will also ensure that the accounting relationships are maintained for the latest 4 to 7 quarters. It is not possible to have additivity for earlier quarters without compromising the quality of the volume measures. Revisions to growth rates will continue to occur as a result of revisions to the underlying data.

The fixed-weighted price indexes currently published in 5206.0 will be replaced by annually-reweighted, chain Laspeyres price indexes. Implicit price deflators will continue to be published.

Experimental annually-reweighted, chain Laspeyres volume measures of GDP(E) and its components, consistent with the December quarter 1997 issue of 5206.0, are presented in Appendixes 2 and 3.

Updates of these experimental measures will also be published in the March and June quarter 1998 issues of 5206.0, in addition to the constant price estimates.

There is to be a second release of the June quarter 1998 issue of 5206.0 in which the data will be presented on the basis of the ABS's implementation of *System of National Accounts, 1993* (SNA93). This will include annually-reweighted, chain Laspeyres volume measures of GDP, including both its expenditure and production components.

The move from constant price estimates to chain volume measures will apply also to other ABS statistics for which constant price estimates are currently released, namely: retail trade, new capital expenditure, stocks and sales of selected industries, building approvals, building activity, engineering construction, and research and experimental development. The move from constant price estimates to chain volume measures will be made progressively, and the timing of the changes will be announced in the relevant publications.

SECTION 1 INTRODUCTION

1.1 The Australian national accounts (ANA), like those of the vast majority of countries, are compiled within a general statistical framework known as the System of National Accounts (SNA). This system consists of a coherent, consistent and integrated set of macroeconomic accounts, balance sheets and tables based on a set of internationally agreed concepts, definitions, classifications and accounting rules.

1.2 The SNA was first published in 1953 under the auspices of the United Nations. This system became widely used by national statistical services throughout the world.

1.3 1968 may be said to be the start of national accounting's modern era. In that year the (then) United Nations Statistical Office published a fully revised version of the SNA which drew together all the various threads of economic accounting: estimates of national income and expenditure; input-output production analysis; flow-of-funds financial analysis; and balance sheets of national wealth. Since the early 1970s, the ABS's suite of economic statistics and particularly its national accounts statistics have been compiled largely in accordance with the standards and concepts set out in the 1968 SNA.

1.4 A revised and substantially updated version of the SNA (hereafter referred to as SNA93) was released in 1993 under the combined auspices of the United Nations (UN), International Monetary Fund (IMF), Commission of the European Communities (EEC), Organisation of Economic Co-operation and Development (OECD) and the World Bank. The new standard marks a major step forward in the evolution of the system. It comes as a result of: further research; changes in economic circumstances and institutions; additional data requirements; and the need to harmonise national accounting standards with other statistical standards.

1.5 The framework articulated by SNA93 is different in a number of respects from the current framework within which the ABS constructs the national accounts. The ABS is planning to move to a SNA93 basis for the quarterly national accounts in 1998, and changes to their content and presentation will be incorporated in the September quarter 1998 issue of *Australian National Accounts: National Income, Expenditure and Product* (Cat. no. 5206.0). An information paper entitled *Implementation of Revised International Standards in the Australian National Accounts* (Cat. no. 5251.0) describing the ABS's plans in relation to this implementation was released on 30 September 1997.

1.6 SNA93 recommends the use of annual chain volume indexes which link together year-to-year volume movements in production and expenditure calculated using current period weights in preference to constant price estimates calculated using the fixed weights of some selected base year (i.e. fixed-weighted volume indexes). Some of the world's leading national statistical agencies have already accepted this recommendation and introduced chain volume measures in their national accounts statistics. The ABS also plans to follow this recommendation for reasons that are explained in this paper.

1.7 As explained later, annually linked and reweighted, chain volume measures provide better indicators of movement in real output and expenditures than constant price estimates. Unlike constant price estimates, however, they are not perfectly additive: the sum of the chain volume measures for the components of some aggregates, such as total consumption expenditure or GDP, may differ somewhat from the chain volume measure of the total.

1.8 SNA93 also recommends that chain volume measures should be expressed in terms of the values of a particular reference year. This is accomplished by extrapolating, backwards and forwards, the current price dollar value of an aggregate, such as GDP, in the reference year by the chain volume index for that aggregate. In other words, the value of the chain volume index for each period is divided by the value in the reference year and then multiplied by the current price value of the aggregate in the reference year.

SECTION 2 OUTLINE OF THE PAPER

2.1 The sections immediately following this one describe the existing measures of volume growth and then, with the help of a numerical example, some of the ways in which volume indexes can be constructed and how different methods of construction can lead to different results. The paper compares the current approach with the one proposed in SNA93. It also explains the reasoning behind the SNA's preference for chain over fixed-weighted volume indexes. A more detailed exposition of index theory is given in SNA93.

2.2 A major empirical analysis has been undertaken by the ABS to compare the outcomes of using different volume index formulae, including the present one, to derive estimates for GDP(E) and its components. The main results are summarised in the main text of the paper and the details are presented in Appendix 1. These data are consistent with those published in the September quarter 1997 issue of *Australian National Accounts: National Income, Expenditure and Product* (5206.0).

2.3 Experimental annual and quarterly chain Laspeyres volume measures of GDP(E) for the period 1985–86 to 1996–97 and September quarter 1985 to December quarter 1997 are presented in Appendixes 2 and 3, respectively. These data are consistent with those published in the December quarter 1997 issue of 5206.0. ABS plans relating to the introduction of chain volume measures and associated changes are described in Section 13.

SECTION 3 EXISTING MEASURES OF VOLUME GROWTH

3.1 The ABS has, in fact, been publishing chain volume measures for a number of years, but with links many years apart rather than annually. At the present time, constant price estimates are calculated back as far as September quarter 1984 at the average prices of 1989–90. However, estimates for the five years preceding September 1984 are calculated at average 1984–85 prices and are linked to the later series in September quarter 1984. These estimates are in turn linked to earlier estimates at average 1979–80 prices at September quarter 1979, and so on. The resulting linked constant price series, which are referenced to the latest base year, 1989–90, are thus a type of chain volume measure. While the series are additive back as far as September quarter 1984, the series going back beyond September 1984, when the first link occurs, are not. Users, such as econometric modellers, using data prior to September quarter 1984 have had to come to terms with the lack of additivity in the earlier years. It is now proposed to increase the frequency of both rebasing and linking to once a year. This will lead to better indicators of growth, but it will also mean either loss of additivity, or additivity over only much shorter periods than before.

3.2 Against this background, the move from infrequent to annual chain volume measures is evolutionary rather revolutionary. Economists and other users accept that it is not feasible to continue to use the same fixed set of price weights forever, as the price relativities become progressively out of date and irrelevant to the current economic situation as we move further and further away from the base year. Sooner or later the old price relativities have to be replaced by more up to date ones and the old series linked to the new. As SNA 93 says, the real question is not whether to chain or not, but how often. What is the optimal frequency of chaining? The ABS, like many other national statistical offices, has now concluded that annual chaining provides the best growth measures.

3.3 The introduction of annually-reweighted, chain volume measures raises a number of issues such as:

- which index formula should be used?
- should the measures be published in dollar values or only as index numbers?
- how often should the reference year (the year for which the index = 100, or the dollar values equal those of the current price estimates) be changed? and
- what are the implications for price indexes?

Each of these issues is addressed in this paper.

SECTION 4 WHAT IS A VOLUME INDEX AND HOW IS IT CONSTRUCTED?

4.1 One of the prime uses of the national accounts is to measure growth in the volume of production and expenditures on goods and services between any two periods of interest.

4.2 It is easiest to start with a single homogenous commodity such as apples. For example, if 50 apples are produced in period 1 and 60 in period 2 then, assuming no change in their quality, the volume index for apples is given simply by the ratio of the two quantities (usually described as a 'quantity relative'). Setting the value of the index in period 1 to 100 means the value of the index in period 2 is 120, i.e., a 20% increase in the volume of production.

4.3 When there are two or more commodities, it is necessary to introduce some kind of weighting scheme. For instance, when oranges are produced as well as apples, it does not make economic sense simply to add the number of oranges to the number of apples if an orange is not worth the same as an apple. The obvious way to weight each orange or apple is by its market price. In general, market forces may be expected to ensure that the relative prices of apples and oranges reflect not only the relative costs of producing them but also the relative utilities which consumers attach to them. One simple way of constructing a volume index would then be to value the apples and oranges at their prices in one or other period and divide the total value of their combined production in the second period by that in the first. The same prices must be used for both periods to ensure that the index reflects only changes in quantities produced. It can already be seen that we have more than one way of measuring the volume change depending on whether we choose the prices of the first or the second period. In general, they will not give exactly the same answer.

4.4 There is another way of calculating volume indexes. Suppose that the ratios of the quantities, or quantity relatives, are calculated first for apples and oranges separately. One would expect a volume index to be some kind of average of these quantity relatives. It can easily be shown that the indexes described in the previous paragraph are equivalent to weighted averages of the quantity relatives which use the total values of apples and oranges in one or other period as weights.

4.5 There are, however, many other possible ways of averaging the quantity relatives for the two commodities. They could be averaged arithmetically, geometrically or in some other way. Moreover, the weights could relate to values in the first of the two periods, the second period, some sort of average of the two, or possibly to values in some quite different period. Obviously, the choice of functional form and weights affects the growth rate of the volume index. At this point, it is convenient to introduce a numerical example to illustrate the various possibilities.

4.6 The following three tables illustrate the construction of volume indexes using an arithmetic functional form with weights that relate to a

single period. Table 4.1 presents the quantity, price per unit of quantity, and value (price times quantity) of production for three different commodities in years 1, 2 and 3.

4.1 QUANTITIES, PRICES AND VALUES OF GOODS AND SERVICES PRODUCED IN YEARS 1, 2 AND 3

	Year 1			*Year 2*			*Year 3*		
	Quantity q_1	*Price* p_1	*Value* p_1q_1	*Quantity* q_2	*Price* p_2	*Value* p_2q_2	*Quantity* q_3	*Price* p_3	*Value* p_3q_3
Commodity									
A	10	8	80	15	6	90	18	4	72
B	15	12	180	15	14	210	16	15	240
C	20	5	100	25	6	150	25	6	150
Total			360			450			462

4.2 QUANTITIES AND PRICES, AND VALUES AT YEAR 1 PRICES OF GOODS AND SERVICES PRODUCED IN YEAR 1 AND YEAR 2

	Year 1			*Year 2*	
	Quantity q_1	*Price* p_1	*Value* p_1q_1	*Quantity* q_2	*Value* p_1q_2
Commodity					
A	10	8	80	15	120
B	15	12	180	15	180
C	20	5	100	25	125
Total			360		425

4.7 It can be observed from the last column of Table 4.2 that the total value of production in year 2 expressed in year 1 prices is 425. Dividing this value by the value in year 1 (i.e. 425/360) gives an index value of 1.1805 in year 2. By convention, the value of an index is equal to 100 in the reference year, which is year 1 in this example. This gives an index number of 118.05 for year 2 (1.1805x100). In other words, a growth in volume of 18.1% occurred between the two periods.

4.8 The type of index illustrated in Table 4.2, which values the quantities in both years at the prices of the first year, is known as a 'Laspeyres' volume index. It can be interpreted as measuring the percentage change in the total value of production holding prices constant at their year 1 levels. It is also equal to a weighted arithmetic average of the quantity relatives for each of the three commodities using the values produced in the first year as weights.

4.9 Using the same set of information from Table 4.1, an alternative index can be derived by valuing the quantities produced in year 1 at the prices of year 2: see Table 4.3 below.

4.3 QUANTITIES AND PRICES, AND VALUES AT YEAR 2 PRICES OF GOODS AND SERVICES PRODUCED IN YEAR 1 AND YEAR 2

	Year 1		*Year 2*		
	Quantity q_1	*Value* p_2q_1	*Quantity* q_2	*Price* p_2	*Value* p_2q_2
Commodity					
A	10	60	15	6	90
B	15	210	15	14	210
C	20	120	25	6	150
Total		390			450

4.10 From Table 4.3 it can be observed that the value of production in year 1 expressed in year 2 prices is 390. Setting the value for year 1 equal to 100 gives an index number of 115.38 for year 2 ((450/390)x100). In other words a growth in volume of 15.4% occurred between the two periods.

4.11 The type of index illustrated in Table 4.3, which values the quantities in both years at the prices of the second year, is known as a 'Paasche' volume index. This index, like the Laspeyres, also measures the percentage change in the total value of production, but holding prices constant at their year 2, instead of year 1, levels. It can be shown that it equals a weighted harmonic average of the quantity relatives for the three commodities using the values of the second year as weights, i.e. $[(90/450)x(15/10)^{-1}+(210/450)x(15/15)^{-1}+(150/450)x(25/20)^{-1}]^{-1}$

4.12 Which is the better measure of growth — the 18.1% as calculated by the Laspeyres index, or the 15.4% as measured by the Paasche index? There is no simple answer to this question. Obviously, the difference between the two indexes stems from the difference between the two sets of prices used because there is no difference between the quantities. What matters is the extent to which the pattern of **relative** prices (i.e. the ratio of the price of one commodity to another) changes over time and not the general rate of inflation. If all prices were to increase at the same rate the two volume indices would be equal, but if some prices go up faster than others, and especially if some go down while others go up, the two volume indices will diverge. The more variation there is in the price changes, the more the volume indexes will diverge.

4.13 Big changes in relative prices do occur. For example, the oil shocks of the 1970s caused the relative price of oil to rise dramatically, followed by gradual declines over subsequent years. An even more striking example is provided by computers whose relative prices have fallen substantially over several decades so that today they are only a tiny fraction of what they were twenty or thirty years ago. Big changes in the relative prices of major goods or services imply that the price weights used in Laspeyres and Paasche volume indices must be very different. Moreover, the differences tend to be greater the further apart the two periods, because most changes in relative prices tend to be systematic and cumulative.

4.14 It is no accident that the Laspeyres index is greater than the Paasche in the example used here. In general, when economic agents are price takers they tend to react to an increase (*decrease*) in the **relative** price of a commodity by buying less (*more*) of it. They substitute commodities which have become relatively cheaper for commodities which have become dearer — the 'substitution effect' as it is called in the economic literature. Thus, commodities whose relative prices have fallen tend to have faster growth, while those whose relative prices have risen tend to have slower growth. By using the later prices *after* the substitutions have occurred, the Paasche index tends to give less weight to fast growing commodities, and more weight to slow growing ones. It tends to register a smaller overall volume increase than the Laspeyres index. This result is observed time after time in practice, although exceptions do occur occasionally.

4.15 Not only does the Laspeyres formula tend to exceed the Paasche, but these indexes effectively put upper and lower limits on the range of possible measures because other index number formulae that have been proposed almost invariably yield results that lie between them. Despite the divergence between them, both indexes have clear economic interpretations and strong claims to be taken seriously. By using the prices of the first period, the Laspeyres index measures growth from the perspective of the market situation prevailing in that period. Similarly, the Paasche index measures growth from the perspective of the second period. The problem is that growth is different when viewed from these two different perspectives. Neither index is inherently superior, or preferable, to the other, so the basic question remains of whether to accept the Laspeyres or the Paasche or, alternatively, opt for some other index that lies between them. This is often described as the 'index number problem'.

SECTION 5 ECONOMIC INDEXES

5.1 The underlying problem is as much economic as statistical. Economic theory has defined a 'true' measure of volume change, or growth, in terms of movements between points on some utility or production function underlying the observed price and quantity data. It can be shown that the Laspeyres index provides an upper bound to a true economic index based on the first period while the Paasche provides a lower bound to a true index based on the second period, assuming the underlying production function has certain conventional properties. This takes the argument one stage further, because it implies that not only does the Laspeyres index tend to exceed the Paasche, but it also actually tends to overstate 'true' growth from an economic point of view, while the Paasche index tends to understate it.

5.2 This overstatement or understatement of growth is often referred to as 'substitution bias' because it results from the substitution effect described above. The magnitude of the 'bias' will depend on the magnitude of the changes in relative prices. These tend to become cumulatively larger with the passage of time so that substitution bias tends to increase as the two periods compared become further apart. (Substitution bias may affect price as well as volume indexes.)

5.3 If the form of the underlying utility or production function were known, it would be possible to work out which index number formula would measure economic growth correctly. One famous result (see, for example, Diewert, 1976), is that Fisher's Ideal Index (Fisher, 1921) (hereafter referred to as the Fisher index and which is defined as the geometric average of the Laspeyres and Paasche indexes) measures growth in consumption correctly if the utility function can be represented by a homogeneous quadratic function. In practice, however, we can never be sure about the form of the underlying function so we can never be sure what is the true growth rate. On the other hand, certain formulae can be counted on to provide close approximations to the true index under a wide range of circumstances. Such formulae have been described as 'superlative' indexes (Diewert, 1976). They include the Fisher index. Given that the Fisher index is the geometric average of the Laspeyres and Paasche, this suggests that in many cases the true index is likely to lie roughly midway between them, although we cannot take this for granted because we can never be sure exactly where the true index falls.

5.4 When there are only two periods, it may be concluded that a superlative index, such as Fisher, is likely to provide the best measure of growth from an economic point of view. Nevertheless, other considerations, such as cost and timeliness, may, in practice, affect the choice of index number. The Laspeyres index, which does not require weights for the later of the two periods, is less costly than the Fisher and can typically be published more quickly, at least for the most recent periods. These factors have to be weighed against the theoretical advantages of the Fisher. If the gap between the Laspeyres and Paasche

indexes is not very wide anyway, the Fisher may not be worth the extra trouble and delay. As shown later, one of the advantages of chaining is that it may reduce the gap between Laspeyres and Paasche indexes considerably.

SECTION 6 INDEXES COVERING THREE OR MORE PERIODS

6.1 The situation becomes more complicated when three or more periods are involved, and especially when time series of index numbers covering a period of many years are needed. Users are interested in growth rates over different spans of time and expect these to be comparable and consistent.

6.2 Let us go back to the illustrative data given in Table 4.1. Suppose that we now wish to calculate the growth in volume between year 2 and year 3 as well as between years 1 and 2. We could simply repeat the same kind of calculation we did for years 1 and 2, above (see Table 6.1). The Laspeyres volume index could be calculated for year 3 based on year 2 (i.e. using year 2 prices); similarly, the Paasche index could be calculated for year 3 on year 2 (i.e. using year 3 prices); and, finally, the Fisher index could be derived by taking the geometric average of the Laspeyres and Paasche indexes. The Laspeyres index ((482/450)X100=107.11) increases by 7.1%, the Paasche index ((462/435)X100=106.21) by 6.2%, and the Fisher index (square root (107.11X106.21)=106.66) by 6.7%.

6.1 QUANTITIES AND PRICES, AND VALUES AT YEAR 2 AND YEAR 3 PRICES OF GOODS AND SERVICES PRODUCED IN YEAR 2 AND YEAR 3

	Quantity q_2	*Price* p_2	*Value* p_2q_2	*Value* p_3q_2	*Quantity* q_3	*Price* p_3	*Value* p_3q_3	*Value* p_2q_3
Commodity								
A	15	6	90	60	18	4	72	108
B	15	14	210	225	16	15	240	224
C	25	6	150	150	25	6	150	150
Total			450	435			462	482

6.3 When there are three years, we are interested in the cumulative growth between years 1 and 3, and not only in the growth between years 1 and 2 and between years 2 and 3 taken separately. One obvious possibility is to cumulate the growth rates between years 1 and 2 and between years 2 and 3 by multiplying the respective indexes together. For example, the Laspeyres volume index calculated earlier for year 2 on year 1 is 118.05; and that for year 3 on year 2 just calculated is 107.11. This suggests that the cumulative index at year 3 (where year 1 has been set at 100) should be 100(1.1805X1.0711) = 126.4. The cumulative growth between years 1 and 3 is 26.4%.

6.4 On the other hand, we could simply calculate the Laspeyres index for year 3 on year 1 directly, ignoring year 2. All the necessary price and quantity data for years 1 and 3 are already given in Table 4.1. The total value of year 3 quantities at the prices of year 1 is 461: dividing this by 360, the value of year 1 quantities at year 1 prices, gives a Laspeyres index for year 3 on year 1 of 128.06. This is not equal to the product of the two Laspeyres indexes for year 2 on year 1 and for year 3 on year 2 just calculated above. Thus, we now have two different measures of the growth between years 1 and 3, both based on Laspeyres volume indexes.

SECTION 7 DIRECT, INDIRECT AND CHAIN INDEXES

7.1 It is useful at this point to introduce a general distinction between **direct** and **indirect** indexes. A **direct** index is an index which compares two periods directly with each other *using only the prices and quantities in those two periods*. The two periods do not have to be consecutive, of course, or even close together. For example, we can calculate the direct Laspeyres volume index for 1994–95 based on 1984–85 by valuing the quantities in 1994–95 at their prices in 1984–85.

7.2 As an alternative to comparing two periods directly they can be compared indirectly via one or more other periods. An **indirect** index may then be defined as an index which is deduced from two or more direct indexes involving at least one other period in addition to the two periods being compared. For example, suppose there are three periods (not necessarily consecutive) *i, k,* and *m*: an indirect index for period *m* on *k* may be calculated using period *i* as a link by dividing the direct index for *m* on *i* by that for *k* on *i*. The link period may, or may not, lie between the two periods being compared. In the numerical example in paragraph 6.3 above, the cumulative index of 126.44 for year 3 on year 1 is an indirect index because it is deduced from the direct indexes between years 1 and 2 and between years 2 and 3.

7.3 An indirect index may require more than one link. When an indirect index links through two or more consecutive periods, it is usually described as a **chain** index. For example, a chain index for period *m* on period *i* is given by the product of the four direct indexes for periods *m* on *l, l* on *k, k* on *j* and *j* on *i*.

7.4 An indirect index necessarily introduces the prices or quantities of some other period, or periods, into the calculation of the index between the two periods being compared. At first sight, this may appear to be a disadvantage, but the use of this additional information can actually be an advantage in many circumstances, as explained later.

7.5 Going back to the numerical example in Section 6 above, it was shown that the direct and indirect Laspeyres volume indexes for year 3 on year 1 were unequal. They can scarcely be expected to be equal when the indirect index utilises price and quantity information from period 2 that the direct index ignores. In general, when direct and indirect indexes are not equal, the **direct** indexes are said to be **intransitive**. Almost all indexes, including Laspeyres, Paasche and Fisher, turn out to be intransitive. This is a further problem to be taken into consideration.

7.6 In principle, indirect indexes might be avoided by presenting users with direct indexes calculated between every possible pair of years. When there are n years the total number of possible pairs is n(n–1)/2. This means, for example, that over a run of ten years, 45 direct indexes would have to be calculated. The costs of calculating so many indexes could be prohibitive. However, calculating all possible direct indexes does not solve the underlying problem because users are not just

interested in comparisons between particular pairs of years taken *in isolation*. Users are interested in comparing rates of growth over different time spans and expect the growth rates to be numerically consistent. However, when they are not transitive, different direct indexes cannot be numerically consistent. Users would not accept, for example, that the cumulative growth from 1984–85 to 1989–90 and from 1989–90 to 1994–95 does not equal growth measured over the ten year period from 1984–85 and 1994–95 as a whole. An approach of publishing all possible direct indexes is therefore not appropriate.

7.7 In these circumstances, the best solution is to impose numerical consistency on the published data by providing users with *only n–1 direct indexes*, the minimum number needed to connect all *n* years. *All* the remaining indexes are then derived *indirectly*. In practice, all statistical offices do this. There are, however, two fundamentally different ways of going about it, and the ABS is, in effect, proposing to switch from one to the other.

7.8 The first method is to select a base year and calculate the *n–1* direct indexes between all the other years and the fixed base year. This is the procedure followed by ABS, and most other statistical offices, up to now. For example, 1989–90 is the most recent ABS base year and the volume indexes for all years from 1984–85 up to the present are fixed-weighted volume indexes that use the average prices of 1989–90. This implies that the indexes between *every pair of years which do not include the base year* 1989–90 must be **indirect** indexes, including all the year-to-year indexes (except those including the base year).

7.9 The alternative method is to calculate the *n–1* direct indexes connecting successive pairs of years and to derive all remaining indexes indirectly. This is the solution that ABS now proposes to adopt. It follows that all indexes except the *n–1* year-to-year indexes must be indirect indexes. An indirect index between two years that are several years apart has to be a chain index, as two or more links are needed.

7.10 In principle, the question of whether to calculate fixed-weighted volume indexes (or constant price series) or to calculate annual chain volume indexes is equivalent to asking which set of direct indexes is to be preferred: the *n–1* direct indexes on the same base year or the *n–1* direct indexes connecting successive pairs of years? In order to answer the question, the properties and behaviour of fixed-weighted and chain indexes need to be examined more closely. Fixed-weighted indexes will be considered first.

SECTION 8 FIXED-WEIGHTED VOLUME INDEXES (CONSTANT PRICE ESTIMATES)

8.1 When the quantities in a series of years are all valued at the constant prices of the first year, the movements in the resulting time series are identical with those of a sequence of fixed-weighted Laspeyres volume indexes each based on the first year. As just explained, however, the derived volume indexes between any pair of years *which do not include the base year* must be **indirect** indexes. They are not themselves Laspeyres indexes. For example, if year 1 is chosen as the base year for the data in Table 4.1, the volume index for year 3 on year 2 calculated at the prices of year 1 is (461/425)X100=108.47. This increase of 8.5% between year 2 and year 3 may be compared with increases of 7.1% and 6.2% for the Laspeyres and Paasche indexes for year 3 based on year 2.

8.2 The base year does not have to be the first year and it is often placed somewhere in the middle of the sequence. For example, 1989–90 is currently used by ABS as the base year for all years back to 1984–85 as well as for later years. The volume indexes for all the years preceding the base year, i.e. for the years from 1984–85 to 1988–89, must be Paasche type, because they use the prices of the later of the two years being compared. Conversely, from 1990–91 onwards the indexes must be Laspeyres.

8.3 A series of fixed-weighted volume indexes can be converted into time series of dollar values at constant prices simply by multiplying the volume indexes by the current price dollar values in the base year. This is precisely the form of the ABS's constant price estimates from 1984–85 onwards. The resulting series at the constant prices of 1989–90 are equivalent to a run of Paasche type indexes followed by a run of Laspeyres type indexes.

8.4 As explained, economic theory suggests that the Laspeyres index tends to overstate the true rate of growth while the Paasche understates it. Thus, the fixed-weighted volume measures calculated by the ABS will tend to understate growth between 1984–85 and 1989–90 and overstate it after 1989–90. The resulting distortion in growth rates has to be a matter of concern to economic analysts and policy makers. A similar concern was voiced about official fixed-weighted volume measures based on 1987 calculated for the United States. The US Bureau of Economic Analysis (BEA) estimated that GDP volume growth since the recession trough in 1991 was overstated by 0.5 percentage points per year on average, whereas for the five economic expansions between 1960 and 1990, GDP volume growth was understated by 0.5 percentage points a year on average (Landefeld and Parker, 1995). In 1995, the BEA abandoned fixed-weighted volume measures in favour of annually-reweighted, chain Fisher volume measures.

8.5 The extent to which growth may be understated or overstated by fixed-weighted volume indexes depends on the rate at which patterns of relative prices are changing over time. Over a short sequence of years,

the understatement or overstatement may sometimes be so small that it is trivial and difficult to detect, but in other situations it may be serious.

8.6 Further problems arise when the base year for a series of fixed-weighted indexes is changed. If the original base year is the first year, the indexes are all Laspeyres type, but if the base year is moved to the last year they become Paasche type and smaller volume increases will be recorded. In general, moving the base year forward in time will tend to reduce the growth rates previously recorded so that they have to be revised downwards. History is rewritten.

8.7 Statistical offices that compile fixed-weighted volume indexes are obliged to update their base years periodically, otherwise the price weights become obsolete and irrelevant. The slowing down of previously recorded growth rates attributable to updating the base year can sometimes be so pronounced, especially for fast growing economies, that it is difficult for users to understand and may not be readily accepted by governments. The longer updating the base year is postponed, the greater the revisions are liable to be.

Summary

8.8 Fixed-weighted volume indexes and their associated constant price value series are well established and widely used in analysing Australia's national accounts. They are also additive, which means that the constant price aggregates can be decomposed, or components aggregated, as necessary, without discrepancies being created between the components and the aggregates. These are important advantages.

8.9 On the other hand, fixed-weighted indexes may not provide the best measures of growth, especially for long runs of years. When the first year is chosen as the base year, growth tends to be overstated, especially for the later years which are furthest away from the base year. When the base year is placed in the middle, growth tends to be understated for the earliest years and overstated for the latest years. The growth rates are dependent on the somewhat arbitrary choice of base year. Moving the base year to a later year tends to reduce growth rates, so that the periodic updating of the base year can cause significant downward revisions to growth rates.

8.10 The year-to-year movements of a fixed-weighted index are indirect indexes which use the base year as the link between direct indexes. For example, the current ABS practice is to measure growth from 1993–94 to 1994–95 using 1989–90 as the link between direct indexes from 1989–90 to 1993–94 and 1989–90 to 1994–95, even though it is easier to compare 1993–94 and 1994–95 directly than through the base year. An indirect measure of this kind cannot provide the best measure of year-to-year growth and becomes less and less acceptable the further away from the base year.

SECTION 9 CHAIN INDEXES

9.1 In order to understand the advantages and disadvantages of chaining, it is necessary to establish how the resulting indirect index between two years that are far apart may be expected to behave in comparison with the corresponding direct index between the same two years. Chain indexes are inevitably path dependent: that is, a chain index does not depend simply on how much the prices and quantities in the two years differ from each other but also on how the prices and quantities move in the intervening years.

9.2 It is particularly important to establish how chaining affects the relationship between Laspeyres and Paasche indexes, a chain Laspeyres (Paasche) volume index being defined as one in which each direct index between two consecutive periods uses the prices of the first (second) period as weights.

9.3 Suppose that most relative prices and quantities (see paragraph 4.12) tend to change monotonically: that is, to have persistent tendencies either to rise or to fall without fluctuating. For a relative price or relative quantity to fall monotonically, it does not need to fall at a steady rate, but it should either fall, or remain unchanged, from one period to the next. Assuming that relative prices and quantities change monotonically and that Laspeyres indexes are greater than Paasche indexes, a chain Laspeyres volume index will increase less than the direct Laspeyres while the chain Paasche will increase more than the direct Paasche. Chaining reduces the Laspeyres–Paasche gap: that is, the difference between average rates of growth derived from the Laspeyres and Paasche indexes will be reduced.

9.4 In practice, of course, not every relative price and quantity can be expected to change monotonically throughout, but provided most prices and quantities behave this way most of the time, chaining will still reduce the gap. When the data are annual, most of the average annual prices and total quantities may be expected to move monotonically.

9.5 Chaining seems desirable whenever it reduces the Laspeyres–Paasche gap in this way because the measurement of economic growth (or inflation) becomes less sensitive to the choice of index number formula. The index number problem itself is reduced. The underlying explanation is as follows. When relative prices and quantities tend to change monotonically, the pattern of relative prices in the first year is gradually transformed into that of the last year. The changes in relative prices between consecutive pairs of years are then obviously much smaller than the cumulative changes between the first and last years. The smaller the changes in the relative prices, the less sensitive are the volume measures to the choice of index number. (In the limit, if the relative prices were to remain the same between two years, the index number problem would disappear because the Laspeyres and Paasche volume indexes would coincide.) By calculating the *n–1* direct volume indexes between consecutive time periods the resulting

Laspeyres–Paasche gaps are likely to be minimised, not merely for the direct indexes themselves but also for all the indirect indexes derived from them. The Laspeyres–Paasche gaps for the resulting indirect (i.e. chain) indexes, whether the years are close or far apart, will tend to be less than the gaps for the corresponding direct or indirect indexes derived from a set of fixed-weighted indexes.

9.6 On the other hand, the situation may be quite different if relative prices do not change monotonically. When there are important fluctuations in relative prices and quantities, the chain Laspeyres may increase more, and the chain Paasche less, than the corresponding direct indexes, so that the Laspeyres–Paasche gap actually widens. This may happen with both *annual* and *sub-annual* data. For example, chaining quarterly or monthly data subject to regular seasonal fluctuations is liable to increase the gap (although not, of course, if the fluctuations are removed by seasonal adjustment).

9.7 Suppose, for purposes of argument, that an initial set of changes in relative prices is subsequently reversed so that the pattern of relative prices returns to what it was in the first period. Every relative price fluctuates. In this case, a direct volume index should be calculated between the first and last periods because the direct Laspeyres and Paasche volume indexes must be equal if the relative prices are the same in both periods. There is no index number problem. Chaining through the intervening periods produces unacceptable results because the changes in relative prices between consecutive periods are actually much greater, by assumption, than they are between the first and last periods.

9.8 Although price fluctuations do occur, most annual average prices tend to change monotonically. In practice, economies tend to evolve in such a way that changes in relative prices and quantities get cumulatively larger over time instead of reversing themselves. This also suggests that the set of goods and services on the market is continually changing over time. Just as the pattern of relative prices may move gradually further and further way from its initial state, the quantities may also do so, especially as new goods and services appear while older ones disappear. In this situation, it becomes increasingly difficult to calculate direct indexes over long periods of time as the overlap between the sets of goods and services available in both years gets progressively smaller.

9.9 Price changes can only be calculated for goods and services found in both years. As the overlap between the goods and services will usually be greatest in consecutive years, the direct volume and price indexes between them will be able to exploit virtually all the price and quantity information available in each year whereas direct indexes calculated between years much further apart may only be able to utilise a fraction of the information in each year. It may eventually become a practical impossibility to calculate satisfactory direct indexes between two years very far apart because they have so few goods and services in common.

9.10 Even when the 'same' goods or services are found in both years their quality may have changed. Improvements in quality are equivalent to increases in quantity but they become increasingly difficult to measure as the quality changes get bigger. It is difficult enough to measure the improvement in the quality of computers from one year to the next, but trying to measure the improvement in the quality of computers in a direct comparison over ten or more years poses almost insurmountable problems. Changes in quality may become so great that the goods or services can no longer be treated as the same, so that direct comparisons of their prices and quantities with those in earlier periods have to be abandoned.

9.11 The problems caused by quality changes, new goods and disappearing goods are minimised by annual chaining because the sets of goods and services available in consecutive years have more in common than those in years further apart. Or, to put the same point differently, the amount of useable price and quantity information is maximised for direct indexes calculated between consecutive years. A direct index for two years far apart may have to ignore most of the prices and quantities in each year because there are no comparable prices and quantities in the other year. The resulting direct index must have poor coverage and limited economic significance.

9.12 Direct year-to-year volume indexes must, therefore, be more reliable than direct indexes between years further apart, whatever type of index is used. The greater reliability of year-to-year indexes considerably reinforces the case for chaining put forward earlier even though it stems from the same basic phenomenon, namely the fact that relative prices and quantities in consecutive years are more similar than those in years further apart. The combination of greater reliability and a reduced Laspeyres–Paasche gap constitutes a powerful, and possibly decisive, argument in favour of annual chaining if the objective is to obtain the best possible measures of growth.

SECTION 10 CHOICE OF INDEX NUMBER FORMULA

10.1 Although annual chaining reduces the index number problem it does not dispose of it completely. There remains the question of which index number formula to use in a chain index: Laspeyres, Paasche, Fisher, or perhaps some other index? When there are only two periods, it has already been explained that, in principle, a superlative index, such as Fisher, is preferable to Laspeyres or Paasche because it is likely to provide a closer approximation to the underlying economic index. This suggests that each of the individual year-to-year direct indexes from which an annual chain index is constructed should also be superlative.

10.2 Another superlative index that has been proposed as an alternative to Fisher is the Tornqvist index. It is often used for productivity analysis, and is used by the ABS to construct its indexes of multifactor productivity (*Australian National Accounts: Multifactor Productivity* (Cat. no. 5234.0)). Like the Fisher index, it is a symmetrical volume index which gives equal weight to the prices and values in both periods concerned, and, in general, both indexes tend to produce very similar results. The merits of these two superlative indexes are compared both theoretically and empirically in ABS Working Paper No. 96/1 *Choosing a Price Index Formula* L. Johnson (Cat. no. 1351.0). SNA93 recommends that a superlative index be used in constructing the volume indexes in the national accounts, opting for Fisher in preference to Tornqvist.

10.3 In addition to being a superlative index, the Fisher index has the advantage of satisfying both the time reversal test and the factor reversal test. The time reversal test requires that the index for time t from time 0 should be the reciprocal of the index for time 0 from time t. Satisfying the (strong) factor reversal test means that the implicit price (or volume) index calculated by dividing the change in current values by a directly calculated volume (or price) index is itself an index *of the same type*. The implicit price index associated with the Fisher volume index is itself also a Fisher index: it is therefore also a superlative index. This is a desirable property in a national accounts context when price (or volume) indexes often have to be derived indirectly by dividing changes in current values by the corresponding volume (or price) indexes. Neither the Laspeyres nor Paasche indexes (nor most other indexes) satisfy either the time reversal or the factor reversal tests. The Tornqvist index satisfies the time reversal test but not the factor reversal test.

10.4 As the Tornqvist and Fisher indexes are likely to yield very similar results, the fact that the Fisher index satisfies the factor reversal test and the Tornqvist does not tips the balance in favour of chain Fisher indexes, as SNA93 suggests. As each individual year-to-year direct Fisher index is the geometric average of the corresponding direct Laspeyres and Paasche indexes, it follows that chain Fisher indexes must also be the geometric average of chain Laspeyres and chain Paasche indexes.

10.5 An important advantage of a chain Fisher index over a chain Laspeyres or Paasche index is that it is less sensitive to fluctuations in price and volume relativities, because it satisfies the time reversal test. This means that, unlike a chain Laspeyres or chain Paasche index, a chain Fisher index is not liable to 'drift' outside the range spanned by direct Laspeyres and Paasche indexes when relative prices or relative volumes fluctuate. Of course chaining is not recommended anyway for series that fluctuate, especially sub-annual data subject to seasonal fluctuations, but if they do have to be chained for some reason, Fisher is preferred to either Laspeyres or Paasche. An example of an aggregate with components whose price and volume relativities fluctuate is exports of goods.

10.6 Nevertheless, these theoretical advantages of Fisher indexes may not always be decisive. It is also necessary to take account of data availability, cost, timeliness, empirical evidence and other practical considerations.

10.7 A significant practical consideration stems from the annual linking of quarterly data. It is generally considered best to reweight volume and price indexes no more frequently than annually for the following reasons. First, quarterly data are subject to greater volatility than annual data. That part of the short-term volatility that is seasonal can be removed by seasonal adjustment, but this requires seasonally adjusting all the elemental components of an index. In the context of the Australian national accounts, it is considered that this would result in seasonally adjusted estimates of lower quality, because better results are obtained by seasonally adjusting at a higher level of aggregation in a number of cases. Furthermore, the remaining non-seasonal volatility could lead to drift in the chain volume indexes. Second, annual data are generally of higher quality than quarterly data and it is considered better to use them to derive the volume weights. In addition, for some components of the national accounts, including most of GDP(P), there are no quarterly price or value data, so it is not possible to reweight them quarterly.

10.8 Quarterly chain Fisher-like indexes that are reweighted annually can only be compiled up to the year prior to the latest complete year and not beyond. This end point problem was faced by the BEA when it introduced such indexes in 1995. Its initial solution to the end point problem was to have Laspeyres indexes for the latest year or so. In 1997 it abandoned this solution and now compiles quarterly chain Fisher indexes that are reweighted quarterly for the latest periods. Unlike the ABS, the BEA does not compile quarterly volume measures of GDP(P).

10.9 The results of an empirical analysis comparing results obtained using different index formulae are presented in Appendix 1 and are discussed in Section 11.

10.10 To round off this discussion it may be useful to pull together the numerical results from the illustrative data given in Table 4.1. The key results are the differences between the direct and the chain indexes for year 3 on year 1. These are shown in Table 10.1.

10.1 COMPARISON BETWEEN DIRECT AND CHAIN VOLUME INDEXES

Percentage changes between year 1 and year 3

Direct Laspeyres	28.1	Chain Laspeyres	26.4
Direct Fisher	24.0	Chain Fisher	24.5
Direct Paasche	20.0	Chain Paasche	22.8

10.11 The chain indexes have only one link in year 2. The difference between the direct Laspeyres and Paasche indexes is 8.1 percentage points. Chaining reduces the difference to 3.6. As this example is artificial, a few additional comments may be in order. The direct Laspeyres is greater than the direct Paasche because the substitution effect is built into the data. By making the relative price changes in the original data in Table 4.1 more pronounced and the negative correlation between the changes in relative prices and quantities stronger, the Laspeyres–Paasche gap would be increased further. Secondly, relative prices move monotonically so that chaining reduces the gap, as expected in these circumstances. If the prices in year 2 were to be fixed so that each price moved even more smoothly from year 1 to year 3, chaining would reduce the gap even more. Finally, it may be noted that there is no reason to prefer the chain Fisher to the direct Fisher in this particular example as the same three commodities are well represented in both years 1 and 3.

SECTION 11 IMPACT OF CHAINING ON GROWTH RATES OVER THE LAST TWELVE YEARS

11.1 The volume measures currently published by the ABS use the average prices of 1989–90 to calculate fixed-weighted data covering the period from 1984–85 to 1996–97. Data for years before 1984–85 are linked using 1984–85 as the link year and are therefore excluded from consideration here as they already involve an element of chaining. However, the fixed-weighted data for the 12 years from 1984–85 to 1996–97 may be compared with the results obtained from annual chain Fisher indexes and annual chain Laspeyres indexes in which each year-to-year change is measured by a direct index. The results for GDP and some of its main components are shown in the tables at Appendix 1. The data used to calculate the growth rates are as of the September quarter 1997 issue of *Australian National Accounts: National Income, Expenditure and Product* (Cat. No. 5206.0).

11.2 Each table presents year-to-year growth rates and total growth rates and average annual compound growth rates over the 5 year period from 1984–85 to 1989–90, the base year for the fixed-weighted indexes, and the 7 year period from 1989–90 to 1996–97. The format of each of the tables is the same: the first column shows the growth rates of the present fixed-weighted indexes, the second column those of the Fisher indexes and the third column those of the Laspeyres indexes. The fourth column shows the difference between the first column and the second column, the fifth column shows the difference between the first column and the third column and the sixth column shows the difference between the third column and the second column.

11.3 It may be useful to recall that if:

(i) there are significant changes in the relative prices of different goods and services, and

(ii) there is a significant substitution effect in response to these changes, then

index number theory predicts that growth rates derived from the fixed-weighted indexes in the 5 year period will have a downward bias while those in the following 7 year period will have an upward bias. As the Fisher indexes are superlative indexes which may be assumed to be unbiased, they can be used as benchmarks by which to evaluate the fixed-weighted indexes and the Laspeyres indexes. Thus, any substitution effect should manifest itself in slower rates of growth for the fixed-weighted indexes than the chain Fisher indexes in the first 5 year period and faster rates of growth in the following 7 year period. We would also expect the chain Laspeyres indexes to have an upward bias over the whole 12 year span.

11.4 Looking at the average annual growth rates for GDP(E) in Table A1.1, it can be seen that for the first 5 year period the fixed-weighted index grew by 3.7% per year, slightly less (0.1 percentage points) than the chain Fisher index. While this is consistent with a very mild substitution effect, an examination of the differences between the year-to-year growth rates reveals no consistent pattern. For the following 7 year period the average annual growth rate of the fixed-weighted index is 2.9%, again slightly less (0.1 percentage points) than the chain Fisher index and the opposite direction of what one would expect from a substitution effect. Although the differences are very small, it does not follow that the bias would remain negligible in the future and it is certainly not small for some other countries. The differences between the chain Laspeyres and Fisher indexes over both the 5 and 7 year periods are generally less than those between the fixed-weighted and the chain Fisher indexes. Between 1989–90 and 1996–97 there is hardly any difference at all between the chain Laspeyres and Fisher indexes.

11.5 As similar comparisons for United States GDP are of general interest and have attracted some publicity, it is worth examining why the estimated biases in the fixed-weighted GDP indexes for Australia, of less than 0.1 percentage points per year over the 12 year period, are so much smaller than those for the US, of the order of 0.5 percentage points per year, as already mentioned (see paragraph 8.4). One reason seems to be that much of the bias in the US figures was attributable to the dramatic fall in the relative price of computers and whereas the US is a major producer of computers, Australia is not. Australia relies mainly on imports of computers rather than domestic production. (Significant biases do show up in the Australian growth rates of imports and private gross fixed capital expenditure on equipment, as shown below.) Another reason is that the growth of Australian GDP is more affected by the growth of exports, and exports do not always behave as predicted above, as explained later.

11.6 Turning to the components of GDP(E), Table A1.2 shows the results for private final consumption expenditure. The outcome in respect of the fixed-weighted indexes is as expected in both the 5 and 7 year periods, but the extent of the estimated bias is small. It must be concluded that changes in relative prices have been sufficient to generate only a moderate substitution effect. This could change if computers and similar high technology goods begin to account for a larger proportion of consumers' expenditures. The differences between the Laspeyres and Fisher indexes are even smaller, averaging zero and never exceeding 0.1 percentage points in any year.

11.7 The results for private gross fixed capital expenditure on equipment (Table A1.3) — in which computer equipment, and their associated relative price changes, are important — are much more striking and in accordance with predictions. The average annual growth rate of the fixed-weighted index in the 7 year period (7.1%) was almost double that in the earlier 5 year period (3.7%), whereas the Fisher indexes reveal that the average annual growth rate in the 7 year period

(5.0%) was only a little greater than it was in the earlier 5 year period (4.7%). Thus, the currently published estimates are badly distorting the pattern of real growth in this item over the last twelve years. Furthermore, the bias gets appreciably worse the greater the distance from the base year of the fixed-weighted indexes. The growth rate of the fixed-weighted index from 1995–96 to 1996–97 is 17.8%, which is much greater than the 12.0% for the Fisher index and 12.4% for the Laspeyres index.

11.8 Moreover, the past practice of compiling constant price estimates on the latest base year (currently 1989–90) back to the previous base year (currently 1984–85) resulted in large revisions to growth rates, particularly in the period between the base years, where Laspeyres indexes were replaced by Paasche indexes. For example, when 1989–90 was adopted as the latest base year the growth in volume of private gross fixed capital expenditure on equipment between 1984–85 and 1989–90 was changed from 34.7% to 20.6%.

11.9 The Laspeyres indexes are slightly upwardly biased over both the 5 year period and 7 year period as expected: an annual average growth rate of 5.0% compared with 4.7% for the chain Fisher index over the 5 year period and 5.2% compared with 5.0% over the 7 year period. But the biases are much smaller than those of the fixed-weighted indexes. Unlike the fixed-weighted indexes, the chain Laspeyres index does not distort the pattern of growth over the 12 year period to any great extent.

11.10 The results for imports (Table A1.4) are also in line with expectations. They are similar to those for gross fixed capital expenditure on equipment, but not quite so pronounced. This is almost certainly due to the fact that computer equipment accounts for a smaller fraction of imports. Over the 5 year period the average annual growth rate of the chain Fisher index for imports (7.5%) was 0.7 percentage points greater than that of the fixed-weighted index (6.8%). Over the 7 year period the average annual growth rate of the chain Fisher index (6.7%) was 1.8 percentage points lower than that of the fixed-weighted index (8.5%). By comparison, the upward bias of the chain Laspeyres index is quite modest: 0.4 percentage points a year over the 5 year period and 0.3 percentage points over the following 7 year period. Furthermore, the growth rates of the fixed-weighted index in 1995–96 and 1996–97, well away from the base year, are far larger than either the Fisher or Laspeyres indexes, and greatly exaggerate the growth of imports.

11.11 The growth of imports enters into the growth of GDP with a negative weight because imports are subtracted from total final expenditures. The effects just observed for imports, therefore, work in the opposite direction to those observed for private gross fixed capital expenditure on equipment as far as GDP is concerned. They almost cancel out the effects of falling computer equipment prices on final expenditures, for example, and this is one of the reasons why the effects of chaining are not very noticeable for GDP as a whole. The smaller

effects on GDP already noted for Australia than the United States partly reflect the fact Australia imports most of its computers whereas the United States is a major computer equipment manufacturer.

11.12 Exports are also interesting, but for a different reason. The conventional index number predictions depend on purchasers making substitutions in response to changes in relative prices. However, if the economic agents are producers rather than purchasers they may react differently, and their reactions in the short and long term could be quite different, too. Producers of minerals, for example, could be expected to increase their production in response to increases in the relative prices of their outputs at a world level and try to export more, not less. On the other hand, farm output is primarily determined by the weather — not prices — at least in the short term. In the long run, slowly declining relative prices may be a spur to increases in the volume of farm output. Thus, the substitution effect may be working in opposite directions for many Australian exports, or not at all, in which case we cannot expect Laspeyres indexes to be greater than Paasche indexes.

11.13 Although there are significant differences between the yearly growth rates of the fixed-weighted indexes and the Fisher indexes for exports, there is little difference between the average annual growth rates. Over the 5 year period the average annual growth rate of the fixed-weighted index is 6.4%, 0.3 percentage points less than that of the chain Fisher index. Over the following 7 year period the difference between the annual average growth rates is only 0.1 percentage points. The differences between the chain Fisher and Laspeyres indexes are even less, and on average are negligible over both the 5 year period and the 7 year period. In some years, however, the differences between the two are significant. Most importantly, there is little evidence of drift in the chain Laspeyres index. As exports are a major component of final expenditures for Australia, this also helps to explain why the effects of chaining are not so pronounced at the level of GDP, especially compared with a country such as the United States where foreign trade is relatively much less important.

11.14 In summary, the results of the empirical study show that:

- For those aggregates with a substantial computer equipment component — such as private gross fixed capital expenditure on equipment and imports — the growth rates of the fixed-weighted index are substantially different to those of the chain Fisher index, with the extent of the bias tending to get larger as the distance from the base year of the fixed-weighted index increases. The differences between the growth rates of the chain Laspeyres and chain Fisher indexes are generally small.
- For private final consumption expenditure, which has a small computer equipment component, the differences between the growth rates of the fixed-weighted index and the chain Fisher index are small, but consistent with the expected substitution effect. The

differences between the growth rates of the chain Laspeyres and chain Fisher indexes are negligible.

- There is little difference between the average annual growth rates of the three index types for gross domestic product, but the chain Laspeyres is a little closer to the chain Fisher than the fixed-weighted index.

SECTION 12 NON-ADDITIVITY

12.1 As the weights of a chain index change from year to year, chain indexes have no *base* year in the sense in which a fixed-weighted index has a base year, although they must have a reference year. In the reference year a chain index equals 100 and a chain volume measure expressed in dollars equals the corresponding current price value. Chain volume measures are not additive, whatever the type of index formula used for the direct indexes that measure the year-to-year changes. Non-additivity means that when the current price values in the reference year are extrapolated backwards or forwards using a chain index the extrapolated values of the components of an aggregate do not, in general, sum exactly to the extrapolated value of the aggregate. (An exception to this general rule, which allows additivity for the latest year or so, is discussed in paragraph 12.5 and Sections 13 and 15.)

12.2 The only type of volume index which is additive is one that uses a fixed set of prices. Thus, fixed-weighted volume indexes of the kind that ABS currently calculates are additive over the years covered by the fixed weights. The constant price data from 1984–85 up to the present, which use average 1989–90 prices, are additive.

12.3 Chaining will therefore result in the widespread loss of additivity for the volume measures in Australia's national accounts. While this may matter little to users interested only in the growth of a few main aggregates, such as GDP or private final consumption, it could be a serious inconvenience for analysts working with macro economic models containing many inter-dependent variables linked by accounting relationships. Although methods can be developed to cope with the breakdown of additivity, they impose additional burdens. From the point of view of such analysts, the operative question becomes whether the improvements in the measures of growth (and inflation) compensate for the loss of additivity. Limited experience from the United States, where chain indexes were introduced a few years ago, suggests that the improvement in the quality of the measures, and hence in the forecasts or other analyses based on them, does compensate for the loss of additivity. In any case, as already noted, fixed-weighted volume measures cannot be allowed to continue indefinitely. Otherwise, the bias in the growth measures becomes unacceptably large. Base years have to be updated periodically and the new series linked to the old, so that over the very long run chaining becomes inevitable. Ultimately, the issue is not whether to chain or not, but how often to reweight.

12.4 Table A2.1 in Appendix 2 shows the experimental annual values of GDP and its main components obtained by extrapolating the 1995–96 current price values backwards and forwards using chain Laspeyres volume indexes consistent with the December quarter 1997 issue of *Australian National Accounts: National Income, Expenditure and Product* (Cat. no. 5206.0). The only exception to the use of this procedure is in respect of increase in stocks. Following the standard procedure for increase in stocks produces unsatisfactory results (consider

the case if the current price increase in stocks in the reference year were zero, for example), so chain volume measures are derived for stock levels which are then differenced to produce volume measures of increase in stocks. While this procedure produces more satisfactory results, it does lead to a loss of additivity in the reference year.

12.5 The final row of the table is a residual, which shows by how much the sum of the component aggregates differs from the value of GDP obtained from the chain index for GDP itself. The residuals are extremely small in general. The largest discrepancy, that in 1986–87, is 0.4% of the level of GDP. A number of general comments may be added, however. The first is that further disaggregation creates further discrepancies, so that a table of this kind oversimplifies the extent of the problem. The second is that the discrepancies tend to become larger, both absolutely and relatively, the further away the year is from the reference year, here 1995–96. This is a general tendency. The third comment is that chain indexes do not have a base year in the sense that fixed-weighted indexes do. Any year could be chosen as the reference year whose values are extrapolated backwards or forwards. In particular, there is nothing to prevent the year on which the latest weights are based from being used so that the problem of non-additivity is non-existent for subsequent years and relatively small for the reference year and the immediately preceding years. This is what has been done here and what the ABS plans to do when chain volume measures are formally adopted.

SECTION 13 INTRODUCTION OF CHAIN VOLUME MEASURES

13.1 In deciding whether to proceed with the introduction of chain volume measures, and if so which index formula should be used, there are five considerations: index number theory, empirical results for Australia, consistency within the national accounts, cost and, most importantly, what is best for users.

13.2 In situations where price and volume relativities are changing monotonically, index number theory is quite clear: chain volume indexes provide better indicators of growth than fixed-weighted indexes and the more rapid the change the greater the imperative to chain frequently. Theory favours superlative index number formulae and, for the purposes of deriving volume measures of GDP and its components, Fisher's Ideal Index is the preferred superlative index formula. However, frequent chaining diminishes the superiority of the Fisher index over non-superlative indexes, such as the Laspeyres index, although chain Fisher indexes are more robust than chained non-superlative indexes in situations where price and volume relativities do not change monotonically.

13.3 Empirical results for Australia's national accounts over the twelve year period 1984–85 to 1996–97 show quite clearly that chaining is highly desirable for some important components of GDP, if not for GDP itself. The distorted picture of growth presented by the existing fixed-weighted, constant price estimates is likely to get worse as new technologies appear and the ensuing change in price and volume relativities continue. As expected, the empirical results indicate only modest gains from using chain Fisher indexes instead of chain Laspeyres indexes.

13.4 In an environment of rapidly changing price and volume relativities it is impossible to have both good indicators of volume growth rates and additivity for more than a year or two. Given that the principal use of volume measures is to determine growth rates free of the direct effects of price change, then it follows that the ABS should adopt chain volume indexes and forsake additivity. However, the cost of compiling chain Fisher volume measures is considerably higher than chain Laspeyres volume measures. Therefore, the ABS has decided that it will compile chain Laspeyres volume measures as the additional cost does not justify the modest improvements in accuracy offered by chain Fisher volume measures evident over recent years. Nevertheless, the relative performance of chain Fisher volume measures will be kept under review.

13.5 It is possible to publish the chain Laspeyres measures either in index number form or in dollar terms, by using index numbers to extrapolate the current price values in a particular reference year. Publishing the volume measures in dollar terms has a number of advantages: users are used to having volume measures expressed in dollars and it is understood that most economic modellers and

forecasters would prefer to work with dollar values; the impact of non-additivity is explicitly shown; dollars give a perspective of the relative size of aggregates; and an index of changes in stocks is of little use. As there seem to be no disadvantages of any significance, the decision to publish volume measures in dollar terms is an easy one to make. The value of the difference between GDP and the sum of its major components will be shown as an explicit entry in the published accounts.

13.6 The choice of reference year is not so simple. Keeping the reference year fixed for a number of years, as is the case with the currently published constant price estimates, has some attractions, including minimising revisions. However, it would mean that the impact of non-additivity would be more significant in recent time periods. Choosing a reference year that is close to the current period will reduce the impact of non-additivity. On balance, this seems to be the better option, and so the reference year will be the year of the latest weights, i.e. the year prior to the latest complete financial year. For example, the chain volume measures to be published in the September quarter 1998 issue of *Australian National Accounts: Income, Expenditure and Product* (Cat. no. 5206.0) will be in terms of 1996–97 dollars. In the June quarter 1999 edition of 5206.0 the reference year will be updated to 1997–98. This will entail revising the levels of the volume measures for their entire history every year, but re-referencing will not alter growth rates. (However, revisions to growth rates will continue to occur as a result of revisions to the underlying data.)

SECTION 14 IMPLEMENTATION TIMETABLE

14.1 The ABS intends to replace the existing constant price estimates with chain Laspeyres volume measures effective from the September quarter 1998 issue of *Australian National Accounts: National Income, Expenditure and Product* (Cat. no. 5206.0). All subsequent national accounts publications, and special and standard data services will contain chain volume measures rather than constant price estimates.

14.2 There is to be a second release of the June quarter 1998 issue of 5206.0 in which the data are to be presented on the basis of SNA93 (see *Information Paper: Implementation of Revised International Standards in the Australian National Accounts* (Cat. no. 5251.0)). This revised basis will include annually-reweighted, chain Laspeyres volume measures of all components of GDP.

14.3 In the March and June quarter 1998 issues of 5206.0, both constant price estimates and experimental chain Laspeyres volume measures for GDP(E) and its components will be published. Data for the chain volume measures back to September quarter 1988 will appear in the publication and data from September quarter 1985 will be available on request. The data will also be published electronically.

14.4 The move from constant price estimates to chain volume measures will apply also to other ABS statistics for which constant price estimates are currently released, namely: retail trade, new capital expenditure, stocks and sales of selected industries, building approvals, building activity, engineering construction, and research and experimental development. The move from constant price estimates to chain volume measures will be made progressively and the timing of the changes will be announced in the relevant publications.

SECTION 15 COMPILATION OF QUARTERLY, ANNUALLY-REWEIGHTED, CHAIN LASPEYRES VOLUME MEASURES

15.1 There are three key steps taken in deriving the existing constant price estimates. First, volume measures expressed in the prices of the latest base year are derived for each of the elemental components. Second, these are added together to form the desired aggregates. Third, the aggregates are linked to their counterparts valued in the prices of an earlier base year to form long, continuous time series. Linking is accomplished by first choosing a link year. (The link year chosen for linking estimates at average 1989–90 prices to estimates at 1984–85 prices is 1984–85). Link factors are then derived at the link year for each aggregate by dividing the annual estimate on the latest base year by the annual estimate on the earlier base year. The estimates on the earlier base year are then multiplied by the link factor in every period.

15.2 The annually-reweighted, chain Laspeyres volume measures for quarterly series are compiled using a similar multi-step process. There are some important differences, namely:

- the volume measures are valued in the prices of the previous year;
- linking is conducted annually at the June quarter using June quarter data;
- linking by calculating link factors and applying them to the preceding values, as is done to link the existing constant price series, is operationally inefficient when done annually. It is better to calculate quarter-to-quarter indexes and form a quarterly chain index;
- the chain indexes are benchmarked to annual chain Laspeyres volume indexes; and
- the benchmarked indexes are referenced to the year of the latest weights so that the problem of non-additivity is non-existent for subsequent years and relatively small for the reference year and immediately preceding years.

15.3 The steps to be followed in compiling annually-reweighted, chain Laspeyres volume measures for a quarterly series are best illustrated using an example. Here are the steps to be followed for private final consumption expenditure. Assume that there are n financial years of data to be linked, t =1 to n.

1 For each of the 44 components for each state — a total of 352 components — derive volume estimates in the prices of year t–1 for the five quarters from June quarter year t–1 to June quarter year t for years 1 to n–1. For the quarters of the final, incomplete year, year n, derive the estimates in the prices of year n–2.

2 Sum all 352 components in each time period.

3 Calculate quarter-to-quarter indexes of the aggregate. For each year t up to year n–2, the indexes from September quarter to December quarter, December quarter to March quarter and March quarter to June quarter are calculated at year t–1 prices, but the following June quarter to September quarter index is calculated at year t prices. For year n–1 and the final, incomplete year, year n, all quarter-to-quarter indexes are calculated at year n–2 prices.

4 Compound the quarter-to-quarter indexes to form a chain index.

5 Benchmark the quarterly, annually-reweighted, chain Laspeyres volume index of PFCE to the annual Laspeyres chain volume index referenced to the annual current price value in the reference year.

15.4 Following this procedure up to step 4 for increase in stocks produces unsatisfactory results, so chain volume measures are derived for stock levels which are then differenced to produce volume measures of increase in stocks.

15.5 For the experimental volume measures published here (Appendixes 2 and 3) and to be published in the March and June quarters 1998 issues of 5206.0, the latest weights will be in respect of the reference year 1995–96 and will be used from June quarter 1996. In the re-release of the June quarter 1998 issue of 5206.0 and the following September quarter 1998, December quarter 1998 and March quarter 1999 issues, the latest weights will be in respect of 1996–97 and will be used from June quarter 1997. Choosing 1996–97 as the reference year will ensure additivity from September quarter 1997, i.e. the latest 4 to 7 quarters. In the June quarter 1999 edition of 5206.0 the reference year will be changed to 1997–98.

SECTION 16 IMPLICATIONS FOR PRICE MEASURES IN THE NATIONAL ACCOUNTS

16.1 Currently, the ABS publishes two sets of price indexes as part of the national accounts: fixed-weighted indexes (1989–90 base) and implicit price deflators. The implicit price deflators (IPDs) are derived by dividing current price estimates by the corresponding constant price estimates. The IPDs are effectively direct Paasche price indexes in respect of any period post 1989–90 and the base year itself (1989–90) and direct Laspeyres price indexes in respect of any period pre 1989–90 and the base year. When used indirectly, i.e. to measure price change between years that do not include the base year, they are affected by changes in volume relativities and so do not measure pure price change.

16.2 Consistent with the replacement of constant price (i.e. fixed-weighted) volume measures by chain Laspeyres volume measures, the quarterly fixed-weighted price indexes will be replaced by quarterly, annually-reweighted, chain Laspeyres price indexes from the September quarter 1998 issue of 5206.0. These chain price indexes will, in general, be superior to the fixed-weighted price indexes and far superior to the current implicit price deflators (IPDs). The IPDs derived from annually-reweighted, chain Laspeyres volume indexes will be superior to the existing IPDs, because the effect of compositional change will be lessened. Nevertheless they will remain inferior measures.

16.3 The ABS began publication of IPDs to readily facilitate the decomposition of growth rates for aggregates valued in current prices into volume and price components. They were never intended to be indicators of price change in their own right, although the ABS accepts that this is how they have been used for a long time and it recognises that they are now well entrenched and are used in some legal contracts and agreements. The ABS will therefore continue to publish them, but they will be given less prominence in national accounts publications.

SECTION 17 IMPLICATIONS FOR OTHER PRICE INDEXES

17.1 In developing a national system of price and volume measures, an ideal conceptual goal would be a fully integrated system that used compatible methodology across all the component measures. However, before considering implementing a system of annual reweighting for Australia's suite of consumer, producer and international trade price indexes, a number of important issues would need to be carefully addressed. The adoption of frequent reweighting on a mechanical basis should not be viewed as a complete and universal solution to potential index number problems such as bias. In fact, as already discussed, in certain circumstances, increasing the frequency of reweighting a price index may lead to a reduction in the accuracy of the measure.

17.2 There would be significantly greater resource costs associated with implementing annual reweighting of the range of price indexes compared with its introduction for the national accounts volume measures, largely because of data availability problems. The level of detail required for reweighting the price indexes is substantially greater.

17.3 A key area of compromise in price and volume measurement relates to revisions to index series. There is a need for a trade-off between certainty and the use of the optimum methodology; that is, the relative merits of revisability and accuracy need to be carefully weighed up when selecting an index formula. The significant and unavoidable lags in the availability of price index weighting source data mean that the use of any formula involving weights relating to either the current index period or any very recent period will result in revisions to index numbers unless they are published with a considerable delay.

17.4 In summary, the position in relation to more frequent chaining of Australia's non-national accounts price indexes is much less clear than that for the volume indexes, and it is not possible to put forward definitive proposals at this stage. Rather, a substantial amount of research and investigative work would first need to be undertaken, followed by consultation with users.

SECTION 18 CONTACTS FOR FURTHER INFORMATION

18.1 For further information relating to the implementation of chain volume and price measures in the national accounts, readers should write to:

Mr Charles Aspden
Director
Constant Price Estimates Section
Australian Bureau of Statistics
PO Box 10
Belconnen ACT 2617

or contact him on telephone (02) 6252 6711, facsimile (02) 6252 5327, or email

charles.aspden@abs.gov.au

18.2 The ABS Internet address for sales and inquiries is:

client.services@abs.gov.au

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APPENDIX 1 COMPARISON OF EXISTING CONSTANT PRICE ESTIMATES, CHAIN FISHER VOLUME INDEXES AND CHAIN LASPEYRES INDEXES, SELECTED AGGREGATES

TABLES

A1.1 GROSS DOMESTIC PRODUCT (GDP(E)), PERCENTAGE CHANGE FROM PREVIOUS YEAR

	Constant price estimates at average 1989–90 prices (1)	*Chain Fisher index (2)*	*Chain Laspeyres index (3)*	*Constant price estimates less chain Fisher index (4)*	*Constant price estimates less chain Laspeyres index (5)*	*Chain Laspeyres index less chain Fisher index (6)*
	%	*%*	*%*	*% points*	*% points*	*% points*
1985–86	4.3	4.2	4.1	0.1	0.2	–0.1
1986–87	2.3	2.8	2.7	–0.5	–0.4	–0.1
1987–88	4.7	4.7	4.7	0.0	0.0	0.0
1988–89	2.7	2.5	2.3	0.2	0.4	–0.2
1989–90	3.4	3.5	3.6	–0.1	–0.2	0.1
Change						
1984–85 to 1989–90	**18.7**	**19.0**	**18.7**	**–0.3**	**0.0**	**–0.3**
Compound average annual change						
1984–85 to 1989–90	**3.7**	**3.8**	**3.7**	**–0.1**	**0.0**	**–0.1**
1990–91	–0.3	–0.2	–0.3	–0.1	0.0	–0.1
1991–92	1.8	1.9	1.9	–0.1	–0.1	0.0
1992–93	3.6	3.6	3.7	0.0	–0.1	0.1
1993–94	4.3	4.3	4.3	0.0	0.0	0.0
1994–95	3.6	3.6	3.7	0.0	–0.1	0.1
1995–96	3.9	4.0	3.9	–0.1	0.0	–0.1
1996–97	1.8	2.0	2.0	–0.2	–0.2	0.0
Change						
1989–90 to 1996–97	**20.3**	**20.7**	**20.7**	**–0.4**	**–0.4**	**0.0**
Compound average annual change-						
1989–90 to 1996–97	**2.9**	**3.0**	**3.0**	**–0.1**	**–0.1**	**0.0**

A1.2 PRIVATE FINAL CONSUMPTION EXPENDITURE (PFCE), PERCENTAGE CHANGE FROM PREVIOUS YEAR

	Constant price estimates at average 1989–90 prices (1)	*Chain Fisher index (2)*	*Chain Laspeyres index (3)*	*Constant price estimates less chain Fisher index (4)*	*Constant price estimates less chain Laspeyres index (5)*	*Chain Laspeyres index less chain Fisher index (6)*
	%	*%*	*%*	*% points*	*% points*	*% points*
1985–86	3.6	3.7	3.7	–0.1	–0.1	0.0
1986–87	0.6	0.7	0.8	–0.1	–0.2	0.1
1987–88	3.6	3.7	3.7	–0.1	–0.1	0.0
1988–89	4.1	4.2	4.3	–0.1	–0.2	0.1
1989–90	4.4	4.4	4.5	0.0	–0.1	0.1
Change						
1984–85 to 1989–90	**17.4**	**17.8**	**18.0**	**–0.4**	**–0.6**	**0.2**
Compound average annual change						
1984–85 to 1989–90	**3.5**	**3.6**	**3.6**	**–0.1**	**–0.1**	**0.0**
1990–91	1.0	1.0	1.0	0.0	0.0	0.0
1991–92	2.7	2.6	2.7	0.1	0.0	0.1
1992–93	3.1	3.0	3.0	0.1	0.1	0.0
1993–94	3.5	3.3	3.4	0.2	0.1	0.1
1994–95	4.9	4.8	4.8	0.1	0.1	0.0
1995–96	3.9	3.8	3.8	0.1	0.1	0.0
1996–97	2.2	2.0	2.1	0.2	0.1	0.1
Change						
1989–90 to 1996–97	**23.2**	**22.4**	**22.6**	**0.8**	**0.6**	**0.2**
Compound average annual change-						
1989–90 to 1996–97	**3.3**	**3.2**	**3.2**	**0.1**	**0.1**	**0.0**

A1.3 PRIVATE GROSS FIXED CAPITAL EXPENDITURE ON EQUIPMENT, PERCENTAGE CHANGE FROM PREVIOUS YEAR

	Constant price estimates at average 1989–90 prices (1)	*Chain Fisher index (2)*	*Chain Laspeyres index (3)*	*Constant price estimates less chain Fisher index (4)*	*Constant price estimates less chain Laspeyres index (5)*	*Chain Laspeyres index less chain Fisher index (6)*
	%	*%*	*%*	*% points*	*% points*	*% points*
1985–86	–1.4	0.2	0.5	–1.6	–1.9	0.3
1986–87	2.2	3.8	4.3	–1.6	–2.1	0.5
1987–88	8.5	9.2	9.6	–0.7	–1.1	0.4
1988–89	13.8	14.0	14.1	–0.2	–0.3	0.1
1989–90	–4.9	–4.8	–4.8	–0.1	–0.1	0.0
Change						
1984–85 to 1989–90	**18.5**	**23.3**	**24.8**	**–4.8**	**–6.3**	**1.5**
Compound average annual change						
1984–85 to 1989–90	**3.7**	**4.7**	**5.0**	**–1.0**	**–1.3**	**0.3**
1990–91	–12.7	–12.8	–12.7	0.1	0.0	0.1
1991–92	–5.3	–6.2	–5.9	0.9	0.6	0.3
1992–93	12.8	12.4	12.4	0.4	0.4	0.0
1993–94	8.2	7.5	7.5	0.7	0.7	0.0
1994–95	18.3	16.2	16.4	2.1	1.9	0.2
1995–96	6.4	4.8	4.9	1.6	1.5	0.1
1996–97	17.8	12.0	12.4	5.8	5.4	0.4
Change						
1989–90 to 1996–97	**49.6**	**34.8**	**36.3**	**14.8**	**13.3**	**1.5**
Compound average annual change-						
1989–90 to 1996–97	**7.1**	**5.0**	**5.2**	**2.1**	**1.9**	**0.2**

A1.4 IMPORTS OF GOODS AND SERVICES, PERCENTAGE CHANGE FROM PREVIOUS YEAR

	Constant price estimates at average 1989–90 prices (1)	*Chain Fisher index (2)*	*Chain Laspeyres index (3)*	*Constant price estimates less chain Fisher index (4)*	*Constant price estimates less chain Laspeyres index (5)*	*Chain Laspeyres index less chain Fisher index (6)*
	%	*%*	*%*	*% points*	*% points*	*% points*
1985–86	0.0	0.8	1.0	–0.8	–1.0	0.2
1986–87	–6.5	–5.5	–4.6	–1.0	–1.9	0.9
1987–88	10.0	10.3	10.4	–0.3	–0.4	0.1
1988–89	24.0	24.2	24.4	–0.2	–0.4	0.2
1989–90	5.3	5.3	5.4	0.0	–0.1	0.1
Change						
1984–85 to 1989–90	**34.2**	**37.6**	**39.6**	**–3.4**	**–5.4**	**2.0**
Compound average annual change						
1984–85 to 1989–90	**6.8**	**7.5**	**7.9**	**–0.7**	**–1.1**	**0.4**
1990–91	–5.4	–5.5	–5.4	0.1	0.0	0.1
1991–92	3.8	3.4	3.6	0.4	0.2	0.2
1992–93	7.5	6.8	7.0	0.7	0.5	0.2
1993–94	7.7	6.6	6.9	1.1	0.8	0.3
1994–95	18.0	16.5	16.7	1.5	1.3	0.2
1995–96	6.1	3.6	3.9	2.5	2.2	0.3
1996–97	12.1	9.4	9.7	2.7	2.4	0.3
Change						
1989–90 to 1996–97	**59.7**	**46.7**	**49.0**	**13.0**	**10.7**	**2.3**
Compound average annual change-						
1989–90 to 1996–97	**8.5**	**6.7**	**7.0**	**1.8**	**1.5**	**0.3**

A1.5 EXPORTS OF GOODS AND SERVICES, PERCENTAGE CHANGE FROM PREVIOUS YEAR

	Constant price estimates at average 1989–90 prices (1)	*Chain Fisher index (2)*	*Chain Laspeyres index (3)*	*Constant price estimates less chain Fisher index (4)*	*Constant price estimates less chain Laspeyres index (5)*	*Chain Laspeyres index less chain Fisher index (6)*
	%	*%*	*%*	*% points*	*% points*	*% points*
1985–86	3.7	3.6	3.6	0.1	0.1	0.0
1986–87	10.2	10.8	10.4	–0.6	–0.2	–0.4
1987–88	8.2	9.0	9.2	–0.8	–1.0	0.2
1988–89	1.3	1.5	1.8	–0.2	–0.5	0.3
1989–90	5.5	5.2	4.9	0.3	0.6	–0.3
Change						
1984–85 to 1989–90	**32.2**	**33.6**	**33.4**	**–1.4**	**–1.2**	**–0.2**
Compound average annual change						
1984–85 to 1989–90	**6.4**	**6.7**	**6.7**	**–0.3**	**–0.3**	**0.0**
1990–91	11.5	11.7	11.5	–0.2	0.0	–0.2
1991–92	9.0	8.7	9.0	0.3	0.0	0.3
1992–93	6.1	6.6	6.5	–0.5	–0.4	–0.1
1993–94	9.8	9.5	9.6	0.3	0.2	0.1
1994–95	4.3	4.2	4.7	0.1	–0.4	0.5
1995–96	10.6	10.2	10.2	0.4	0.4	0.0
1996–97	9.9	10.0	10.2	–0.1	–0.3	0.2
Change						
1989–90 to 1996–97	**79.6**	**79.1**	**80.6**	**0.5**	**–1.0**	**1.5**
Compound average annual change-						
1989–90 to 1996–97	**11.4**	**11.3**	**11.5**	**0.1**	**–0.1**	**0.2**

APPENDIX 2: EXPERIMENTAL ANNUAL CHAIN LASPEYRES VOLUME MEASURES

A2.1 GROSS DOMESTIC PRODUCT (EXPENDITURE) AND ITS MAJOR COMPONENTS REFERENCE YEAR 1995–96

	1985–86	*1986–87*	*1987–88*	*1988–89*	*1989–90*	*1990–91*
	$ million	*$ million*	*$ million*	*$ million*	*$ million*	*$ million*
Final consumption expenditure						
Private	223 901	225 773	233 624	243 592	254 553	257 005
Government	63 928	66 105	67 958	69 357	71 621	73 543
Gross fixed capital expenditure						
Private						
Dwellings	18 142	16 264	17 794	21 620	20 490	18 283
Non-dwelling construction	11 369	12 009	14 843	15 845	17 085	14 362
Equipment	24 364	25 416	27 845	31 767	30 250	26 423
Real estate transfer expenses	4 802	4 714	5 857	6 750	4 918	5 093
Public						
Public enterprises	13 876	13 535	11 435	11 334	13 493	12 187
General government	8 567	8 675	8 229	8 025	8 829	8 883
Domestic final demand	370 068	373 984	388 940	409 767	422 376	416 191
Increase in stocks						
Private non-farm	1 887	–1 475	1 828	3 882	2 472	–2 872
Farm	–273	84	91	369	–338	–63
Public marketing authorities	–557	–527	–829	266	2 798	1 549
Other public authorities	204	211	138	–32	130	–336
Gross national expenditure	369 195	369 862	388 123	412 805	427 673	414 229
Exports of goods and services	46 589	51 435	56 151	57 166	59 984	66 906
less						
Imports of goods and services	52 736	50 338	55 582	69 161	72 882	68 966
Sum of above components (1)	364 066	371 879	389 386	400 779	413 403	411 995
GDP(E) (2)	363 021	372 906	390 246	399 651	413 632	412 308
Residual (1)-(2)	1 045	–1 027	–860	1 128	–229	–313

A2.1 GROSS DOMESTIC PRODUCT (EXPENDITURE) AND ITS MAJOR COMPONENTS REFERENCE YEAR 1995–96 — *continued*

	1991–92	*1992–93*	*1993–94*	*1994–95*	*1995–96*	*1996–97*
	$ million	*$ million*	*$ million*	*$ million*	*$ million*	*$ million*
Final consumption expenditure						
Private	263 949	271 946	280 818	294 875	306 369	313 229
Government	75 834	76 945	78 418	81 068	83 437	84 661
Gross fixed capital expenditure						
Private						
Dwellings	18 506	21 222	23 750	24 855	21 715	21 937
Non-dwelling construction	11 640	10 678	11 096	11 980	14 844	17 574
Equipment	24 866	27 954	30 062	34 961	37 949	42 571
Real estate transfer expenses	5 598	5 648	6 249	6 040	5 483	5 718
Public						
Public enterprises	11 775	10 201	9 561	11 485	10 788	9 267
General government	9 001	9 491	9 136	9 510	9 507	9 961
Domestic final demand	**421 170**	**433 937**	**448 826**	**474 720**	**490 092**	**504 916**
Increase in stocks						
Private non-farm	–1 894	528	1 373	3 763	2 773	1 079
Farm	123	–219	–340	662	525	6
Public marketing authorities	–516	879	24	–1 813	–231	–185
Other public authorities	–120	–340	–41	128	–830	–2 586
Gross national expenditure	418 514	434 341	449 777	477 427	492 331	503 230
Exports of goods and services	72 950	77 724	85 235	89 254	98 528	108 691
less						
Imports of goods and services	71 471	76 456	81 705	95 346	99 107	108 833
Sum of above components (1)	420 237	436 199	453 639	471 425	491 750	503 089
GDP(E) (2)	420 471	436 130	453 855	471 335	491 752	503 089
Residual (1)-(2)	–234	69	–216	90	–2	0

APPENDIX 3 EXPERIMENTAL QUARTERLY CHAIN LASPEYRES VOLUME MEASURES

TABLES

GROSS DOMESTIC PRODUCT (EXPENDITURE) AND ITS MAJOR COMPONENTS

A3.1 GROSS DOMESTIC PRODUCT (EXPENDITURE) AND ITS MAJOR COMPONENTS — TREND REFERENCE YEAR 1995–96

	Sep–85	*Dec–85*	*Mar–86*	*Jun–86*	*Sep–86*	*Dec–86*	*Mar–87*	*Jun–87*
	$ million	*$ million*	*$ million*	*$ million*	*$ million*	*$ million*	*$ million*	*$ million*
Final consumption expenditure								
Private	55 987	55 945	55 977	56 102	56 240	56 305	56 381	56 882
Government	15 724	15 854	16 079	16 350	16 504	16 509	16 464	16 549
Gross fixed capital expenditure								
Private								
Dwellings	4 643	4 600	4 485	4 314	4 162	4 047	4 011	4 047
Non-dwelling construction	2 714	2 839	2 884	2 866	2 854	2 895	3 043	3 239
Equipment	6 422	6 153	5 875	5 875	6 164	6 395	6 446	6 446
Real estate transfer expenses	1 293	1 233	1 160	1 127	1 136	1 159	1 173	1 226
Public								
Public enterprises	3 700	3 582	3 403	3 259	3 245	3 350	3 415	3 344
General government	2 071	2 110	2 167	2 228	2 259	2 217	2 140	2 123
Domestic final demand	93 046	92 576	92 266	92 414	92 880	93 237	93 478	94 266
Increase in stocks								
Private non-farm	216	562	559	78	–492	–586	–111	412
Farm	–63	–103	–92	–50	8	23	41	40
Public marketing authorities	–127	–157	–179	–171	–144	–124	–185	–309
Other public authorities	111	86	49	24	56	82	80	58
Gross national expenditure	92 680	92 453	92 067	91 733	91 729	92 048	92 729	93 914
Exports of goods and services	11 636	11 635	11 643	11 810	12 179	12 660	13 034	13 376
less								
Imports of goods and services	13 481	13 295	13 040	12 794	12 590	12 491	12 553	12 820
Sum of above components (1)	90 844	91 043	90 969	91 017	91 580	92 439	93 379	94 611
GDP(E) (2)	90 756	90 755	90 704	90 891	91 622	92 682	93 760	95 025
Residual (1)-(2)	88	287	265	127	–42	–242	–381	–414

A3.1 GROSS DOMESTIC PRODUCT (EXPENDITURE) AND ITS MAJOR COMPONENTS — TREND REFERENCE YEAR 1995–96 — *continued*

	Sep–87	*Dec–87*	*Mar–88*	*Jun–88*	*Sep–88*	*Dec–88*	*Mar–89*	*Jun–89*
	$ million	*$ million*	*$ million*	*$ million*	*$ million*	*$ million*	*$ million*	*$ million*
Final consumption expenditure								
Private	57 656	58 295	58 632	58 869	59 468	60 437	61 478	62 291
Government	16 784	16 987	17 100	17 178	17 166	17 208	17 328	17 450
Gross fixed capital expenditure								
Private								
Dwellings	4 165	4 331	4 548	4 824	5 105	5 352	5 527	5 563
Non-dwelling construction	3 402	3 589	3 795	3 920	3 904	3 859	3 989	4 252
Equipment	6 587	6 919	7 025	7 035	7 245	7 789	8 350	8 522
Real estate transfer expenses	1 318	1 419	1 523	1 628	1 716	1 756	1 682	1 525
Public								
Public enterprises	3 265	3 067	2 766	2 564	2 523	2 677	2 928	3 093
General government	2 157	2 130	2 025	1 910	1 910	1 980	2 023	2 060
Domestic final demand	95 712	97 098	97 736	98 211	99 293	101 380	103 731	105 223
Increase in stocks								
Private non-farm	464	370	308	539	897	1 015	1 094	1 223
Farm	6	–32	–2	77	179	148	26	–50
Public marketing authorities	–399	–356	–170	32	146	115	13	167
Other public authorities	41	39	19	–21	–47	–46	12	68
Gross national expenditure	95 294	96 606	97 404	98 407	100 106	102 260	104 516	106 363
Exports of goods and services	13 890	14 268	14 224	14 028	13 891	14 080	14 405	14 549
less								
Imports of goods and services	13 277	13 745	14 060	14 582	15 570	16 882	18 028	18 566
Sum of above components (1)	96 060	97 281	97 731	98 001	98 535	99 488	100 827	102 146
GDP(E) (2)	96 443	97 604	97 938	98 054	98 394	99 196	100 483	101 883
Residual (1)-(2)	–383	–323	–207	–53	140	292	344	263

A3.1 GROSS DOMESTIC PRODUCT (EXPENDITURE) AND ITS MAJOR COMPONENTS — TREND REFERENCE YEAR 1995–96 — *continued*

	Sep–89	*Dec–89*	*Mar–90*	*Jun–90*	*Sep–90*	*Dec–90*	*Mar–91*	*Jun–91*
	$ million	*$ million*	*$ million*	*$ million*	*$ million*	*$ million*	*$ million*	*$ million*
Final consumption expenditure								
Private	62 898	63 431	63 955	64 286	64 360	64 186	64 130	64 456
Government	17 633	17 842	18 036	18 213	18 230	18 243	18 440	18 730
Gross fixed capital expenditure								
Private								
Dwellings	5 451	5 226	4 993	4 826	4 713	4 616	4 506	4 427
Non-dwelling construction	4 440	4 421	4 231	4 010	3 840	3 692	3 502	3 250
Equipment	8 203	7 725	7 381	7 165	6 999	6 740	6 434	6 219
Real estate transfer expenses	1 346	1 218	1 187	1 222	1 257	1 266	1 277	1 302
Public								
Public enterprises	3 250	3 359	3 420	3 440	3 309	3 066	2 925	2 926
General government	2 142	2 219	2 261	2 203	2 164	2 192	2 251	2 296
Domestic final demand	105 761	105 750	105 712	105 580	105 024	104 111	103 541	103 658
Increase in stocks								
Private non-farm	1 073	767	269	–271	–655	–783	–682	–583
Farm	–49	–41	–34	–16	90	66	–76	–125
Public marketing authorities	524	798	804	743	768	699	333	–76
Other public authorities	77	51	27	31	13	–51	–141	–187
Gross national expenditure	107 275	107 315	106 744	105 972	105 129	103 949	102 878	102 593
Exports of goods and services	14 676	14 837	15 083	15 476	15 855	16 340	17 008	17 669
less								
Imports of goods and services	18 723	18 521	18 159	17 820	17 523	17 218	16 991	17 028
Sum of above components (1)	102 944	103 335	103 456	103 508	103 420	103 054	102 917	103 277
GDP(E) (2)	102 808	103 294	103 424	103 473	103 380	103 064	102 978	103 373
Residual (1)-(2)	136	41	32	35	40	–10	–61	–96

A3.1 GROSS DOMESTIC PRODUCT (EXPENDITURE) AND ITS MAJOR COMPONENTS — TREND REFERENCE YEAR 1995–96 — *continued*

	Sep–91	*Dec–91*	*Mar–92*	*Jun–92*	*Sep–92*	*Dec–92*	*Mar–93*	*Jun–93*
	$ millionv	*$ million*	*$ million*	*$ million*	*$ million*	*$ million*	*$ million*	*$ million*
Final consumption expenditure								
Private	65 039	65 636	66 246	66 885	67 447	67 826	68 069	68 429
Government	18 944	18 953	18 928	19 089	19 276	19 279	19 172	19 051
Gross fixed capital expenditure								
Private								
Dwellings	4 428	4 532	4 697	4 873	5 061	5 247	5 407	5 541
Non-dwelling construction	3 055	2 944	2 859	2 784	2 696	2 649	2 660	2 672
Equipment	6 153	6 165	6 091	6 239	6 697	7 114	7 246	7 051
Real estate transfer expenses	1 340	1 382	1 409	1 424	1 428	1 413	1 409	1 432
Public								
Public enterprises	3 008	2 984	2 991	2 918	2 788	2 579	2 387	2 379
General government	2 289	2 245	2 218	2 223	2 287	2 379	2 402	2 350
Domestic final demand	104 268	104 838	105 443	106 449	107 660	108 445	108 702	108 857
Increase in stocks								
Private non-farm	–593	–491	–299	–271	–281	8	171	163
Farm	–32	60	38	–71	–59	–42	–65	–100
Public marketing authorities	–298	–273	–70	131	239	236	224	218
Other public authorities	–138	–41	30	10	–62	–98	–92	–71
Gross national expenditure	103 124	104 043	105 094	106 190	107 403	108 447	108 854	109 003
Exports of goods and services	18 055	18 170	18 222	18 518	18 911	19 266	19 584	19 993
less								
Imports of goods and services	17 397	17 727	17 975	18 361	18 812	19 098	19 183	19 332
Sum of above components (1)	103 853	104 539	105 384	106 391	107 616	108 758	109 392	109 776
GDP(E) (2)	103 931	104 612	105 453	106 455	107 618	108 744	109 395	109 781
Residual (1)-(2)	–77	–73	–69	–64	–2	14	–3	–5

A3.1 GROSS DOMESTIC PRODUCT (EXPENDITURE) AND ITS MAJOR COMPONENTS — TREND REFERENCE YEAR 1995–96 — *continued*

	Sep–93	*Dec–93*	*Mar–94*	*Jun–94*	*Sep–94*	*Dec–94*	*Mar–95*	*Jun–95*	*Sep–95*
	$ million	*$ million*	*$ million*	*$ million*	*$ million*	*$ million*	*$ million*	*$ million*	*$ million*
Final consumption expenditure									
Private	69 072	69 852	70 671	71 477	72 261	73 206	74 158	75 014	75 748
Government	19 132	19 406	19 772	20 092	20 157	20 136	20 249	20 445	20 690
Gross fixed capital expenditure									
Private									
Dwellings	5 650	5 801	6 017	6 247	6 403	6 361	6 185	5 959	5 695
Non-dwelling construction	2 688	2 748	2 790	2 824	2 850	2 907	3 059	3 308	3 536
Equipment	7 016	7 361	7 692	8 024	8 346	8 652	8 909	8 925	8 983
Real estate transfer expenses	1 480	1 542	1 599	1 633	1 623	1 560	1 459	1 373	1 341
Public									
Public enterprises	2 413	2 309	2 337	2 508	2 801	2 946	2 883	2 781	2 739
General government	2 274	2 261	2 299	2 378	2 408	2 396	2 369	2 366	2 402
Domestic final demand	109 658	111 207	113 118	115 140	116 801	118 133	119 269	120 190	121 148
Increase in stocks									
Private non-farm	150	269	565	829	905	983	953	874	727
Farm	–91	–71	–129	–129	–2	146	253	308	304
Public marketing authorities	139	47	–107	–383	–579	–567	–328	–63	–20
Other public authorities	–52	–24	8	44	48	38	49	–5	–105
Gross national expenditure	109 765	111 407	113 484	115 591	117 274	118 761	120 130	121 214	122 024
Exports of goods and services	20 518	21 127	21 583	21 902	22 126	22 237	22 416	22 768	23 425
less									
Imports of goods and services	19 635	20 028	20 595	21 601	22 881	23 874	24 228	24 070	23 986
Sum of above components (1)	110 755	112 600	114 502	115 844	116 465	117 126	118 385	119 983	121 482
GDP(E) (2)	110 769	112 655	114 640	116 003	116 550	117 108	118 317	119 918	121 478
Residual (1)-(2)	–14	–55	–138	–159	–84	18	68	66	3

A3.1 GROSS DOMESTIC PRODUCT (EXPENDITURE) AND ITS MAJOR COMPONENTS — TREND REFERENCE YEAR 1995–96 — *continued*

	Dec–95	*Mar–96*	*Jun–96*	*Sep–96*	*Dec–96*	*Mar–97*	*Jun–97*	*Sep–97*	*Dec–97*
	$ million	*$ million*	*$ million*	*$ million*	*$ million*	*$ million*	*$ million*	*$ million*	*$ million*
Final consumption expenditure									
Private	76 370	76 902	77 348	77 659	77 953	78 465	79 481	80 735	82 079
Government	20 868	20 966	21 062	21 101	21 126	21 195	21 313	21 469	21 598
Gross fixed capital expenditure									
Private									
Dwellings	5 458	5 283	5 183	5 210	5 358	5 585	5 784	5 902	5 974
Non-dwelling construction	3 651	3 772	3 985	4 278	4 440	4 417	4 324	4 246	4 136
Equipment	9 263	9 652	10 031	10 145	10 377	11 017	11 702	12 134	12 300
Real estate transfer expenses	1 358	1 383	1 387	1 370	1 385	1 449	1 526	1 571	1 589
Public									
Public enterprises	2 730	2 672	2 540	2 553	2 496	2 353	2 248	2 299	2 467
General government	2 422	2 356	2 285	2 295	2 443	2 556	2 528	2 456	2 423
Domestic final demand	122 125	122 994	123 813	124 537	125 400	126 790	128 626	130 523	132 349
Increase in stocks									
Private non-farm	612	636	823	730	375	–24	–172	–151	–56
Farm	208	18	–54	–32	2	–31	–69	–51	–11
Public marketing authorities	–77	–55	32	37	–56	–160	–219	–277	–382
Other public authorities	–211	–303	–279	–91	–304	–734	–902	–616	–180
Gross national expenditure	122 682	123 338	124 367	125 198	125 419	125 837	127 288	129 436	131 699
Exports of goods and services	24 307	25 026	25 442	25 640	26 310	27 655	28 707	29 041	28 847
less									
Imports of goods and services	24 364	24 998	25 665	26 168	26 706	27 582	28 553	29 379	30 075
Sum of above components (1)	122 595	123 310	124 120	124 726	125 197	126 160	127 698	129 381	130 709
GDP(E) (2)	122 631	123 362	124 142	124 728	125 191	126 161	127 704	129 379	130 825
Residual (1)-(2)	–35	–52	–21	–2	6	–1	–6	1	–116

A3.2 GROSS DOMESTIC PRODUCT (EXPENDITURE) AND ITS MAJOR COMPONENTS — SEASONALLY ADJUSTED REFERENCE YEAR 1995–96

	Sep–85	*Dec–85*	*Mar–86*	*Jun–86*	*Sep–86*	*Dec–86*	*Mar–87*	*Jun–87*
	$ milllion	*$ milllion*	*$ milllion*	*$ milllion*	*$ milllion*	*$ milllion*	*$ milllion*	*$ milllion*
Final consumption expenditure								
Private	55 819	56 440	55 413	56 229	56 533	56 123	56 358	56 758
Government	15 695	15 933	15 920	16 380	16 680	16 433	16 374	16 618
Gross fixed capital expenditure								
Private								
Dwellings	4 775	4 544	4 511	4 312	4 161	4 029	4 011	4 063
Non-dwelling construction	2 762	2 881	2 859	2 867	2 861	2 898	2 966	3 283
Equipment	6 602	6 037	5 870	5 855	5 873	7 023	6 061	6 459
Real estate transfer expenses	1 314	1 238	1 147	1 103	1 149	1 181	1 157	1 226
Public								
Public enterprises	3 758	3 498	3 601	3 019	3 318	3 354	3 415	3 449
General government	2 041	2 162	2 099	2 265	2 266	2 230	2 153	2 027
Domestic final demand	93 033	93 001	91 673	92 360	93 070	93 697	92 861	94 356
Increase in stocks								
Private non-farm	95	283	1 104	418	–1 399	–272	46	148
Farm	13	–131	–171	12	61	–96	141	–23
Public marketing authorities	–111	–117	–245	–172	–91	–177	–158	–220
Other public authorities	100	128	35	–15	80	69	154	–63
Gross national expenditure	92 624	92 663	91 874	92 034	91 134	92 638	92 495	93 595
Exports of goods and services	11 520	11 860	11 506	11 703	12 166	12 913	12 760	13 597
less								
Imports of goods and services	13 496	13 313	13 006	12 920	12 357	12 759	12 333	12 888
Sum of above components (1)	90 887	91 443	90 643	91 056	91 301	92 949	93 105	94 434
GDP(E) (2)	90 532	91 225	90 370	90 894	91 311	93 239	93 470	94 886
Residual (1)-(2)	355	218	273	162	–10	–290	–365	–452

A3.2 GROSS DOMESTIC PRODUCT (EXPENDITURE) AND ITS MAJOR COMPONENTS — SEASONALLY ADJUSTED REFERENCE YEAR 1995–96 — *continued*

	Sep–87	*Dec–87*	*Mar–88*	*Jun–88*	*Sep–88*	*Dec–88*	*Mar–89*	*Jun–89*
	$ milllion	*$ milllion*	*$ milllion*	*$ milllion*	*$ milllion*	*$ milllion*	*$ milllion*	*$ milllion*
Final consumption expenditure								
Private	57 710	58 449	58 688	58 776	59 293	60 438	61 734	62 127
Government	16 725	16 999	17 233	17 001	17 261	17 301	17 019	17 776
Gross fixed capital expenditure								
Private								
Dwellings	4 136	4 341	4 588	4 729	5 159	5 393	5 437	5 631
Non-dwelling construction	3 505	3 438	3 758	4 141	3 834	3 753	4 003	4 255
Equipment	6 636	6 897	7 074	7 238	6 758	7 859	8 612	8 538
Real estate transfer expenses	1 274	1 512	1 445	1 627	1 761	1 727	1 704	1 558
Public								
Public enterprises	3 057	3 222	2 923	2 232	2 582	2 908	2 630	3 214
General government	2 206	2 187	2 036	1 801	1 982	1 924	2 119	2 000
Domestic final demand	95 553	97 420	98 083	97 884	98 832	101 620	103 653	105 662
Increase in stocks								
Private non-farm	763	528	–276	876	819	1 275	728	1 151
Farm	104	–157	68	37	169	218	93	–265
Public marketing authorities	–518	–380	–129	45	141	150	127	–138
Other public authorities	142	–15	29	21	–114	9	–61	127
Gross national expenditure	95 556	96 884	97 264	98 419	99 506	102 963	104 157	106 179
Exports of goods and services	13 607	14 357	14 733	13 455	13 929	14 341	14 094	14 801
less								
Imports of goods and services	13 224	13 818	14 286	14 255	15 417	17 102	18 087	18 556
Sum of above components (1)	96 123	97 560	97 884	97 724	98 157	100 194	100 152	102 219
GDP(E) (2)	96 442	97 898	98 112	97 794	98 027	99 943	99 667	102 015
Residual (1)-(2)	–319	–338	–228	–70	130	251	485	204

A3.2 GROSS DOMESTIC PRODUCT (EXPENDITURE) AND ITS MAJOR COMPONENTS — SEASONALLY ADJUSTED REFERENCE YEAR 1995–96 — *continued*

	Sep–89	*Dec–89*	*Mar–90*	*Jun–90*	*Sep–90*	*Dec–90*	*Mar–91*	*Jun–91*
	$ milllion	*$ milllion*	*$ milllion*	*$ milllion*	*$ milllion*	*$ milllion*	*$ milllion*	*$ milllion*
Final consumption expenditure								
Private	62 982	63 337	64 006	64 229	64 584	64 069	64 112	64 240
Government	17 517	17 705	18 214	18 185	18 214	18 288	18 289	18 752
Gross fixed capital expenditure								
Private								
Dwellings	5 511	5 154	4 978	4 847	4 722	4 566	4 593	4 403
Non-dwelling construction	4 488	4 424	4 298	3 875	3 866	3 758	3 459	3 278
Equipment	8 076	7 766	7 292	7 116	7 148	6 578	6 556	6 141
Real estate transfer expenses	1 306	1 200	1 197	1 215	1 270	1 289	1 248	1 286
Public								
Public enterprises	3 440	3 032	3 618	3 402	3 389	2 977	2 937	2 884
General government	2 079	2 324	2 240	2 186	2 202	2 073	2 379	2 228
Domestic final demand	105 775	105 275	106 060	105 266	105 605	103 746	103 575	103 264
Increase in stocks								
Private non-farm	1 706	262	144	380	–1 171	–983	–277	–479
Farm	23	137	–239	–13	200	1	104	–465
Public marketing authorities	470	1 304	486	672	769	980	151	–75
Other public authorities	95	8	41	7	61	–70	–124	–207
Gross national expenditure	107 989	107 100	106 363	106 221	105 335	103 638	103 272	101 985
Exports of goods and services	14 681	14 641	15 215	15 448	15 888	16 310	16 833	17 875
less								
Imports of goods and services	18 767	18 354	18 571	17 190	17 969	17 200	16 863	16 934
Sum of above components (1)	103 607	102 940	102 919	104 359	103 173	102 636	103 397	102 927
GDP(E) (2)	103 486	103 035	102 763	104 347	103 158	102 741	103 296	103 113
Residual (1)-(2)	121	–95	156	12	15	–105	101	–186

A3.2 GROSS DOMESTIC PRODUCT (EXPENDITURE) AND ITS MAJOR COMPONENTS — SEASONALLY ADJUSTED REFERENCE YEAR 1995–96 — *continued*

	Sep–91	*Dec–91*	*Mar–92*	*Jun–92*	*Sep–92*	*Dec–92*	*Mar–93*	*Jun–93*
	$ milllion	*$ milllion*	*$ milllion*	*$ milllion*	*$ milllion*	*$ milllion*	*$ milllion*	*$ milllion*
Final consumption expenditure								
Private	65 257	65 725	65 981	66 986	67 575	67 819	67 922	68 629
Government	19 125	18 891	18 885	18 933	19 475	19 378	18 953	19 138
Gross fixed capital expenditure								
Private								
Dwellings	4 339	4 612	4 680	4 875	5 026	5 302	5 398	5 496
Non-dwelling construction	3 033	2 891	2 941	2 776	2 640	2 715	2 585	2 738
Equipment	6 276	6 086	6 156	6 347	6 051	7 929	6 899	7 076
Real estate transfer expenses	1 388	1 346	1 408	1 457	1 404	1 416	1 424	1 405
Public								
Public enterprises	3 005	3 127	2 867	2 775	3 251	2 113	2 645	2 192
General government	2 329	2 235	2 209	2 229	2 241	2 423	2 391	2 436
Domestic final demand	104 708	104 938	105 137	106 387	107 617	109 118	108 189	109 013
Increase in stocks								
Private non-farm	–1 058	–248	–171	–437	–165	–275	395	538
Farm	163	70	62	–125	–112	28	11	–259
Public marketing authorities	–306	–297	–99	140	451	–73	446	80
Other public authorities	–188	8	40	13	–49	–150	–80	–29
Gross national expenditure	103 208	104 423	104 926	105 956	107 587	108 590	108 829	109 335
Exports of goods and services	18 111	18 163	18 063	18 613	18 780	19 565	19 313	20 066
less								
Imports of goods and services	17 406	18 045	17 687	18 333	18 839	19 418	18 868	19 331
Sum of above components (1)	104 068	104 564	105 335	106 249	107 729	108 772	109 434	110 175
GDP(E) (2)	104 070	104 652	105 403	106 347	107 641	108 866	109 407	110 216
Residual (1)-(2)	–2	–88	–68	–98	88	–94	27	–41

A3.2 GROSS DOMESTIC PRODUCT (EXPENDITURE) AND ITS MAJOR COMPONENTS — SEASONALLY ADJUSTED REFERENCE YEAR 1995–96 — *continued*

	Sep–93	*Dec–93*	*Mar–94*	*Jun–94*	*Sep–94*	*Dec–94*	*Mar–95*	*Jun–95*	*Sep–95*
	$ milllion	*$ milllion*	*$ milllion*	*$ milllion*	*$ milllion*	*$ milllion*	*$ milllion*	*$ milllion*	*$ milllion*
Final consumption expenditure									
Private	68 807	69 917	70 919	71 175	72 441	73 108	74 126	75 200	75 543
Government	19 229	19 089	20 009	20 090	20 191	20 123	20 048	20 707	20 534
Gross fixed capital expenditure									
Private									
Dwellings	5 735	5 739	5 953	6 323	6 412	6 351	6 236	5 856	5 793
Non-dwelling construction	2 682	2 684	2 838	2 892	2 723	2 993	3 034	3 230	3 604
Equipment	7 043	7 116	8 184	7 719	8 275	8 703	8 928	9 055	8 995
Real estate transfer expenses	1 487	1 545	1 606	1 611	1 652	1 568	1 442	1 378	1 314
Public									
Public enterprises	2 524	2 463	2 059	2 514	2 975	2 875	2 942	2 693	2 784
General government	2 134	2 345	2 255	2 401	2 376	2 502	2 255	2 377	2 460
Domestic final demand	109 572	110 829	113 667	114 759	117 053	118 216	118 987	120 464	121 001
Increase in stocks									
Private non-farm	–645	802	453	742	978	1 073	777	965	830
Farm	–42	–1	–129	–193	–115	418	67	288	430
Public marketing authorities	270	–63	–150	–18	–1 021	–467	–259	–92	20
Other public authorities	–88	–34	34	52	–4	123	–51	43	3
Gross national expenditure	108 990	111 523	113 914	115 350	117 128	119 331	119 471	121 497	122 321
Exports of goods and services	20 515	21 102	21 615	22 003	21 969	22 342	22 533	22 409	23 682
less									
Imports of goods and services	19 790	19 998	20 542	21 374	23 009	24 014	24 373	23 949	23 944
Sum of above components (1)	109 861	112 706	115 104	115 937	115 843	117 698	117 705	120 160	122 048
GDP(E) (2)	109 839	112 778	115 139	116 099	116 119	117 649	117 596	119 971	122 080
Residual (1)-(2)	22	–72	–35	–162	–276	49	109	189	–32

A3.2 GROSS DOMESTIC PRODUCT (EXPENDITURE) AND ITS MAJOR COMPONENTS — SEASONALLY ADJUSTED REFERENCE YEAR 1995–96 — *continued*

	Dec–95	*Mar–96*	*Jun–96*	*Sep–96*	*Dec–96*	*Mar–97*	*Jun–97*	*Sep–97*	*Dec–97*
	$ milllion	*$ milllion*	*$ milllion*	*$ milllion*	*$ milllion*	*$ milllion*	*$ milllion*	*$ milllion*	*$ milllion*
Final consumption expenditure									
Private	76 544	76 730	77 552	77 519	78 117	78 315	79 278	80 899	82 128
Government	20 886	21 094	20 924	21 114	21 229	21 087	21 232	21 635	21 531
Gross fixed capital expenditure									
Private									
Dwellings	5 434	5 209	5 279	5 158	5 303	5 626	5 850	5 872	5 960
Non-dwelling construction	3 783	3 620	3 836	4 578	4 262	4 541	4 193	4 357	4 080
Equipment	9 011	9 869	10 074	9 989	10 421	10 051	12 111	11 930	11 606
Real estate transfer expenses	1 377	1 374	1 418	1 356	1 371	1 429	1 562	1 587	1 555
Public									
Public enterprises	2 669	2 766	2 568	2 340	2 571	2 791	1 565	2 585	2 587
General government	2 348	2 465	2 233	2 235	2 430	2 612	2 683	2 177	2 583
Domestic final demand	122 033	123 159	123 899	124 289	125 703	126 451	128 473	131 043	132 029
Increase in stocks									
Private non-farm	485	516	926	834	548	–555	273	–455	60
Farm	193	–14	–119	–6	100	–157	52	–199	105
Public marketing authorities	–7	–221	–33	394	–305	–249	–21	–297	–517
Other public authorities	–415	–136	–366	–265	–11	–257	–2 167	90	–2
Gross national expenditure	122 314	123 331	124 365	125 246	126 035	125 233	126 610	130 181	131 676
Exports of goods and services	24 072	25 313	25 461	25 583	26 273	26 856	29 979	28 970	28 188
less									
Imports of goods and services	24 138	25 190	25 835	25 859	27 079	27 058	28 836	29 623	29 732
Sum of above components (1)	122 242	123 395	123 918	124 971	125 230	125 031	127 752	129 528	130 132
GDP(E) (2)	122 261	123 441	123 970	124 971	125 230	125 031	127 752	129 528	130 132
Residual (1)-(2)	–19	–46	–52	0	0	0	0	0	0

A3.3 GROSS DOMESTIC PRODUCT (EXPENDITURE) AND ITS MAJOR COMPONENTS — ORIGINAL REFERENCE YEAR 1995–96

	Sep–85	*Dec–85*	*Mar–86*	*Jun–86*	*Sep–86*	*Dec–86*	*Mar–87*	*Jun–87*
	$ million	*$ million*	*$ million*	*$ million*	*$ million*	*$ million*	*$ million*	*$ million*
Final consumption expenditure								
Private	55 706	59 631	53 144	55 420	56 454	59 402	54 140	55 777
Government	15 370	16 355	15 046	17 158	16 386	16 824	15 471	17 423
Gross fixed capital expenditure								
Private								
Dwellings	4 916	4 740	4 255	4 231	4 243	4 250	3 785	3 985
Non-dwelling construction	2 885	2 936	2 636	2 913	3 002	2 954	2 725	3 328
Equipment	6 447	6 381	5 117	6 419	5 621	7 296	5 425	7 075
Real estate transfer expenses	1 346	1 248	1 082	1 126	1 172	1 198	1 110	1 233
Public								
Public enterprises	3 537	3 633	3 165	3 541	3 051	3 490	2 970	4 024
General government	1 722	2 215	1 725	2 905	1 938	2 302	1 844	2 591
Domestic final demand	92 088	97 360	86 248	94 371	92 000	98 158	87 593	96 232
Increase in stocks								
Private non-farm	879	166	1 455	–614	–582	–393	377	–877
Farm	–479	484	5	–283	–381	466	322	–323
Public marketing authorities	–566	2 275	–1 071	–1 195	–461	1 771	–639	–1 198
Other public authorities	93	207	–64	–32	108	128	38	–63
Gross national expenditure	91 277	101 428	85 547	90 943	89 876	100 358	86 912	92 716
Exports of goods and services	11 279	12 197	11 377	11 737	11 965	13 340	12 594	13 536
less								
Imports of goods and services	14 091	13 301	12 503	12 840	12 882	12 785	11 894	12 776
Sum of above components (1)	89 044	99 167	85 369	90 486	89 634	100 243	88 268	93 735
GDP(E) (2)	88 165	100 410	84 505	89 941	89 090	101 581	88 173	94 063
Residual (1)-(2)	879	–1 243	864	545	544	–1 338	95	–328

A3.3 GROSS DOMESTIC PRODUCT (EXPENDITURE) AND ITS MAJOR COMPONENTS — ORIGINAL REFERENCE YEAR 1995–96 — *continued*

	Sep–87	*Dec–87*	*Mar–88*	*Jun–88*	*Sep–88*	*Dec–88*	*Mar–89*	*Jun–89*
	$ million	*$ million*	*$ million*	*$ million*	*$ million*	*$ million*	*$ million*	*$ million*
Final consumption expenditure								
Private	57 753	61 581	56 558	57 732	59 467	63 675	59 226	61 223
Government	16 439	17 374	16 311	17 835	16 915	17 566	16 143	18 733
Gross fixed capital expenditure								
Private								
Dwellings	4 234	4 581	4 355	4 625	5 325	5 658	5 124	5 513
Non-dwelling construction	3 661	3 541	3 476	4 166	3 998	3 889	3 712	4 246
Equipment	6 287	7 333	6 329	7 896	6 578	8 327	7 599	9 262
Real estate transfer expenses	1 311	1 523	1 398	1 625	1 827	1 741	1 613	1 569
Public								
Public enterprises	2 808	3 367	2 532	2 728	2 314	3 029	2 200	3 790
General government	1 942	2 257	1 752	2 279	1 742	1 945	1 848	2 490
Domestic final demand	94 650	101 947	92 853	99 489	98 308	106 196	97 707	107 557
Increase in stocks								
Private non-farm	1 574	423	86	–255	1 699	1 182	1 139	–138
Farm	–381	557	201	–286	–195	1 063	84	–582
Public marketing authorities	–698	1 433	–838	–726	–205	2 093	–637	–985
Other public authorities	159	46	–78	11	–56	49	–129	105
Gross national expenditure	94 707	104 254	91 560	97 602	99 279	110 804	97 528	105 194
Exports of goods and services	13 401	14 897	14 515	13 339	13 715	14 846	13 963	14 642
less								
Imports of goods and services	13 804	13 883	13 803	14 093	16 058	17 262	17 507	18 334
Sum of above components (1)	94 686	105 030	92 794	96 876	97 066	107 801	94 378	101 534
GDP(E) (2)	94 539	106 014	92 657	97 036	96 747	108 262	93 537	101 105
Residual (1)-(2)	147	–984	137	–160	319	–461	841	429

A3.3 GROSS DOMESTIC PRODUCT (EXPENDITURE) AND ITS MAJOR COMPONENTS — ORIGINAL REFERENCE YEAR 1995–96 — *continued*

	Sep–89	*Dec–89*	*Mar–90*	*Jun–90*	*Sep–90*	*Dec–90*	*Mar–91*	*Jun–91*
	$ million	*$ million*	*$ million*	*$ million*	*$ million*	*$ million*	*$ million*	*$ million*
Final consumption expenditure								
Private	63 091	66 554	61 608	63 300	64 625	67 350	61 618	63 411
Government	17 193	18 241	17 242	18 946	18 454	18 639	17 497	18 954
Gross fixed capital expenditure								
Private								
Dwellings	5 638	5 402	4 712	4 737	4 811	4 946	4 232	4 294
Non-dwelling construction	4 664	4 600	3 984	3 838	3 994	3 937	3 188	3 242
Equipment	7 798	8 291	6 482	7 679	6 975	7 126	5 734	6 587
Real estate transfer expenses	1 350	1 211	1 152	1 205	1 322	1 324	1 174	1 273
Public								
Public enterprises	3 172	3 188	3 056	4 077	3 128	3 090	2 430	3 539
General government	1 812	2 325	1 962	2 730	1 911	2 068	2 100	2 804
Domestic final demand	105 087	110 113	100 322	106 853	105 368	108 591	97 950	104 282
Increase in stocks								
Private non-farm	2 696	129	609	–963	–151	–1 154	198	–1 764
Farm	–354	998	–240	–741	–111	892	174	–1 018
Public marketing authorities	138	3 267	–325	–283	228	3 092	–733	–1 038
Other public authorities	136	45	–50	–1	110	–33	–200	–213
Gross national expenditure	107 612	115 657	99 886	104 518	105 171	111 797	97 042	100 220
Exports of goods and services	14 461	15 058	15 220	15 245	15 854	16 634	16 789	17 629
less								
Imports of goods and services	19 554	18 501	17 997	16 830	18 736	17 403	16 302	16 525
Sum of above components (1)	102 241	110 808	97 415	102 939	102 414	110 508	97 899	101 175
GDP(E) (2)	102 044	111 792	96 986	102 810	102 162	110 930	97 694	101 523
Residual (1)-(2)	197	–984	429	129	252	–422	205	–348

A3.3 GROSS DOMESTIC PRODUCT (EXPENDITURE) AND ITS MAJOR COMPONENTS — ORIGINAL REFERENCE YEAR 1995–96 — *continued*

	Sep–91	*Dec–91*	*Mar–92*	*Jun–92*	*Sep–92*	*Dec–92*	*Mar–93*	*Jun–93*
	$ million	*$ million*	*$ million*	*$ million*	*$ million*	*$ million*	*$ million*	*$ million*
Final consumption expenditure								
Private	65 250	69 006	63 693	66 000	67 655	71 320	65 257	67 713
Government	19 607	19 156	18 004	19 066	19 847	19 484	17 992	19 622
Gross fixed capital expenditure								
Private								
Dwellings	4 476	4 910	4 387	4 733	5 160	5 705	5 013	5 344
Non-dwelling construction	3 092	3 038	2 694	2 815	2 623	2 892	2 366	2 797
Equipment	6 078	6 490	5 503	6 795	5 773	8 571	6 069	7 541
Real estate transfer expenses	1 467	1 353	1 358	1 420	1 468	1 425	1 379	1 376
Public								
Public enterprises	2 706	3 184	2 441	3 443	2 928	2 131	2 282	2 859
General government	2 022	2 231	1 928	2 820	1 921	2 401	2 058	3 111
Domestic final demand	104 674	109 383	99 929	107 184	107 340	113 854	102 332	110 410
Increase in stocks								
Private non-farm	–85	–391	241	–1 659	791	–399	721	–584
Farm	–456	1 102	151	–675	–792	997	277	–702
Public marketing authorities	–428	1 241	–712	–616	–186	1 646	745	–1 326
Other public authorities	–130	50	–41	1	–4	–103	–61	–171
Gross national expenditure	103 475	111 016	99 610	104 412	107 232	115 488	103 743	107 879
Exports of goods and services	17 980	18 793	17 806	18 371	18 651	20 164	19 111	19 797
less								
Imports of goods and services	18 263	18 266	17 106	17 836	19 810	19 724	18 167	18 755
Sum of above components (1)	103 316	111 897	100 347	104 678	106 025	116 510	105 042	108 622
GDP(E) (2)	103 314	111 653	100 443	105 062	106 170	116 060	104 827	109 073
Residual (1)-(2)	2	244	–96	–384	–145	450	215	–451

A3.3 GROSS DOMESTIC PRODUCT (EXPENDITURE) AND ITS MAJOR COMPONENTS — ORIGINAL REFERENCE YEAR 1995–96 — *continued*

	Sep–93	*Dec–93*	*Mar–94*	*Jun–94*	*Sep–94*	*Dec–94*	*Mar–95*	*Jun–95*	*Sep–95*
	$ million	*$ million*	*$ million*	*$ million*	*$ million*	*$ million*	*$ million*	*$ million*	*$ million*
Final consumption expenditure									
Private	68 880	73 700	68 016	70 222	72 664	76 832	71 079	74 301	75 519
Government	19 363	19 266	19 117	20 672	20 243	20 139	19 258	21 429	20 201
Gross fixed capital expenditure									
Private									
Dwellings	5 934	6 189	5 505	6 122	6 639	6 771	5 786	5 660	5 938
Non-dwelling construction	2 665	2 881	2 597	2 954	2 713	3 213	2 769	3 285	3 623
Equipment	6 809	7 778	7 068	8 408	8 061	9 457	7 676	9 766	8 588
Real estate transfer expenses	1 554	1 586	1 532	1 577	1 737	1 585	1 372	1 346	1 370
Public									
Public enterprises	2 201	2 448	1 669	3 243	2 644	2 810	2 556	3 475	2 315
General government	1 802	2 298	1 935	3 101	2 009	2 457	1 956	3 088	2 083
Domestic final demand	109 094	116 053	107 314	116 365	116 654	123 253	112 379	122 434	119 628
Increase in stocks									
Private non-farm	287	682	736	–332	1 906	994	935	–73	1 808
Farm	–794	845	233	–625	–752	1 118	489	–193	–586
Public marketing authorities	–513	3 567	–1 343	–1 687	–768	1 219	–1 217	–1 046	–437
Other public authorities	0	3	58	–101	107	159	–17	–120	177
Gross national expenditure	108 236	120 101	107 267	114 173	117 458	126 201	112 684	121 084	120 732
Exports of goods and services	20 374	21 694	21 438	21 729	21 882	23 051	22 330	21 991	23 609
less									
Imports of goods and services	20 854	20 288	19 778	20 784	24 210	24 389	23 407	23 340	25 184
Sum of above components (1)	107 708	122 649	108 783	114 499	114 875	125 416	111 565	119 569	119 024
GDP(E) (2)	107 791	121 717	109 081	115 266	115 080	124 920	111 556	119 779	119 125
Residual (1)-(2)	–83	932	–298	–767	–205	496	9	–210	–101

A3.3 GROSS DOMESTIC PRODUCT (EXPENDITURE) AND ITS MAJOR COMPONENTS — ORIGINAL REFERENCE YEAR 1995–96 — *continued*

	Dec–95	*Mar–96*	*Jun–96*	*Sep–96*	*Dec–96*	*Mar–97*	*Jun–97*	*Sep–97*	*Dec–97*
	$ million	*$ million*	*$ million*	*$ million*	*$ million*	*$ million*	*$ million*	*$ million*	*$ million*
Final consumption expenditure									
Private	80 273	73 907	76 670	77 473	81 851	75 322	78 582	80 709	86 144
Government	21 152	20 358	21 726	20 854	21 416	20 305	22 085	21 394	21 671
Gross fixed capital expenditure									
Private									
Dwellings	5 781	4 880	5 116	5 349	5 665	5 249	5 674	6 012	6 379
Non-dwelling construction	4 043	3 295	3 883	4 635	4 556	4 143	4 240	4 422	4 364
Equipment	9 804	8 600	10 957	9 603	11 386	8 692	12 889	11 180	12 437
Real estate transfer expenses	1 401	1 318	1 395	1 437	1 394	1 330	1 557	1 656	1 585
Public									
Public enterprises	2 543	2 531	3 398	1 882	2 416	2 544	2 425	2 117	2 455
General government	2 297	2 156	2 970	1 843	2 340	2 273	3 505	1 749	2 509
Domestic final demand	127 292	117 014	126 157	123 077	131 024	119 858	130 957	129 239	137 544
Increase in stocks									
Private non-farm	391	640	–66	1 824	445	–471	–718	546	–17
Farm	1 379	324	–592	–986	1 273	154	–435	–1 155	1 250
Public marketing authorities	3 071	–1 402	–1 463	–680	4 889	–2 138	–2 256	–913	3 171
Other public authorities	–363	–102	–542	–91	39	–202	–2 332	272	56
Gross national expenditure	132 011	116 284	123 303	123 144	137 669	117 202	125 215	127 989	142 005
Exports of goods and services	24 689	25 126	25 104	25 299	26 794	26 912	29 687	28 584	28 707
less									
Imports of goods and services	24 495	24 189	25 239	27 192	27 392	25 846	28 402	30 962	30 255
Sum of above components (1)	131 966	117 442	123 317	121 251	137 071	118 268	126 500	125 611	140 457
GDP(E) (2)	132 267	117 201	123 159	121 251	137 071	118 268	126 500	125 611	140 457
Residual (1)-(2)	–301	241	158	0	0	0	0	0	0

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