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Discrepancies Between Quarterly GDP Estimates

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Abstract

Countries compiling quarterly estimates for gross domestic product (GDP) often use alternative approaches simultaneously. This may result in the publication of different measures of quarterly GDP and discrepancies between these measures. Such discrepancies are unavoidable, unless reconciliation takes place or the measures are mutually interdependent. This paper examines international practices in this respect, focusing on OECD member countries that publish quarterly GDP data. Of these, five publish GDP data with discrepancies—the United States, the United Kingdom, Canada, Australia, and New Zealand—and the paper examines causes and the development of these discrepancies.

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Contents

	Page
Summary	3
I. Introduction	4
II. Compilation Methods	4
III. Discrepancies and the Role of Balancing	6
IV Country Practices and Experiences	9
A. Overview of Methods in OECD Countries	9
B. Countries Facing Quarterly Discrepancies	11
United States	11
United Kingdom	14
Canada	19
Australia	23
New Zealand	27
V. Conclusions	29
Table	
1. Scope and Coverage of Quarterly National Accounts: OECD Country Practices ..	10
Charts	
1. U.S. - Ratio of GDI to GDP, Quarterly	31
2. U.K. - Ratio of GDI (I) to GDP (E) at current factor cost, Quarterly	32
3. U.K. - Ratio of Annual GDP (I) to GDP (E), 1966-1986	33
4. Canada - Ratio of GDP (I) to GDP (E), Quarterly	34
5. Australia - Ratio of GDP (I) to GDP (E), Quarterly	35
6. Australia - Ratio of GDP (P) to GDP (E), Quarterly	36
7. New Zealand - Ratio of GDP (P) to GDP (E), Quarterly	37
References	38

SUMMARY

There are three main methods to estimate gross domestic product (GDP): the expenditure approach, the production approach, and the income approach. Countries compiling quarterly estimates for GDP often use some combination of these alternative approaches simultaneously. This may result in the publication of different measures of quarterly GDP and discrepancies between these measures. Such discrepancies are unavoidable, unless reconciliation takes place or the measures are mutually interdependent.

Occasionally, discrepancies between the various estimates are a cause for concern. For instance, in the 1980s the U.K. Central Statistical Office was severely criticized for persistently large discrepancies among its quarterly GDP estimates, and in 1989 a Cabinet Office scrutiny report was published in response to growing concerns. More recently, attention has been drawn to discrepancies between the two U.S. quarterly GDP estimates.

This paper examines the problem of discrepancies in an international context. It gives a general overview of quarterly national accounts compilation methods and their relative weaknesses and strengths. Subsequently, it discusses ways in which discrepancy problems can be dealt with in general, followed by an overview of practices in statistically advanced countries within the OECD. This analysis is elaborated for those OECD members that have to deal with discrepancies in their quarterly national accounts--the United States, the United Kingdom, Canada, Australia, and New Zealand--and causes and the development of these discrepancies are examined.

I. INTRODUCTION

In countries that simultaneously publish more than one estimate of gross domestic product (GDP) for each quarter, discrepancies between the various estimates may cause concern. For instance, in the 1980s the Central Statistical Office of the U.K. was severely criticized for persistently large discrepancies among its quarterly GDP estimates, and in 1989 a Cabinet Office scrutiny report was published in response to growing concerns. More recently, attention has been drawn to discrepancies between the two U.S. quarterly GDP estimates.

The purpose of this paper is to examine the problem of discrepancies in an international context. To this end, the paper will first give a general overview of quarterly national accounts (QNA) compilation methods and their relative weaknesses and strengths. Subsequently, the paper will discuss ways in which discrepancy problems can be dealt with in general, followed by an overview of practices in statistically advanced countries within the OECD.² The overview elaborates on those OECD members that have to deal with discrepancies in their quarterly national accounts.

II. COMPILATION METHODS

The three main methods to estimate GDP are (1) the expenditure approach, (2) the production approach, and (3) the income approach. The expenditure approach generates estimates of GDP as the sum of all expenditure categories; these include government and household consumption, fixed capital formation, changes in inventories, and exports minus imports. The production approach, also called output approach, estimates GDP as the sum of value added of all industries (i.e., the difference between output and intermediate consumption) plus taxes less subsidies on products. The income approach estimates GDP as the sum of wages and salaries, gross operating surplus of enterprises, and mixed income generated by households that engage in production.³

The expenditure approach usually has two strong pillars, namely, foreign trade and government consumption; the other categories are often less well covered. The major

²This is not to imply a value judgment on the quality of other countries' statistical systems, but this selection seems sufficient for the paper's purposes.

³Alternatively, GDP can be derived as the sum of primary incomes generated in the economy. These include wages and salaries and property incomes such as interest, dividends, and rent on land. If this alternative is followed, the sum of these incomes should be adjusted with the balance of labor and property income from abroad.

components of foreign trade are usually imports and exports of goods; these are covered through merchandise trade statistics that often have a strong basis in comprehensive data collection for custom purposes. Data on trade in services are usually less accurate because they are derived mostly from sources that do not distinguish clearly between services and income flows. Data on government consumption can often be derived from administrative data; if this is not the case, good estimates of government consumption can often be based on volume indicators (e.g., number of employees). Other expenditure components (i.e., household consumption, fixed capital formation, and changes in inventories) are usually covered less well. Data from household budget surveys, if available quarterly, suffer from inherent downward biases in reporting income and expenditures, and the quality of the data may be low owing to sampling problems. Directly observed data on fixed capital formation and changes in inventories are often simply lacking.

The production approach usually relies heavily on output data that are often reasonably accurate. However, often a major weakness of this approach is that a lack of data on inputs⁴ forces accountants to rely on fixed input/output coefficients. For quarterly GDP estimates, the use of fixed coefficients is risky in view of changes in capacity utilization rates and possible seasonality of inputs (e.g., in cold climates the energy demand peaks in winter). The reliance on fixed coefficients is even more perilous if compilations are in current prices.

The income approach may have a sound underpinning in wage statistics or in administrative data on wages (e.g., for social security purposes), but quarterly observations of operating surplus/mixed income may be difficult to achieve.

The weaknesses of the various methods can, to some extent, be dealt with by comparing all available information. Production and income data can be cross checked if both are specified to industries, which is particularly meaningful if the value-added data for industries can be broken down into wages and salaries, operating surplus, and mixed income. Production and expenditure data can be combined using the commodity flow method. This method is based on the axiom that supply meets demand, from which the familiar textbook identity can be derived:

$$P = C + I + E - M$$

In which:

- P = production (in national accounts terminology: value added, or output minus intermediate consumption)
C = final consumption by households and government

⁴Sometimes the situation is in reverse, and the estimates are based on input data while output data are lacking. The occasion in which both quarterly output and input data are available is rare.

I = fixed capital formation and changes in inventories
E = exports
M = imports

The commodity flow method can be applied on different levels, for example, for groups of commodities or for individual commodities. The more detailed the level at which the method is applied, the more accurate the result (in particular, because detailed information requires fewer assumptions on origin and use). This method is particularly strong if applied in an input/output or supply/use framework, even if of limited dimensions. Application of such frameworks may seem daunting in a quarterly context but has proved feasible.⁵

III. DISCREPANCIES AND THE ROLE OF BALANCING

If several basic approaches are used simultaneously but independently, discrepancies between the results of the various methods are unavoidable. Opinions differ on the significance of this phenomenon. Some see merit in having several GDP estimates (to some extent size and development of the discrepancies indicates the accuracy and reliability of the approaches); others see this as confusing to users. The latter opinion may prevail if discrepancies are large, for instance if they surpass growth rates percentage-wise or are growing through time.

An approach avoiding discrepancies altogether is to balance data at a detailed level before the macroaggregates are derived. Very powerful devices to achieve balancing are commodity flow methods and supply/use techniques—both elaborations of the supply/demand function mentioned above. If all relevant supply and demand data are available but conflicting, detailed balancing has the advantage of allowing informed decisions on the most likely estimate, based on a judgment of the relative accuracy of the conflicting data.

It should be noted that commodity flow methods and supply/use techniques are often used to derive estimates for variables for which no source data are available. This applies in particular to estimates of fixed capital formation and changes in inventories. If these techniques are used to derive estimates for such unobserved variables, then discrepancies are avoided as a matter of course. However, this is not the situation being discussed here because this is not an independent use of the basic approaches.

If the macroaggregates are not derived through a process of detailed balancing, compilers have the choice either to compile completely independent estimates following the

⁵For instance, this method has been applied in the Netherlands since 1983, with a relatively small staff (about five). For a description of the compilation method used, see R. Jansen, and S. Algera, *The Methodology of the Dutch System of Quarterly Accounts*, Occasional Paper Nr. NA-025 (Netherlands Central Bureau of Statistics).

various approaches or to work through an iterative process in which results of the various approaches are compared and, as far as possible, reconciled.

If discrepancies remain or are detected only after the macroaggregates have been derived, several options are available for dealing with them. The first option would be to accept these discrepancies and publish them explicitly or implicitly. The second option would be to remove the discrepancies. Several options exist to remove discrepancies.

The first option to remove discrepancies is to go back to the detailed level and to apply balancing methods as a kind of secondary procedure. If discrepancies remain after applying such procedures, again a choice has to be made whether to accept them or to remove them.

The second option to remove discrepancies, including those that may remain after detailed balancing, is to apply some allocation technique. The main two options in this respect are (1) proportional distribution and (2) selective attribution. Proportional distribution implies that the discrepancies are distributed to all measures. For instance, in the case of an excess of demand over supply, this could be done through adjusting both the demand and the supply side by half the discrepancy. Selective attribution implies that the whole discrepancy is attributed to one approach that is then increased or decreased with the full amount of the discrepancy.

Both the proportional distribution and selective attribution will, in the first instance, result in shifting the problem, that is, from the aggregate level to the level of component categories. For instance, if GDP from the expenditure approach is adjusted to accommodate the discrepancy between production-based GDP and expenditure-based GDP, this will result in a discrepancy between GDP and expenditures on GDP. This means that the above-mentioned choices will have to be repeated in a second round, with again as main options acceptance of the discrepancy or removal through either proportional distribution or selective attribution. When applying the latter method to expenditure data, a fairly common choice is to allocate the discrepancy fully to one of the weaker categories, such as changes in inventories. However, it should be emphasized that for many users the latter is a key variable for business cycle analyses.

Presently, no consensus exists among the profession of national accountants on how to deal with discrepancies or, more generally, with conflicting data. Many European countries share a tradition of balancing on a detailed level, strongly supported by the practice of compiling annual supply and use or input/output tables. As early as 1942, Stone, Champernowne, and Meade proposed a comprehensive approach to balancing on a detailed

level, encompassing the full framework of national accounts.⁶ However, in the U.K. his advice was not followed until recently (see below), and several other countries continue publishing discrepancies. One reason for this may be that balancing implies corrupting the original data; this point is made, for example, by Oleg Arkhipoff.⁷ While Arkhipoff discusses mainly the mathematical and methodological aspect of this, it can also be pointed out that in practice the corruption of the data depends on the expertise and integrity of the statisticians and on possible interference of interested parties. Furthermore, it has been argued that simple balancing procedures (e.g., taking an unweighted average) do not take the relative accuracy of the estimates into account. On the other hand, it has been mentioned that balancing procedures that do take relative accuracy into account imply subjective estimates of error (see Stone, 1980).⁸ Other reasons may be that, to some extent, discrepancies can be seen as indicative of the reliability of the data. However, it has also been pointed out that small discrepancies do not necessarily mean strong estimates, because the various approaches may be biased in the same direction. This is not unlikely in cases where the same source data are used for several approaches. For instance, the same government finance statistics are often used in alternative approaches.⁹

⁶ See, for instance, J. R. N. Stone, D. G. Champernowne, and J. E. Meade, "The Precision of National Income Estimates," *Review of Economic Studies*, Vol. 9, (1942), pp. 111-125.

⁷ See, for instance, Oleg Arkhipoff, "Importance et diversité des problèmes d'agrégation en comptabilité nationale : esquisse d'une théorie générale de l'agrégation" in *La Comptabilité Nationale Face au Défi International*, ed. by E. Archambault, and O. Arkhipoff, Economica (Paris, 1990).

⁸ J. R. N. Stone, "Direct and indirect constraints in the adjustment of observations," in Statistics Norway National Accounts Models and Analysis, To Odd Aukrust in Honor of His Sixtieth Birthday, Samfunnsøkonomiske Studier no. 26 (Social Economic Studies no. 26), (Oslo, 1975).

⁹ See Statistics Canada's Guide to the Income and Expenditure Accounts, Catalogue 13-603E, No.1, p. 114, and the U.S. Bureau of Economic Analysis' Mid-Decade Strategic Review of BEA's Economic Accounts, 1995-386-542/22024, (Washington: Government Printing Office), VI37.

IV. COUNTRY PRACTICES AND EXPERIENCES

A. Overview of Methods in OECD Countries

From the OECD publication *Quarterly National Accounts: Sources and Methods by OECD Member Countries*, it appears that 18 OECD countries compile quarterly national accounts and that all of these countries use several approaches.¹⁰ The expenditure approach is the most widely used; all OECD members that compile quarterly national accounts use this method. Eight of these countries use all three methods. Another eight use the production and the expenditure approach, and two, the expenditure and the income approach. Data on changes in inventories and operating surplus are often derived as a residual; in eight cases, changes in inventories are derived as the residual, and in five cases, operating surplus. In four cases both changes in inventories and operating surplus are derived as a residual; this suggests a strong reliance on the production method.

Five countries—the U.S., the U.K., Canada, Australia, and New Zealand—face discrepancies between different quarterly GDP estimates. The other OECD countries have only one independent quarterly estimate, usually from the production approach. The main reason why these other countries do not have discrepancies is that components of the other approach or approaches are derived as a residual. Another reason may be that data are balanced on a detailed level, as is the case in Sweden and Turkey.

For some countries, such as Norway and the Netherlands, both reasons apply, because they use detailed balancing and derive changes in inventories as a residual. Japan publishes both expenditure and income estimates but not simultaneously (expenditure data are published shortly after each quarter, but income data only after the annual data have become available.)

¹⁰ Since the publication of the report, other OECD countries have established QNAs; for lack of information, these countries have not been included in this overview.

**Table 1. Scope and Coverage of Quarterly National Accounts: OECD
Country Practices¹¹**

	Production	Expenditure	Income	Discrepancies
Canada	X	X	X	published
United States		X	X	published
Japan		X	X	nonexistent
Australia	X	X	X	published
New Zealand	X	X		published
Austria	X	X ⁽¹⁾		nonexistent
Denmark	X	X	X ⁽²⁾	averted
Finland	X	X ⁽¹⁾	X ⁽²⁾	nonexistent
France	X	X ⁽¹⁾	X ⁽²⁾	nonexistent
Germany	X	X ⁽¹⁾	X ⁽²⁾	nonexistent
Italy	X	X ⁽¹⁾		nonexistent
Netherlands	X	X ⁽¹⁾		nonexistent
Norway	X	X ⁽¹⁾	X ⁽²⁾	nonexistent
Spain	X	X ⁽¹⁾		nonexistent
Sweden	X	X		averted
Switzerland	X ⁽³⁾	X ⁽¹⁾		nonexistent
Turkey	X	X		averted
U.K.	X	X	X	averted ⁽⁴⁾

- (1) Changes in inventories are mainly derived as a residual
(2) Operating surplus is mainly derived as a residual
(3) A production approach is used to estimate GDP but with no breakdown by kind of activity
(4) Except in the most recent few quarters

¹¹Source: OECD, *Quarterly National Accounts: Sources and Methods by OECD Member Countries*.

B. Countries Facing Quarterly Discrepancies

United States¹²

Introduction

The Bureau of Economic Analysis (BEA) produces quarterly estimates of GDP at current prices by the income and expenditure approaches. The estimates are based on the U.S. National Income and Product Account (NIPA) system, which uses many of the same concepts found in the 1968 and 1993 *SNA* but does not include the full set of *SNA* accounts. Emphasis in the analysis is placed on the constant price series referred to as the "real" GDP.

For the quarterly series, only seasonally adjusted estimates at annual rates are published. The first estimates of GDP (from the expenditure approach) and personal income are published four weeks after the end of the quarter. Two months later (three months after the end of the quarter) the revised estimates of GDP are released along with the first estimate of Gross Domestic Income (GDI). However, the quarterly data are subject to more revisions. Once each year, usually at the end of July, an annual revision of the estimates is made using more complete source data. In most cases, data for the previous three years are revised. Every five years the estimates are subject to a benchmark revision as information from the economic censuses of business and agriculture becomes available. At the time of the benchmark revision, all years potentially could be revised if definitional or major methodological changes are made. The last benchmark revision occurred in 1995 when data for the period covering 1987 through 1992 were revised with subsequent revisions of historical data back to 1929.

The estimates obtained by the two methods are largely independent, given that the information used is different in nearly all cases. The main exceptions are compensation for government workers, imputed financial service charges and rental values of the housing stock, inventory valuation adjustment, change in farm stocks, and rents paid on tenant-occupied residential housing. A summary of the data sources is given below.

Current price estimates

The quarterly **income** estimates at current prices are mainly based on:

- monthly surveys of employment and payroll records, federal government accounting records and employer contributions to private pension plans and to health insurance (used to derive compensation of employees);

¹²Sources: U.S. Department of Commerce, Bureau of Economic Analysis, "Updated Summary Methodologies," *Survey of Current Business*, August 1996, pp. 81-103; U.S. Department of Commerce, Bureau of Economic Analysis, *Mid-Decade Strategic Review of BEA's Economic Accounts: Background Papers*, 1995; and OECD, *Quarterly National Accounts: Sources and Methods by OECD Member Countries*.

- quarterly surveys of corporate profits in goods-producing and regulated industries, profits reported in company financial reports, rental income adjusted by the CPI for rent, trend extrapolations for profits in most service industries, and interest paid and received (relating to operating surplus);
- interpolation and extrapolation of annual data based on tax records (consumption of fixed capital); and
- monthly Treasury Department statements for customs duties, activity indicators for excise taxes, and Commodity Credit Corporation profit and loss statements for agricultural subsidies (taxes less subsidies on production).

The **expenditure** estimates for the U.S. are referred to as the product accounts in the NIPA but should not be confused with the production accounts in the *SNA* framework. These estimates are based mainly on:

- monthly surveys of retail sales and revenues or closely related data for goods and services, housing rent adjusted by the CPI for rent, employment, and earnings for selected education, welfare, and medical services (used to derive personal consumption expenditures);
- the federal government budget, wages and salaries in federal government, a monthly employment survey for state and local government, trend extrapolation for state and local government expenditures (government consumption);
- monthly survey of construction projects, monthly housing starts, a monthly survey of manufacturing shipments, orders, and inventories, a monthly survey of trade inventories, trade association data on purchases and inventories of automobiles and trucks, and imports of capital goods from monthly trade reports (capital formation and changes in inventories); and
- balance of payments statistics (exports and imports).

BEA has viewed the expenditure estimates as generally more accurate, because the source data for the quarterly estimates are more comprehensive.¹³ As shown in Chart 1, on average, the expenditure estimate has exceeded the income estimate. Only in the most recent period, in 1987-88, and in the early 1960s, the income estimates were substantially higher than the expenditure estimates. Over the whole period, the U.S. discrepancy has been typified by cyclical behavior, rather than quarter-to-quarter fluctuations (which appear to be more important in Canada and Australia). The pattern of the 1990s is distinctive because of the

¹³ See Robert Parker, "The Statistical Discrepancy," *Survey of Current Business*, August 1997, p.19.

relatively large and fast shift in the relationship between the two measures and the fact that the amplitude is increasing. Recently, there have been suggestions that the income estimates may provide a better indication of current growth rates than the expenditure estimates.¹⁴ However, the current period is not strictly comparable to earlier periods, in that it is subject to further revisions, while the earlier data have already been through several rounds of revisions. The true story may not be known until the next benchmark revision sometime in the year 2000.

The source of the recent discrepancies is not known and BEA is investigating the situation. Previous studies indicate that there is no known relationship between past revisions and future revisions of current quarterly estimates, nor is the discrepancy a complete indicator of the quality of the GDP estimates, because both sides can be affected by the same errors.¹⁵

Constant price estimates

Detailed constant price measures are produced only for expenditure components of GDP. In the NIPA the constant price series are referred to as real dollar measures. An estimate is made for real gross domestic income (GDI); this is accomplished by deflating the gross income estimate by the GDP deflator from the expenditure side.

The expenditure estimates are derived by direct deflation of the current price values primarily through the use of a wide range of specific fixed weight price indices (mostly CPI, some PPI, international price indices, and a few BEA specific indices). Extrapolation of base year values by changes in volume indicators is used for rental value of farm dwellings, stock brokerage charges, financial services, and government compensation. Re-valuation of current production at base year prices is used for net purchases of used automobiles, some military goods and structures, net purchases of agricultural commodities, and selected petroleum transactions.

Reconciliation

In the quarterly compilation process for the income and expenditure approaches, there is an attempt to reconcile differences that arise from inconsistencies among various data sources. Because the NIPA does not have a full set of accounts (it is missing the production, capital, and financial accounts) and because it does not have an annual input-output framework for analyzing potential sources of the discrepancy, reconciliation is necessarily less thorough than in some other countries. It is unlikely, given the stringent budgetary climate in

¹⁴ See Council of Economic Advisors, *Economic Report of the President*, February 1997, pp. 72-74.

¹⁵ See discussion of the statistical discrepancy in U.S. Department of Commerce, Economics Statistics Administration, "Revisions In the Economic Accounts: Implications for Improvements," *Mid-Decade Strategic Review of BEA's Economic Accounts*, September 1995, pp. VI 32-34 and 37-39.

the U.S., that additional resources would be available to undertake the development of production-based measures or reconciliation in an annual input-output framework.

United Kingdom¹⁶

Introduction

The U.K. Office for National Statistics (ONS) produces a quarterly measure of GDP with its income and expenditure components at current prices and its output and expenditure components at constant prices. The output components are available in volume index form only. Emphasis is placed on seasonally adjusted series.

A preliminary estimate of quarterly volume growth, based on output information, is published three weeks after the end of the quarter. Five weeks later (at eight weeks), expenditure, output, and income breakdowns of GDP are published, and after a further four weeks (twelve weeks), a full set of accounts is published (GDP(I) and (E) at current prices, market prices, and factor cost; GDP(O) and (E) at constant prices; current, capital, and financial accounts for seven institutional sectors).

The estimates obtained by the three methods are largely independent, because the information used is different in nearly all cases—the main exception being employment data, which are used, to some extent, in all three measures. A summary of the data sources is given below.

Current price estimates

The **expenditure** estimates at current prices are derived from information obtained from :

- surveys of consumers' expenditure and retail sales, and supply statistics for alcohol and tobacco (consumers' expenditure);
- records of central-government expenditure and local-government wages and salaries (government final consumption);
- quarterly surveys of capital goods purchases by manufacturing, energy, distributive, and service industries, and quarterly surveys of building output (gross fixed capital formation);
- monthly and quarterly stocks inquiries (changes in inventories); and

¹⁶ Sources: Central Statistical Office, *United Kingdom National Accounts—Sources and Methods* (1985); Central Statistical Office, "Quarterly National Accounts in the U.K.," *Economic Trends* (April 1995).

- overseas trade statistics for goods and services (exports and imports).

The **income** estimates at current prices use :

- wages and salaries based on tax data, numbers in employment, and quarterly surveys of average earnings (compensation of employees);
- tax data, quarterly profits inquiries, and records from public corporations (gross trading profits);
- tax data, and estimates of income to farmers (income from self-employment); and
- annual data for income from rent (rent).

Chart 2 shows, from 1960, the ratio of quarterly GDP(I) to GDP(E) as published on June 27, 1997. As a result of reconciliation procedures introduced in the early 1990s, there are now no differences in the measures between 1985 and 1995 inclusive, and differences between quarterly measures for the most recent years will be removed once annual data for those years are fully reconciled. During the 1960s and 1970s, the expenditure measure was generally higher than the income measure and most significantly so in the mid-1970s. During the 1980s however, the income measure became increasingly larger than the expenditure measure (this is shown in Chart 3), to such an extent that the U.K. government commissioned a scrutiny team to investigate the growing discrepancy and, as a result of the team's findings, provided the resources to improve data collection and compilation processes.¹⁷ This is discussed more fully under "Discrepancies in the 1980s and the resulting changes in reconciliation policy"

Constant price estimates

Constant price net **output** (value added) is estimated by using volume indicators of gross output as a proxy for net output at constant prices. Because it would be very difficult to obtain the large amount of data needed to deflate gross outputs and gross inputs, volume of gross output is accepted as a satisfactory indicator of short-term movements in constant price value added. Data for volume output are collected via monthly production inquiries and quarterly services inquiries. Indices are constructed for different industries and weighted together using estimates of 1990 value added at factor cost obtained from input-output tables.

Estimates of constant price **expenditure** are obtained using a combination of volume indicators (including roughly 40 percent of consumers' expenditure and 30 percent of government final consumption) and deflated current price values. A range of price indices is used for deflation, principally the components of the Retail Prices Index (annually

¹⁷ Cabinet Office, *Government Economic Statistics*.

reweighted), the Producer Price Index (1990 base-weighted), and the Average Earnings Index (1990 base-weighted).

Where constant price **income** estimates are needed for the reconciliation process (these are not published), they are obtained by deflating current price GDP(I) by the implicit expenditure deflator, that is, GDP(E) at current prices divided by GDP(E) at constant prices.

Reconciliation

The accounts are balanced both on an annual and quarterly basis, although different methods are used for each, and the quarterly process depends on the results of annual balancing. The ONS believes that input-output tables provide a coherent definitive measure of the annual level of current price GDP, whereas quarterly growth in output is regarded as yielding the best short-term measure of changes in GDP and is thus given a high weight in the quarterly reconciliation process.

Whereas the aim of balancing the three measures of annual GDP is principally to reconcile levels, quarterly balancing is more concerned with aligning estimates of growth. This is because users of U.K. quarterly GDP data are more interested in changes than levels. Less formal methods are used in quarterly reconciliation than in the annual exercise mainly because the large volume of data necessary for input-output balancing is not available on time.

There is also a lag between the production of annual GDP estimates and input-output tables and input-output data are therefore not available for balancing the most recent year's estimates. For example, if 1997 = t, then annual GDP estimates are published for 1996 (t-1) in August but are not reconciled using input-output; estimates prior to this (t-2, 3...) are fully reconciled. So, statistical discrepancies will appear in periods when data for input-output reconciliation are not available, that is, for annual GDP at t-1, quarterly GDP during t-1 and t, and also in the years prior to 1985 before input-output reconciliation was introduced. Annual GDP at t-1 is partially reconciled using estimates of current price value added, compiled using output data.

So, for example, at August 1997 the position would be :

	1983	1984	1985	1994	1995 (t-2)	1996 (t-1)	1997 (t)
Annual GDP :							
Input-output reconciliation	n.a.	n.a.	✓	✓	✓	n.a.	n.a.
Statistical discrepancy	✓	✓	zero	zero	zero	✓	n.a.
Quarterly GDP :							
Statistical discrepancy	✓	✓	zero	zero	zero	✓	✓
Annual constraint	✓	✓	✓	✓	✓	✓	n.a.
						(n.a.	not available)

The lag in fully reconciled annual GDP is important because the quarterly balancing process is constrained by annual estimates. The underlying principle of the quarterly balancing process is that similar quarterly movements for each of the three measures should be agreed upon, but that where annual estimates for GDP are known but not fully reconciled, the quarterly balancing process must not alter these agreed estimates. Obviously, for quarters in the current year, annual totals will not be known, but the effect of the future constraint is borne in mind.

The quarterly balancing process¹⁸ concentrates on constant price estimates, which are automatically available for output and expenditure measures, but constant price income must be derived by deflating current price income by implied expenditure deflators. Once the constant price estimates have been balanced, current price estimates of expenditure and income components can be derived by reflation using the implied expenditure deflator.

The output measure is considered to provide the best estimate of quarter-to-quarter volume movements in GDP, owing to the absence of highly volatile components such as changes in inventories and company profits. Also, output components are available earlier and tend to be revised less than other measures.

The balancing process consists of three stages :

- **scrutiny**
The scrutiny of initial estimates tests the plausibility of the movements in individual series and the consistency across the accounts. Additional information from non government surveys and sources is used. Supply-side analysis is used to validate expenditure at product level.
- **judgmental adjustments**
After the scrutiny stage large discrepancies may still exist. A quarterly movement in aggregate GDP is agreed upon by discussion, giving a high weight to the movement in the output aggregate. Judgmental adjustments may be made to component data at this stage in line with the agreed to aggregate movement. These adjustments are made to a variety of components, within their error ranges.
- **alignment adjustments**
It is highly unlikely that, after judgmental adjustments to component series, the movements in aggregate expenditure and income will match that of output. The final balancing step therefore involves the mechanical calculation of alignment adjustments to alter the quarterly paths of income and expenditure so that they match, as closely as possible, the movements in output **without altering annual totals** (annual totals are

¹⁸Office for National Statistics, "Quarterly integrated economic accounts—the U.K. approach," *Economic Trends* (March 1997).

known in year t-1 but not in year t). The adjustments are made to changes in inventories (expenditure) and company profits (income), because these components are believed to have the widest error margins.

It is the alignment stage that will differ according to whether it is quarters in year t-2, t-1, or t that are being reconciled :

t-2 After input-output data are available for year t-2, a single annual GDP estimate will exist and the quarterly movements for income and expenditure measures will automatically become the same as each other.

t-1 Annual estimates of GDP(I) and GDP(E) will exist but will be different as a result of incomplete reconciliation. The quarterly movements (paths) of income and expenditure will have the same “shape” as the path for GDP(O) but will arrive at their respective annual totals at the end of the year.

t The quarterly paths of all three measures will be similar, but their end-points will be uncertain, although annual figures may be anticipated.

Thus, the process results in similar movements for the three measures, which are then applied to earlier levels to produce aligned totals for income and expenditure. The level for aggregate GDP is then calculated as the average of the aligned income and aligned expenditure.

The difference between aligned income and average GDP is known as the statistical discrepancy (income) and is similar for expenditure. The income and expenditure discrepancies are shown explicitly in the income and expenditure analyses (the discrepancy is implicit in the output analysis).

Current price GDP is derived by reflatting the aligned income and expenditure levels by the expenditure deflator.

Discrepancies in the 1980s and the resulting changes in reconciliation policy

The methods described above for reconciling quarterly and annual GDP were adopted largely as a response to concern about widening discrepancies in the late 1980s. In 1989, a Cabinet Office scrutiny report, “Government Economic Statistics,” was published in response to growing concern among users of macroeconomic statistics. It concluded that “concern about the quality of these statistics has been focused on three main areas: wide discrepancies between the three measures of GDP, large and growing balancing items, and frequent and major revisions to statistics.”

The review team found that “the level of GDP at current prices is measured by both income and expenditure routes. The difference between the two—the “residual error,”—has

fluctuated widely. Over the last six years the income measure has been consistently higher than the expenditure measure, and the gap has been widening.”

Chart 3 shows the ratio of GDP(I) to GDP(E) at current factor cost between 1966 and 1986. It clearly demonstrates how the discrepancy between the two measures grew during the 1980s; during this period GDP(E) grew on average by 0.5 percent a year less than GDP(I) and GDP(O). Several users suspected that GDP(E) was underrecorded, particularly in the areas of investment and consumers' expenditure.

As a response to the report, in May 1990 and November 1991, two phases of measures aimed at improving the reliability of economic statistics were announced by the Chancellor of the Exchequer. Both phases had three key objectives :

- to improve the reliability of early estimates of GDP and the overseas current account;
- to reduce the discrepancies between the three measures of GDP; and
- to reduce the size of the balancing items in the sector accounts.

The strategy for achieving these objectives was to improve the quality and timeliness of survey data by the introduction of new surveys, enlargement of existing surveys, more use of quarterly inquiries, and more use of statutory powers. The areas that were particularly targeted were services, companies, and the balance of payments.

This shift towards more reliable monthly and quarterly reporting reduced the need for large revisions. It also allowed the production of input-output tables much more quickly than in the past, which has led to their use for reconciling annual GDP. This means that annual GDP is now fully reconciled for all years from 1985 to 1994 (1995 will be published in reconciled form in August 1997). There are thus no statistical discrepancies for annual or quarterly measures in these years.

The processes of reconciliation carried out by the ONS are resource intensive and rely heavily on the expertise and experience of the compilers involved.

Canada¹⁹

Introduction

Statistics Canada produces quarterly estimates of GDP at current prices by the income and expenditure approaches and at constant prices by the expenditure and production

¹⁹Sources: Statistics Canada, *Guide to the Income and Expenditure Accounts, Income and Expenditure Accounts Sources and Methods Series*, Catalogue 13-603E, No. 1; OECD, *Quarterly National Accounts: Sources and Methods by OECD Member Countries*.

approaches. The estimates are produced in accordance with the *1968 SNA* and will be updated to the *1993 SNA* by the end of 1997. Emphasis in the analysis is placed on the constant price series.

For the quarterly series, only seasonally adjusted estimates at annual rates are published. The first estimates of GDP for each of the published series are available about 60 days after the end of the quarter. Each quarter's estimate is subject to revision during the year as new quarterly information is released. At the time of the annual revision, with the release of the first quarter estimates, quarterly data in the previous four years are subject to revision. Once a decade, a historical revision is made, and the quarterly data may again be revised. These revisions occur at the time that information from the census and other benchmark sources is available and are usually accompanied by major changes in concepts and/or methodology. The last historical revision occurred in 1986 with revisions dating back to 1926. The next historical revision will occur in December 1997 with the introduction of the *1993 SNA*.

The estimates obtained by the three methods are largely independent, because the information used is different in nearly all cases. The main exceptions are employment and wage information for government workers and imputed rental values of the housing stock. A summary of the data sources is given below.

Current price estimates

The **income** estimates at current prices are based on:

- a monthly survey of employment and payroll records and government accounting records (used to derive wages and salaries);
- a quarterly survey of corporate profits, interest, and miscellaneous investment income and monthly surveys of housing starts and farm receipts (property and entrepreneurial income and consumption of fixed capital); and
- government finance statistics (taxes and subsidies).

The **expenditure** estimates at current prices are based on:

- monthly surveys of retail sales and revenues or closely related data for goods and services (used to derive personal consumption expenditures of households);
- government finance statistics (government consumption and capital formation);
- monthly data on housing starts, employment/wages and building materials/prices for nonresidential construction, and surveys of manufactures and imports of machinery (capital formation);

- a monthly survey of inventories (changes in inventories); and
- merchandise trade statistics from customs records and quarterly surveys of service trade flows (exports and imports).

Statistics Canada presents a single measure of GDP with discrepancies (of equal and opposite signs) in each of the income and expenditure data. There is no accepted view as to which measure is more accurate, although Statistics Canada believes in general that the data sources for the expenditure estimates historically have been more reliable than the sources for the income estimate.²⁰ The expenditure estimate has generally been higher than the income estimate. Since the second quarter of 1995, the discrepancy between the series has narrowed considerably, and the income estimate has exceeded the expenditure estimate similar to the situation in the U.S. Statistics Canada has not been able to identify any specific sources for the closing of this gap and the recent reversal. It is exploring the possibility that some sales data from mass merchandisers are not adequately reflected in the current methodology and that the growth of small firms may be understated in the wholesale and retail sales surveys. This discrepancy between the two series has occurred many times before and does not appear to be unusual, as shown in Chart 4. It is important to remember that the current period during which the discrepancy has narrowed and reversed is not comparable to previous data because it is still subject to annual revisions. Also, a historical revision will occur in December 1997, which can affect the series.

The trend for the Canadian GDP discrepancy rate has narrowed over the years, which is attributed to the improvements in the source data and their review procedures. Statistics Canada does not consider the statistical discrepancy to be a very good indicator of the overall accuracy of national accounts estimates. Errors exist in most of the source data used in each of the methods, and, even when the discrepancy is small, similar errors can occur in each of the different source materials.²¹

In the quarterly compilation process, there is an attempt to reconcile differences where possible. In most instances, the series cannot be fully reconciled and a discrepancy remains. Because it is not possible to determine the true source of the discrepancy, it is split evenly between the expenditure and income approaches.

Constant price estimates

There are two measures of quarterly GDP at constant prices--namely, from the expenditure and from the production approach. The expenditure estimates are derived from the current price values using a wide range of specific fixed-weight price indices as deflators.

²⁰ Statistics Canada, *A Guide to the Income and Expenditure Accounts*, Catalogue 13-603E, No. 1, pp. 114-116.

²¹ *A Guide to the Income and Expenditure Accounts*, p. 114.

Some items (e.g., rents, energy, and tobacco) are derived directly through multiplying current volumes by average 1986 prices.

The quarterly GDP by industry is a projection of the annual estimates, relying on various indicators such as employment and deflated gross shipments. It also excludes taxes less subsidies. The annual production-based estimates are calculated in an input-output framework using a double-deflation method in which the deflated value of inputs is subtracted from the deflated value of output to yield value added at constant prices.

The statistical discrepancy published for the constant price GDP expenditures-based series is simply the current price discrepancy deflated by the implicit deflator, not the difference between the expenditure and production-based constant price estimates. At this time, there is no statistical discrepancy included in the production estimates. This is due to the different concepts used. The production estimates are at factor cost, whereas the expenditures are at market prices. The difference between the two series is taxes less subsidies on production. With appropriate adjustments, the two series would be measured using the same concepts, and there would be a discrepancy between them.

Neither method is preferred over the other, and the two sets are used for detailed analysis of expenditure sources and industrial contributions. Each year (but with a data lag of two years), the production account is reconciled in an input-output framework.

Reconciliation

Statistics Canada uses a balancing system to determine internal consistency between financial and capital accounts and similar components within the production, income, and expenditure accounts. However, in many cases the source of differences cannot be determined; thus, the discrepancy remains. Until recently, the expenditure basis has been higher, so its statistical discrepancy has been negative, and the discrepancy for the income side has been positive.

A reconciliation of the two constant price series for the current quarter is difficult because of the different methods used in the deflation of expenditures versus the revaluation of current quantities at base period prices and extrapolation by volume indicators used to derive the production estimates. However, a consistency check is conducted each quarter, in which specific industries are reconciled with closely related expenditure components (e.g., construction and investment in residential and nonresidential structures). Also, a mapping of exports is done using the most recent input-output table.

Australia²²

Introduction

The Australian Bureau of Statistics (ABS) produces quarterly estimates of GDP by the income, expenditure, and production approaches. All three are produced at constant prices, whereas only the first two are produced at current prices. The estimates are produced in accordance with the *1968 SNA* and will be updated to the *1993 SNA* in 1998.

The results from the alternative approaches are published at the same time. In addition, for constant prices, an average of the three measures is also published. Notes in the publications explain the methods and advise users to consider the margin of error when interpreting the data. The different estimates are shown separately in their own right, but the statistical discrepancy is no longer shown explicitly as a separate item.

All three sets of estimates are shown in original, seasonally adjusted, and trend terms. The data are released about two months after the end of the quarter. Estimates are subsequently revised each quarter. Revisions are concentrated in the most recent few years; therefore, the discrepancy tends to be more volatile in the most recent periods. However, data for earlier periods may also be changed as a result of new annual benchmarks or methodological reviews.

The data sources for the different estimates are largely independent. However, there are some cases (e.g., private consumption of goods/retail output, construction output/capital formation, general government production/ income, inventory valuation adjustment, dwelling rent) where the data sources used are the same.

Current price estimates

The **income** estimates—GDP(I)—at current prices are based mainly on:

- surveys of employment and wages (used to derive compensation of employees);
- a survey of profit, interest, and depreciation (estimates of operating surplus); and
- government finance statistics (taxes on production and subsidies).

²² Source: Australian Bureau of Statistics, *Annual Report 1995-96*.

----, *Australian National Accounts: National Income, Expenditure and Product Catalogue* 5206.0.

----, *Australian National Accounts: Concepts, Sources and Methods*, Catalogue 5216.0.

The **expenditure** estimates—GDP(E)—at current prices are based on a wide range of indicators including :

- surveys of retail sales and service takings and specific indicators for components such as petroleum, vehicles, rent, and health (household consumption);
- government finance statistics (government consumption and capital formation);
- surveys of work done by construction enterprises and business expenditure on equipment (capital formation);
- surveys of the book value of inventories and quantity information on agricultural inventories (changes in inventories); and
- balance of payments data (exports and imports of goods and services).

Conceptually the measures are equal, but, owing to inconsistent sources, there is usually a difference. The ratio between the income and expenditure series is shown in Chart 5. The difference exceeded 1 percent in 67 of the 156 quarters since the start of the series in 1959. Over the long term, the ___ tend to cancel, so there is no consistent difference.

A high proportion of the differences consists of fluctuations that are reversed in the subsequent quarter. This tends to suggest that the cause is problems at the time transactions are recorded, for instance, inconsistent recording of transactions owing to the cash basis of government accounts, the customs basis of international trade, and business use of accounting periods that do not aggregate exactly to quarters, such as one-week and four-week periods. These problems are more concentrated in the expenditure measure, and consequently it appears to be more volatile.

Some of these timing effects can be smoothed away in the moving average series, as shown in Chart 5. The smoothed series shows some similarity to the recent pattern in the U.S. and Canada, in that the income-based measure was relatively high in the late-1980s, was relatively low in the early 1990s, and has become relatively high again in the mid-1990s. The discrepancies are proportionately larger in Australia than in the U.S. or Canada. However, in contrast to the U.S., the peaks and troughs of the 1990s are of similar magnitudes to those in earlier periods. Like the U.S., the move in the ratio from trough to peak in the 1990s has been unusually large and consistent.

Constant price estimates

At constant prices, there are three measures of alternative quarterly GDP. In addition to the income and expenditure-based estimates, there is a series of GDP estimated by the production approach—GDP(P).

The expenditure estimates are derived mainly by deflating the current price values by a wide range of specific fixed-weighted price indices at as detailed a level as possible for domestic final demand the deflation is done by state. Current-weighted price indices are used for capital formation of equipment. Wage indicators and extrapolation, using volume and price indicators, are also used in some cases.

The estimates of GDP(I) at constant prices are derived by deflating the current price value by the implicit price deflator from the expenditure estimates. Consequently, the ratio of the income to expenditure estimates at constant prices is the same as at current prices.

The estimates of GDP(P) are derived from a wide range of industry-specific indicators. These include data on physical quantities, hours worked, and values deflated by price indices. For example, manufacturing, and wholesale and trade are based on turnover data deflated by price indices. Mining, electricity, gas, transport, and communication are based on physical indicators. Financial and insurance services are based on indicators of services provided. Other business, professional, and community services estimates are based on measures of hours worked. Estimates for agriculture use double deflation based on physical indicators of production and commodity flow data. Other industries mainly use output measures with an assumption that value added to output ratio is stable in constant price terms. Some of these indicators are also used in the expenditure estimates, such as construction and general government, while the majority are independent.

The ratio between the production-and expenditure-based measures is shown in Chart 6. The GDP(P) measure was been a few percent lower than the other two measures for most of the 1960s to late 1980s. The difference exceeded 1 percent in 82 of the 152 quarters in the series, but only 10 of the 30 quarters of the 1990s.

During the 1990s, the production and income measures have been very similar, suggesting that there be some problem in the expenditure estimates (The production and income measures have differed more than 1 percent only once in the 1990s). The quarterly volatility (i.e., indication of timing problems) is less marked between GDP(P) and end of the other two measures than between GDP(I) and GDP(E).

There is no accepted view as to which of the three measures of GDP is more accurate or reliable. Mathematical analysis of the data by the ABS did not show any of the series as being preferable to the others in terms of revisions or volatility of quarterly movements.²³ They are published with equal status, with explanatory notes for users. In addition, there is a measure of GDP that is the average of the other three measures. Because the differences between the series show substantial volatility, the average tends to be the smoothest series and has the smallest revisions.

²³ C. Aspden, "Which is the Best Short-Term Measure of Gross Domestic Product?" in *Australian National Accounts: National Income, Expenditure and Product* (Catalogue 5206.0), June 1990.

A major problem of business-based collections is the coverage of new businesses. A phenomenon of the 1990s appears to be the growth of consulting, contracting, and outsourcing, which results in changing input-output ratios and growth concentrated in enterprises that are difficult to identify. The income estimates take into account the results of the monthly household survey of the labor force and, therefore, are adjusted for new enterprises more effectively and quickly than the other approaches, which rely more heavily on surveys of businesses. As well, the income and expenditure estimates do not use the fixed input-output ratios assumed in the most recent quarters of the production estimates. To the extent that changes in organization, technology, and capacity utilization are becoming more significant, the production estimates would be less accurate.

Reconciliation

In the quarterly compilation, there is no process of reconciliation and adjustment of the series. However, the differences are closely monitored for trends and guidance to possible problems.

The ABS plans to produce input-output tables on an annual basis in the future. (The frequency has varied in the past, with one, three, and five-year intervals used at different times.) In input-output compilation, there is a balancing process that eliminates discrepancies. There is some discussion and reconciliation between input-output compilers and other national accounts compilers that can identify areas where adjustments could be made or where updated methods could be used. However, in cases where there are differences of opinion or no explanations, the data are left unchanged.

The ABS has published annual fully reconciled national accounts data on an experimental basis. These used adjustments by mathematical techniques—a least squares method in association with quality assessments.²⁴ The ABS has stated that its objective in the future is to move to a fully reconciled system, based on an input-output reconciliation process and based on judgment rather than mathematical techniques. It will cover the full set of accounts on a quarterly and annual basis integrated with the input-output tables.

²⁴Source: C. Kim, G. Salou, and P. Rossiter, *Balanced Australian National Accounts*, ABS Working Papers in Econometrics, No. 94/2.

New Zealand²⁵

Introduction

Statistics New Zealand produces quarterly estimates of GDP by the expenditure and production approaches. Expenditure estimates are produced at both current and constant prices, while the production estimates are produced at constant prices only. The estimates are produced in accordance with the *1968 SNA* and will be updated to the *1993 SNA* over the next few years.

The results from the alternative approaches are published together within thirteen weeks of the end of the reference quarter (except the third quarter, which is slightly later). The production-based measure is preferred for quarter-on-quarter and annual movements in GDP at constant prices. The expenditure measure is more volatile, because it is the sum of a small number of indicators and so is more vulnerable to errors in those components; small relative errors in components can be significant when considering quarter-to-quarter changes. As well, the expenditure measure is probably more subject to timing problems, and change in inventories is considered to be difficult to measure. Notes in the publications explain the methods and advise users to consider the margin of error when interpreting the data.

Both sets of estimates are shown in original and seasonally adjusted terms. Estimates are revised each quarter. Revisions are concentrated in the most recent years; consequently, the discrepancy tends to be more volatile in the most recent periods. Data for earlier quarters are revised once a year as a result of changes in annual benchmarks or whenever underlying survey data are altered.

The quarterly indicators for the two measures are largely independent. However, there is an attempt to use the same data source in both production and expenditure estimate, where possible; for example, values of work put in place are used to estimate building investment on the expenditure side and building activity on the production side. The annual income and expenditure data are reconciled so that the annual sums of the quarterly data are not completely independent.

Current price estimates

The **expenditure** estimates at current prices are based on:

- surveys of retail sales and service takings and specific indicators for rent, vehicles, health, tobacco, and alcohol (household consumption);

²⁵ Sources: OECD, *Quarterly National Accounts: Sources and Methods by OECD Member Countries*; Statistics New Zealand, *Quarterly Gross Domestic Product, Sources and Methods*.

- surveyed government finance statistics and employment (government consumption);
- surveys of construction work and data on registration of transport equipment, production, and imports of equipment (capital formation);
- surveys of the book value of inventories and quantity information on agricultural inventories (change in inventories); and
- balance of payments data (exports and imports of goods and services).

Because there are no quarterly production data at current prices, no discrepancy occurs.

Constant price estimates

The current price expenditure estimates are deflated by a wide range of price indices and volume measures.

The production measures are derived from a wide range of specific indicators. These include:

- turnover data (most of manufacturing and trade, all deflated by price indices);
- volume indicators (agriculture, fishing, forestry, mining, electricity, building and construction, transport, and communications); and
- employment indicators (business services and general government).

Conceptually the measures are equal, but, owing to inconsistent sources, there is usually a difference in the data. The ratio between the series is shown in Chart 7. (The discrepancy data for the 1980s were extremely volatile but were back-calculated and less thoroughly edited than the more recent data, so no strong conclusions can be made about that period.)

A tendency for faster growth in the production-based measure has emerged. The difference between the measures has exceeded 1 percent of GDP in 11 out of the 29 quarters of the 1990s. The production measure has exceeded the expenditure estimates by more than 1 percent in all but one quarter since the third quarter of 1994, and by more than 2 percent in all quarters since the third quarter of 1995. (Note that the data for these periods will be brought closer together when the annual balancing process, discussed below, is applied to these years.)

As with other countries, there is a high degree of short-term volatility in the data, suggesting inconsistencies in the time at which transactions are recorded. The problem is considered to be more serious in the expenditure estimates.

Reconciliation

There are processes of checking and reconciling annual fiscal year estimates (for the fiscal year ending March 31), including five-yearly interindustry studies (1986/7, 1991/2, and the next for 1995/6, due to be released in 1999) and annual input-output tables (which are much less detailed than a full study and rely heavily on the work from the previous full interindustry study). With the use of these sources, fully balanced annual accounts have been implemented for 1986/7, 1991/2, and 1992/3. Later this year, the estimates for 1993/4 and 1994/5 will be completed. However, while the balancing process tends to bring the quarterly constant price data closer together, it does not ensure equality. The ability to investigate and adjust data on a quarterly basis is limited because of less detailed information and less compilation time.

V. CONCLUSIONS

Internationally, the experience with discrepancies among alternative quarterly GDP estimates is limited. Of the 18 OECD countries for which information is available about quarterly national accounts compilation, only five publish alternative measures that differ. The other countries either apply detailed balancing and/or derive one or more variables as a residual so that the measures are interdependent. The five OECD countries that face discrepancies are the United States, the United Kingdom, Canada, Australia, and New Zealand.

The discrepancies in most cases have been in a range of plus or minus 1 percent. However, discrepancies in some of the countries and over particular periods have been large and volatile enough to cause for concern in economic analysis.

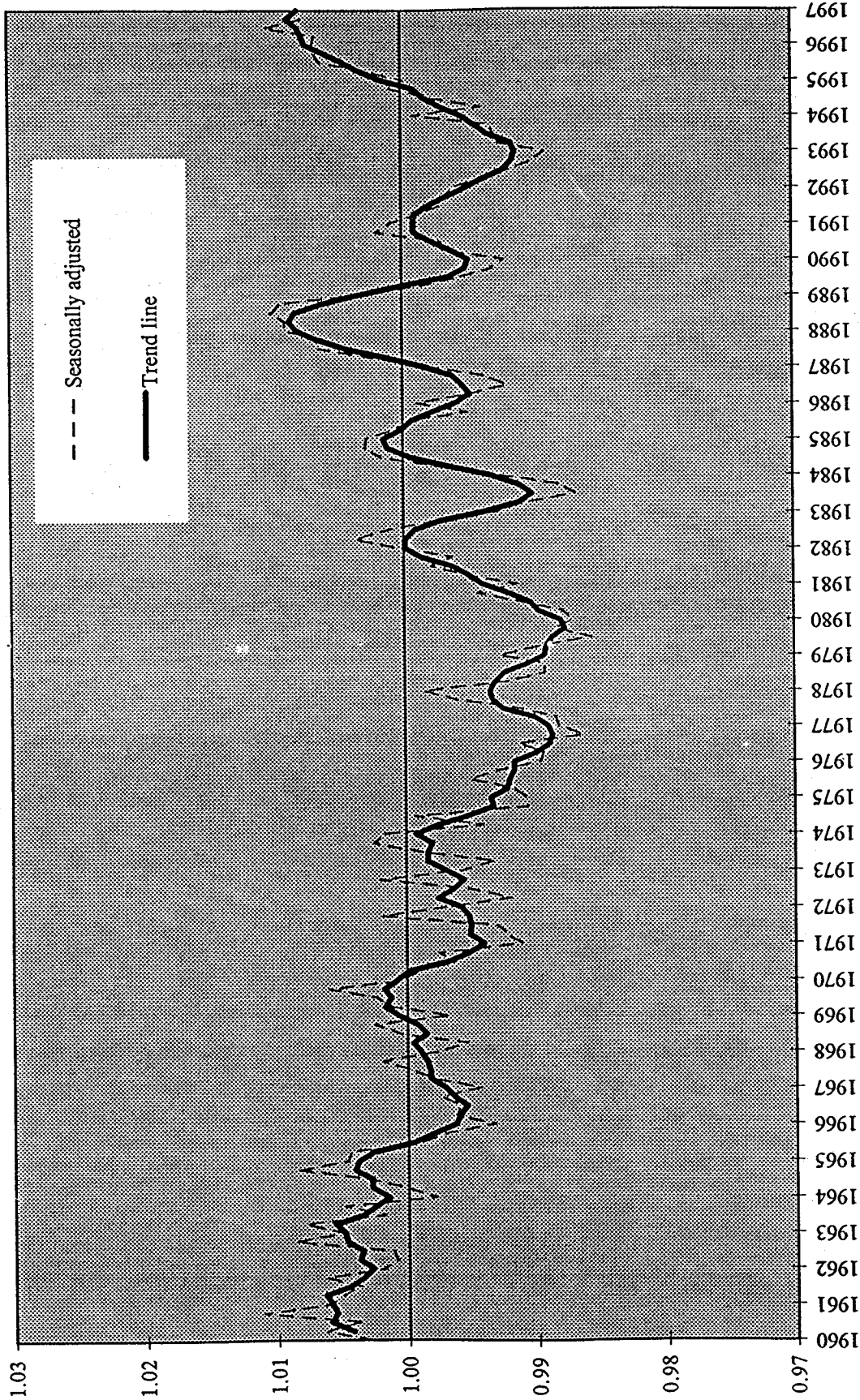
In the **United States**, where there are quarterly expenditure and income measures, there has been a pattern of cycles in the size of the discrepancy at the same time there has been a tendency toward a rising amplitude. Since 1993, the income measure has grown faster than the expenditure estimate to an extent not shown in present data on earlier periods. (It should be noted that recent data are subject to revision). In the **United Kingdom**, all three measures are produced quarterly, and discrepancies became a matter for severe concern in the late 1980s. As a result, reconciliation procedures and improvements to data sources have been implemented that have reduced or eliminated discrepancies. In **Canada**, all three measures are available quarterly, although the monthly production-based measure is not directly comparable because of different valuations. In the 1990s, the income estimates have usually been slightly lower than the expenditure estimates, but the gap has been small and fairly stable. In the most recent few quarters, the income estimate has risen faster, but it is too early to tell if this will be sustained. In **Australia**, there are three measures on a quarterly basis. Their relationship is relatively volatile in the short term. Over the longer term, income and expenditure estimates have been about the same, but the production-based measures have tended to be lower. Like in the U.S., the income estimate has risen faster than the expenditure estimate during the mid-1990s. In **New Zealand**, there are two measures on a quarterly basis. The production-based measure has grown faster in the mid-1990s.

For all five countries, there is a substantial part of short-term variation that appears to be due to timing problems, although in some cases this factor appears to be decreasing. Discrepancies tend to be smaller for the larger economies, because individual transactions have less significance, and hence timing and other measurement errors tend to cancel each other out to a greater extent.

There is some indication that significant trends in discrepancies have been emerging in several of the countries in recent periods, and in some cases these are larger than in the past. Possible causes are structural change in the economies and tighter budgets for statistical collection and compilation. The growth of new firms and new marketing techniques are not adequately reflected in the expenditure source statistics during growth cycles. Business registers are slow to be updated with information on new business formations, and new firms cannot be incorporated into sample surveys in a timely fashion. Omitted enterprises may affect alternative measures in inconsistent ways. New marketing techniques involving international mass merchandising through catalogue, direct television, and Internet sales may not always be adequately covered in traditional retail sales surveys, and it will take time for their full integration.

Discrepancies indicate problems and can be inconvenient to users. Of course, countries that do not have a statistical discrepancy do not necessarily have better estimates, and alternative estimates may help highlight uncertainty and identify otherwise hidden problems. However, it is important that the discrepancies are investigated and resolved to the extent possible. In a number of other countries, the discrepancy problem is mitigated by developing other aspects of the national accounts system. **First**, annual input-output tables are a tool for identifying problems and reconciling alternative estimates. These are used in some countries, are now being used by the U.K. to resolve its discrepancies, and are planned for future use in Australia. The use of the input-output framework requires extra compilation work. However, it would not necessarily require additional data collection, except to the extent that it would point to problems in existing collections. **Second**, in the case of the United States, production-based measures of quarterly GDP may provide a further check on the other estimates, and many countries prefer these measures. However, budgetary constraints may prevent the development of reconciliation methods or improvements to source data.

Chart 1: U.S. - Ratio of GDI to GDP, Quarterly



Seasonally adjusted data as released by BEA on August 1997. Trend line uses five-term moving average.

Chart 2: U.K. - Ratio of GDP(I) to GDP(E) at current factor cost, Quarterly

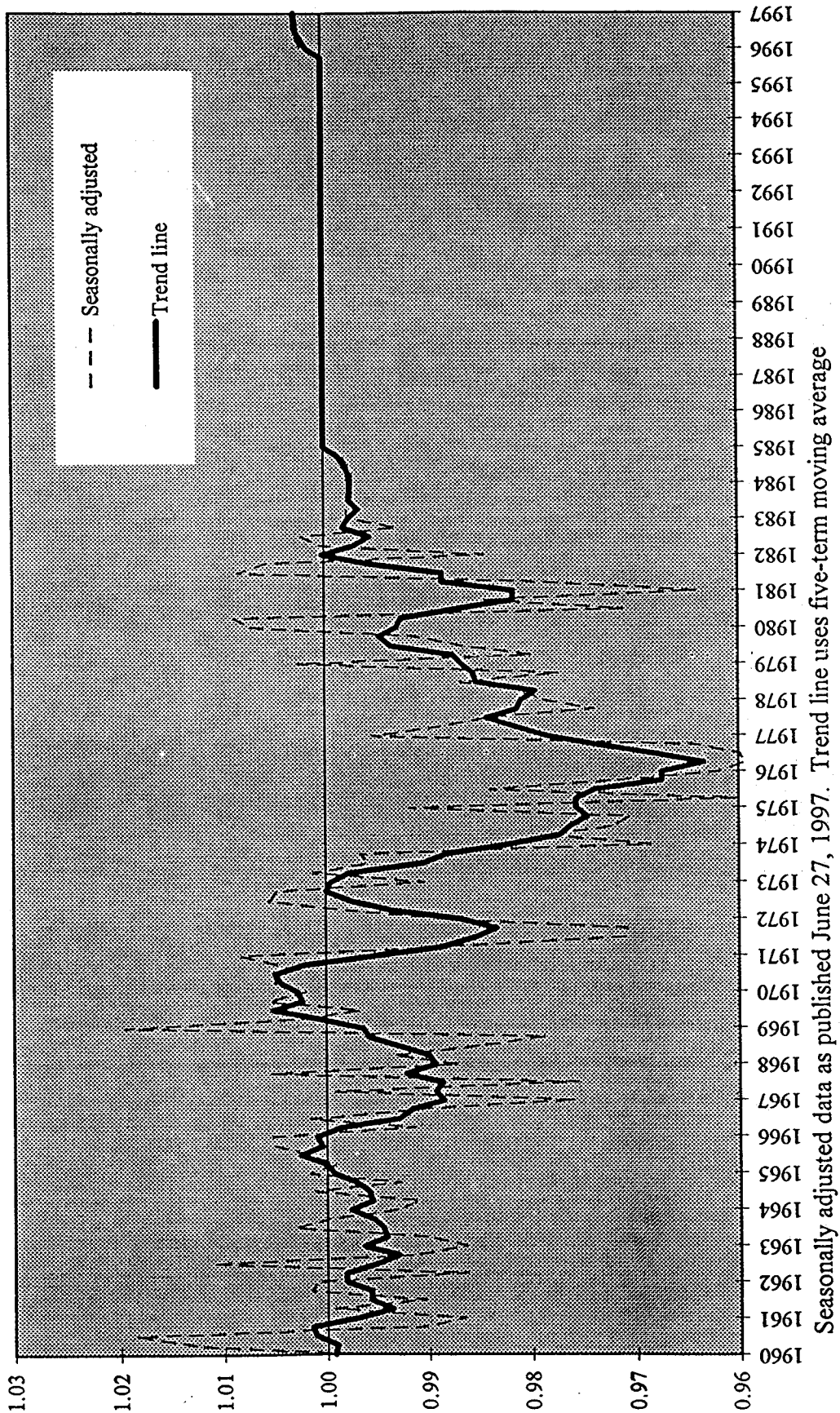
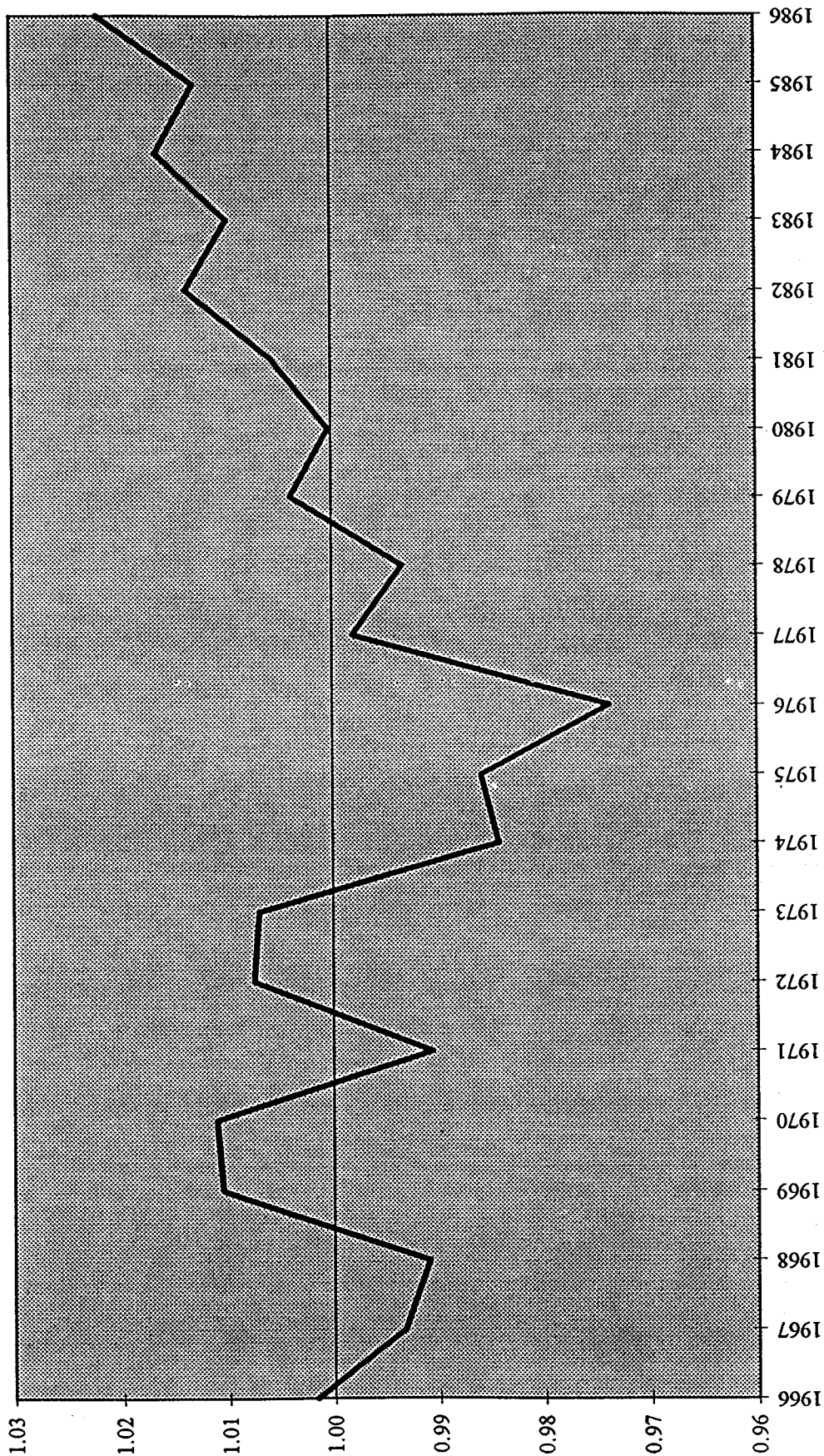


Chart 3: U.K. - Ratio of Annual GDP(I) to GDP(E), 1966 - 1986



Seasonally adjusted data as published in "UK National Accounts 1988 - The CSO Blue Book".

Chart 4: Canada - Ratio of GDP (I) to GDP (E), Quarterly

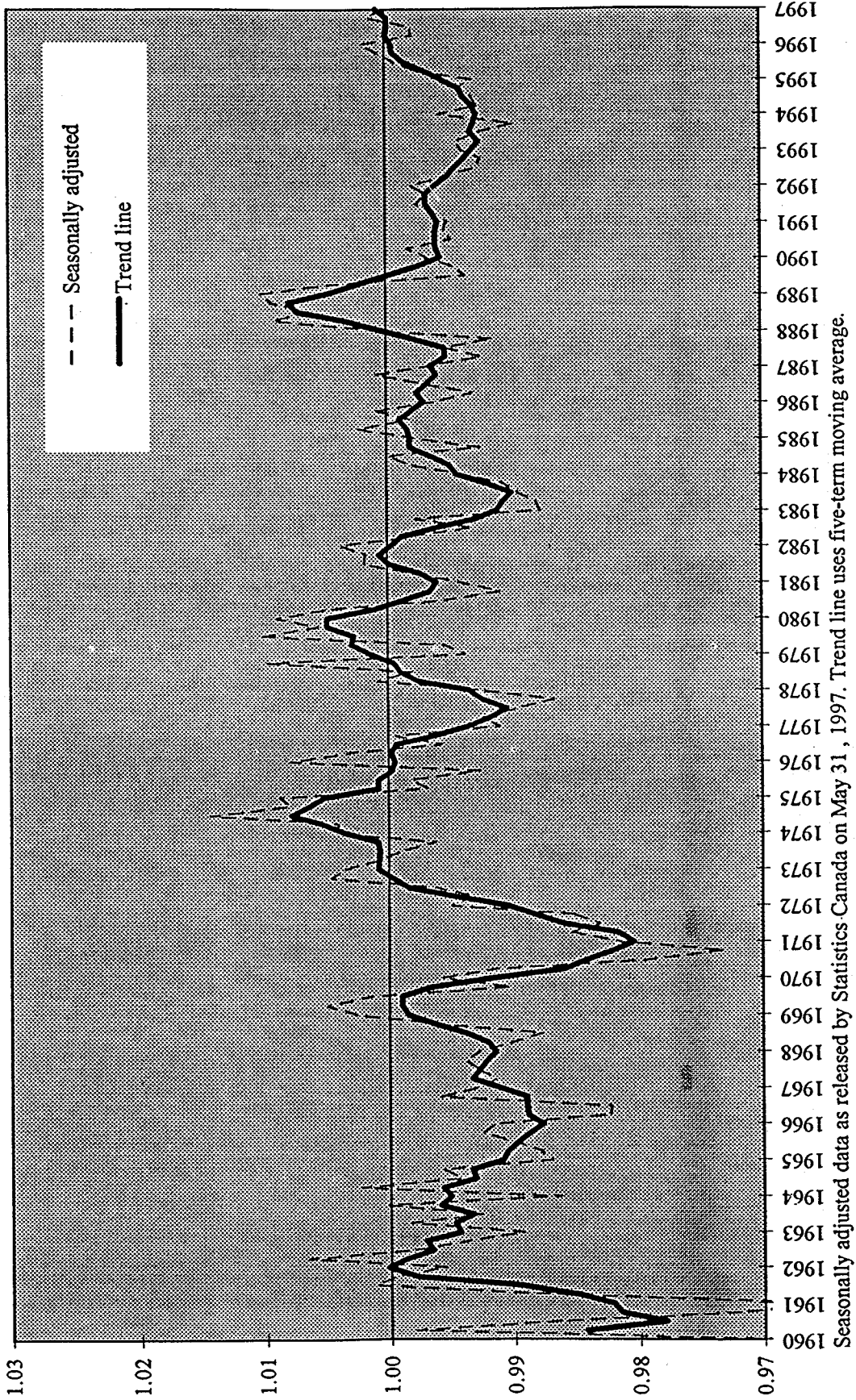
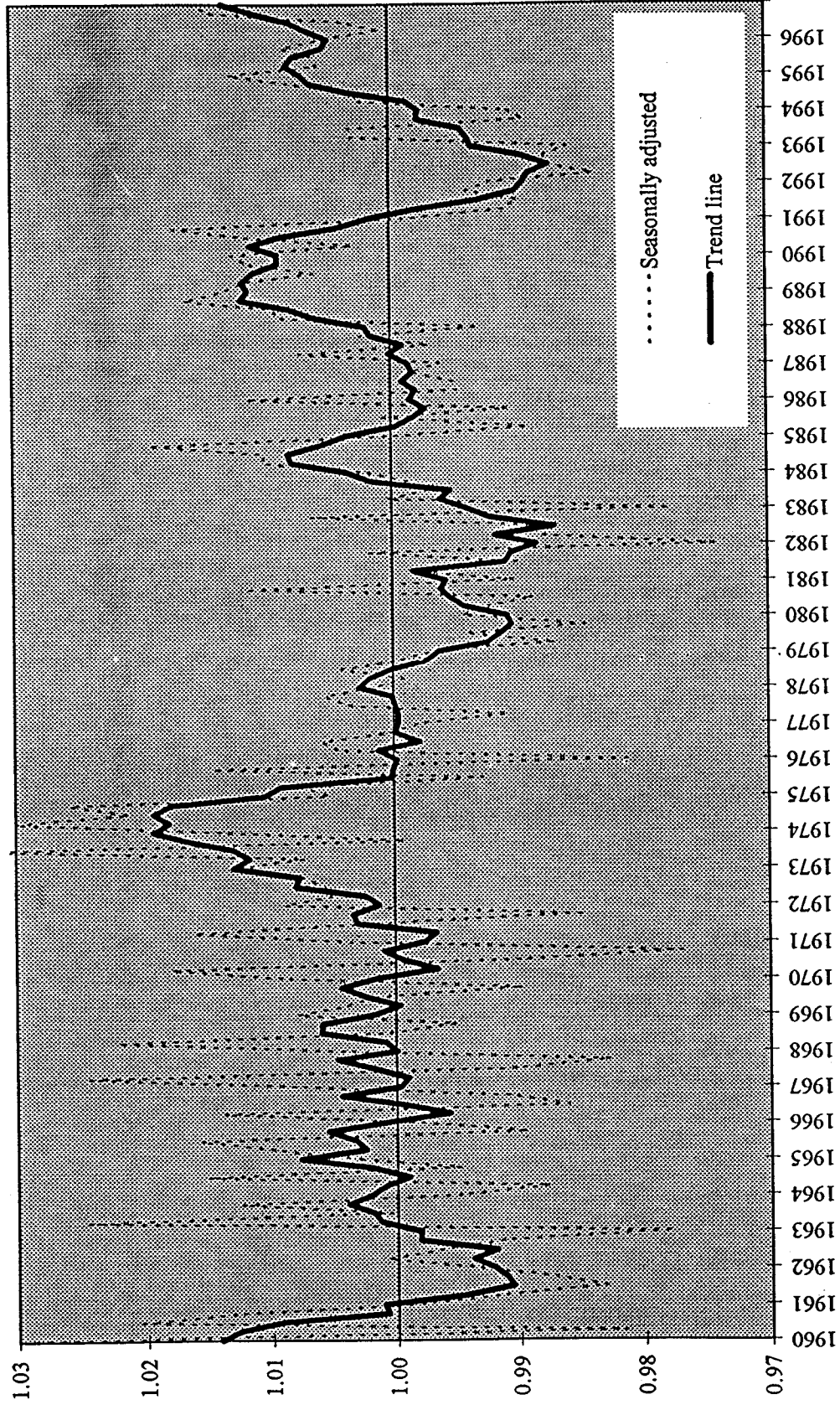
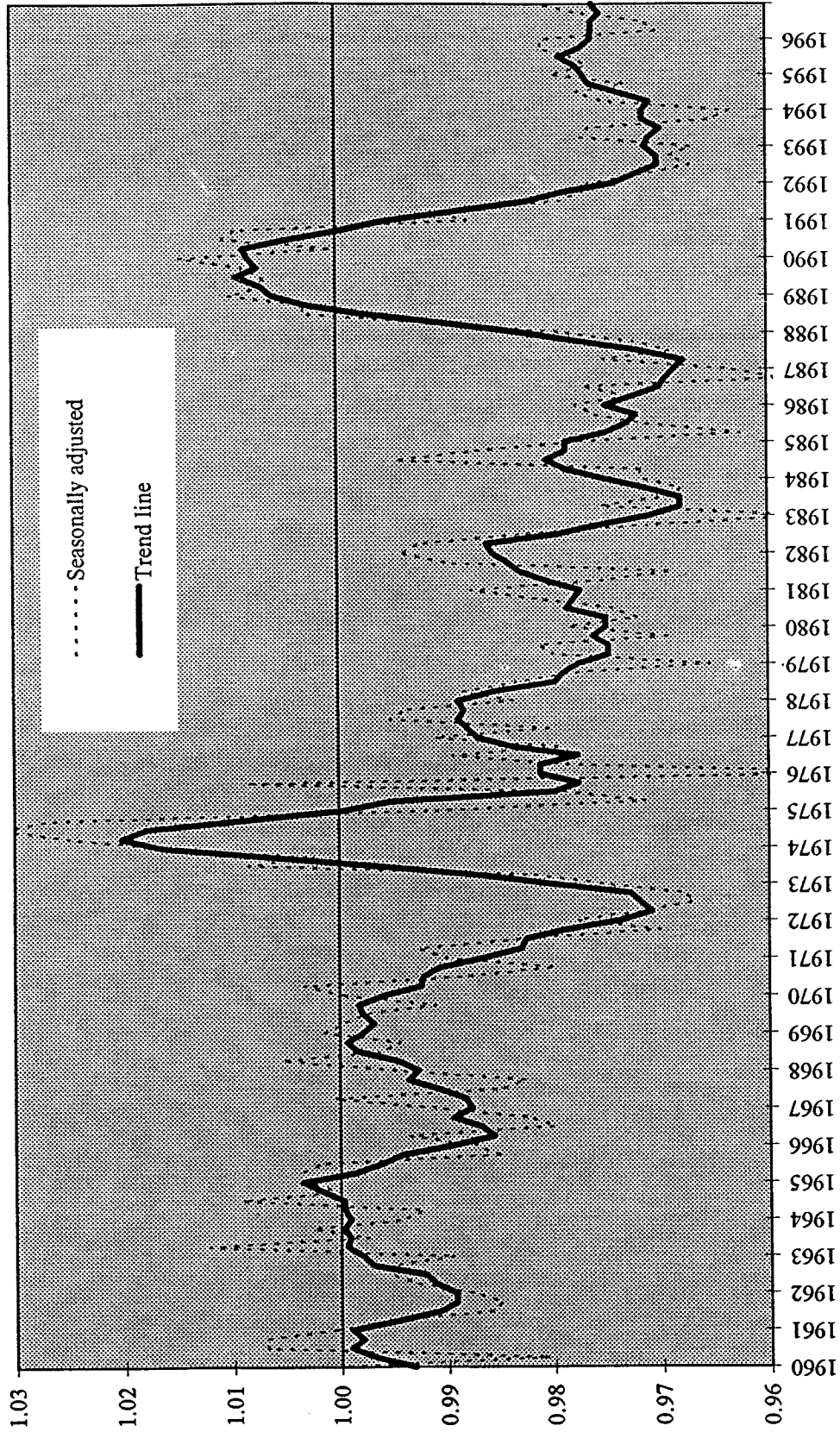


Chart 5: Australia - Ratio of GDP(I) to GDP(E), Quarterly



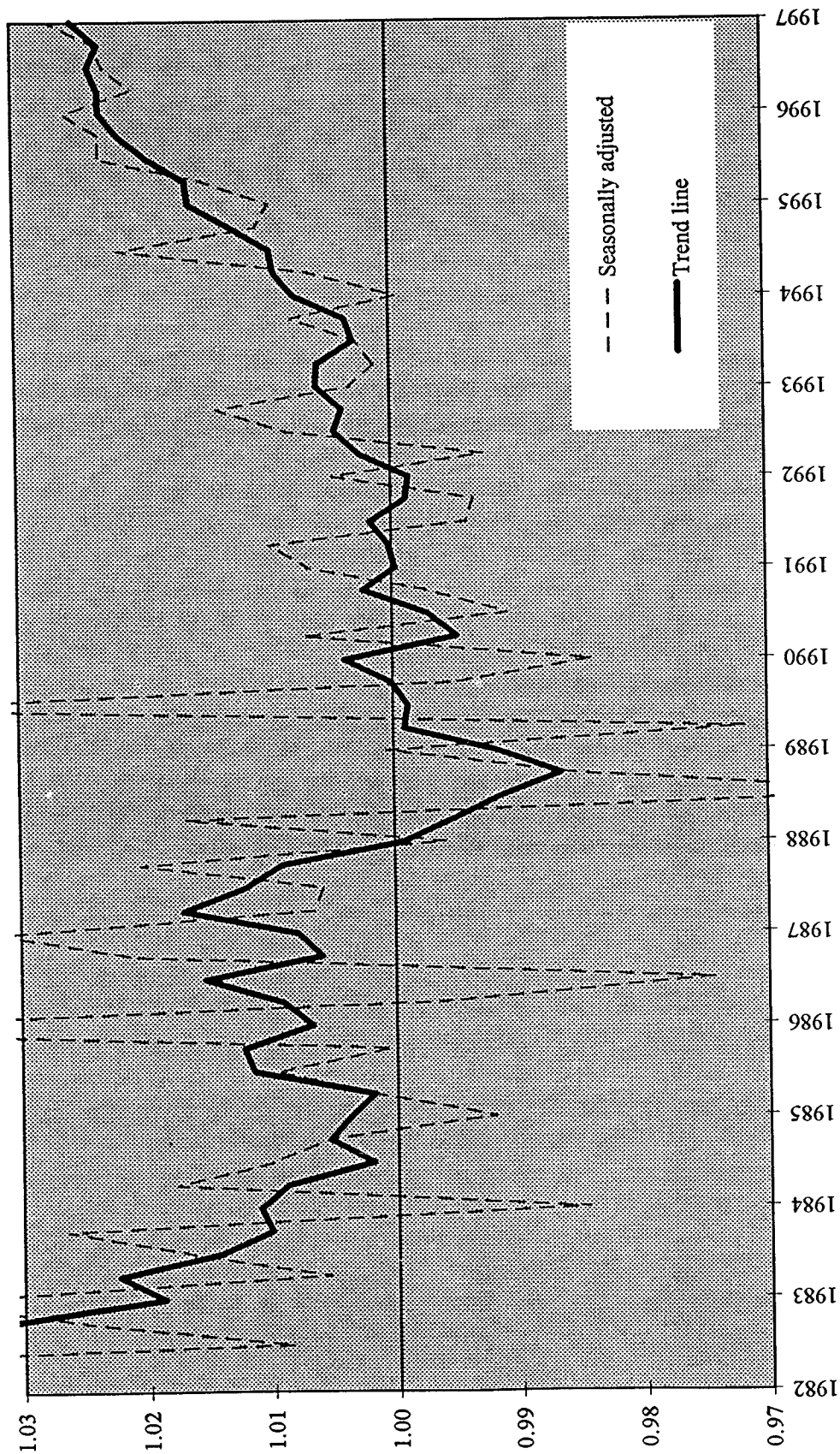
Seasonally adjusted data as at Q1 1997. Trend line uses five-term moving average.

Chart 6: Australia - Ratio of GDP(P) to GDP(E), Quarterly



Seasonally adjusted data as at Q1 1997. Trend line uses five-term moving average.

Chart 7: New Zealand - Ratio of GDP(P) to GDP(E), Quarterly



Seasonally adjusted data as at Q1 1997. Trend line uses five-term moving average.

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