QUARTERLY NATIONAL ACCOUNTS IN ASIA:
SOURCES AND METHODS

Proceedings of Joint OECD-ADB-ESCAP Workshop on Quarterly National Accounts

Bangkok, October 2001
FOREWORD

In October 2001 a Workshop on Quarterly National Accounts was held in Bangkok, Thailand. It was organised jointly by the Organisation for Economic Co-operation and Development, the United Nations Economic and Social Commission for Asia and the Pacific and the Asian Development Bank. Participants attended from 14 developing economies in Asia and from three OECD Member countries, Australia, Japan and Korea.

The financial crises that affected many countries in Asia during the late 1990s highlighted the need for more reliable and up to date statistics. Together with its partner organisations in the region, the OECD has launched a programme to share its experience with non-Members in Asia wishing to develop a range of early-warning indicators, including Business Tendency Surveys, Composite Leading Indicators and Quarterly National Accounts. OECD participation in this programme has been made possible by a grant from the Japanese Government.

Quarterly national accounts are widely used by policy-makers in both the public and private sectors to monitor the current economic situation. The purpose of the Workshop was to exchange information on the methods used by Asian economies to estimate quarterly national accounts, to compare them with the methods used by OECD Member countries and to identify best practices in line with international standards. Several economies attending the Workshop do not yet compile quarterly national accounts and for participants from these economies, the Workshop served as an encouragement to start doing so by showing how a useful set of quarterly accounts can be compiled using indicator methods based on partial and incomplete data sources.

Participants presented papers on how they estimate quarterly national accounts or, in the case of those that do not currently do so, on their plans for doing so in the future. This document contains the papers presented by participants, a summary report on the meeting, as well as supporting documents prepared by the organisers. It provides a comprehensive overview of the present situation regarding the availability and methodology of quarterly national accounts in Asia.

This document has been prepared within the framework of the Emerging Asian Economies programme, managed by the OECD Centre for Co-operation with Non-Members and is published on the responsibility of the Secretary-General.

Eric Burgeat
Director
Centre for Co-operation with Non-Members
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USE OF QUARTERLY NATIONAL ACCOUNTS

Mr Abuzar Asra, Asian Development Bank (ADB)

1. Introduction

The 1997 East Asian financial crisis uncovered an increasing and pressing need for statistical information that has three C characteristics (3Cs): current, comprehensive, and credible, or three R characteristics (3Rs): recent, representative, and reliable. It further highlighted the need for greater transparency. Working in a rapidly changing economic environment, decision takers both in public and private sectors require more frequent production and timely release statistical information. This is in addition to the need for more diversified and comprehensive statistics covering new areas of monetary, financial and banking statistics that are traditionally not part of the activities of most national statistics offices (NSOs). The current and comprehensive statistics will, of course, be useful for decision-taking and policymaking processes if these statistics are of high quality.

Since the crisis the Asian Development Bank (ADB) has launched various initiatives, impacting on the production of statistical information. Within ADB, a new unit, the Regional Economic Monitoring Unit (REMU), was formed in early 1999. This unit helps ADB’s developing member countries (DMCs) harness the full benefits of global financial integration while minimizing disruptive effects of volatile capital movements. In addition, REMU supports efforts to promote monetary and financial co-operation among the DMCs. In 1999; ADB adopted poverty reduction as its overarching objective and set up a Poverty Reduction Unit.

REMU’s most important activities currently are providing support to the Association of Southeast Asian Nations (ASEAN) and ASEAN+3 (People’s Republic of China, Japan, and Republic of Korea) surveillance processes and housing the ARIC.
This short note highlights these initiatives and is designed to provide participants of the workshop with insights into the new challenges faced by NSOs. The note will hopefully enable the participants to have a greater awareness of why users demand close attention to the three Cs or three Rs statistical information.

2. ADB as a data user

With the recent reorganisation of ADB, the Operations Departments are divided into two: Group 1 with 3 departments; South Asia, Mekong, and Private Sector, and Group 2 with 4 departments; East and Central Asia, South Asia, Pacific, and Central Operations Services. The other two groups are the President’s Group where the Regional Economic Monitoring Unit (REMU) and the Economics and Research Department (ERD) are located, and Finance and Administration Group.

By the nature of their work, different units require different sets of (statistical) information. In relation to macro-economic statistical information, in particular national accounts estimates, the relevant units are the departments in operations, ERD, and REMU.

The Operations Departments prepare an annual Country Strategy Plan (CSP) for each country; a three-year plan, which also assesses the country’s macro-economic situation. The range of statistical information used in the CSP is attached (Appendix 1). On an ad-hoc basis, the operations departments prepare internal documents monitoring the socio-political-economic trends of the country. Every 5 to 7 years a full-blown CSP is prepared. At an overall level, ERD produces the (annual) Asian Development Outlook (ADO) and the Annual Report (AR), which is usually launched during the ADB Annual Meeting (usually around May), and the ADO Update, usually in September. The statistical information used in the ADO and the AR is also attached (Appendix 1). In addition, ERD produces another flagship publication of ADB; the annual Key Indicators. ERDI also produces the Basic Statistics covering more than 40 statistics/indicators (grouped under 12 headings: Land, Population, Millennium Development Goals, Environment, National Accounts, Monetary, Prices, Central Government Finance, External Trade, Balance of Payment, External Debt, and International Flows) for 40 ADB Regional Countries. This two-page document is usually distributed during the ADB Board of Directors Annual Meeting. More complete statistical information is stored in the Statistics Database System of the Development Indicators and Policy Research Division of ERD.

REMU requires more frequent economic information, given its role to “monitor the social and economic impacts of the Asian crisis and the recovery process with a view to identify the remaining policy agenda for a sustained social as well as economic recovery.” It publishes the Asia Economic Monitor (AEM) Report, which is a quarterly review of Asia’s growth and recovery, financial and corporate sector reforms, and social developments. It replaces the Asia Recovery Report series. The country coverage has been expanded from the five countries most affected by the 1997 crisis, to include the 10 ASEAN countries, People's Republic of China, and Republic of Korea.

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2. There were five objectives before: promoting economic growth, supporting human development, reducing poverty, improving the status of women, and managing natural resources and the environment. The new strategy is discussed in ADB’s Poverty Reduction Strategy, November 1999 (see: www.adb.org/Poverty/default.asp).

3. It has been renamed the Poverty Reduction and Social Development Division.

4. In particular with regard to REMU activities which have close relevance to this workshop.

5. The most recent ADO and AR publications are ADO 2002 and AR 2001. Both were presented during the recent ADB Annual Meeting in Shanghai on May 2002.
3. The need for quarterly data at ADB

REMU has taken initiatives to collect quarterly data. The data are disseminated via Asia Recovery Information Center (ARIC) website managed by REMU. The ARIC website contains information on six themes: economic focus (asset markets, macro economy, and financial and corporate sectors), ARIC indicators, policy forum, social development, international assistance, and special reports. ERDI produces a one-page Quarterly Bulletin of Key Indicators as inputs to various units of ADB. It has 23 indicators and 26 basic statistics (Appendix 2 is an example for India for March 2002).

At ARIC website, official seasonally adjusted quarterly GDP series are available for Singapore, Thailand, and Philippines. However, for comparison, ADB derives the seasonally adjusted quarterly GDP series for other countries (Malaysia, Korea, and Indonesia). The three series that ADB derives are quarterly GDP, monthly Industrial Production Indexes, and monthly CPIs. In addition to quarterly GDP series, Asia Economic Monitor also uses real private consumption expenditure. The ADB derived seasonally adjusted data are updated once new information is received (continuous updating mechanism, i.e. concurrent adjustment).

6. In the aftermath of the East Asian Crisis the need for closer monitoring of economic trends becoming critically important. This need led to the concept of ARIC. At the Meeting on Development Co-operation: Responding to the Asia Crisis held in Sydney on 5 March 1999, the Australian Government proposed and the meeting agreed that an Internet-based facility would provide the most efficient means of gathering, collating, and disseminating this information. The Australian Government subsequently invited ADB to house ARIC at its headquarters in Manila. The objectives of the ARIC web site are to (i) monitor the social and economic impacts of the Asian crisis and the recovery process with a view to identify the remaining policy agenda for a sustained social as well as economic recovery; (ii) provide information on the response of the international community, concerned governments, non-government organisations (NGOs), and civil society-at-large to the crisis; and (iii) monitor and contribute to ongoing discussions of policy reform in response to the crisis. ARIC’s initial coverage included the five countries most affected by the Asian crisis: Indonesia, Republic of Korea, Malaysia, Philippines, and Thailand. This has been expanded to include the rest of the Association of Southeast Asian Nations member countries--Brunei Darussalam, Cambodia, Lao People’s Democratic Republic, Myanmar, Singapore, and Viet Nam--as well as the People’s Republic of China.

7. ECONOMIC FOCUS contains hyperlinks to press releases, reports, articles, and other documents that describe the current status of Asia’s economic recovery for the region as a whole and for each individual country. ARIC INDICATORS has more than 60 statistical indicators available in various frequencies and classified into four categories: Asset Markets, Macroeconomy, Financial and Corporate Sectors, and Poverty and Social Indicators. A useful addition is the ARIC Database, which allows users to create their own tables and download them as Excel files. POLICY FORUM contains hyperlinks to studies, papers, reports, and other research documents related to policy issues arising from the Asian financial crisis and the ongoing recovery. SOCIAL DEVELOPMENT contains hyperlinks to studies, papers, reports, press releases, speeches, and other documents related to the social aspects of the Asian crisis and the recovery process. INTERNATIONAL ASSISTANCE provides hyperlinks and direct information on the strategies and projects of multilateral and bilateral institutions to mitigate the impacts of the Asian crisis and hasten the recovery process. SPECIAL REPORTS contains hyperlinks to major reports published by the Asian Development Bank, Asian Development Bank Institute, International Monetary Fund, World Bank, United Nations, and Other Institutions on various economic issues and developments.

8. The software package used to drive the seasonally adjusted data is the EViews. To deseasonalize monthly and quarterly data, the multiplicative methodology was used. The additive methodology was used in cases in which the data included negative values.
4. Uses of quarterly national accounts at ADB

The need for quarterly estimates of GDP was clearly expressed by the IMF (2001) “the main purpose of quarterly national accounts is to provide a picture of current economic developments that is more timely than that provided by the annual national accounts and more comprehensive than that provided by individual short-term indicators” (p. 1).9 This view is an elaboration of position articulated in the System of National Accounts 1993 (paragraph 19.84) which says that “… for short-term analysis, annual accounts are not sufficient because they do not generally permit the various short-term movements to be followed as closely as necessary.” In short, the main advantage of the quarterly national accounts figures is that they are able to provide the information closer to the ideal situation, i.e. “bring the story up to the present”. For the policy maker, it is not good enough to know where the economy was last year or six months ago.

In line with these positions, ADB has attempted to provide, through its AEM Report, estimates of quarterly GDP together with related short-term indicators. These estimates and indicators are used to assess the current economic performance of countries in the region. This is in contrast with the practice in the past where the annual GDP estimates were used to indicate the trends in the economic performance. Nowadays with the availability of the quarterly estimates for a number of countries in the region, more timely assessment of economic performance becomes possible.

In describing trends, AEM uses two methods: annual growth rates and year-to-date movements. Annual and quarterly data are used to derive annual growth rates (on a year-on-year basis), which is generally less volatile than the adjacent period-to-period movement.

For example, real sector developments for 2001 are reviewed in April 2002. The AEM Report, by presenting real GDP growth and the manufacturing sector GDP growth (year on year growth in %) for all quarters between 1998 and 2001, is able to assess the most recent trends. In addition to the growth of merchandise exports, the growth of domestic demand of net private capital flows and inflation rates are also examined. Through wide dissemination, ADB is able to meet both public and private sector needs.10

ADB is acutely aware that with globalisation the private sector is a key and dynamic player. It is thus an important user of data. Its data need encompass recent trend and forecasts of overall economic activity (shown by the growth of quarterly Growth Domestic Product). Such estimates serve as a general frame of reference to provide a starting point for “top-down” forecasts of industry or product sales.11

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9. Other uses include its instrumental uses as a co-ordinating conceptual framework for design and collection of economic source statistics, and a framework for identifying major gaps in the range of available short-term statistics (see Kendrick, 1972 and the IMF, 2001). For the position of quarterly national accounts between annual national accounts and short-term indicators, please see the IMF (2001), pp. 1-3.

10. For the uses of national accounts by business sector, a useful reference is a survey done by Kircher (1958). “A Survey of Business Uses of the Data”, Studies of Income and Wealth, Vol. 22: 394-402. He listed a number of the uses of national income data in business firms, e.g. as the background for executive decisions, forecasting (industry sales, total/ regional company sales, product line sales, production, prices, and budget items), evaluation of the progress, and public relations and advertising.

11. Two reasons we need forecasts: (i) the future is uncertain, and (ii) the full impact of many decisions taken now is not felt until later (there is a lag). Thus, as policy takes time to formulate and implement, and further time to take effect upon an economy, the policy settings have to be made in response to expected, rather than actual, economic circumstances. Accurate predictions of the future improve the efficiency of the decision making process. A specific example is inventory decision (such as the particular quantity to order) directly depends on the demand (sales) forecast while the demand forecast is related to the GDP per capita (real disposable income per capita) level or growth. In deriving the quantity to order there are two types of
For an investment decision, businesses do (i) risk profile of a certain market, could be sector, region, or country, (ii) corporate earning outlook, and (iii) liquidity of a certain market. In most cases, quarterly GDP is used in analysing the corporate earning outlook. The business, in most cases, looks at the quarterly GDP by expenditure, rather than by sector. GDP by type of expenditure shows the final demand for goods and services. Corporate earning outlook is related to the profile of the demand, which could be approximated by looking at the growth of private consumption expenditure. But what is more required is what drives/are behind the movement of the private consumption expenditure, e.g. is it the growth of the car sales or other something else?

In short, firms use data in their day-to-day planning and control of corporate operations. The success of a business depends on the ability of management to foresee and prepare for the future. Reliable macro-forecasts enable businesses to assess overall economic conditions and the environment in which they operate.

The need for current economic information for business decision-making is one of the reasons why the ARIC web site has become a popular and frequently visited website according to the Forbes Magazine. The web site is cited "as a wonderful resource for investors in Indonesia, South Korea, Malaysia, the Philippines and Thailand" and "a good first stop for investors."

5. The Future Potential Uses

Other potential use of the quarterly GDP estimates is likely to be the identification of the turning points in the business cycle. The present AEM Report examines trends against the corresponding period in the previous year (year on year GDP growths) as the basis for comparison. For some purposes, especially when one is interested in long-term trends/changes, this may indeed provide a solid basis for analysis, but it is of limited use if the focus of interest is the course of the economy over the most recent months or quarters.

In looking for momentum, quarter-on-quarter real GDP growth rates are more important. These year on year rates “can be inadequate in identifying the current trend in economic activity” – as they could indicate, for example, that an economy is still in recession when it has actually been recovering for sometime.” (IMF, 2001, page. 11). In other words, a year-long span is too broad and insensitive to quarterly (or monthly) growth reversals: e.g. a yearly growth can be negative due to the fact that the current observation is below its counterpart one year ago, but monthly or quarterly trend movements may have been in growth for many months or quarters. In sum, “year-to-year rates of change are not suitable for business cycle analysis, and analysing the economy on the basis of these rates of change can have an adverse impact on the soundness of macroeconomic policy”. (IMF, 2002, p. 11).

inventory costs to be considered: ordering costs, the costs of getting an item into the firm’s inventory (cists of issuing the purchase order, salaries, stationary, etc), and holding or carrying costs, the costs incurred because a firm owns or maintains inventories (interest on money invested in inventory, obsolescence (costs incurred when inventories go out of style), storage space costs, stores operation, taxes, insurance, and pilferage. The so-called economic order quantity model aims at finding that particular quantity which will minimise total inventory costs.

12. Based on an informal discussion with Mr. Adrian Panggabean, Economist, REMU.

Take for examples, the GDP growth rates of Indonesia, Malaysia, Thailand, and Korea (Figures 1 to 4). Assuming that the estimated seasonally adjusted quarterly GDP series are ‘right’\textsuperscript{14}, it can be seen that the

14. There are a number of ways to derive the seasonally adjusted series, and the results may vary depending on the methods being used. Den Butter and Fase (1991), for instance, group the methods into three: mechanical adjustment methods (including Census X-11 method), model-based methods (such as ARIMA models), and causal methods. In the ARIC website, the deseasonalized-monthly and quarterly data were derived using the (fixed) multiplicative methodology. The (fixed) additive methodology was used in cases in which the data included negative values.\textsuperscript{2}

Ratio to moving average - Multiplicative

Denote the series to be filtered by $y_t$. First compute the centered moving average of $y_t$ as

$$X_t = \begin{cases} (0.5y_{t-6} + y_{t-5} + \ldots + y_{t} + \ldots + y_{t-3} + 0.5y_{t+3})/12 & \text{for monthly series} \\ (0.5y_{t-2} + y_{t-1} + y_{t} + y_{t+1} + 0.5y_{t+2})/4 & \text{for quarterly series} \end{cases}$$

Take the ratio $r_t = y_t/X_t$

Compute the seasonal indices. For monthly series, the seasonal index $i_m$ for month $m$ is the average of $r_t$ using observations only for month $m$. For quarterly series, the seasonal index $i_q$ for quarter $q$ is the average of $r_t$ using observations only for quarter $q$.

The seasonal indices are adjusted so that they multiply to one. This is done by computing the seasonal factors as the ratio of the seasonal index to the geometric mean of the indices:

$$S = \begin{cases} i_m / \sqrt[i_{m2}i_{m3}i_{m4}} & \text{for monthly series} \\ i_q / \sqrt[i_{q1}i_{q2}i_{q3}i_{q4}} & \text{for quarterly series} \end{cases}$$

The interpretation is that the series $y$ is $i_j$ percent higher in period $j$ relative to the adjusted series.

The seasonally adjusted series is obtained by dividing $y_t$ by the seasonal factors.

Difference from moving average - Additive

Denote the series to be filtered as $y_t$. First compute the centered moving average of $y_t$ as

$$X_t = \begin{cases} (0.5y_{t-6} + y_{t-5} + \ldots + y_{t} + \ldots + y_{t-3} + 0.5y_{t+3})/12 & \text{for monthly series} \\ (0.5y_{t-2} + y_{t-1} + y_{t} + y_{t+1} + 0.5y_{t+2})/4 & \text{for quarterly series} \end{cases}$$

Take the difference $d_t = y_t - X_t$.

Compute the seasonal indices. For monthly series, the seasonal index $i_m$ for month $m$ is the average of $d_t$ using observations only for month $m$. For quarterly series, the seasonal index $i_q$ for quarter $q$ is the average of $d_t$ using observations only for quarter $q$.
quarterly trend growth measure discloses the growth peaks and troughs in the GDP some quarters before they are detected by the yearly growth measure. For Indonesia, for instance, the quarterly growth indicator (Figure 1) points to a turning point (after the 1997 crisis) in the second quarter of 1998, with the peak growth at the first quarter of 1999 and declining growth until the fourth quarter of 1999 and fluctuating growths thereafter, whereas the yearly growths disclose the turning point three quarters later in the first quarter of 1999. Also for the other three countries, Korea, Thailand and Malaysia, after the 1997 crisis, like Indonesia, the turning point of the growths is in the second quarter of 1998 (as shown by the quarterly growth rates), but the yearly growth rates detect the turning point of the growths later (for Korea and Thailand two quarters later, i.e. in the fourth quarter of 1998; while for Malaysia three quarters later, i.e. in the first quarter of 1999) (Figures 2 to 4). One of the reasons why REMU has not used quarter-on-quarter changes of the GDP (based on the seasonally adjusted figures) in its AEM report is that most countries have not produced officially the seasonal adjusted GDP series. That is why in ARIC database the ADB-derived figures are called unofficial seasonally adjusted series. 

As a matter of fact some country chapters of ADO 2002 use quarter-on-quarter seasonally adjusted figures (e.g. on the private consumption and gross fixed capital formation) on the analysis of the outlook for 2002-2003 (e.g. the chapter on Korea). This encouraging development will need to be strengthened by, for instance, indicating the usefulness of the seasonally adjusted quarterly GDP estimates in the short-term analysis.

Another important use of the quarterly GDP (and other national accounts parameters) is for short-term forecasting. Although the techniques are not yet clearly documented, these quarterly figures have indeed been used for short-term forecasting.

The above issues highlight the need for official quarterly data together with their corresponding seasonally adjusted figures and reinforce the need for a coherent program for the development of quarterly GDP estimates. Attaining the goal will demand investment by national governments in the development of better basic data for estimating quarterly GDP series.

The seasonal indices are adjusted so that they add up to zero. This is done by setting \( s_i = i - i^* \) where \( i^* \) is the average of all seasonal indices. The interpretation is that the series is \( s_j \) higher in period \( j \) relative to the adjusted series.

The seasonally adjusted series is obtained by subtracting the seasonal factors from \( y_t \).

15. ARIC website provides a number of seasonally adjusted figures, mostly “unofficial” (except for GDP figures), meaning the seasonally adjusted figures were derived by the REMU staff. These are as follow: (i) External Sector [Export growth rate, month-on month (m-o-m), seasonally adjusted (sa); Import Growth rate, m-o-m, sa; Merchandise Exports, sa; Merchandise Imports, sa; (ii) Financial Sector (Real Bank Credit Growth Rate, m-o-m, sa; Real Bank Credit, sa; (iii) Real Sector (CPI, sa; GDP Growth Rate at constant prices, q-o-q; sa, official; GDP Growth Rate at constant prices, q-o-q; sa, unofficial; GDP Index, 1997Q2= 100; sa, official; GDP Index, 1997Q2= 100; sa, unofficial; GDP, sa, official; Industrial/Manufacturing Production Index, June 1997= 100; sa; Industrial/Manufacturing Production Index, sa; Inflation Rate, m-o-m, sa.

16. Based on the informal interview with some ADB economists. More formal use of the quarterly national accounts is in the Quarterly Econometric Model for short-term projection. For Indonesia, for instance, the most recent work on the quarterly econometric model is the work of N. Usui, 1999. Quarterly Outlook of the Indonesian Economy: A Short-term Projection by a Quarterly Econometric Model, JICA/Chiba University. In this model, in December 1999 quarterly forecast (up to the first quarter of 2001) of the Indonesian economy was generated.
Figure 1: GDP Growth Rates - Indonesia

Figure 2: GDP Growth Rates - Korea
References:


## List of Socio-Economic Indicators Used in Various Bank Reports

<table>
<thead>
<tr>
<th>No.</th>
<th>Indicators</th>
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<th>AR</th>
<th>AEM</th>
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<td>Balance of Payments on Current Account</td>
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<td>Foreign Direct Investment (net) as % of GDI</td>
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### List of Socio-Economic Indicators Used in Various Bank Reports

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<td>21</td>
<td>Income Ratio of Highest 20% to Lowest 20%</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>22</td>
<td>Infant Mortality Rate (per 1,000 Live Births)</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>23</td>
<td>Life Expectancy at Birth (Years), female</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>No.</td>
<td>Indicators</td>
<td>ADO</td>
<td>AR</td>
<td>AEM</td>
<td>CSP</td>
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<tr>
<td>24</td>
<td>Life Expectancy at Birth (Years), male</td>
<td>X</td>
<td>X</td>
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<tr>
<td>25</td>
<td>Maternal Mortality Rate (per 100,000 live births)</td>
<td>X</td>
<td>X</td>
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<tr>
<td>26</td>
<td>Nominal Wage Rate</td>
<td></td>
<td></td>
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<tr>
<td>27</td>
<td>Per Capita Real Private Consumption Expenditure</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
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<tr>
<td>28</td>
<td>Per Capita Real Private Consumption Expenditure Index (1996=100)</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>29</td>
<td>Population in Poverty (%)</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>30</td>
<td>Population with Access to Safe Drinking Water, rural</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>31</td>
<td>Population with Access to Safe Drinking Water, total</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
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<tr>
<td>32</td>
<td>Population with Access to Safe Drinking Water, urban</td>
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<td>X</td>
</tr>
<tr>
<td>33</td>
<td>Population with Access to Sanitation Facilities, rural</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>34</td>
<td>Population with Access to Sanitation Facilities, total</td>
<td></td>
<td></td>
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<tr>
<td>35</td>
<td>Population with Access to Sanitation Facilities, urban</td>
<td></td>
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<td>X</td>
</tr>
<tr>
<td>36</td>
<td>Poverty Incidence, % of Total Population below $1-a-day poverty line</td>
<td></td>
<td></td>
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<td>X</td>
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<tr>
<td>37</td>
<td>Poverty Incidence, % of Total Population below $2-a-day poverty line</td>
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<td>X</td>
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<tr>
<td>38</td>
<td>Poverty Incidence, % of Total Population below official poverty line (rural)</td>
<td></td>
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<td></td>
<td>X</td>
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<tr>
<td>39</td>
<td>Poverty Incidence, % of Total Population below official poverty line (total)</td>
<td></td>
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<td></td>
<td>X</td>
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<tr>
<td>40</td>
<td>Poverty Incidence, % of Total Population below official poverty line (urban)</td>
<td></td>
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<td>X</td>
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<tr>
<td>41</td>
<td>Real Wage Rate</td>
<td></td>
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<td></td>
<td>X</td>
</tr>
<tr>
<td>42</td>
<td>Real Wage Rate Index (1997Q2=100)</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
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<tr>
<td>43</td>
<td>Share of Income of the Highest Quintile of the Population</td>
<td></td>
<td></td>
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<tr>
<td>44</td>
<td>Share of Income of the Lowest Quintile of the Population</td>
<td></td>
<td></td>
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<td>X</td>
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<tr>
<td>45</td>
<td>Total Fertility Rate (Births Per Woman)</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
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<tr>
<td>46</td>
<td>Under-5 Mortality Rate</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
</tbody>
</table>

Notes: ADO - Asian Development Outlook
AR   - Annual Report
AEM  - Asia Economic Monitor
CSP  - Country Strategy Plan
ESTIMATING QUARTERLY GDP - OECD COUNTRY PRACTICES -

Kil-Hyo Ahn, Statistics Directorate, OECD

1. Introduction

Quarterly national accounts are the only coherent set of indicators, which is available with a short time lag and thus provide a short-term overall picture of the economy. Quarterly national accounts are being used in many ways: economic and monetary policy decisions, macro economic monitoring, business cycle analysis, short-term forecast, etc.

The aim of this paper is to summarize some of main principles and techniques commonly used in quarterly GDP estimation and to present a review of OECD country practices on the production approach in the compilation of quarterly GDP.

This paper starts by introducing the three approaches to estimate quarterly GDP, followed by an overview of OECD country practices on the three approaches. It then discusses the sources and methods of the production approach and its problematic variables. The rest of this paper deals with OECD country practices of the production approach and their seasonal adjustments.

2. Three approaches to GDP

Theoretically, GDP can be observed from three different aspects; namely production, expenditure, and income side. In line with this idea, three approaches for measuring GDP have been introduced traditionally: the production approach, the expenditure approach and the income approach. However, this distinction is somewhat artificial because these approaches often use the same source data. For example, estimates of government output and government consumption are often based on the same source data. Part of fixed capital formation is estimated based on the output of construction and production of machinery. And the estimates of wages and salaries are often used to calculate output and value added of industries.

It is not always possible to estimate directly all components of a particular approach due to lack of source data. Therefore, some components are derived as residuals. Usually these residuals are operating surplus in the income approach and changes in inventories in the expenditure approach.

Since applying these approaches together makes it possible to check the estimates of GDP, it is recommended that at least two of the three approaches be adopted to measure GDP, particularly both the production and the expenditure approach together (IMF Manuel on Quarterly National Accounts, paragraph 2.15).

3. OECD country practices

At present the OECD has 30 Member countries. The OECD publication, “Quarterly National Accounts, Volume 2002/1”, provides information on the main national accounts aggregates for OECD Member
countries. This publication contains quarterly GDP data for 28 Member countries; Luxembourg and Greece do not compile quarterly GDP (below, “all OECD countries” refers to the 28 Member countries that compile quarterly GDP).

Twenty-one countries adopt the production approach and provide quarterly estimates of GDP by industry. Other seven countries including Japan, the United States do not use the production approach in the compilation of quarterly GDP estimates.

All OECD countries take the expenditure approach and compile quarterly estimates of GDP by type of expenditure. These estimates are required by national governments for routine economic management and are accorded first priority by OECD Member countries. Fourteen countries produce quarterly estimates of GDP by the income approach. In general, the income approach has difficulties in calculating net operating surplus and consumption of fixed capital.

Thirteen countries provide quarterly estimates of all three components of GDP. If a country takes more than one independent approach to estimate total GDP, the difference among GDP figures from different approaches can be handled in a number of ways. One particular approach may be regarded as the most accurate and so adjustments are made to the other estimates. For example, the United Kingdom adopts this process. Another alternative method is to average the difference. In Australia, three approaches are used, and the average of the three is considered to provide the best measure of economic development.

Table 1. Approaches used to estimate quarterly GDP

<table>
<thead>
<tr>
<th>Country</th>
<th>Production approach</th>
<th>Expenditure approach</th>
<th>Income approach</th>
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<tbody>
<tr>
<td>Australia</td>
<td>X</td>
<td>X</td>
<td>X</td>
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<td>Austria</td>
<td>X</td>
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<td>Japan</td>
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<td>Switzerland</td>
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<td>Turkey</td>
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<tr>
<td>United Kingdom</td>
<td>X</td>
<td>X</td>
<td>X</td>
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<tr>
<td>United States</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>21</strong></td>
<td><strong>28</strong></td>
<td><strong>14</strong></td>
</tr>
</tbody>
</table>
4. Production approach to GDP

Compilation methods of quarterly national accounts can be classified into two main approaches: direct approach and indirect approach.

Direct approach relies on a comprehensive set of surveys using the same method to compile both quarterly national accounts and annual national accounts. This approach requires the availability of comprehensive data at quarterly intervals. The quality of data should be of similar level to those used to compile annual national accounts.

Indirect approach uses short-term indicators within the framework of a statistical model to estimate quarterly national accounts. It can be viewed as method based on partial surveys using regression models to correct sample estimates. The use of mathematical and statistical methods often increases with the lack of available information, but it does not necessarily imply a lack of information.

A. Sources and methods

The production approach is the most widely used for measuring quarterly GDP, because many countries have developed short-term statistics on manufacturing industries as main indicators for economic development. In general terms, quarterly estimates of GDP are extrapolations of annual series of GDP. The estimates of GDP by industry are compiled by extrapolating value added with relevant indicators.

The use of supply/use or input/output frameworks are increasing in the calculation of quarterly GDP estimates. This tendency may be encouraged not only by its usefulness of cross-checking data but also by the help of developed computer system which make it quick and easy to calculate the input-output table itself. Five countries, Denmark, France, Netherlands, Norway, Sweden, use input/output frameworks in their quarterly compilation explicitly. The frameworks should be quarter specific, which means that the structure of each quarter may be different. For example, tourism in July, August, and September may produce specific supply/use equations for the third quarter.

The production approach generally involves calculating output, intermediate consumption, and value added both at current and constant prices. However, source data are often available only on either output or intermediate consumption. The case is relatively rare where both output and intermediate data are available at the same time. If both data are available, value added can be derived as a residual (double indicator method).

If either output data or intermediate consumption data are available, value added can be estimated based on additional information; either ratios of value added to output or of intermediate consumption to value added. This situation is more common for compiling quarterly GDP. Most widely used ratios are fixed input-output (IO) coefficients. However, fixed IO ratios may be a weak assumption due to seasonal effects, changing capacity utilization rates, technological change, and productivity trends.

B. Problematic variables

1. Work-in-progress

As the accounting period is shorter for quarterly national accounts than for the annual accounts, it is necessary to pay particular attention to the definition and measurement of work-in-progress. In a certain industries, production activity may be carried out during more than one quarter, while, sales may take place
at very infrequent intervals. The amount of work-in-progress in such industries usually proceeds continuously throughout the year but actual completions and sales may occur quite irregularly. The important issue on work-in-progress is when the operating surplus is considered to accrue.

If operating surplus accrues only at the moment when the sale occurs, then irregularities in the flow of operating surplus (value added) could happen in quarterly GDP estimates. This problem becomes most important for construction, shipbuilding and agricultural industries where the period of production may span several accounting periods.

In the 1993 SNA, it is recommended that additions to work-in-progress in a given period is valued by multiplying the base price of the relevant finished output by the share of the total production costs incurred during that period\(^\text{17}\). This procedure ensures that the value of the final output is distributed over the various periods during which production takes place in proportion to the cost incurred.

As the eventual price of the final product might not actually be known until the sales occur, especially in the situation with high inflation, these provisional estimates must be revised when the actual sale price become known.

2. Agricultural products

Measuring output of crops on a quarterly basis presents special difficulties. Sales of crops are largely confined to a single quarter of the year although the production process occurs on a continuous basis throughout the year.

The 1993 SNA recommends that crop output should be distributed among quarters in proportion to the costs incurred each quarter and that value added imputed to quarters when there is no harvest should be recorded as work in progress.

When growing crops are included in work-in-progress and are valued at purchasers’ prices including an allowance for operating surplus, there would be no particular theoretical problems associated with the measurement of agricultural output on a quarterly basis. In practice, however, the ability to measure the output of field crops in a continuous way throughout the year depends on the availability of adequate data on acres sown and crop conditions during the growing season.

The method used by countries for measuring crops vary considerably. Some countries exclude growing crops from work-in-progress mainly because of lack of data; others include them and distribute them over the four quarters by more or less arbitrary methods.

According to the information reported by countries for the OECD’S Quarterly National Accounts- Sources and Methods (1996), the ways in which countries treat the issue of agriculture products can be categorized as follows:

Crop production is distributed to the quarters in which harvest occurs – Austria, Germany, Norway

Crop production is distributed to the third quarter – Denmark, Finland, Netherlands (sugar beet in the fourth quarter)

A quarter of forecasted total output is distributed to each quarter – Sweden

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17. Refer to the 1993 SNA paragraph 6.77-79, 10.102-105 and 19.72-73.
C. Current and constant prices

Constant price values are expressed in terms of a base period. Base period refers to the period on which the price weights of a volume index are based. In general, the current and constant values are identical in the base period. Three basic methods are identified to calculate constant estimates: quantity revaluation, deflation, and volume extrapolation.

Quantity revaluation method involves the following procedure. First, collect quantity data of current period and then revalue them using base year prices. Since value added does not take a quantity form, quantity revaluation has to be applied to the output and intermediate consumption. Constant price estimates of value added are derived as residuals. Due to the problems associated with accurately measuring quantities, this approach can only be used for commodities that can be measured at a detailed homogeneous level. Also the commodities involved should be affected by quality change over time.

Deflation method refers to obtaining constant price estimates by deflating current prices, which means current prices is divided by a price index. This method is the most common method of revaluation, because it requires less data than quantity revaluation. Price data tend to move in similar ways with other similar items due to price competition. Quality changes are easier to take into account with the help of a sophisticated price index. Deflation method may be applied to the current price value added, if relevant price indices for the estimates of value added can be found or created. Deflation should be done at as detailed a level as possible.

Volume extrapolation means that the current value in the base year is updated using a volume index. True volume indices take account of both quantity and quality changes. If quantity changes only are available, indices should be used at as detailed a level as possible to try to ensure homogeneity.

5. OECD country practices

A. Sources and methods of production approach

The method generally used is to extrapolate value added with indicators relating to output such as an index of industrial production or other physical quantity measures. Value measurements derived from sales/turnover/receipt information are also used to estimate value added. Trend extrapolation and other techniques are used to fill the data gap.

For the agriculture, forestry and fishing industry, the double indicator method (value added = output – intermediate consumption) is used in most countries. Physical quantity indicators are used in most countries since they are generally available at detailed commodity level.

For estimating value added of the manufacturing industry, the index of industrial production is widely used in many countries. However, some countries such as Australia, New Zealand, Austria, Denmark, Germany, Netherlands and Turkey use sales/turnover/other data on receipts to estimate value added of manufacturing sector.

For the electricity, gas and water industry, the index of industrial production is widely used as a source data. New Zealand, Denmark, Netherlands and Turkey use sales/turnover/other data on receipts.
For the construction industry, the source data vary considerably across countries. Both sales/turnover/other data on receipts and employ/earning data are used in many countries for estimating value added of construction. In some countries, construction activity is often estimated using two sets of data: permits issued and average length of time to completion. Investment data, either from surveys or budget statements, are also widely used in the estimation of construction activity.

The contributions of wholesale and retail trade to GDP by industry are estimated from one of the two approaches. Sales/turnover data are widely used in most countries. On the other hand, the contributions are based on estimated trade margins on goods for exports, final and intermediate consumption and gross fixed capital formation in the case of France, Italy, Netherlands, Norway and Turkey.

Physical quantity indicators such as ton/km, passenger/km, passenger numbers, telephone calls, letters carried etc. are used by most countries for at least part of transport activities and communications. As mentioned above, they are the preferred indicators for agriculture, forestry and fishing.

Estimates based on employment and earnings data are almost entirely confined to service activities such as government services, social and cultural services and business services. It is difficult to identify output of those services sector. A number of countries modify the basic data to reflect the changes in productivity or shifts in the grade/skill composition of the labor force. Several countries use labor inputs in the estimation of construction value added.

Trend extrapolation method is used mainly for the activities whose contribution to GDP is small. This method is often used in the estimation of value added of rents, financial services, fishing and hunting. For the value added of owner-occupied dwellings, housing stock data primarily derived from perpetual inventory models are used in many countries.

**B. Current and constant price estimates**

All OECD countries compile quarterly estimates of GDP by type of expenditure in both current and constant prices. Estimates of GDP by income can only be compiled.

All countries using the production approach are publishing quarterly estimates of GDP by industry at constant prices. The United Kingdom publishes the estimates of GDP by industry in index form. Several countries such as Australia, Canada, New Zealand and the United Kingdom do not publish the estimates of GDP by industry at current prices. The current estimates of quarterly GDP by industry are considered to have low priority for the users of quarterly GDP.
Table 2. Constant and current estimates

<table>
<thead>
<tr>
<th></th>
<th>Production approach</th>
<th>Expenditure approach</th>
<th>Income approach</th>
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<tbody>
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<td></td>
<td>Constant prices</td>
<td>Constant prices</td>
<td>Constant prices</td>
</tr>
<tr>
<td>Australia</td>
<td>X</td>
<td>X</td>
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<td>Austria</td>
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<td>United States</td>
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C. Seasonal adjustment

The aggregates of quarterly GDP must be provided in such a way as to reflect trends of economic activity. Therefore, a basic requirement is that seasonally adjusted estimates of the main aggregates are available. Without seasonal adjustment data, changes in trend can only be judged by comparing the level of change in the latest quarter with the same quarter of the previous year. Such process is likely to result in turning points being detected on average some six month late. It is not possible to read from the unadjusted data how trends are changing quarter by quarter.

Most OECD countries publish seasonally adjusted estimates of main quarterly GDP aggregates. Seasonal adjustment method adopted by most countries are either X-11 ARIMA or X-12 ARIMA model. Eight countries do not publish seasonally adjusted quarterly GDP series. Several reasons for not publishing seasonally adjusted series are identified. Some countries have started to compile quarterly GDP very recently and thus they do not have enough time series for seasonal adjustment. Other countries may suffer from lack of seasonal adjustment experts. Countries with many irregular shocks often find it difficult to explain the results of seasonal adjustment results to the users of quarterly GDP, including the general public.
Table 3. Approaches used to estimate quarterly GDP

<table>
<thead>
<tr>
<th>Country</th>
<th>Seasonally adjusted</th>
<th>Method of seasonal adjustment</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australia</td>
<td>X</td>
<td>X-11 ARIMA</td>
<td></td>
</tr>
<tr>
<td>Austria</td>
<td>X</td>
<td>Tramo Seats</td>
<td>Not shown in the OECD ‘Quarterly National Accounts’ publication</td>
</tr>
<tr>
<td>Belgium</td>
<td>X</td>
<td>Tramo Seat</td>
<td></td>
</tr>
<tr>
<td>Canada</td>
<td>X</td>
<td>X-12 ARIMA</td>
<td></td>
</tr>
<tr>
<td>Czech Republic</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Denmark</td>
<td>X</td>
<td>X-11 ARIMA</td>
<td></td>
</tr>
<tr>
<td>Finland</td>
<td>X</td>
<td>X-11 ARIMA</td>
<td></td>
</tr>
<tr>
<td>France</td>
<td>X</td>
<td>X-11 ARIMA</td>
<td></td>
</tr>
<tr>
<td>Germany</td>
<td>X</td>
<td>X-12 ARIMA</td>
<td></td>
</tr>
<tr>
<td>Hungary</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Iceland</td>
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<tr>
<td>Ireland</td>
<td></td>
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</tr>
<tr>
<td>Italy</td>
<td>X</td>
<td>Tramo Seats</td>
<td></td>
</tr>
<tr>
<td>Japan</td>
<td>X</td>
<td>X-12 ARIMA</td>
<td></td>
</tr>
<tr>
<td>Korea</td>
<td>X</td>
<td>X-12 RegARIMA</td>
<td></td>
</tr>
<tr>
<td>Mexico</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Netherlands</td>
<td>X</td>
<td>X-12 RegARIMA</td>
<td></td>
</tr>
<tr>
<td>New Zealand</td>
<td>X</td>
<td>X-11 ARIMA</td>
<td></td>
</tr>
<tr>
<td>Norway</td>
<td>X</td>
<td>X-12 ARIMA</td>
<td></td>
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<tr>
<td>Poland</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Portugal</td>
<td>X</td>
<td>X-11 ARIMA</td>
<td></td>
</tr>
<tr>
<td>Slovak Republic</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Spain</td>
<td>X</td>
<td>Tramo Seats</td>
<td></td>
</tr>
<tr>
<td>Sweden</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Switzerland</td>
<td>X</td>
<td>X-12 ARIMA</td>
<td>With trend cycle (irregular variations) adjustments</td>
</tr>
<tr>
<td>Turkey</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>United Kingdom</td>
<td>X</td>
<td>Unspecified</td>
<td></td>
</tr>
<tr>
<td>United States</td>
<td>X</td>
<td>X-12 ARIMA</td>
<td></td>
</tr>
</tbody>
</table>

6. Summary

Most OECD countries compile the estimates of quarterly GDP estimates based on the production approach. However, the estimates of GDP by type of expenditure (expenditure approach) are regarded as the most important data for the policy formulation and assessment.

More and more countries are attempting to adopt supply/use frameworks in compilation of their quarterly national accounts. This tendency may be encouraged not only by its usefulness of cross-checking data with commodity balance but also by the help of developed computer system which make it quick and easy to calculate input-output table itself.

Value added is extrapolated by indicators relating to output such as index of industrial production or physical quantity measures. Volume measurements derived from sales/turnover/receipts information are also used in many OECD countries.

The ways in which the OECD countries treat the issue of agricultural crops vary considerably. Some countries distribute crop production to the quarters in which harvest occurs; others allocate the total output to each quarter equally or distribute it to the quarters related to production period according to the costs of production.
All OECD countries compile constant estimates of GDP by industry. But some countries do not provide current estimates of GDP by industry, because current estimates of quarterly GDP by industry are considered to be less important to the users of quarterly GDP estimates.

Most OECD countries publish seasonally adjusted estimates of main quarterly GDP aggregates. Most common method of seasonal adjustment adopted by countries is either X-11 ARIMA or X-12 ARIMA model. Eight countries do not compile seasonally adjusted GDP series. The main reason for not publishing seasonally adjusted series is that time series data are not long enough to derive seasonally adjusted data, since they have compiled quarterly GDP very recently.
COMPILATION OF QUARTERLY GDP

Sources and Methods Used by Countries in the ESCAP Region
AUSTRALIA

Michael Morgan, Australian Bureau of Statistics, Australia

1. Introduction

This paper has been outlined to include;
- Brief history
- SNA93 implementation
- The Australian approach to benchmarking quarterly time series to annual estimates
- Seasonal adjustment
- Revision, publication
- Recent developments
- Details of data sources in the appendixes

The main purpose of quarterly national accounts is to provide an up-to-date picture of the performance of the Australian economy. Information is used as an input to the formulation of fiscal and monetary policy. Other uses of the quarterly national accounts include: a broad indicator of economic activity; and a provider of input to various forms of economic modelling. Government departments, industry groups, universities and private researchers are among the users of the quarterly national accounts.

2. Brief History

The first official estimates of national income for Australia (based on estimates prepared by Clark and Crawford) were published in 1938 in *The Australian Balance of Payments, 1928-29 to 1937-38*, although unofficial estimates by several economists had been published in the 1920s and 1930s. In 1945, the first official set of national accounts was prepared by the then Commonwealth Bureau of Census and Statistics (CBCS) and published in the Commonwealth Budget Paper *Estimates of National Income and Public Authority Income and Expenditure*.

The 1960s and early 1970s were times of significant development for Australian national accounting. The first official quarterly estimates of national income and expenditure were published in December 1960. In 1963 the CBCS published the first *Australian National Accounts: National Income and Expenditure* (ANA) bulletin, which included the first annual constant price estimates for Australia. The CBCS began to seasonally adjust its quarterly estimates of expenditure - based GDP and its components in 1967. Annual estimates of gross product by industry at constant prices were published for the first time in 1969. In 1971, the CBCS first published seasonally adjusted, constant price quarterly estimates of national income and expenditure, which later proved to be among the most used of all national accounting estimates. The CBCS

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18. Although the information contained in this paper has been compiled from the Australian National Accounts: Concepts, Sources and Methods, 2000(ABS Cat. 5216.0), and information prepared by the staff of the ABS. The views contained in this paper reflect those of the author and not necessarily those of the Australian Bureau of Statistics.
published estimates of national income and expenditure based on the revised SNA (1968 version) in 1973, and also published the first official input-output statistics in the same year.

In the 1980s, the former CBCS, now called the Australian Bureau of Statistics (ABS), again made significant progress in national accounting. The first full edition of *Australian National Accounts: Concepts, Sources and Methods* was published in 1981 at about the same time as the first experimental estimates of capital stock. The ABS conducted a study into the accuracy and reliability of the quarterly estimates of national income and expenditure and published the results in 1982. Experimental State accounts were published in 1984, followed by the first official estimates in 1987. They are now published annually in *Australian National Accounts: State Accounts* (Cat. no. 5220.0). A subset of major State statistics is published along with the national estimates in the quarterly *Australian National Accounts: National Income, Expenditure and Product* (Cat. no. 5206.0). The first quarterly estimates of constant price gross product by industry were released in 1988. These estimates have also been incorporated.

Further significant developments in national accounting and associated statistics occurred during the 1990s. An updated edition of *Australian National Accounts: Concepts, Sources and Methods* was published in 1990 (subsequently available on CD-ROM), the same year as the first estimates of multi-factor productivity were published. In 1990, the ABS also published developmental flow of funds accounts, showing the changes in financial assets and liabilities arising from the financing of productive activity in the economy. Flow of funds estimates are now published on a quarterly basis, along with estimates of stocks of financial assets and liabilities at the end of each quarter in *Australian National Accounts: Financial Accounts* (Cat. no. 5232.0).

SNA93 was formally introduced into the Australian national accounts in the September quarter 1998 issue, which was released in December 1998, this also included quarterly chain volumes measures replacing the previously produced constant price estimates. In 2000 a new edition of *Australian National Accounts: Concepts, Sources and Methods* was published describing Australia's implementation of SNA93.

3. SNA93 Implementation

The main features of the implementation of SNA93, were to the asset boundary. These relate to the capitalisation of certain defence expenditures and the creation of a new asset type ‘intangible fixed assets’ which covers mineral exploration, computer software, and entertainment, literary and artistic originals. In addition, the ABS has implemented the treatment of livestock that was included in SNA68 and retained in SNA93, but not previously reflected in the Australian National Accounts.

Under SNA68, nearly all defence expenditures were treated as government final consumption expenditure. Certain defence expenditures on assets those that are used in a fashion similar to civilian assets and could conceivably be switched from military to civilian use are now treated as gross fixed capital formation. However, expenditure on weapons and weapons delivery systems continues to be classified as government final consumption expenditure. Gross fixed capital formation has risen by the amount of the reclassified expenditures. However, government final consumption expenditure has not fallen by the same amount, as consumption of fixed capital on the now capitalised assets has been included. Accordingly, gross output, general government gross operating surplus and GDP have risen by the increase in the estimated value of consumption of fixed capital.

One of the most significant revisions to the SNA is the recommendation that the indirectly charged services proportion of the production of financial services of banks and other financial intermediaries should be allocated to the users of the services, both depositors and borrowers. The indirectly charged services of banks effectively relate to the differences in interest rates offered to borrowers and depositors. Thus the payment for service is implicit in the higher interest paid by borrowers or the lower interest
received by depositors. The value of these services to borrowers and lenders is taken into account in
determining the gross output of financial intermediaries, and the services are known as Financial
Intermediation Services Indirectly Measured (FISIM).

A. Integration of Input Output tables

Australia’s quarterly national accounts have been integrated with annual, balanced supply-use tables. These are a particular type of Input-Output (I-O) table. SNA93 recommends use of the Input-Output (I-O) framework for compiling basic production data, and integration of the I-O tables within the national accounts. I-O tables present a comprehensive picture of the supply and use of goods and services (referred to collectively as ‘commodities’) in the economy and the incomes generated from production. The current supply and use tables are built on a matrix of 42 industries by 147 commodities. These tables are presently being redeveloped to have a 55 industries and 240 commodities dimension.

Improvements in data sources and timeliness of the compilation of ABS I-O tables has enabled the ABS, as part of the national accounts compilation strategy for implementation of SNA93, to implement the commodity flow method (the so called ‘I-O approach’). Beginning with 1994-95, and for each subsequent year up to the year prior to the latest complete financial year, the compilation of the NIEP accounts has been integrated with the compilation of the I-O supply-use tables. Components of each year's supply-use tables have also been compiled in prices of the preceding year, enabling chain volume movements of GDP also to be integrated with these tables.

One of the main strengths of I-O tables is that they provide a ‘balanced’ measure of GDP. There are three broad approaches to measuring GDP: the income approach, the production approach, and the expenditure approach. Each measure should, compiled independently using different data sources then different estimates of GDP result. This was previously the case for the estimates that appeared in the quarterly and annual national accounts publications. To achieve a ‘headline’ measure of GDP, the ABS calculated the simple average of the three, which it labelled GDP(A). However, an essential element in the compilation of I-O tables is the confrontation of estimates of the supply of all the commodities produced in an economy with the demand for all commodities, and of incomes earned from production with the value of production. This confrontation leads to a balancing of supply and use, and income and production, and as a consequence the same estimate of GDP is obtained regardless of which measurement approach is adopted.

A balanced gross domestic account means that GDP, whether derived by:

the income approach, GDP(I) i.e. summing factor incomes,

the expenditure approach, GDP(E) i.e. summing final expenditures less imports, or

the production approach, GDP(P) i.e. summing the gross value added of each industry is the
same and there are no statistical discrepancies. It also means that the income, expenditure and
production components are more coherent.

In a "normal year" three editions of the supply and use tables are produced: a 'final' for year t-3, a second preliminary for year t-2 and a first preliminary for year t-1, where the current year is t+1. In other years, say one in two or three years an historical revision is made in which the entire history is subject to revision.

B. Chain Volume Measures

The ABS replaced its constant price estimates with annually-reweighted chain volume measures. In doing so, the ABS has adopted the Laspeyres formula. In general, chain volume measures provide better
indicators of movement in real output and expenditure than constant price estimates, relativities that occur from one year to the next. Chain Laspeyres volume measures are compiled by linking together (compounding) movements in volumes, calculated using the average prices of the previous financial year, and applying the compounded movements to the current price estimates of the reference year.

The reference year for ABS chain volume measures is the year prior to the latest complete financial year. Therefore, the chain volume measures contained in our March 2002 publication are expressed in 1999-00 dollars. This will continue until the release of the June quarter 2002 issue of 5206.0, at which time they will be expressed in terms of 2000-01 dollars, and every year thereafter the reference year will change with the release of each June quarter issue of 5206.0. A change in reference year changes levels but not growth rates. However, revisions to growth rates will still occur as a result of other factors. The reference year has been chosen to coincide with the period for which the most recent price weights are available.

An unavoidable aspect of chain volume estimates is that the components of GDP will not sum to the chain volume estimates of total GDP. An exception to this is that the chain volume estimates for quarters after the reference year and for the reference year itself (but not for the quarters within the reference year) will be additive. To attempt to maintain additivity of the components for earlier periods would compromise the quality of the movements in the overall volume measures.

4. The Australian approach to benchmarking quarterly time series to annual estimates

For most aggregates, quarterly estimates are compiled using indicators to interpolate and extrapolate annual benchmarks. An example is the use of monthly retail trade survey estimates for household final consumption expenditure. Annual data is obtained from the retail industry survey (collected every five to seven years), which provides after scope adjustments an annual benchmark through a supply and use framework. The monthly retail trade information provides an indicator to interpolate between each retail industry survey benchmark and to extrapolate forward. Using this type of methodology, the quarterly distribution within a year is determined by the quarterly indicator series while the levels are determined by the annual benchmark.

Initial quarterly current price estimates are benchmarked to the annual estimates using an ‘optimal’ benchmarking procedure which seeks to minimise amendments to the quarterly growth rates of the initial quarterly estimates while ensuring that the final quarterly estimates sum to their annual counterparts. The benchmarking procedure uses Cholette’s proportional method that was developed by Pierre Cholette of Statistics Canada (attributed to Denton in the IMF manual). It is used to benchmark the quarterly flow data to the annual data. Let \( c_t \) and \( b_t \) respectively denote the unbenchmarked and benchmarked current price estimates for quarters \( t \). The estimates of \( b_t \) minimise the sum of \( (c_t /b_t - c_{t-1} /b_{t-1})^2 \) over a moving five year span subject to the \( b_t \)'s summing to the annual current price estimate for flows (June quarter equal to annual for inventories). The values of the \( b_t \)'s in the central year are used, except at the ends of the series.

Estimates for the latest financial year are obtained by aggregation of the quarterly estimates, which are obtained in turn by extrapolation from the latest annual benchmark estimates using the most appropriate indicators. In some cases these are basically the same sources as those used in constructing the annual.

Where there are no quarterly direct data sources or indicator series available it is necessary to generate a quarterly time series by adopting the most appropriate allocation procedure. One possible method would be to divide the annual estimate by four, but this would result in steps each September quarter and no change in the other three quarters. The method used in the Australian System of National Accounts is to apply a linear interpolation method to calculate quarterly time series from annual series. The procedure involves
forecasting annual estimates for two extra years, using a weighted average of the movements in year t-1 and year t. However, if information is available which provides a superior forecast for the annual estimates for those two years, such forecasts are used in preference to the standard projection produced by the interpolation procedure. This method is particularly appropriate for series such as consumption of fixed capital, where only annual estimates are available and where it is reasonable to expect that movements in the quarterly series will be relatively smooth.

5. Seasonal Adjustment

Quarterly time series such as those in national accounts publications are affected by three influences - calendar (mostly seasonal), trend and irregular. When interpreting a quarterly series, it is often helpful to take account of the seasonal and other regular calendar-related influences. The seasonal adjustment process removes these influences, and the remaining (seasonally adjusted) series reflects the trend and irregular influences. The irregular component refers to changes attributable to irregular events such as industrial disputes or lumpy investments. A further statistical process (Henderson smoothing) removes the irregular influence to reveal the trend.

Seasonal effects usually reflect the influence of the seasons themselves, either directly or through production series related to them (such as farm production), or social conventions (such as the incidence of holidays) or administrative practices (such as the timing of tax payments). Other types of calendar variation occur as a result of influences such as the number and composition of days in the calendar period (trading day), accounting or recording practices adopted by businesses, the effect of regular pay-days on activity levels or the incidence of movable holidays (such as Easter).

Statistical techniques can be used to evaluate the effects of normal seasonal and other calendar influences operating on a series. If significant stable seasonal or calendar variation is detected, then the estimated effects may be removed from the series to produce a seasonally adjusted series. Although stable calendar variation may be present in a series, factors applying in a particular period may vary significantly from year to year due to the variability in the number and composition of days in that particular period. This is especially evident in series affected by, say, the payment of salaries or pensions on a fortnightly basis.

Not all statistical series are significantly affected by seasonal or calendar influences which are regular enough to be described as 'stable', so seasonal or calendar influences cannot always be removed from them. In such cases the original series may be regarded as also being the seasonally adjusted series. Some examples in the quarterly national accounts are the rent component of farm costs and the series related to the consumption of fixed capital.

The ABS method of seasonal adjustment is the SEASABS (SEASONal analysis to ABS standards) package, a knowledge-based seasonal analysis and adjustment tool. The seasonal adjustment algorithm used by SEASABS is based on the X-11 ARIMA package from Statistics Canada. This in turn is based on the United States Bureau of the Census Method II Seasonal Adjustment Program, X-11 Variant. In the X-11 method, calendar effects, where measurable, are estimated using mainly filtering techniques, and occasionally regression procedures. In certain cases (such as the payment of pensions) additional information may be used to estimate appropriate prior adjustment factors. The estimated seasonal and calendar influences, together with certain prior adjustment factors, provide the combined adjustment factors by which the original series is seasonally adjusted.

The X-11 technique proceeds by decomposing the series to be analysed into estimated trend, seasonal and irregular components. The irregular component reflects the influence of unusual or transitory effects, e.g. the effect of a major industrial dispute or of unseasonal weather conditions. It also reflects sampling and non-sampling errors which may be present in the original series. The X-11 program includes a statistical
procedure for identifying and discounting unusually large or small values included in the original series. Supplementary information is used to assess the results produced by this technique. Occasionally, prior modification of extreme values is undertaken, again using supplementary information, in order to better allow for these influences. This procedure minimises the extent to which the estimated seasonal component is affected by irregular influences. It should be noted that only the estimates of seasonal and/or other types of calendar variation are removed from the original series to form the seasonally adjusted series. Since the irregular influences remain, an unexpectedly large movement in the seasonally adjusted series does not necessarily indicate a change in the underlying trend of the series.

Adjustments are also made prior to seasonal analysis to deal with abrupt discontinuities in the seasonal pattern or the trend where sufficient observations are available to estimate the magnitude of the effects. These ‘break factors’ have been employed retrospectively in the analysis of a number of national accounts series, and some series contain more than one such break. However, it is impossible in most cases to recognise and assess changes in seasonality or trend at the time they occur. The seasonal adjustment process alone cannot indicate whether an unexpected movement appearing in current seasonally adjusted figures denotes a variation in trend, or an unusual (irregular) effect, or whether it is due to an abrupt change in seasonality.

6. Revision, publication and user forum on GDP (quarterly or annual)

A. Revisions

Economic analysts and policy makers not only require accurate and timely information on the movements in and magnitude of the principal national accounts aggregates, but they must also have confidence that these indicators are unlikely to change significantly as more complete data become available.

The extent to which statistics are subject to revision is one of the more easily quantifiable aspects of quality. However, these measures do not provide an unambiguous guide to quality. A series may be subject to few revisions, but the series may be highly inaccurate due to poor data sources. Revisions can be reduced by delaying the release of statistics until all or most ‘final’ data sources are available, but this would mean that the statistics would be less relevant to users. On the other hand, it may be possible to compile timely statistics that are not subject to revision only by placing an unacceptable load on survey respondents or at great cost to the compiler.

An analysis of revisions can, however, identify the possibility of inaccurate initial data or inefficient compilation methods. If it can be established that revisions are significantly biased (i.e. consistently positive or negative) then it is self-evident that initial estimates are inaccurate. The information on revisions can then be used to improve compilation methods to remove systematic distortions arising from the estimation process. However, even if there are no systematic distortions in compilation processes, users may still consider certain statistics to be unreliable because the revisions are significantly dispersed (i.e. the mean absolute values of the revisions are large). Generally, it is only possible to deal with such problems by improving the quality of source data by, for example, increasing initial survey response rates.

Revisions are a natural consequence of the processes used to compile the national accounts. Initial quarterly estimates are based on survey responses received and processed before a particular cut-off time. Following the cut-off, imputations are made for the non-respondents based on the responses of similar businesses and the responses of the non-respondents in the previous quarter. Subsequently, when the non-respondents finally respond the imputations are replaced and revisions to the estimates result. For many aggregates, quarterly estimates are compiled by applying indicators to annual (or less frequent) benchmarks based on superior data sources. This benchmarking process typically leads to revisions over an
extended period of time. Often the first benchmark data to become available are preliminary estimates and are therefore themselves subject to revisions. For the most part, benchmarks are considered 'final' three years after the period to which they relate has passed.

Another source of revisions is the availability of a major new data source or the development of an improved estimation methodology. Sometimes, the resultant revisions may even effect estimates for periods prior to those for which the benchmark estimates would have otherwise been considered 'final'.

Seasonally adjusted and trend estimates will usually experience some degree of revision over several years, due to the prolonged period required to finalise the estimation of seasonal adjustment factors.

The ABS has a comprehensive revisions policy for its national accounts statistics, a brief extract is below.

<table>
<thead>
<tr>
<th>Publication issue</th>
<th>Revisions to quarters</th>
</tr>
</thead>
<tbody>
<tr>
<td>June reference quarter</td>
<td>Previous 7 quarters</td>
</tr>
<tr>
<td></td>
<td>With the exceptions of:</td>
</tr>
<tr>
<td></td>
<td>chain volume measures - the entire history will be revised. This is due to the introduction of a new base year and re-referencing.</td>
</tr>
<tr>
<td></td>
<td>15 quarters for BOP transfers, Financial Accounts and International Investment Position.</td>
</tr>
<tr>
<td>September reference quarter</td>
<td>Previous 16 quarters (this is to introduce the new annual S-U benchmarks into the quarterly system)</td>
</tr>
<tr>
<td></td>
<td>With the exception of:</td>
</tr>
<tr>
<td></td>
<td>seasonally adjusted data - the entire history for both current price and chain volume measures will be revised. This is due to the incorporation of the latest seasonal reanalysis</td>
</tr>
<tr>
<td>December reference quarter</td>
<td>Previous 5 quarters</td>
</tr>
<tr>
<td>March reference quarter</td>
<td>Previous 6 quarters</td>
</tr>
</tbody>
</table>

B. Publication

The release of Australia's quarterly national accounts generally occurs 66 days after the reference period. A hardcopy publication is released at 11.30am containing 53 tables, 10 pages of analysis and comments, plus 8 pages of explanatory notes. Coinciding with the 11.30am release, a full set of time series spreadsheets are released electronically, this includes an additional 75 tables, not released in the hardcopy publication. The additional tables provide for a complete set of tables containing original, seasonally adjusted and trend information for both Australia and its states and territories.

The ABS also regularly includes within its quarterly national accounts feature articles of interest to users. These generally include new estimation methods to calculate national accounts data, and new national accounts measures.

More significant changes affecting the national accounts are released as information papers. With the introduction of SNA93 into the Australian National Accounts, two major information paper were released. The first described the changes due to SNA93 and it's impacts, and the second foreshadowed the introduction of chain volumes measures.

Following each quarter release, a number of seminars are conducted across Australia. These seminars are used to inform interest groups such as state treasuries, the central bank and other users of the quarterly national accounts.
national accounts, of the major points within the release, as well as any additional information to clarify underlying movements in both the national and state information.

7. Recent Developments

A. Development of quarterly supply and use tables

Work has begun in National Accounts Branch on the development of quarterly supply and use tables. The aim is to use them to reduce and possibly completely eliminate statistical discrepancies between the various quarterly measures of GDP. This project is extending to the quarterly accounts the methods used to achieve balanced estimates of GDP and its components in the annual accounts.

In some respects compiling quarterly supply and use tables is simpler than compiling annual tables, because we use a smaller range of products groups and we do not propose to fully balance the supply and use of intermediate products, but in other respects it is more demanding. Particular challenges include the need to cope with seasonality and revisions to data for earlier periods and, critically, the need to complete the compilation in a very short time.

The annual estimates of GDP and its components are compiled in supply and use tables by a process of confronting and balancing the supply and use of goods and services, thereby ensuring final domestic expenditures, intermediate usage and exports are consistent with output and imports, and by ensuring the incomes and gross value added of each industry are the same. The quarterly gross domestic product account is not compiled in a supply and use framework and is unbalanced. However, the discrepancies are now generally smaller than they used to be. This is because the quarterly estimates are benchmarked to balanced annual estimates. In other words the quarterly current price and chain volume estimates are constrained to sum to the balanced annual estimates. While there has been a reduction in the absolute size of the quarterly statistical discrepancies, substantial differences still remain in the quarter-to-quarter movements of the three independent measures of GDP. This is of critical importance to users.

National Accounts Branch has embarked on a project to develop prototype quarterly supply and use tables as a means of reducing and possibly eventually eliminating quarterly statistical discrepancies in the gross domestic product account. The quarterly supply and use tables are now being used as an editing tool to identify the source of discrepancies, and to correct major imbalances before finalising the accounts.

In some quarters the differences between the growth rates of initial estimates derived using the three approaches are not large and no ‘balancing’ adjustments are required, but more often than not the differences in growth in the initial estimates are considered too great and further data investigations are required to reduce the differences. To a degree, a certain amount of balancing occurs already. Although adjustments are determined after a careful examination of the components, they are to some extent arbitrary, and underlying inconsistencies could still remain. The quarterly supply and use framework will enable these inconsistencies to be investigated more systematically, and at a greater level of detail.

A further issue is the relationship between the national accounts and the partial indicators that are released beforehand. Currently, there are strong relationships because only limited balancing takes place. However, the quarterly supply and use approach may lead to greater adjustments and so there could be a weakening in the relationships. It would not be possible to adjust the partial indicators to take account of quarterly supply and use balancing. Therefore, the movements in the partial indicators may become a less reliable guide to movements in the corresponding national accounts components.
B. Quarterly Economic Activity Survey

The ABS has recently made significant improvements to it is quarterly business indicators, through the introduction of the Quarterly Economic Activity Survey (QEAS).

The surveys and publications affected by the new collection are:
- Survey of Company Profits, and the publication Company Profits, Australia (Cat. no. 5651.0);
- Survey of Inventories, Sales and Services, and the publication Inventories and Sales, Selected Industries, Australia (Cat. no. 5629.0); and
- Survey of Employment and Earnings, and the publication Wage and Salary Earners, Australia (Cat. no. 6248.0).

As well as being indicators of economic performance in their own right, the results of these surveys are used as major inputs into the compilation of quarterly estimates of the Australian national accounts. The changes involved the integration of samples, questionnaires, data collection, data processing and data dissemination for each of the surveys into a single survey.

The improvements to the Quarterly Economic Activity Survey are used in the compilation of the quarterly estimates of the Australian National Accounts. Inventories data are used to compile estimates of the increase in book value of non-farm inventories. Estimates of income from sales of goods and services are used to help derive quarterly chain volume measures of gross value added for selected industries. Company gross operating profits data are used to compile estimates of gross operating surplus of private non-financial corporations. From March quarter 2002, estimates of wages and salaries are being used to compile estimates for compensation of private sector employees.

C. Output indicators for health and education

Improved methods for calculating chain volume estimates of gross value added for some important service industries were introduced in the June quarter 2001 issue of Australian National Accounts: National Income Expenditure and Product (Cat. no. 5206.0). Counterpart components of government final consumption expenditure have also incorporated the new methods. Current price estimates are unaffected.

For the health and community services and education industries, the new method has been used to backcast estimates to September quarter 1993. Prior to those periods, the existing series will be spliced onto the new. Changes will flow through to the full suite of national accounts releases, including State and Territory accounts where relevant.

D. Health

Health services make up 90% of the total value added of the combined industries of health and community services. It has not been possible to develop output indicators for the community services component (they remain input-based). Health services are composed of services provided in hospitals and nursing homes; medical services provided by general practitioners and medical specialists; dental; optometry and optical dispensing; community health services; paramedical; veterinary and ambulance services.

Over 55% of health services are supplied by hospitals and nursing homes, the majority being provided by the government sector. The Department of Health and Aged Care collects detailed treatments data from all government and private acute care hospitals in accordance with the Australian National Diagnostic Related Groups Classification (AN-DRGs). The current version of the classification consists of over 660 separate diagnostic related groups. Volume is represented by the number of episodes (separations) for each group. Detailed cost studies have also been undertaken by the Department of Health and Aged Care in order to
construct average cost weights per separation for each diagnostic related group. The ABS has used these cost weights to derive a chain weighted volume index since 1995-96. For prior years the cost weights are fixed with base year 1995-96.

Measurement of outpatient episodes provided by hospitals remains a problem. Outpatient episodes are currently excluded from the index because data of satisfactory quality are not available. This is not expected to have an appreciable impact on the quality of the overall estimates. For nursing homes, the number of patient days categorised by level of care is used. Nursing home patient days are classified under a Resident Classification Instrument (RCI) rating system which measures the level of care required by a patient. Data are also available on the cost per patient per day for each of the RCI categories (this cost is based on a care component and an infrastructure component). An annual chain weighted volume index has been constructed using these cost weights.

For medical services, detailed data are available from the Medicare system. For general practitioners and medical specialists (e.g. in obstetrics, anaesthetics, diagnostic imaging and surgical operations), output is measured by the numbers of attendances weighted together by fees charged. In the case of pathologists, the number of tests has been used as the output volume indicator.

The ABS believes that the new method is a significant advance on the existing input-based method. It captures much of the anticipated increased productivity that one would expect from technological improvements in the industry. A shortcoming is the degree to which it can capture all quality change in the services provided. Using a fine level of detail helps to capture compositional quality changes, namely any shift to new and more advanced medical treatments being offered. It does require that cost data are regularly updated to properly weight these new treatments and diagnostic techniques. However, the new method fails to detect quality changes occurring within a particular medical treatment category. By undertaking detailed analyses of changes in the quality of treatments it may be possible to develop better indicators of output within AN-DRG categories at some time in the future.

E. Education

The new chain volume estimates of education output are based mainly on annual student enrolments. Enrolments for each level of education are weighted together by the cost of providing those services. Student numbers for primary schools and secondary schools are converted to full time equivalents (part-time students are counted as 0.5 of a full time student). Module hours are available for vocational education and are used in preference to student numbers. For universities, full-time equivalent student numbers enrolled in each of eleven discipline groups are used as the output indicators for the tuition component. In the absence of actual cost data, HECS weights are used as a proxy to weight student numbers in each discipline group. The university research component is estimated by weighting together data for the number of publications and student research completions.

The chain volume estimates for the remaining education services pre-schools and other education services will continue to be derived using suitable input price indexes. In the main, the new output indicators simply capture changes in the number of students enrolled adjusted for compositional change between the various levels of education, and subjects in the case of universities. They do not capture any quality change over time in the education services provided. A number of national statistical offices and international agencies, including the ABS, have investigated ways of incorporating quality adjustment factors into the education output measure. For example, class sizes and public examination results have been considered as indicators of change in the quality of the education service. Adjusting for class size has been widely rejected on the grounds that there does not appear to be an observable relationship certainly not a linear one between class size and the quality of services provided. Public examination results are useless unless the same test standards are maintained over time, and while results from standardised tests provide a better
prospect, changes in scores over time could also reflect external factors such as changes in the quality of home life as well as changes in the quality of education services. Nevertheless, once a sufficient time series of such data becomes available and after taking into account external factors, it may be possible to at least discern the direction of change in quality.

Despite this shortcoming, the ABS is of the view that the output indicator method is conceptually superior to the existing input-based method, and yields more plausible results for Australia.

**F. Services Industry Prices**

In recognition of the increasing contribution of service industries to the Australian economy, the ABS has embarked on a long-term development program to progressively extend the scope of the producer price indexes into the service sectors of the economy. Producer price indexes for the output of the Transport (freight) & Storage Division, and the Property & Business Services Division of the Australian and New Zealand Standard Industrial Classification (ANZSIC) have been developed.

As services indexes are output indexes the valuation basis is basic prices. The basic price is the amount received by the service provider exclusive of taxes (less subsidies) on products, and transport and trade margins (where relevant). First results from this program were published in March 1999, by way of experimental indexes, in Information Paper: Producer Price Index Developments (Cat. no. 6422.0). Index numbers for each of the divisions and subdivisions and for selected groups and classes are compiled. The index numbers are calculated on the reference base 1998-99=100.0.

The service industry price index development work is being undertaken within the classification framework provided by the ANZSIC. Prices are generally obtained from principal providers of the services concerned. Actual transactions prices are used in the indexes that is, the prices that service providers actually charge buyers. Price series relate to a set of services with fixed specifications. The aim is to incorporate in the indexes price changes for representative services of constant quality.

The indexes are fixed weights indexes. The ANZSIC class indexes are aggregated to the relevant group, subdivision and division using weights derived from 1994-95 Input-Output production values, in combination with data from other ABS surveys and industry sources.
Appendix 1.

Data sources

Data are collected in respect of the productive activity (as defined in SNA93) of all individuals, businesses and government units. A wide range of national accounting aggregates, relating to production, income, expenditure and capital accumulation, are published. Major aggregates are presented in original, seasonally adjusted and trend terms, and in current prices and as chain volume measures. Estimates of production are broken down by industry (in chain volume terms only), while income and expenditure data are separately identified for the household sector and the general government sector. Most data sources are obtained through direct survey collection or administrative by-products and are collected in original terms.

The current price estimates of GDP are compiled using both the income and the expenditure approaches, whereas the chain volume estimates of GDP are compiled using both the production and the expenditure approaches. A chain volume measure for the income-based measure of GDP is also obtained by deflating the current price measure of GDP, using the expenditure implicit price deflator. The so-called "headline" chain volume measure is referred to simply as GDP and is the average of the three independent measures. Explicit quarterly statistical discrepancies are included to equate the sum of the expenditure and industry chain volume measure components with total GDP. GDP at current prices is obtained by deflating the chain volume measure of GDP using the expenditure implicit price deflator. The differences between the sums of the income and expenditure components and GDP are shown as explicit statistical discrepancies.

Production approach: Australia does not produce a quarterly current price measure of GDP using the production approach (although two components of current price GDP could be described as being estimated using a production approach (GOS dwellings and farm income). The current price estimates of GDP are compiled using both the income and the expenditure approaches, whereas the chain volume estimates of GDP are compiled using both the production and the expenditure approaches.

The annual current price and volume estimates are compiled in a supply-use framework. The major data source for the non-general government sector is the annual economic activity survey integrated with data from the tax office. Quarterly volume estimates are mostly derived using output indicators obtained by deflation. The principal price indexes used are: price data from Producer Price Indexes (q) (6427.0); International Trade Price Indexes (q) (6457.0); Consumer Price Index (q) (6401.0); Wage Cost Index (q) (6435.0); several building and construction price indexes; and Australian Petroleum Statistics (q) (Department of Industry Science and Resources). The other major data sources used to derive chain volume estimates of GDP using the production approach are described below for each industry at the one digit level of ANZSIC. Quarterly data sources are indicated with a (q), annual with an (a), and less frequent data sources with an (i).

Agriculture, forestry and fishing: quantity and value data from census of agricultural establishments (a); Value of Agricultural Commodities Produced, Australia (a) (7503.0); Agricultural Finance Survey (a) Crops and Pastures, Australia (a) (7321.0); Livestock and Livestock Products, Australia (a) (7221.0); Livestock Products, Australia (q) (7215.0); data from agricultural commodity wholesalers (q and a); and Timber Supply Review (a), Forest Product Statistics (a), and Agriculture and Resources, Quarterly (q), all from the Australian Bureau of Agricultural and Resource Economics (ABARE).

Mining: quantity and value data from census of mining establishments (a); Quarterly Mineral Statistics (q) (ABARE); Mineral Production, Australia (q) (8405.0); and value data from Mineral Exploration, Australia (q) (8407.0).
Manufacturing: census of manufacturing establishments (a); and quarterly economic activity survey (private sector) (q).

Electricity, gas and water supply: For electricity and gas, quantity and value data from annual censuses of establishments for gas and electricity; and electricity and gas quantity data from Manufacturing Production, Australia (q) (8301.0). For water, annual value data from government finance statistics and quarterly quantity data from water boards.

Construction: building activity survey (q); and engineering activity survey (q).

Wholesale trade: wholesale industry survey (i); and quarterly economic activity survey (private sector) (q).

Retail trade: retail industry survey (i); monthly retail turnover survey; new motor vehicle registrations; wholesale sales of petrol.

Accommodation, cafes and restaurants: quantity data from tourism accommodation survey; for cafes and restaurants, monthly retail survey.

Transport and storage: For road, rail and water transport: quarterly economic activity survey (private sector) (q); for air transport: passenger and freight kilometres from major transport providers; for services to transport: a variety of indicators including cargo handling quantity data, car park quantity indicators and, importantly, the flow of services from roads (derived using the PIM).

Communication services: quarterly economic activity survey (private sector) (q), supplemented with revenue and quantity data (q) from the major public sector businesses.

Finance and insurance: survey of the finance and insurance industry (a); data from supervisory bodies (a and q).

Property and business services: labour force survey (q) and quarterly economic activity survey (private sector) (q).

Government administration and defence: government finance data (a): labour force survey (q) and survey of employment and earnings (q).

Education: number of full time equivalent students (a).

Health and community services: number of patient episodes, doctors’ visits and hospital separations (a and q).

Cultural and recreational services: quarterly economic activity survey (private sector) (q) and government finance data (a and q).

Personal and other services: quarterly economic activity survey (private sector) (q) and government finance data (a and q).

Ownership of dwellings: Household final consumption expenditure on dwelling rent.
**Expenditure approach:**

- Household final consumption expenditure: monthly retail trade survey; quarterly tourist accommodation survey, and miscellaneous indicators for other services.

- Government final consumption expenditure: government finance statistics.

- Private gross fixed capital formation: quarterly survey of private capital expenditure; building activity collection; engineering construction survey.

- Public corporations gross fixed capital formation: government finance statistics and quarterly survey of public corporations.

- General government gross fixed capital formation: government finance statistics.

- Changes in inventories: quarterly economic activity survey (private sector) (q); and government finance statistics (q).

- Exports of goods and services: balance of payments statistics.

- Imports of goods and services: balance of payments statistics.

**Income approach:**

- Compensation of employees: quarterly economic activity survey (private sector) (q); Australian Bureau of Agricultural and Resource Economics statistics; government finance data (a and q); labour force survey; Australian Taxation office statistics; balance of payments statistics (q); Survey of employment and earnings, survey of major labour costs; economic activity survey (a).

- Gross operating surplus; Private non-financial corporations and quasi corporations gross operating surplus: company profits survey; quarterly economy wide surveys, financial accounts statistics; Reserve bank bulletin; Australian Prudential Regulation Authority (APRA) publications, computer software survey; artistic originals statistics; survey of mineral exploration survey(q); Australian Taxation Office statistics

- Public non-financial surveys and quasi corporations: Auditors’ - generals reports; Annual financial statements of non-financial corporations and quasi corporations(a)

- Gross mixed income, unincorporated enterprises: taxation statistics; government finance statistics; Reserve Bank of Australia bulletin; the Australian Prudential Regulatory Authority (APRA); Agricultural finance survey; Draft white paper Reform of the Australian Tax system, Australian Bureau of Agricultural and Resource (ABARE)(a); Quarterly indicators include retail sales, capital expenditure on dwellings, receivals data supplied by the respective marketing boards estimates for consumption of medical services; wages and salaries paid, survey of livestock; value data supplied for the farm sector.

- Dwellings owned by persons gross operating surplus: census of Population and Housing; survey of building activity; Australian Prudential Regulatory Authority (APRA); Consumer price index; Housing Occupancy Survey; Agents’ fee schedules; Government finance statistics.

- General Government gross operating surplus: Perpetual Inventory model(a)
Financial corporations and quasi corporations Gross operating surplus: Reserve Bank of Australia bulletin; Economic activity survey returns for banks, annual reports of individual financial enterprises; State Auditor's General reports; quarterly and annual ABS surveys conducted to produce statistics on the operations of various types of financial intermediaries.

Non-life Insurance corporations gross operating surplus: Australian Prudential Regulatory Authority (APRA); the Commonwealth department of Family and Community services; State Auditors-General; State insurance offices and the Survey of Major labour costs (a); Private Health Insurance Administration Council, report on organisations financial operations.

Life insurance corporations and pension funds gross operating surplus: Australian Prudential Regulatory Authority (APRA); State insurance offices and survey of Superannuation Funds.

Taxes less subsidies on production and imports: Commonwealth and State budget papers and Auditors’ General Reports, Commonwealth Department of Finance and administration ledgers and supplementary departmental documents; joint ABS/Commonwealth Grants Commission annual return (a); Commonwealth Department of Finance and Administration quarterly ledger; State government monthly and quarterly statements of receipts and expenditure; local government authorities.
Appendix 2.

Compilation/estimation methods

Production approach: The accounts do not cover illegal activities such as prostitution and illicit drugs. Adjustments are made for under-reporting of income for taxation purposes when using taxation data for compiling the estimates of GOS and gross mixed income.

Not compiled at current prices.

Quarterly chain volume estimates of gross valued added at basic prices are derived in the prices of the previous financial year ending June 30, using a number of different estimation methods. "Double deflation" is used for agriculture in which some components of output and intermediate input are derived using deflation and others by quantity revaluation. For government administration and defence, quarterly estimates of hours worked are used as indicators of value added growth. For all the other industries growth in value added is estimated using output indicators - some using quantity indicators such as for mining, the utilities, health and education; and some using deflation such as for retail trade, wholesale trade and manufacturing. Most quarterly indicators within an industry are weighted together using current price value added weights (the previous year's in most cases) and in the remaining cases by revenue. From 1994-95 all quarterly estimates are benchmarked to annual estimates (in the prices of the previous year) derived in supply-use tables. Quarterly estimates are published at the one digit level (ANZSIC) for all industries and the two-digit level for some industries.

Expenditure approach:

Household final consumption expenditure: An adjustment is made to include the value of backyard production. Expenditure on tobacco products is estimated using a population approach and retail price information, rather than using data from the retail sales survey which would provide only partial information on the sale of tobacco products. Adjustments are made to retail sales data to allow for direct sales to households by manufacturers, wholesalers and direct sellers. Adjustments are made for purchases by households within the cash economy. However, no adjustments are made for expenditure on illegal goods and services, such as illegal drugs and illegal prostitution.

Government final consumption expenditure: Adjustments are made to defence expenditure to allow for the timing of deliveries of major items of defence equipment. Estimates for consumption of fixed capital are included.

Estimation at current prices:

Household final consumption expenditure: Retail turnover survey used to extrapolate from periodic annual benchmark for sales of goods to households. Dwelling rent is extrapolated from benchmarks obtained from five yearly population census using average rent data from the CPI and numbers of dwellings added to the stock of dwellings from the Building Activity Survey. Household expenditure on motor vehicles is obtained from data provided by a private sector company providing statistical services to the motor vehicle industry. Expenditure on services is compiled from a wide range of data sources including sales to households by various public and private sector enterprises for transport services, health services etc.

Private gross fixed capital formation: GFCF on dwellings is estimated using the quarterly Building Activity Survey for new construction and major extensions, and an additional allowance for
alterations and additions not covered by the Building Activity Survey using data from the periodic
Household Expenditure Surveys (usually five yearly). GFCF on other buildings and structures is
estimated using the quarterly Building Activity Survey and the quarterly Engineering Construction
Survey. GFCF on machinery and equipment is estimated by extrapolating annual benchmarks
using the quarterly Survey of Private New Capital Expenditure. GFCF on intangible fixed assets
are extrapolated using available indicators such as imports of computer software and the quarterly
survey of Mineral Exploration Expenditure.

Public corporations gross fixed capital formation: Annual benchmarks from GFS are extrapolated
using data from quarterly surveys of public corporations.

General government gross fixed capital formation: Annual benchmarks from GFS are extrapolated
using quarterly data from the Commonwealth and State Treasuries.

Changes in inventories: Estimates are compiled from the quarterly economic activity survey
(private sector) and government finance statistics.

Exports of goods and services: Provided directly from Australia’s balance of payments statistics.

Imports of goods and services: Provided directly from Australia’s balance of payments statistics.

Volume measures: All volume estimates are compiled in the prices of the previous financial year ending
June 30, and from 1994-95 are benchmarked to annual estimates (in the prices of the previous financial
year) from supply-use tables. Most components of household final consumption expenditure are deflated
using CPIs. For government final consumption expenditure, the health and education components are
directly estimated using quantity indicators and the remainder are deflated using wage rate and price
indexes related to intermediate inputs. Gross fixed capital formation is deflated using a combination of
import and domestic production price indexes. A complex supply-use model is used for equipment to
derive Paasche deflators from the Laspeyres elemental price indexes. All components of domestic final
demand are derived at the state level and then aggregated to obtain national estimates. Changes in
inventories are derived by deflating levels and then differentiating for all non-farm commodities. Quantity
data are used for farm commodities. Imports are derived by deflation at the 3-digit BEC by 5-digit SITC
level. Primary exports (about 80 percent of goods) are derived by quantity revaluation at the 8-digit level
of the HS. The remainder are price deflated.

Base year and update cycle: The chain volume measures are derived as annually-rewighted chain
Laspeyres indexes referenced to the current price values in the last but one complete financial year ending
June 30. Every year the reference year is advanced one year together with the introduction of a new base
year, coinciding with the release of the June quarter accounts.

Income approach
Compensation of employees
Industry estimates for Australia are derived annually from the balanced S-U tables, except for the latest
financial year, for which estimates are obtained by extrapolation using movements based on the quarterly
data sources

Estimates of wages and salaries are made for each State and Territory by summing the following elements:
wages and salaries paid in cash to employees of the private non-farm sector and
civilian employees of the public sector, both of which are on a basis adjusted for
pay periodicity;
farm wages and salaries;
changes in provisions for future employee entitlements (not yet included); payments to members of the defence forces; payments made to the staff of Australian embassies and consulates overseas; the value of income paid in kind; and adjustments for labour income included in the balance of payments statistics.

Gross operating surplus: Private non-financial corporations and quasi corporations
Quarterly data for company profits, net interest paid and depreciation from the survey are applied to the corresponding annual benchmark estimates for these components of GOS. There are a number of other components of GOS which cannot be collected in the Profits Survey, including the Inventory Valuation Adjustment (IVA), FISIM payable, imputed insurance service charges and adjustments relating to the capitalisation of software, mineral exploration expenditure and artistic originals. The IVA is estimated directly each quarter and aggregated to derive annual estimates, while the other components of the GOS of private non-financial corporations are either allocated using appropriate indicators or estimated by linear trend interpolation and extrapolation.

Gross operating surplus: Public non-financial corporations and Quasi corporations
Estimates are compiled from annual financial statements included with the annual reports of the corporations and quasi corporations and Auditor-General reports. A quarterly survey of large public non-financial corporations and quasi corporations is conducted to obtain revenue and expenditure data.

Gross mixed income
Estimates of unincorporated enterprises’ gross mixed income are derived separately for the farm and non-farm sectors. Annual gross mixed income by industry for non-farm unincorporated enterprises is derived from Taxation Statistics supplemented by information from ABS and other sources.

Net business income (excluding amounts pertaining to agriculture) from Taxation Statistics is adjusted as follows to derive GMI for Unincorporated enterprises:

<table>
<thead>
<tr>
<th>Gross mixed income equals net business income</th>
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<tbody>
<tr>
<td>plus investment allowances deducted in the taxation data</td>
</tr>
<tr>
<td>plus depreciation allowed in the taxation data</td>
</tr>
<tr>
<td>plus net interest, land rent and rent on natural resource assets paid</td>
</tr>
<tr>
<td>plus a finance lease adjustment</td>
</tr>
<tr>
<td>plus owner-builders’ gross mixed income</td>
</tr>
<tr>
<td>plus net non-dwelling rent received</td>
</tr>
<tr>
<td>plus adjustment for understatement of net business income</td>
</tr>
<tr>
<td>plus adjustment for home production of goods</td>
</tr>
<tr>
<td>plus non-life insurance adjustment</td>
</tr>
<tr>
<td>plus capitalised software adjustment</td>
</tr>
<tr>
<td>less FISIM</td>
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<tr>
<td>less IVA.</td>
</tr>
</tbody>
</table>

Estimates for net interest, land rent and rent on natural resource assets are prepared using a matrix of flows for each of the three components. The matrices represent a fully balanced system of flows between each sector.

Gross operating surplus: Dwellings owned by persons
GOS for ownership of dwellings is derived as gross rent (both actual and imputed) less operating expenses (but before the deduction of consumption of fixed capital). An estimate of GOS for dwellings owned by sectors other than households is deducted to obtain GOS for dwellings owned by persons.
Gross operating surplus: General Government
Quarterly estimates are derived from the annual estimates by interpolation and extrapolation using a linear trend model.

Gross operating surplus: Financial enterprise
At present there are no ABS surveys which provide direct quarterly estimates for the GOS of financial corporations. Consequently, the quarterly estimates are obtained by linear trend interpolation and extrapolation.

Taxes less subsidies on production and imports
Information about Commonwealth and State general government production taxes and subsidies is extracted from administrative sources such as the Commonwealth Department of Finance and Administration quarterly ledger, and State government monthly and quarterly statements of receipts and expenditure. Quarterly data for local government rates are collected from a sample of local government authorities. As no specific information is available on the actual quarterly incidence of fringe benefits the annual liability data for years ended 31 March which are obtained from the ATO are allocated to quarters using linear trend interpolation.
1. Introduction

Bhutan has started compiling National Accounts in late eighties with the launch of a UNDP funded Project. Since then, it has been estimating Annual GDP and its related Aggregates. The National Accounts Section of the CSO was set up in 1988 although attempts were made to make the estimates available since 1980 both in current and constant prices. The 1968 System of National Accounts is adopted.

Apart from GDP by Production approach at factor cost and at market prices and in constant Prices, we also bring out GDP by expenditure in current price, consolidated accounts of the nation and external transaction with detail tables on Capital formation and Gross Domestic savings. However GDP by expenditure at constant price is not compiled at the moment the base year for national accounts is 1980.

The CSO brings out the National Accounts Report annually with a time lag of less than a year. The estimates of Gross Domestic Product in respect of Agriculture, Mining, Manufacturing, Electricity, Transport, Trade are based on Production Approach while construction sector of the private as such is based on commodity flow approach and for government, the information are compiled from the budgetary document of the Ministry of Finance. For other sectors like Finance, Government etc, the estimates are based on their annual accounts.

At present, any statistical discrepancy arising from differences either on data and concepts used are embedded in the private consumption expenditure which is estimated as a residual.

The National accounts estimation in the country needs to be improved not only in terms of data, methodology of estimation and concepts but also in the accounting framework and schedule of publication.

The national accounts estimates are still based on 1980 price which is too far back. Attempts are being made to bring the base year to 2000.

The revision and rebasing of national accounts involves much more than the updating of rates and ratios. It also includes the improvement of the methodology of estimation, expansion of scopes and coverage etc.

2. Implementation of 1993 SNA

The framework of compilation of National Accounting is based on the concepts, classifications and recommendations of the UN System of National accounts 1968.

The implementation of the 1993 UN System of National Accounts in Bhutan will be given due consideration after having built the strong quality database. Once a decent national accounts database and
suggested series for the revision of national accounts is compiled, then definite estimation methodology can be adopted according to 1993 SNA.

The CSO has a project funded by ADB in which their main focus is on improvements of National Accounts statistics. The main objectives of the Technical Assistance in the Project are the strengthening of the Statistical system in the country. One of the major considerations was the revision of the accounts in consistency with the 1993 SNA, both in concepts, format and estimation techniques.

In the past years through the ADB Project, the CSO was able to conduct a pilot survey on Household Income and Expenditure. Under the ongoing ADB Project another nation-wide survey on Living Standard is to be carried out by the end of 2002.

The results of these surveys will be a valuable input for the re-basing of the Consumer Price Index, the re-basing of the National Accounts and finally to derive the Personal consumption expenditure which will be used to revise the GDP by the Expenditure side in line with 1993 SNA.

Attempts are being made to compile the accounts by Institution. Government Accounts and Financial Institutions are the first two accounts that are being taken up.

3. Assessment of data for quarterly GDP

The estimates of National Accounts are based on administrative records though the information is scanty and disorganised. The various line ministries have now started having their own statistical sections for generating various types of statistics in their sectors in which the present problems of getting information will be solved to some extent.

The main sources of data for compilation of National Accounts are the secondary data from the administrative source and some reports of few ad-hoc surveys carried out. Few case studies have been carried out in the past to come up with Gross value added Ratio (GVAR). These ratios need to be updated. On the whole, data is quite scanty. A lot of data gap exists even for compiling the annual estimates.

For the agricultural sector, it is the annual production data that are not readily available. The Report of the agriculture survey carried out in 2001 is yet to be out. For live stock, we get the livestock census data from the livestock office. For forestry, data on forest product is availed from the forestry office on an annual basis.

Mining: information on Annual production of minerals
Manufacturing: The main data source is the Annual Financial Statements of all the major industries and the quarterly Production figures of these major industries.
Electricity and water: Data on electricity generation is available from the Power department. Revenue earned from water.
Construction: data on construction materials and Government budget for construction works are used.
Transport, storage and Communication: Number of vehicles
Wholesale and retail Trade & Hotels and Restaurants: Sales turnover data
Finance, Insurance and Real Estate: Annual reports of the Institutions
Government: Government Budget.
For the GDP by the Expenditure side, Government Expenditure was compiled from the budget Document and Private Expenditure was a residual item. A survey on the Household Income and Expenditure was carried out in 2000 and the Report will be used for getting Private consumption expenditure. The only data that are readily available are the quarterly Production data of all the major Industries which can be used for compiling quarterly Gross Value added emerging from Manufacturing sector. Initiatives have to be taken with the data suppliers to come up with Quarterly data for sectors like Mining, Finance, Insurance and Government. For the other sectors, appropriate indicators may have to be developed.

4. Initial estimation of QGDP

So far, no quarterly estimates have been made.

5. Plan for compilation of QGDP

The compilation of Quarterly GDP is one of the activities to be taken up by CSO within these five years. The activity may be taken up with technical assistance through the ongoing ADB Project or further Technical Assistance may have to be sought. The officials working in the National accounts section may be given some short training or study tour to learn how QGDP is being compiled in other countries.

The CSO has a very ambitious programme for the Improvement and implementation of the 1993 SNA. However, the biggest challenge will be the availability of resource and Technical assistance besides the support and co-operation needed from all the government and private agencies with regard to timely and quality data.

6. Proposed plan for the improvement and implementation of 1993 SNA in Bhutan

The CSO has availed the free advisory services of the Regional Advisor on National Accounts of UN ESCAP. The advisor was able to assess the existing National Accounts Statistics and then prepare programme of activities for 2002-2007 on the improvement and implementation of 1993 SNA based on the discussion and inputs of sector specialists.

The proposed improvement of the SNA in Bhutan includes the implementation of the 1993 SNA along the ISWGNA recommendations endorsed by the Statistical Commission in its meeting in March 2001.

The following are the proposed improvement that will be adopted by the CSO within the period 2002-2007 divided into three period namely 2002-2003,2004-2005, 2006-2007.

A. Adoption of Selected Conceptual Recommendations of the 1993 SNA

Inclusion of consumption of fixed capital of government fixed assets including infrastructure in the estimation of GDP
Inclusion of Mineral exploration in capital formation.
Measuring development and purchase of software and artistic originals in capital formation.
Measurement of growth of cultivated assets as output and addition to inventory
Treatment of FISIM and insurance based on 1993 SNA recommendations.
Treatment of pension equity as part of household savings
Improving the measurement and estimation of remittances of workers abroad
Breakdown of government consumption expenditure into individual and collective.
B. Accounts and Tables

Annual GDP and Other national accounts aggregates

Improve basic data input and compilation of transactions.  
Compilation of annual estimates based on the 1993 SNA (minimum data set)  
GDP by production and expenditure at current and constant 2000 prices.  
Value added by Industry at current (required) and constant prices (optional)  
Accounts of the Nation (production, income, capital and financial)  
Rest of the World account (consistent with BOP rev5).

Compilation of recommended accounts (recommended data sets)
Supply and Use Table  
Government Sector Accounts  
Financial Sector Accounts  
Government Expenditure by COFOG  
Household Consumption Expenditure by COICOP  
GDP by Type of Income

Quarterly GDP
GDP by production at current price  
GDP by expenditure at current price

C. Prices and Volume Measures

Price indices with base year 2000  
CPI – change of base year to 2000  
Producers prices for goods producing industries with 2000 as base year  
Primary industry: agriculture, forestry  
Secondary industry: mining, manufacturing, electricity  
Export and Import price indices with 2000 as base year

Estimation of 2000 constant price annual GDP  
GDP by Production  
GDP by Expenditure

Trial estimation of chained volume measure of annual GDP by production.

D. Improvement of system and quality of National Accounts Compilation

Development of computerised database for national accounts compilation  
Preparation of Compilation Manual for Annual National Accounts.  
Setting of revision and release calendar of national accounts including metadata.
1. Introduction

Hong Kong Special Administrative Region (HKSAR) has quite a long history of compiling quarterly national accounts. The quarterly Gross Domestic Product figures were first released officially in August 1991 with a time series back-dating to first quarter 1973. Apart from releasing GDP and its expenditure components at current and constant prices, HKSAR compiles quarterly economic aggregates Real Gross Domestic Income, Gross National Income and Real Gross National Income. In addition, the quarterly constant price GDP by economic activity will be released for the first time in end July 2002.

The purpose of quarterly accounts is to give an overall picture of the short-term macroeconomic situation. There are at least 3 main uses of quarterly national accounts:

A tool for taking economic policy decisions, particularly the management of monetary and fiscal policies.

A tool for detecting the phase of economic cycles, highlighting positive and negative changes over time.

A tool for business cycles analysis and econometric forecasting modelling.

2. Data sources for compiling Gross Domestic Product

Expenditure approach: The quarterly expenditure-based GDP measures the total expenditures on the final use of goods and services, comprising final consumption expenditure, gross capital formation, and exports, net of their import content. The basic data for estimation of the expenditure categories of GDP are described in the following paragraphs.

Private consumption expenditure refers to the final consumption expenditure of households and non-profit institutions serving households. Main data sources include external trade statistics, economic surveys, household expenditure surveys and administrative data.

Government consumption expenditure: Data sources include government accounts data and income and expenditure data of quasi-government institutions.

Gross domestic fixed capital formation: The main data sources for various components of the gross domestic fixed capital formation are:
Public sector construction: government accounts data and administrative data from public corporations.

Private sector construction: value of work put in place from annual and quarterly surveys on construction output.

Real estate developers’ margin: annual survey of the real estate sector (for the annual estimate) and extrapolation based on the growth rate of construction output in respect of private sector buildings from data collected from the quarterly survey on construction output (for the quarterly estimates).

Transfer costs of land and buildings: government accounts data (for stamp duties in connection with property transactions), and administrative data on number of property transfer cases, average property transaction value and average rate of charge (for estimates of legal fees and agents’ commissions).

Changes in inventories: Data are mainly collected from annual and quarterly economic surveys.

Exports and imports of goods (including domestic exports and re-exports): Are mainly based on external trade statistics.

Exports and imports of services: The basic data sources include (a) Tourism statistics from the Hong Kong Tourism Board (for expenditure of incoming tourists), data on household surveys (for per capita expenditure abroad of Hong Kong residents), and administrative data on number of Hong Kong residents travelling abroad. (b) Annual and quarterly surveys on services covering transport, trade-related services, insurance, and financial services. (c) Administrative data e.g. for government services.

Production approach: The data sources for compiling quarterly constant price value added include a wide range of statistical data: business receipts and PPIs obtained from various monthly and quarterly economic surveys, consumer price indices, trade statistics, banking statistics, various administrative returns from government departments and related indicators.

3. Estimation methods of Gross Domestic Product

A. Expenditure approach:

1. Estimation of current price data:

Private consumption expenditure: Private consumption expenditure is estimated by first compiling estimates of consumption expenditure on goods and services in the domestic market, then adding residents’ expenditure abroad for non-business purposes, and deducting expenditure of non-residents in the domestic market. For consumption expenditure in the domestic market, the benchmark estimates are derived using the commodity flow method. The quarterly estimates are derived by extrapolation of the benchmark data using value indicators (e.g. retail sales, restaurants receipts), volume indicators (e.g. population, employment in selected services industries), and administrative records (e.g. rental of public housing). The estimate of residents’ expenditure abroad is derived by multiplying the number of residents’ outbound trips (based on administrative records) for non-business purposes by the estimate of per resident person’s expenditure abroad (based on household survey data).
Government consumption expenditure: Government consumption expenditure is computed as the sum of compensation of government employees and purchases of goods and services by the government units, less sales receipts for goods and services provided by these government units.

Gross domestic fixed capital formation: The estimate of gross fixed capital formation in new buildings, including dwellings, at purchasers’ prices covers the value of work put in place, real estate developers’ margin and transfer costs incurred on purchasers in acquiring the assets. Real estate developers’ margin of new buildings and structures is estimated by taking the sales value of property less the sum of the current cost of the land which the property stands on and the project development outlays (including payments to contractors, architectural, engineering, other professional fees and project related expenses). Adjustments are made to discount holding gains on land over the course of project development. The margin covers all newly developed properties, irrespective of whether they are completed during the period in question or are still under construction; whether they have been fully sold or partly sold, awaiting sale, or have in fact been sold before the period in question. For buildings that are not yet put on the market for sale, their current market values are estimated based on information on the assessment values provided by real estate developers who report data to the economic survey. For acquisition of existing buildings, only the transfer costs are included. For private sector, the quarterly estimate of the value of work put in place is based on the quarterly survey on construction output. For public sector, the quarterly estimate is based on government accounts data and administrative records from public corporations.

Gross domestic fixed capital formation in machinery and equipment is estimated using the commodity flow method. The estimate at purchasers’ prices is derived by adding the distributors’ margin to the value of retained imports of capital goods. The latter is based on external trade statistics. The estimate also takes account of domestically produced machinery and equipment based on data from economic surveys.

Changes in inventories: They are derived as the difference in book value of inventories between the beginning and the end of the reference period, with adjustment for appreciation of the value of inventories within the period. The adjustment is made by revaluing the opening and closing book values of inventories at the average current prices of the period by means of appropriate price indices.

Imports and exports of goods: Imports and exports of goods are based on monthly external trade statistics.

Imports and exports of services: Data on receipts from inbound tourism are based on special inquiries conducted by the Hong Kong Tourism Board. The estimate of residents’ expenditure abroad is compiled from data from household surveys (for per capita expenditure abroad of Hong Kong residents) and administrative records (for the number of outbound trips by residents). For services other than travel, the benchmark estimates are based on data from annual surveys on imports and exports of services. The quarterly estimates are compiled by extrapolation of the annual benchmark data using quarterly value and volume indicators from quarterly surveys and administrative records.

At present, imports of goods are valued at c.i.f. and hence inclusive of insurance and freight associated with the imports of goods. In order to balance out the cost of services provided by resident units included in the value of imports of goods, an item of “adjustment for import shipment” is added to the exports of services.

2. Estimation of constant price data:

Private consumption expenditure: The constant price estimates of consumption expenditure on goods and services in the domestic market are obtained by deflation of the values at current prices, at disaggregated level, by the respective goods and services components of the consumer price indices.
Government consumption expenditure: Compensation of employees - deflation by the tailor-made salary rate index for government employees. Purchases of goods and services by government units and quasi-government institutions - deflation by the tailor-made government purchases price index. Sales by government to household and enterprises - deflation by the tailor-made price index.

Gross domestic fixed capital formation: Building and construction work put in place deflated by type-specific construction output deflators derived with reference to the appropriate tender price indices (for buildings) and the input-based indices on labour and material cost (for civil engineering works). Real estate developers’ margin extrapolated using the real growth rate of the output in respect of private sector buildings, as the volume indicator. Transfer costs of land and buildings—Stamp duties deflated by the property price index and the indices on stamp duty rates. Legal fees extrapolated using the number of property transfer cases as volume indicator. Agents commission deflated by the property price index. Machinery and equipment deflated by the unit value index of retained imports of capital goods.

Changes in inventories: Petroleum products—quantities of petroleum products revalued at base year prices. Others deflated by the unit value indices of retained imports of the respective commodity groups.

Imports and exports of goods: deflation of the values at current prices, at disaggregated level, by the corresponding unit value indices (compiled from external trade data), and for some commodities, by the specification price indices compiled from data obtained from the monthly specification price survey.

Imports and exports of services: Receipts from inbound tourism—deflation of the values at current prices by the tailor-made Tourist Price Indices compiled by the Hong Kong Tourism Board. Other services—deflation by the tailor-made price indices compiled from data on freight rates, air fares, wage indices etc.

Base year and update cycle: The base year of the constant price estimates is currently 1990. The base year is updated about every 10 years. The previous base years used were 1973 and 1980. Time series data backdated to 1961 are published. Data for 1986 onwards are based on prices in 1990. Data series from 1961 to 1986 are linked using different base years.

B. Production approach:

1. Estimation of quarterly constant price data:

In theory, the constant price value added (VA) is equal to the difference of the constant prices gross output (GO) and intermediate consumption (IC). Unlike the annual figures, much less information on gross output and intermediate consumption can be collected from companies for deriving quarterly GDP. Moreover, detailed data required for compiling various deflators of the appropriate GO and IC components are not available. Other approaches for compiling quarterly constant price VA have to be applied.

In considering the methodologies of constant price value added by economic activities in Hong Kong, reference has been made to the recommendations of international statistical organisations (the IMF, Eurostat and OECD) and the practices of statistically advanced economies (e.g. Australia, New Zealand, and UK). The method selected to obtain constant price value added for a particular economic activity also depends on the data available in respect of that economic activity.

Constant price value added of economic activities in Hong Kong is generally compiled using four methods: (a) single extrapolation of base year value added by deflated gross output measures e.g. business receipts deflated by PPI; (b) single extrapolation of base year value added by volume/quantity measures such as volume of trade and physical units of outputs; (c) single extrapolation of base year value added by input
indicators such as hours worked; (d) double indicators methods. The first two methods are most frequently applied in Hong Kong for compiling quarterly constant price value added, as in statistically advanced economies.

**Single extrapolation by deflated gross output measures**

In calculating deflated gross output, relevant price deflators are needed. For manufacturing, producer’s price indices (PPIs) are used as price deflators of gross output. For construction, price deflators employed include type-specific construction output deflators (e.g. offices, residential buildings, civil engineering works), the Civil Engineering Works Index (CEWI), building services tender price index and other price indices. For hotels and boarding houses; air, land and maritime transport activities, respective PPIs are also used.

**Single extrapolation by volume/quantity indicators**

The method of single extrapolation by volume/quantity indicators is commonly applied under two circumstances. The first circumstance is where the prices of the output of economic activities are both theoretically and practically very difficult to measures, as in the case of wholesale, retail and import/export trade margins and output of financial intermediation services indirectly measured (FISIM). The second circumstance is where quantity indicators are highly correlated with volume of output and hence provide good proxies for estimating constant price value added (e.g. the number of stock transactions is used as indicator to extrapolate the constant price value added of stock and share companies).

**Single extrapolation by input indicators**

In extrapolation by input indicators, the commonly used indicators are deflated wages and hours worked. Deflated wages indicators are applied to economic activities of which the output is estimated by cost approach, viz. the government and private non-profit bodies output in Hong Kong. For indicators of hours worked, they are at present applied to selected business service industries.

**Double indicators method**

In double indicators method, it requires detailed data on the outputs and inputs of respective economic activities and their prices. Owing to data availability problem, this method is not commonly used by statistically advanced economies in deriving quarterly constant prices value added. In Hong Kong, double indicators method is applied to the electricity, gas and restaurants industries.

4. **Compilation of seasonally adjusted GDP data series**

To measure economic growth in a quarter, some economies use year-on-year change in GDP (GDP in the reference quarter compared with that in the same quarter, proceeding year). General speaking, this approach enables the discounting of the influence of seasonal variations on GDP growth to certain extent. Furthermore, analysis on a year-on-year basis has the practical merit that it is generally well understood by data users. However, it is not sensitive enough to reveal turns in economic cycles. Quarter-to-quarter changes in the seasonally adjusted series, with the seasonal variations removed, can normally capture the turning points over the economic cycle more promptly than the year-on-year series, and hence is more useful for analysis of short-term fluctuations.

The “X-11 ARIMA” method has been used by HKSAR in compiling seasonally adjusted GDP data series. This method was developed by Statistics Canada and is used commonly world-wide. Under this method, diagnostic tests on the presence of seasonality in a data series are first carried out. Data series which does not display a distinct seasonal pattern or in which the irregular elements are predominant fail to pass the
diagnostic tests and seasonal adjustment should not be performed on them. The diagnostic tests also check for the presence of stable seasonality throughout the time series. Stable seasonality refers to the situation in which the seasonal effects are recursive in the same period each year throughout the time series.

For data series that displays abrupt changes in the seasonal patterns from one period to another, seasonal adjustment is not done. For data series which shows a clear and stable seasonal pattern, the data series are subject to iterative cycles in which seasonal factors are computed at various stages. A final set of seasonal factors is then derived for application in seasonal adjustment.

The seasonal adjustment of the quarterly GDP data series has been performed at the aggregate level. Results of diagnostic tests indicate the presence of seasonality in the GDP data series. The series of seasonal factor shows that GDP has a relatively lower seasonal factor in the first and second quarters and a higher factor in the third and fourth quarters. This pattern repeats systematically each year.

Seasonally adjusted data series are currently compiled for the aggregate GDP and some of its components, including private consumption expenditure, government consumption expenditure, exports of goods, exports of services, imports of goods and imports of services. However, seasonally adjusted data series is not compiled for gross domestic capital formation as no clear seasonal pattern is found in this component.

When comparing the quarter-to-quarter changes of the deseasonalized GDP series with the year-on-year changes of original GDP series, it is observed that the quarter-to-quarter changes in the seasonally adjusted GDP series are generally more responsive to turns in the economic cycle.

While the seasonally adjusted GDP series provides useful signal to detect changes in the underlying direction of economic activity or the occurrence of turning points over the economic cycles, the figures for particular quarters should not be interpreted in isolation. Rather, the seasonally adjusted figures for several consecutive quarters should be analysed together in order to ascertain whether an evolving turning point has actually developed. Furthermore, there are instances where a negative quarter-to-quarter change in the seasonally adjusted GDP only signifies a moderation in economic growth rather than an economic downturn.

5. Benchmarking quarterly GDP to annual GDP

Annual estimates of nominal GDP are not computed as the sum of the four quarterly estimates for the year but on the basis of detailed industry data compiled from more comprehensive data sources of annual survey. Thus, the yearly sums of the quarterly estimates would not be expected to be equal to the independently compiled annual estimates.

It is necessary to re-align or benchmark the quarterly estimates with the annual estimates. Benchmarking of quarterly estimates to annual estimates will ensure consistency in these estimates. The Denton benchmarking technique is adopted and results in a revised series of quarterly estimates with growth rates similar to the original series, but whose annual totals are equal to the annual estimates.

If the differences between the yearly sums of the quarterly estimates and the annual estimates were constant, a simple approach would be to distribute the differences among the four quarters using a fixed ratio. However, as the differences vary from year to year, this approach would introduce significant breaks or discontinuities between the fourth quarter estimate of the previous year with the first quarter estimate of the current year.
The introduction of these artificial discontinuities may be avoided through quadratic minimisation to obtain a series of re-aligned quarterly estimates which parallels the original series but whose annual totals equal the annual estimates. What this procedure does is to minimise the differences between the re-aligned and original series subject to the constraint that the yearly sums of the re-aligned estimates are equal to the annual estimates.

Mathematically, the problem is find a series of re-aligned quarterly estimates, \( y_{i,t} \) by minimizing

\[
\sum \left( \frac{\left( (y_{i,t} - y_{i,t-4}) - (x_{i,t} - x_{i,t-4}) \right)^2}{x_{i,t}} \right)
\]

subject to \( \sum_{t=1}^{4} y_{i,t} = a_i \)

where \( x_{i,t} \) denotes the original estimates for quarter \( t \) in year \( i \)
\( y_{i,t} \) denotes the re-aligned estimates for quarter \( t \) in year \( i \)
\( a_i \) denotes the annual benchmark value in year \( i \)

With this procedure, the adjustments applied to each observation are proportional to its magnitude; the larger values will be adjusted by a larger extent than the smaller values. By avoiding the introduction of artificial discontinuities between the fourth quarter and the first quarter of the following year, this procedure has the further advantage of preserving the seasonality of the original series.

6. Revision practice and publication schedule of GDP

In HKSAR, the first release of GDP in respect of a period is called “Preliminary figures”. When more data become available, the preliminary figures will be revised. This routine is in accordance with international practice to compile and release GDP figures at the earliest possible time by using only partial data. All those figures published subsequently, on revision, are called “Revised figures”. The figures are finalised when data from all regular sources are incorporated.

For annual GDP by expenditure components, preliminary figures are released about two months after the reference year. For annual GDP by economic activity, preliminary figures are released about eleven months after the reference year because of data limitation. Subsequently, GDP figures compiled under expenditure and production approaches are revised based on latest information available until they become finalised around the third March after the reference year. Conceptual framework and methods of compiling GDP are detailed in the annual publication on “Gross Domestic Product” published in March each year.

Preliminary figures for quarterly GDP by expenditure components are released about two months after the reference quarter. The quarterly series are then revised and released based on latest information available, in particular when the annual figures are revised. Latest quarterly GDP are published in the quarterly report on “Gross Domestic Product”.

7. Future Development

The 1993 SNA has recommended the use of chain volume measure of GDP in tracking the changes in volume terms over time. Recognising that the chain indices are not additively consistent (e.g. chain dollar estimates of components do not add up to the total GDP), the 1993 SNA also recommends economies to publish the Laspeyres volume indices with a fixed base year in addition to the chain volume indices. Such Laspeyres volume indices have nevertheless to be rebased every five years or so, or at least every ten years.

Like most of the other Asian economies, in Hong Kong the volume of quarterly GDP is compiled based on the fixed base index approach. The quarterly constant price GDP with the new base year of 2000 will be released in mid-2002. Plan is in hand to rebase the constant price series every five years in future. We are also actively exploring the feasibility and desirability of compiling chain volume measure of GDP as part of the longer term development plan. This includes carrying out internal research studies on chain volume measures of GDP and monitoring the latest international developments in this subject.

As PPIs are important inputs for compiling constant price value added by economic activity, more PPIs for the service sector will be developed by phase. These include PPIs for storage, real estate management, real estate brokerage and agency, rental of machinery and equipment, stock and share companies, legal, accounting, auditing and bookkeeping services. However, in view of the special nature of some services (e.g. the one-off nature of consultancy services and the problems of identifying and measuring quality changes in some service products), more research on methodologies (including model pricing, charge-out rates) will need to be undertaken for developing PPIs for these service activities.
INDIA

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1. Introduction

The importance of Quarterly Gross Domestic Product (QGDP) estimates lies in providing the seasonality factors in the economy, structural trends during the year, as an early indicator of economic development, a framework for business cycle analysis, for analysis and forecasting purpose, and for studying price trends.

The Central Statistical Organisation (CSO) in the Ministry of Statistics and Programme Implementation is responsible for the compilation of National Accounts Statistics for India. Prior to 1999, the CSO was releasing only annual estimates of GDP and other related aggregates. Although the CSO was releasing the GDP estimates even before the close of the year in January/February (India’s financial year is from April to March) through the Advance Estimates of National Income, and an update in June after the close of the year, quarterly estimates of GDP, as such, were not attempted mainly because of lack of availability of quarterly data on agriculture sector.

Following India’s subscription to the system of Special Data Dissemination Standards (SDDS) of the International Monetary Fund (IMF) in 1997, which required release of QGDP estimates with the timeliness of one quarter, the CSO undertook methodological exercises to meet this requirement. Since the overriding approach for measuring GDP in the Indian annual national accounts is from data on production, it was decided to compile QGDP estimates, to begin with, only by economic activity. Further, the QGDP estimates would be compiled using the benchmark-indicator method, as there are no quarterly surveys of enterprises in India. In the annual national accounts, private final consumption expenditure and gross fixed capital formation are entirely or largely estimated using the commodity flow approach, as there are no annual surveys on consumption expenditure and enterprises (excepting registered manufacturing sector) for direct measurement of these aggregates. Surveys on household consumption expenditure, and on unorganised sector of the economy (which is quite significant in India, the unorganised segment in non-agricultural activities accounts for about 30 per cent of GDP) are conducted once in 5 years. Besides, budgets of general government and accounts of corporations have annual periodicity. The absence of quarterly/annual surveys of consumption expenditure, accounts of corporations and government hampered compilation of QGDP estimates by expenditure aggregates.

The methodological exercises undertaken by the CSO during 1997-1998 mainly focussed on identifying appropriate administrative and other centralised data sources, so that suitable indicators are available for compiling QGDP estimates by economic activity using the benchmark-indicator method. The major problems of availability of sectoral data at quarterly intervals with appropriate timeliness was identified to be in the sectors agriculture, and manufacturing. A series of meetings with the concerned administrative ministries enabled the CSO to overcome these problems (i) by developing a crop-calendar of harvests of various crops in different seasons and states in the case of agriculture sector, and (ii) by reducing the timeliness of production index, for the manufacturing sector. Trial exercises were also carried out to aim at achieving consistency between annual and quarterly estimates, and also to avoid step problem between the GDP estimates of Q4 and Q1 of the following year, following the benchmarking of previous year’s quarterly data with the annual estimates. In its efforts to compile QGDP estimates, the CSO received
valuable inputs from the OECD (through Mr. Derek Blades), IMF (through the two workshops conducted on quarterly estimates in Thailand), Australian Bureau of Statistics, and NSCB, Philippines.

The CSO started releasing the QGDP estimates beginning with the estimates relating to January-March 1999, both at constant (1993-94) and current prices, on 30.6.1999. For the purpose of analysis and comparison, the CSO released the quarterly GDP data from 1996-97 onwards. The quarterly GDP estimates are now released by the CSO on the last working day of each quarter, the estimates referring to the previous quarter. As stated above, the quarterly accounts provide exclusively estimates from the production approach and a breakdown by expenditure categories is not being compiled.

The major users of QGDP data in India are the Ministry of Finance, Planning Commission of India, the Reserve Bank of India (which is the Central Bank of the country), the industry associations, and the research institutions. The QGDP data is used extensively by the governmental agencies in the macro-economic policy formulations (monitoring fiscal deficit, structure and growth of economy, announcing credit policies, etc), and by the industry associations in analysing the business cycles, and forecasting market trends.

2. Data sources used to compile QGDP estimates

The sector-wise details of data sources and the methodology of estimating the QGDP at constant prices is described below:

A. Agriculture

The responsibility for collection, compilation, and release of agricultural statistics lies with the Agricultural Statistics Authorities in the States, and the Ministry of Agriculture at the Centre. While the statistics of area under different crops are collected on complete enumeration basis through village level officials and are maintained in village records, estimates of yield for principal crops are based on about 500,000 crops cutting experiments conducted every year. For other crops, data on production is derived through commodity administrative boards, and adhoc sources. The data on agricultural inputs are available from the annual cost of cultivation studies, and benchmark surveys on feed of livestock.

Prior to 1997, data on quarterly production of agricultural crops was not available. The crop production data (only for principal crops which account for about 70 per cent of total value of output) was available according to two crop seasons, namely, Kharif (July to October) and Rabi/Summer (November to June). The Indian agriculture year is from July to June.

Since most crops have a duration of more than a quarter, the production of crops cuts across the quarters for most crops in various states of the country. The 1993 System of National Accounts (SNA) recommends that crop output be distributed among quarters in proportion to the costs incurred in each quarter and that value added imputed to quarters when there is no harvest, should be recorded as work-in-progress. Another alternative to this is the harvest stage approach (i.e. to record the output of the crops in the quarters in which it is harvested). Considering the merits and demerits in the two above stated approaches and having regard to the problems of natural disasters affecting the crop production (which would require treating such losses under other changes in volume of assets account), the IMF sponsored workshops for countries having a large share of agriculture in their GDP during 1998/1999, recommended the adoption of harvest stage approach for the agriculture sector.

Following adoption of the harvest stage approach for the agriculture sector, the National Sample Survey Organisation (NSSO) of the Ministry of Statistics and Programme Implementation updated the Indian Crop
Calendar in collaboration with State Agricultural Statistics Authorities. The Indian Crop Calendar presents state-wise, season-wise, and crop-wise harvesting calendar in different months. Using this crop-calendar, and assuming that the harvest in the current year follows the crop calendar, the Ministry of Agriculture compiles quarterly agriculture production data for the principal crops. This compilation procedure involves apportioning the state/season/crop output (estimates on which are compiled/updated right from the sowing stage) in different months of harvest (in proportion to number of days of harvest in each month) and aggregating this monthly production of crops/states/seasons, into various quarters. Since this procedure assumes that crops are harvested in different parts of the country according to the Indian Crop Calendar, there is a need for regular updating of the crop calendar.

For crops other than the principal crops, which account for about 30 per cent of value of output of crops, the annual forecast is prepared using regression techniques, targets, or likely estimates announced by the Ministry of Agriculture. The annual forecast is apportioned equally in all the four quarters.

While adopting the quarterly agriculture production data according to the above procedure in the national accounts, the problem of consistency between annual and quarterly national accounts remained as agriculture year (July to June), and financial year (April to March) differed, and for the purpose of annual national accounts, production during agriculture year is assumed to have accrued in the financial year. When we add up the four quarters crop production data, this was at variance with the annual estimates, which used the agriculture year production. This problem has been overcome by adjusting the quarterly production data in the financial year to the production data in the agriculture year on prorata basis.

Quarterly data on inputs of agriculture sector are not separately available, as the cost of cultivation studies have an annual periodicity. Therefore, for the purpose of QGDP, inputs are estimated on the basis of previous year’s input-output ratio.

**B. Livestock**

The responsibility for collection, compilation, and release of livestock statistics lies with the Departments of Animal Husbandry and Dairying in the States, and the Ministry of Agriculture at the Centre. The data on population of livestock are available through the 5-yearly Indian Livestock Census. Statistics on output of major livestock products, namely, milk, egg, and wool (accounting for about 75 per cent of livestock sector’s output) are collected through the annual Integrated Sample Survey. For other products, data on production is derived through commodity administrative boards, and adhoc sources. The data on livestock sector’s inputs are available from the benchmark surveys on feed of livestock.

In the case of livestock sector too, earlier only annual estimates of production were available, through the Integrated Sample Survey for milk, egg, wool, and meat. The survey is conducted in three sub-rounds, namely, summer, rainy, and winter seasons. Special tabulation of the questionnaires of the three sub-rounds of this survey enabled in the generation of quarterly production data of these four livestock products.

For other livestock products, which account for about 25 per cent of value of output of livestock sector, the annual forecast is prepared using regression techniques, targets, or likely estimates announced by the Ministry of Agriculture. The annual forecast is apportioned equally in all the four quarters.

Quarterly data on inputs of livestock sector are not separately available, as the inputs of livestock sector are based on benchmark surveys. Therefore, for the purpose of QGDP, inputs are estimated on the basis of previous year’s input-output ratio.
C. Forestry

The responsibility for collection, compilation, and release of forestry statistics lies with the Forest Departments of State Governments, and the Ministry of Forests and Environment at the Centre. The data on forest products, namely, industrial wood, fuel wood and minor forest products are collected as by product of administration, and are generally based on auctions of forest products conducted by these Departments. However, the CSO uses only the data on industrial wood and minor forest products from this source and does not use the statistics on fuel wood production made available by the official agencies, on the ground that these data do not represent actual production, since most of the fuel wood is gathered by households. Therefore, for the purpose of estimation of GDP, output of fuel wood is estimated from the consumption side making use of the results of 5-yearly consumption expenditure surveys of households conducted by the National Sample Survey Organisation. For the inputs, a fixed input-norm of 10 per cent of output is adopted, which is based on analysis of budget documents of forest departments during the base year.

The time lag in the availability of annual data from the state forest departments is about two years. It was felt that co-ordinating with these agencies for quarterly data is not a feasible option. In the absence of quarterly data on production of major and minor forest products, the annual forecast of value of output/inputs of these items, prepared on the basis of likely production figures for the year/targets or extrapolation, is apportioned equally to the four quarters of the year. This sector, however, accounts for only about 1 per cent of GDP. The estimates of input are derived on the basis of previous year’s input-output ratio.

D. Fishing

The responsibility for collection, compilation, and release of fisheries statistics lies with the Fisheries Departments of State Governments, and the Ministry of Agriculture at the Centre. The data on production of inland and marine fish is compiled through sample surveys on inland water bodies and the various landing centres. For the inputs, the CSO uses fixed input ratios for different categories of fish, which are based on type-studies conducted by the state governments and other research bodies.

The quarterly estimates of production of inland and marine fish are available from the Ministry of Agriculture through tabulation of questionnaires collected in different quarters of the sample surveys on inland water bodies and landing centres. The estimate of value of input for the reference quarter has been derived on the basis of previous year’s input-output ratio.

E. Mining

Mining activity in India is predominantly in the Public Sector. The source agencies for the major minerals are the Indian Bureau of Mines (IBM), Coal India Ltd. (CIL) and its subsidiaries, and Oil & Natural Gas Corporation (ONGC). For the data on minor minerals, the source agencies are the State Geological Departments. Most data on mining is available as a by-product of administration. The Annual Reports of the companies engaged in mining activity provide sufficient details to compile national accounts. For inputs, the source agencies are the Office of Coal Controller, IBM, ONGC and Oil India Limited. An enterprise survey conducted in 1992 by the CSO is also a source on minor minerals.

Since Reports of companies are not available on quarterly basis, the indicators used for QGDP estimates are the production data of minerals. The data on production of coal, crude petroleum and the Index of Mining are available on monthly basis, from the Office of the Coal Controller, Indian Bureau of Mines, Ministry of Petroleum, as a by-product of administration. These data are also used to compile India’s production index, namely, the index of industrial production for the mining sector, compilation of which is
the responsibility of the CSO. The estimated inputs in the mining sector are derived separately for fuel minerals and all others, based on the previous year’s input-output ratios for these minerals.

F. Registered Manufacturing

The registered sector of manufacturing covers all factories employing 10 or more workers and using power and those employing 20 or more persons but not using power. Data on products and by-products of the factories covered under Factories’ Act, 1948 and material inputs are collected annually through the Annual Survey of Industries (ASI) by the CSO. Generally factories employing 100 persons or more are covered on census basis and other factories are covered on a sample basis. Non-response is taken care of by adjusting the estimates of GDP on the basis of the number of workers in the non-responding units assuming that the gross value added per worker in the responding and non-responding unit is of the same order.

In the absence of quarterly surveys on enterprises, the data on Index of Industrial Production (IIP) for the manufacturing sector which is compiled by the CSO and is available on monthly basis at 2-digit level of National Industrial classification (NIC) is used as the indicator for the sector. The source agencies for the data used in the compilation of IIP are the administrative Ministries/agencies, which collect the production data of various commodities from the industrial undertakings. These undertakings submit monthly production returns to the concerned administrative Ministries/agencies. The timeliness for the release of IIP is 6 weeks and it is the responsibility of the CSO to compile the IIP for the country. These data have been used to develop average quarterly IIP at 2-digit level, and to prepare QGDP estimates at constant prices.

G. Unregistered Manufacturing

The responsibility for conducting large scale sample surveys in India lies with the National Sample Survey Organisation (NSSO) of the Ministry of Statistics and Programme Implementation. Statistics on unregistered manufacturing sector (factories other than those covered under the ASI) are collected once in five years on sample basis through the follow-up surveys of the Economic Census (which is conducted once in about 10 years to obtain an aerial frame of enterprises). The survey distinguishes three separate types of unregistered units, namely, directory establishments employing 6 persons and more and non-directory establishments employing 1 to 5 persons and own account enterprises. In the absence of annual surveys on this sector, the Index of Industrial Production (IIP) compiled by the CSO is generally used for extrapolating the base year estimates for the annual national accounts.

As in the case of registered manufacturing, the IIP data is used to compile QGDP estimates, in the absence of quarterly enterprise surveys.

H. Electricity, Gas and Water Supply

The information on output/sales and material inputs of electricity, gas supply by pipeline and water supply, are available in respect of public sector departmental undertakings, Central/State Power Corporations, and State Electricity Boards. For data on bio-gas, the source agencies are the Ministry of Non-conventional Energy and the Khadi and Village Industries Commission (KVIC). The estimates of water supply are based on the data of responding municipalities and estimates of workforce engaged in this activity. The annual estimates of workforce are made through extrapolation techniques and are based on 5-yearly employment and unemployment household surveys conducted by the National Sample Survey Organisation, and the 10-yearly Population Census, which is conducted by the Registrar General of India.
For preparing annual estimates, the estimates of value added at base year prices are moved forward with the help of quantum indices prepared from the data on quantity of energy sold. In the case of gas, production is valued at base year prices. The estimates for water supply are prepared separately for private and public sectors, by using the workforce figures and deflating the current year’s estimates.

For the QGDP estimates, the indicator for the electricity sub-sector is the monthly Index of Industrial Production for Electricity segment. The source agency for supply of data on generation of electricity is the Central Electricity Authority of Ministry of Power. This agency compiles the data on generation through production returns furnished by the electricity generating units. In respect of gas sub-sector, no data is available on quarterly basis. The annual data for this sector is available from the Gas Authority of India Ltd., and the Khadi and Village Industries Commission. Therefore, for this sector, the annual forecast is apportioned equally into four quarters. For the water-supply sub-sector the central government revenue expenditure deflated by the consumer price index for industrial workers, CPI(IW), which is available on monthly basis, is taken as the physical indicator for the QGDP estimates.

I. Construction

The basic approach for estimating annual GDP of construction sector is (a) through commodity flow approach in respect of accounted part of the construction, and (b) through expenditure approach in respect of unaccounted part of construction (normally using locally available materials and labour intensive).

In respect of (a) above, information on (i) basic construction materials with regard to their current production, export and import, intermediate consumption etc. are available from official sources, and on (ii) other construction materials from the norms provided by National Buildings Organisation (NBO), Central Public Works Department (CPWD) and Central Building Research Institute (CBRI) etc. on various types of constructions namely; residential buildings, non-residential buildings, roads, bridges, etc.

In respect of (b) above, expenditures made on the unaccounted part of construction are compiled separately for (i) public sector from the budget documents of Administrative Departments and annual reports and Departmental and Non-Departmental Undertakings, (ii) private corporate sector from the information provided by Tea, Coffee and Rubber Boards, and (iii) household sector from the decennial All India Debt and Investment Survey (AIDIS) conducted by the National Sample Survey Organisation.

The annual estimates of GDP at constant prices for construction are prepared by deflating the current price estimates using appropriate deflators for different types of construction works. The current price estimates of the value of output are prepared separately for accounted construction and labour intensive unaccounted construction. Whereas the value of output for accounted construction is prepared through commodity-flow approach from (i) the value based on inputs of five basic construction materials, (ii) the value based on inputs of other construction materials, and (iii) the value based on inputs of factor payments for construction activity, that of unaccounted part of construction is prepared by the expenditure approach using data from sample surveys, budget documents and annual reports.

For the purpose of QGDP estimates, the key indicators of accounted construction sector are taken to be the production of cement, steel, bricks & tiles and the IIP relating to fixtures & fittings, data on which is available on monthly basis from official sources. For the construction part unaccounted in commodity flow approach, since quarterly data on expenditures made by public sector, private corporate sector, and household sector are not available, the annual forecast is apportioned equally into the four quarters.
J. Trade, Hotels and Restaurants

The principal sources of data for annual national accounts are (i) budget documents of Administrative Departments and annual reports and Departmental and Non-Departmental Undertakings for public sector, (ii) Reserve Bank of India (RBI)’s Company Finance Studies for the private corporate sector, and (iii) 5-yearly enterprise surveys for the unorganised segment of private sector. For the annual estimates of the unorganised sector, an index of gross trading income is specially compiled in the CSO which is computed from the value of output of marketable surplus (available from type studies) and trade and transport margins (estimated from retail prices and wholesale prices) in commodity producing sectors.

While the annual GDP estimates are compiled for the public and private corporate sectors from direct data sources, those of unorganised segment are prepared by extrapolating the base year estimates with the index of GTI. The base year GDP estimates for the unorganised segment are compiled as a product of per worker value added (from the 5-yearly Enterprise Surveys conducted by the CSO) and the workforce engaged in the activity (from the 5-yearly employment and unemployment surveys conducted by the NSSO and the 10-yearly population census).

For the QGDP estimates, the key indicator for the entire sector, which is largely in the unorganised sector, has been taken as the index of gross trading income, which is computed on the basis of the total estimated gross trading income. The gross trading income for each commodity producing sector (agriculture, livestock, forestry, fishing, mining, registered manufacturing, unregistered manufacturing and imports) is computed by using the quarterly estimates of value of output of the respective sectors.

K. Railways

The responsibility for compiling statistics on railways, which is entirely in the public sector, lies with the Railway Board of the Ministry of Railways. The sources of data for this sector are the budget documents and other publications brought out by the Ministry of Railways.

The annual estimates of GDP at current prices are prepared by analysing the budget documents, those at constant prices are prepared by moving forward the base year estimates with the combined indicator of passenger kilometres and net tonne kilometres (with the earnings from passengers and freight as weights), data on both these indicators is available from the Ministry of Railways.

For the QGDP estimates at constant prices, data on the above two key indicators of this sector, namely, passenger kilometres and net tonne kilometres are available on monthly basis from the Ministry of Railways.

L. Transport other than Railways

The activities of transport – railways and other transport, storage and communication are covered separately for the public sector, private organised sector and unorganised sector. For public sector components, the requirements relating to factor incomes, capital formation etc. are met with from the budget documents and annual reports of the departmental and non-departmental commercial undertakings. For private sector particularly the private shipping companies and air transport, annual reports of the companies are available which provide required information for compiling GVA and other aggregates. For the unorganised segments of other activities namely; mechanised road transport, non-mechanised road transport, other sailing vessels other than ships, the services incidental to transport and storage, the source is the 5-yearly enterprise surveys. For the annual estimates physical indicators, like registered commercial vehicles, cargo handled at major ports, etc., data on which is available from administrative sources, are used.
While the annual GDP estimates are compiled for the public and private corporate sectors from direct data sources, those of unorganised segment are prepared by extrapolating the base year estimates with physical indicators. The base year GDP estimates for the unorganised segment are compiled as a product of per worker value added (from the 5-yearly Enterprise Surveys conducted by the CSO) and the workforce engaged in the activity (from the 5-yearly employment and unemployment surveys conducted by the NSSO and the 10-yearly population census). The annual estimates are compiled for mechanised road transport on the basis of the number of workers/vehicles including buses, for non-mechanised road transport and inland water transport by using a weighted volume index of index of manufacturing and agricultural production, the weights being their contribution to the GVA in the base year, for shipping companies and supporting services, the estimates by using a composite index of the volume of cargo handled and passengers carried by the Indian shipping companies and the cargo handled at major ports. In respect of air transport, the indicator used is the index of revenue passenger kilometres, cargo tonne kilometres and mail tonne kilometres.

For the QGDP estimates, indicators used are number of registered commercial vehicles (estimated from the production of commercial vehicles), cargo handled at major ports, and passenger kilometres flown and freight tonne kilometres flown, in the case of civil aviation. Data on these indicators are available on monthly basis from the administrative sources.

**M. Communication**

The principal sources of data for this sector are the Department of Telecommunications, Department of Posts, and the annual reports of departmental and non-departmental commercial undertakings. The source of data for the private part of communication sector for the base year is the 5-yearly enterprise survey, and for the annual estimates, the growth observed in the public sector.

While the annual estimates of GDP at current prices for this sector are prepared by analysing the budget documents and annual reports, those at constant prices are prepared by extrapolating the base year estimates with the help of the combined weighted index of number of money orders, number of telegrams, number of telephones and number of postal articles handled, weights being the respective gross earnings in the base year. The data on physical indicators mentioned above are available with considerable time lag from administrative sources.

Since data on the physical indicators used in annual estimates are available with a time lag and, therefore, not suitable for compiling QGDP estimates, an alternative indicator in the form of number of telephones, including cellular phones installed in the country, data on which is available from administrative sources, is used as the indicator for the QGDP estimates.

**N. Banking and Insurance**

As most of the banking and insurance activities are in the public sector, requisite data are available from the annual reports. Also, the RBI provides information on the banks including the Reserve Bank. The information on co-operative credit societies is available from the Statements Relating to Co-operative Movement in India published by National Bank for Agricultural and Rural Development (NABARD).

For preparing the annual estimates, the methodology used is to move forward the base year's estimates with appropriate physical indicators. In the case of the banking sub-sector, the physical indicator is based on aggregate deposits and bank credits deflated by the wholesale price index and in the case of insurance sector, the indicator is based on premiums net of claims (both life and non-life).
For the QGDP estimates, data on aggregate bank deposits and bank credits and the wholesale price index are available on monthly basis, from the Reserve Bank of India and the Ministry of Commerce and Industry. For the insurance sub-sector, concerned Corporations are making available quarterly data on life and non-life insurance premiums received.

O. Public Administration & Defence

The GDP from the activities of public administration and defence comprises compensation of employees and consumption of fixed capital (CFC). The sources of data for deriving this estimate are, interalia, the budget documents of centre/state/UT governments and the local bodies and information available in the reports of the Comptroller and Auditor General (CAG) of India. The estimates at constant prices are derived by deflating the estimates at current prices by the consumer price index (industrial workers).

Since the data on centre/state/UT expenditure on compensation of employees is not available on quarterly basis, the revenue expenditure data of the central government, which are available on a monthly basis are used as an indicator to derive the quarterly net domestic product (NDP) estimates for this sector. The estimates of CFC are derived by apportioning equally the annual forecast among all the four quarters. The data on consumer price index are available on monthly basis. The current price estimates are, therefore, deflated by the consumer price index of the reference quarter to arrive at the net and gross domestic product for the quarter.

P. Other Services

For rest of the services activities, the estimates are broadly compiled separately for (a) public sector, based on the budget documents of administrative departments, and annual reports of departmental and non-departmental commercial undertakings, (b) private corporate sector, based on RBI’s Company Finance Studies, and (c) private-unorganised sector based on 5-yearly benchmark surveys. The annual estimates are built up using various physical indicators. The various sources for these indicators are the Population Census (for dwellings), NSSO (for rent per dwelling), Bar Council (for no. of registered advocates), Ministry of Human Resource Development (for recognised educational institutions), Enterprise Surveys (for value added per worker) and Directorate General of Employment and Training (DGE&T) (for no. of workers in the organised sector, which is required to derive the workforce in unorganised sector) and other adhoc sources.

This sector covers a large number of services: real estate, ownership of dwellings, business services, educational, research and scientific, medical and health, sanitary, religious, legal, recreation and entertainment, personal and international extra-territorial bodies and services, n.e.c. For the Annual Estimates, the estimates for the base year are moved forward by physical indicators like the growth in the workforce or by deflating the estimates at current prices by the consumer price index. The estimates for the ownership of dwellings are derived by applying the reference year's growth rate on the estimated number of census dwellings in rural and urban areas separately over the previous year's estimate of gross rentals; the estimates for real estate services by moving forward the base year estimates of GDP with the growth rate in the estimated number of urban dwellings; and in the case of business services, the total earnings of workers in the base year are moved forward with a composite indicator based on appropriate workforce. The indicators used in the preparation of Annual Estimates are annual figures, and data are not available at intervals of less than one year.

For the QGDP estimates, this sector is bifurcated into two components, namely, the public component and the private component. The public part QGDP is estimated using monthly revenue expenditure of the central government. For the private part, the annual forecast is apportioned equally into four quarters of the year.
3. Broad approach for compiling QGDP estimates

The QGDP estimates are compiled using the benchmark-indicator method, and take into account the quarterly performance of various sectors of the Indian economy, at sufficiently detailed levels. The methodology of preparing QGDP estimates, at constant (1993-94) and current prices, involves three steps, namely, (i) benchmarking of quarterly estimates at constant (1993-94) prices with the annual estimates, (ii) preparing quarterly estimates for the reference quarter at constant (1993-94) prices, and to avoid the step problem, and (iii) estimating the implicit price deflators for the reference quarter from appropriate price indexes, to derive QGDP estimates at current prices.

In the first instance, the QGDP estimates for different sectors of the economy were prepared at constant (1993-94) prices for the year 1996-97, by apportioning the annual output/input/GDP estimates of 1996-97 of various sectors at detailed level (at which quarterly production data is available) into the four quarters of the year, 1996-97 on the basis of the quarterly performance of physical indicators of the respective sectors.

For the subsequent years, i.e. for the years 1997-98 onwards, the QGDP estimates of different sectors at constant (1993-94) prices are prepared using quarter-on-quarter growth rates, according to two alternative methods, depending upon whether the GDP estimates are to be derived as value of output minus value of inputs or as GDP estimates directly. In the case of sectors, agriculture, forestry, fishing and mining, the former approach is followed. Whereas the output data is extrapolated with the production data, inputs are estimated using the previous year’s input-output ratios. In the case of all other sectors, the QGDP estimates are compiled directly, using the production data. For those items for which quarterly production data is not available, the estimates of value of output/GDP for such items are first derived for the entire current financial year, by using regression techniques and using past several years’ data on value of output of such items. These annual values of output of these items are then divided equally into the four quarters of the year.

A table showing the indicators used for QGDP estimates is placed at Annex-1. The data sources and brief method of compilation of annual GDP estimates is placed at Annex-2. Quarterly GDP data at current and constant prices is placed at Annex-3.

4. Estimates at current prices

The current price QGDP estimates are compiled by superimposing the relevant Wholesale Price Index/CPIs on the constant price QGDP data. Firstly, the quarterly sectoral implicit price indexes are computed using appropriate wholesale/consumer price indexes, with the help of past relationship between the annual implicit price indexes and the annual price indexes. Finally, the estimated quarterly implicit price indexes are multiplied with the constant price QGDP data, at sectoral level, to obtain current price estimates.

5. Benchmarking and seasonal adjustment techniques

Since the QGDP estimates are compiled on the basis of indicators and at all-India level only, whereas the annual estimates are compiled through detailed calculations at considerable disaggregated and also at state level, it is possible that the quarterly estimates of GDP may not add up to the annual estimates. This gives rise to the problem of allocating the discrepancy between the total of the quarters and the annual estimate to the quarters without destroying the quarterly pattern or the growth from the last quarter of the year to first quarter of the following year. This leads to the step problem. Although the CSO does not follow the Denton’s least square method or other techniques, the procedure it follows for benchmarking the quarterly
data with annual estimates avoids the ‘step’ problem partly. The CSO prepares the estimates for all quarters of the current year all the time (even while preparing Q1 estimates, it makes forecasts for Q2, Q3, and Q4, based on available data on forecasts, targets, and other auxiliary information) for the current year and makes them consistent with the annual forecasts of GDP made on this information. This procedure automatically adjusts the Q1 estimates so as to make them consistent with the annual forecasts, and thus avoids the ‘step’ problem between the estimates of Q4 of the previous year and the estimates of Q1 of the current year. However, the CSO is considering the use of available techniques to avoid the step problem.

The CSO does not compile seasonally adjusted QGDP data, mainly due to lack of demand for such data. Most users prefer to see the original data and deseasonalise the estimates themselves. None of India’s monthly data sets are presently seasonally adjusted.

6. Other issues

Revision Policy: The QGDP data are always revised along with the revisions in the annual national accounts, which are normally released in the months of January/February. Other than this, the QGDP data is revised only at the time of the release of Q4 data in June.

Frequency of Publication: The QGDP data are published through press notes every quarter, and is also simultaneously placed on the Ministry’s web-site www.nic.in/stat. Estimates are also included in the CSO’s annual publication, National Accounts Statistics.

User Forum: The Indian National Accounts takes advice from an Advisory body, namely, the Advisory Committee on National Accounts Statistics, which largely comprises various users from the academics and governmental agencies. This Committee is always headed by a noted academician, and gives feedback and guidance/advice on the CSO’s compilations on national accounts.

Analytical Framework: The annual national accounts of India are compiled following a mix of SNA 1968 and SNA 1993. These comprise the consolidated accounts of the nation, namely, Gross domestic product and expenditure; National disposable income and its appropriation; Capital finance; and External transactions accounts. The annual national accounts statistics also include estimates of domestic product (gross and net) by 18 major economic activities, private final consumption expenditure by object and by type of goods, domestic saving by type of institutions, capital formation by type of institutions, by type of assets and by industry of use, estimates of net capital stock by type of institutions and by industry of use, public sector transactions, and disaggregated statements. The input-output tables of India are compiled once in 5 years.

Classification systems: For the estimates of GDP by economic activity, India follows its National Industrial Classification 1987 (NIC-1987) which is broadly based on ISIC Rev.2 published by UNSD. The institutional sectors for which annual data is released in respect of saving, capital formation, and capital stock estimates refer to public sector (comprising administrative departments, departmental commercial undertakings and non-departmental commercial undertakings), private corporate sector, and household sector. For the private and government final consumption expenditures, India follows the SNA 1968 purpose classifications.

Transaction coverage: The data cover the entire economy, include all activities within SNA production boundary and there are no exclusions. However, production of goods (other than those in the agriculture, forestry and fishing) within the households for their own final consumption are not included.
Unrecorded activity: These are not explicitly accounted for. However, for the unorganised sector, estimates are based on work-force (which are compiled from the results of household surveys on employment and unemployment) and hence illegal activities are accounted for indirectly. For agriculture sector, estimates are based on land-use statistics and, therefore, illegal crops are covered indirectly, under ‘area under other crops’. In the forestry sector, 10 per cent of production of major forest products is assumed to be from illegal felling of trees. Firewood production is captured from the consumption estimates and, hence account for illegal gathering of firewood. However, smuggling and other explicit illegal activities are not directly covered in the GDP.

Time of recording: The primary accounting methods used are on accrual basis for most transactions, but cash basis for some government purchases.

Valuation: Total GDP (at current and constant 1993-94 prices) by economic activity, is valued at factor cost, i.e. output is valued at factor cost and inputs at purchaser’s prices. The owner-occupied housing is valued at comparable rental value; and, non-market services at cost. The final consumption expenditure is valued at purchaser’s prices; inventories at basic prices; gross fixed capital formation at producer’s prices plus set-up costs.

Expenditure approach: The quarterly GDP estimates by expenditure aggregates are not compiled in India.

The annual GDP estimates by expenditure aggregates are compiled using various data sources. The estimates of government final consumption expenditure are compiled by analysing the budget documents of centre, state and local governments. The estimates of private final consumption expenditure are generally derived through commodity flow approach. The estimates of gross fixed capital formation (GFCF) are prepared through three independent approaches, namely, from the financing side (sum of saving and net capital inflow), from the asset side (construction and machinery and equipment) through the commodity flow approach, and from the expenditure approach (made by various industries). The estimates of GFCF made from the financing side are considered as firm estimates, and discrepancies with the GFCF estimates arrived from the other two approaches are shown separately. The estimates of change in stocks are prepared separately for the institutional sectors, public, private corporate and households, using annual data available on public and private corporate sectors and benchmark surveys conducted on households. Data on exports and imports are available from the Customs records, and are compiled using the HS classification. Estimates at constant prices are compiled in respect of all expenditure aggregates, except exports and imports.

Base year and update cycle: The constant price series referenced to now is 1993-94, and is proposed to be revised once in 5 years.

Geographic detail: The QGDP data are not available at sub-national level. The responsibility for compiling regional level domestic product estimates lies with the respective state governments. Annual estimates of domestic product compiled by the state governments for their respective states are available.

7. Future plans for improvement

As stated above, the CSO’s approach to derive the QGDP estimates by kind of activity through benchmark-indicator method is similar to the practice adopted by several countries. However, data gaps remain with reference to few activities, for which as per current methodology of QGDP, estimates are obtained by apportioning the annual forecast equally among the four quarters. Although, the activities where this equal apportionment is adopted account for about 15 per cent of the GDP, efforts are being made to plug these data gaps. These data gaps generally relate to services sectors and in particular due to
the absence of quarterly enterprise surveys, quarterly accounts of institutional sectors, and quarterly data on workforce. Lack of expenditure QGDP is also a weak area in Indian national accounts.

The National Statistical Commission (NSC), which was constituted by the Government of India, submitted its Report in August 2001. The NSC had made a number of recommendations for revamping and restructuring the statistical system of the country. Some of these recommendations pertain to filling up of the data gaps in the annual and quarterly national accounts. The Ministry of Statistics and Programme Implementation is now examining this Report with the purpose of implementing the recommendations. To begin with the CSO is contemplating on introducing annual enterprise surveys with four sub-rounds coinciding with four quarters of the year, so that direct data on the performance of unorganised segments of the economy are available. Also the CSO is examining the issue of using quarterly financial results announced by the companies listed on stock exchanges of the country. If these financial results provide suitable indicators, the data gaps in the QGDP estimates for the private non-financial corporations can be filled. Another area of developmental plans is the introduction of a service sector index (quarterly periodicity), on the lines of monthly index of industrial production (which covers mining, manufacturing, and electricity sectors). The CSO also has plans to introduce expenditure QGDP, when the NSC recommendations on implementation of various surveys on households, non-profit institutions serving households, and enterprises are implemented.
1. Introduction

The Statistical Office of Indonesia-BPS had studied compiling quarterly GDP (Q-GDP) after learning from the Philippines (NEDA) in 1987. The official Q-GDP for production as well as expenditure accounts were first published in 1998 with data from 1993. The current Q-GDP just issued in May 2002 covered the first quarter of 2002. Moreover since 1999, as the local autonomy movement has been launched in line with improving democratisation in Indonesia, the Central Bank of Indonesia (Bank Indonesia) in order to anticipate the economy changes especially at provincial level, requires the quarterly gross domestic regional product (GDRP) at provincial level. In this case Regional Statistical Offices should prepare the compilation of the Q-GDRP.

There are some users that always wait for launching Q-GDP; those are National Planning Board, Bank Indonesia, and fund managers. Bank Indonesia uses the Q-GDP besides for the purpose mentioned above also as complementary material when they study core inflation.

Number of sub-sectors that are estimated is 37, starting from agriculture up to services sub-sectors. Source of data and method of estimation are summarised in the appendix of this paper.

Since the annual GDP is total of four quarters of Q-GDP therefore there is no need for benchmarking. This is due to the fact that any revision of quarterly data is always inserted in the next quarter publication. However, officially there would be a benchmarking annual GDP to Input-Output table that are produced every five years. It is believed that GDP as part of I-O table is more reliable since it has been considered the balance of demand and supply in the system. Then benchmarking of Q-GDP would follow it.

Up to now, there is no publication of seasonal adjustment for Q-GDP. However, in the coming years there would be a plan to release seasonally adjusted as well as raw Q-GDP. This plan is in line with the program of revising base year from 1993 to 2003. Therefore the seasonal adjustment that has been done in this paper is still under study. In other words all data compiled in this paper are unofficial estimates.

2. X-12 ARIMA and identifying seasonality

Seasonal adjustment procedures for analysing quarterly data in this paper use the X-12 ARIMA computer program that was developed in the U.S Department of Commerce-US Census Bureau. By writing particular instructions the program will run seasonal adjustment as we want. The procedure of writing this program for this paper follows the one that has been done by John Kuiper in analysing seasonality on some commodities in order to capture the effect of Idulfitri (Moslem holidays before and after Ramahdan) in Indonesia in 2002. However this program is still new thing for most BPS staffs therefore they should learn it intensely. Only summary results such as identifying seasonality with some indicators are presented. This program also gives results of monitoring and quality assessment statistics indicated by M01 up to M07, Q1 and Q2. The description of these indicators is presented in the appendix. Moreover the X-12 also gives a
facility that allows us to run a smoothness test that showing which is the smoother one, direct or indirect adjusted results.

Both current and constant prices series of Q-GDP 1993-2002 are identified. Although there are 37 sub-sectors compiled for the quarterly GDP data, in this occasion only 9 sectors are identified for analysing seasonality.

3. Results and findings

As shown in table 1 and table 2 we can see that most of the 9 sectors and 5 kinds of expenditures exhibit seasonal patterns. Only the financial sector does not show any seasonal pattern either for current or constant prices series. Furthermore, mining, construction, and services sectors have seasonal patterns in constant prices series but not in the current prices series. This evidence also reveals that total GDP has a seasonal pattern in constant price series but not in the current prices series as we can see on graphic G1 and G2.
Table 1. Summary of Identifying Seasonality of GDP by industrial origin at current and constant prices, using X-12 ARIMA

<table>
<thead>
<tr>
<th>Type of Expenditure</th>
<th>M01</th>
<th>M02</th>
<th>M03</th>
<th>M04</th>
<th>M05</th>
<th>M06</th>
<th>M07</th>
<th>Q</th>
<th>Q2</th>
<th>Identifiable seasonality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture</td>
<td>Cu</td>
<td>0.449</td>
<td>0.186</td>
<td>0.185</td>
<td>1.034</td>
<td>0.200</td>
<td>0.106</td>
<td>0.224</td>
<td>0.328</td>
<td>0.345</td>
</tr>
<tr>
<td></td>
<td>Co</td>
<td>1.349</td>
<td>0.967</td>
<td>2.258</td>
<td>0.414</td>
<td>3.000</td>
<td>0.773</td>
<td>0.254</td>
<td>1.038</td>
<td>1.048</td>
</tr>
<tr>
<td>Mining</td>
<td>Cu</td>
<td>0.775</td>
<td>0.158</td>
<td>0.000</td>
<td>0.414</td>
<td>0.200</td>
<td>0.657</td>
<td>3.000</td>
<td>1.342</td>
<td>1.448</td>
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<tr>
<td></td>
<td>Co</td>
<td>0.365</td>
<td>0.122</td>
<td>0.156</td>
<td>0.569</td>
<td>0.200</td>
<td>0.322</td>
<td>0.241</td>
<td>0.371</td>
<td>0.402</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>Cu</td>
<td>0.067</td>
<td>0.063</td>
<td>0.000</td>
<td>0.569</td>
<td>0.200</td>
<td>1.043</td>
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<td>Co</td>
<td>0.113</td>
<td>0.023</td>
<td>0.000</td>
<td>0.052</td>
<td>0.200</td>
<td>1.092</td>
<td>0.568</td>
<td>0.520</td>
<td>0.590</td>
</tr>
<tr>
<td>Elec. Water S. &amp; C.Gas</td>
<td>Cu</td>
<td>0.089</td>
<td>0.030</td>
<td>0.000</td>
<td>0.414</td>
<td>0.200</td>
<td>0.493</td>
<td>0.753</td>
<td>0.583</td>
<td>0.660</td>
</tr>
<tr>
<td></td>
<td>Co</td>
<td>0.190</td>
<td>0.051</td>
<td>0.000</td>
<td>0.724</td>
<td>0.200</td>
<td>1.610</td>
<td>0.163</td>
<td>0.166</td>
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</tr>
<tr>
<td>Construction</td>
<td>Cu</td>
<td>0.327</td>
<td>0.118</td>
<td>0.000</td>
<td>0.724</td>
<td>0.200</td>
<td>0.515</td>
<td>0.952</td>
<td>1.597</td>
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</tr>
<tr>
<td></td>
<td>Co</td>
<td>0.309</td>
<td>0.016</td>
<td>0.000</td>
<td>0.724</td>
<td>0.200</td>
<td>0.018</td>
<td>0.825</td>
<td>0.439</td>
<td>0.491</td>
</tr>
<tr>
<td>Trade, Hotels &amp; Rest.</td>
<td>Cu</td>
<td>0.081</td>
<td>0.033</td>
<td>0.000</td>
<td>0.569</td>
<td>0.200</td>
<td>0.591</td>
<td>0.592</td>
<td>0.562</td>
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<td>0.414</td>
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<td>0.496</td>
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<tr>
<td>Transport. &amp; Communication</td>
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<td>0.061</td>
<td>0.000</td>
<td>0.259</td>
<td>0.200</td>
<td>0.490</td>
<td>0.767</td>
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</tr>
<tr>
<td></td>
<td>Co</td>
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<td>0.028</td>
<td>0.000</td>
<td>0.724</td>
<td>0.200</td>
<td>0.139</td>
<td>0.591</td>
<td>0.350</td>
<td>0.390</td>
</tr>
<tr>
<td>Bank &amp; Other Financial Inst.</td>
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<td>0.430</td>
<td>0.165</td>
<td>0.000</td>
<td>0.879</td>
<td>0.200</td>
<td>0.232</td>
<td>2.366</td>
<td>1.132</td>
<td>1.251</td>
</tr>
<tr>
<td></td>
<td>Co</td>
<td>0.709</td>
<td>0.064</td>
<td>0.000</td>
<td>0.569</td>
<td>0.200</td>
<td>0.083</td>
<td>1.104</td>
<td>0.534</td>
<td>0.590</td>
</tr>
<tr>
<td>Services</td>
<td>Cu</td>
<td>0.734</td>
<td>0.194</td>
<td>0.000</td>
<td>0.569</td>
<td>0.200</td>
<td>0.493</td>
<td>1.015</td>
<td>0.783</td>
<td>0.866</td>
</tr>
<tr>
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<td>Co</td>
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<td>0.062</td>
<td>0.000</td>
<td>0.724</td>
<td>0.200</td>
<td>0.607</td>
<td>0.631</td>
<td>0.652</td>
<td>0.734</td>
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<tr>
<td>GDP</td>
<td>Cu</td>
<td>0.081</td>
<td>0.021</td>
<td>0.000</td>
<td>1.345</td>
<td>0.200</td>
<td>0.237</td>
<td>1.258</td>
<td>0.746</td>
<td>0.847</td>
</tr>
<tr>
<td></td>
<td>Co</td>
<td>0.358</td>
<td>0.036</td>
<td>0.000</td>
<td>0.724</td>
<td>0.200</td>
<td>0.547</td>
<td>0.388</td>
<td>0.466</td>
<td>0.519</td>
</tr>
</tbody>
</table>

Note: Cu is for current prices series. Co is for constant prices series.

Of course there are still many things that may lead us to scrutinise other evidence such as there is no aligning between constant prices and current prices series for particular sectors and the total GDP. However, the first question may arise that prices do not have any seasonal pattern. Or should not there be any relation between seasonality in constant price series with current price series?

Meanwhile, only two data series of GDP by expenditure that have seasonal patterns are government consumption expenditure (GCE) at constant price and gross domestic fixed capital formation (GDFCF) at constant price.

The interesting thing is especially the evidence that most of the economic sectors have seasonal patterns, but PCE does not have any seasonal pattern. As another evidence that in the last several years more than 70% of GDP at constant price is accounted for by PCE. Some initial conclusions may be able to explain this evidence is that since the 1997 economic crisis has been surrounding Indonesia had triggered increasing in the poverty. Before crisis attacking Indonesia, that was just one year before the crisis, number of population below the poverty line in 1996 was 34.5 million or 17.7 percent of total population. After three years, number of population below the poverty line in 1999 was 37.1 million or 18.0 % of total
population. This situation was almost at same level as depicted in 1984, that 35 million people were below the poverty line or 21.6 percent of total population. There is an opinion that only high-income people have seasonal pattern on their consumption. But one may still argue that during peak season all terminals at the big cities crowded by people. As also mentioned by John Kuiper, Idulfitri affects railways transportation by 32.08 percent above when the Idulfitri fall at certain month. In this occasion people always want to go back to their provinces or villages to see their relatives. As additional information, Idulfitri follows lunar calendar instead of solar calendar. However, according to the National Social-Economic Survey 1997 (SUSENAS) only 12.50 percent of the population had travelled. Moreover the time reference of this survey was during October-December 1996 i.e. at the peak season. Another thing, although there is no adequate evidence but many Indonesians perceive that just several days before the Idulfitri many people who live in their province (village) receive money from their relative who live in the city, but these money would not be spent immediately. They only spend small portion of that money, and the rest will be saved. They would spend it on building or renovating their houses or for financing education of their children. Therefore the consumption will spread all the year.

Other arguments may happen in method of estimation of quarterly PCE. Since PCE is estimated by using consumption elasticity with respect to GDP. This is estimation method for annual PCE that is applied for the quarterly GDP. It means that the elasticity is constant throughout the year where this is not always true. Therefore there should be an effort in order to respond to those questions whether due to the inappropriate method of estimation in a way to capture the lunar calendar. As mentioned above Idulfitri refers to lunar calendar is significantly showing huge household consumption. It seems, as if people work all the year and spend most of their income only for celebrating the Idulfitri.

Table 2. Summary of Identifying Seasonality of GDP by type of expenditure at current and constant prices, using X-12 ARIMA

<table>
<thead>
<tr>
<th>Type of Expenditure</th>
<th>M01</th>
<th>M02</th>
<th>M03</th>
<th>M04</th>
<th>M05</th>
<th>M06</th>
<th>M07</th>
<th>Q</th>
<th>Q2</th>
<th>Identifiable seasonality</th>
</tr>
</thead>
<tbody>
<tr>
<td>PCE</td>
<td>Cu</td>
<td>0.540</td>
<td>0.109</td>
<td>0.000</td>
<td>0.259</td>
<td>0.200</td>
<td>0.240</td>
<td>1.764</td>
<td>0.920</td>
<td>1.033</td>
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<tr>
<td></td>
<td>Co</td>
<td>0.764</td>
<td>0.136</td>
<td>0.032</td>
<td>0.259</td>
<td>0.306</td>
<td>0.739</td>
<td>1.560</td>
<td>0.958</td>
<td>1.073</td>
</tr>
<tr>
<td>GCE</td>
<td>Cu</td>
<td>1.570</td>
<td>0.449</td>
<td>0.374</td>
<td>0.569</td>
<td>0.285</td>
<td>0.080</td>
<td>1.466</td>
<td>1.030</td>
<td>1.102</td>
</tr>
<tr>
<td></td>
<td>Co</td>
<td>0.237</td>
<td>0.061</td>
<td>0.228</td>
<td>0.724</td>
<td>0.265</td>
<td>0.749</td>
<td>0.663</td>
<td>0.715</td>
<td>0.806</td>
</tr>
<tr>
<td>GDFCF</td>
<td>Cu</td>
<td>0.442</td>
<td>0.100</td>
<td>0.000</td>
<td>0.569</td>
<td>0.260</td>
<td>0.705</td>
<td>1.661</td>
<td>0.995</td>
<td>1.119</td>
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<tr>
<td></td>
<td>Co</td>
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<td>0.024</td>
<td>0.000</td>
<td>0.569</td>
<td>0.200</td>
<td>0.651</td>
<td>0.621</td>
<td>0.663</td>
<td>0.752</td>
</tr>
<tr>
<td>Export</td>
<td>Cu</td>
<td>0.775</td>
<td>0.094</td>
<td>0.000</td>
<td>0.724</td>
<td>0.200</td>
<td>0.407</td>
<td>1.686</td>
<td>0.862</td>
<td>0.957</td>
</tr>
<tr>
<td></td>
<td>Co</td>
<td>1.184</td>
<td>1.121</td>
<td>0.236</td>
<td>0.879</td>
<td>0.551</td>
<td>0.050</td>
<td>1.327</td>
<td>0.878</td>
<td>0.972</td>
</tr>
<tr>
<td>Import</td>
<td>Cu</td>
<td>0.696</td>
<td>0.135</td>
<td>0.000</td>
<td>0.052</td>
<td>0.200</td>
<td>0.339</td>
<td>1.953</td>
<td>0.793</td>
<td>0.875</td>
</tr>
<tr>
<td></td>
<td>Co</td>
<td>0.632</td>
<td>0.053</td>
<td>0.000</td>
<td>0.103</td>
<td>0.200</td>
<td>0.078</td>
<td>1.748</td>
<td>8.777</td>
<td>0.979</td>
</tr>
<tr>
<td>GDP</td>
<td>Cu</td>
<td>0.081</td>
<td>0.021</td>
<td>0.000</td>
<td>1.345</td>
<td>0.200</td>
<td>0.237</td>
<td>1.258</td>
<td>0.746</td>
<td>0.847</td>
</tr>
<tr>
<td></td>
<td>Co</td>
<td>0.358</td>
<td>0.036</td>
<td>0.000</td>
<td>0.724</td>
<td>0.200</td>
<td>0.547</td>
<td>0.388</td>
<td>0.466</td>
<td>0.519</td>
</tr>
</tbody>
</table>

Note: Cu is for current prices series. Co is for constant prices series

relative who live in the city, but these money would not be spent immediately. They only spend small portion of that money, and the rest will be saved. They would spend it on building or renovating their houses or for financing education of their children. Therefore the consumption will spread all the year.
If the Idulfitri is disregarded, the other problem may be in defining the ARIMA model. Although the X-12 twelve has been used in the USA and Canada that automatically can define the appropriate model but this program probably not suitable for capturing the effect of Idulfitri that refers to lunar calendar or the Indonesia economy as a whole. Fortunately, this program gives us possibility in defining the model that might be suitable for particular economy. But the process of defining would be time consuming since this is a ‘trial and error’ procedure.

4. Problem (possible) encountered

There could be a problem when the GDP that has been adjusted for the effects of seasonality are published, since only just four years ago the first official Q-GDP has been published. In this period, many people still faced difficulties in understanding the Q-GDP, especially when they compared the same quarter of particular year to the previous one. Of course, the economists and the decision-makers are able to understand it. Therefore it can be predicted that others may be puzzled by the seasonally adjusted series. This is a task for BPS in educating the users how to understand and to use the data. One of many other ways in educating the users is via seminars. But of course this will depend on the government budget to cover this need.

5. Suggestion for Improvement

Without avoiding the other sectors that still need attention, the significant evidence that should be tackled is to scrutinise the absence of seasonality in PCE. Besides undertaking ‘trial and error’ procedure in defining the ARIMA model such a quarterly household survey could be recommended. As for initial assessment, pilot survey is preferred especially conducted in the big cities and complemented in the some rural areas, which is also differentiating the high and low-income people. This survey could be used to answer the questions whether only high-income people have seasonal consumption, while the low-income people do not.

The design of the questionnaire should not be complicated, as in the SUSENAS there are many items and details that should be asked to the household. The simple question that will be asked to the household in percentage instead in nominal term, expected total amount of the consumption. Number of questions is about how much the household spends on food, transportation, health, education, and eating in restaurant. These kinds of questions also can be used for assessing and improving the estimation of sectors that are covered in that household survey, especially the services sectors. It is realised that the method of estimation for these sectors is still weak due to the lack of adequate data.

Jammal, Yahya., Quarterly National Accounts in Indonesia: Current Sources and Methods (Draft), Feb.2001
Kuiper, John., Seasonal Adjustment for Lebaran, Feb. 2002
KOREA

Jin Wook Park, Bank of Korea, Republic of Korea

1. Introduction

The Bank of Korea has compiled and published Gross Domestic Product of Korea, since it was entrusted with the official compilatory agency of National Income Statistics in 1957. Annual GDP data start from 1953 and quarterly data begin since 1968. GDP by kind of economic activity and expenditure on GDP are compiled on a quarterly and yearly basis, but cost-structure estimates of GDP are compiled annually.

The national accounts are, in the main, based on the 1968 System of National Accounts (1968 SNA). However, in 1999, when the base year was changed to 1995, some changes were made to align the accounts more closely with the 1993 SNA. Most of the changes affected the income accounts rather than the production account, but the valuation of imports of goods was changed from cost, insurance and freight (c.i.f.) to free on board (f.o.b.). The BOK is gradually introducing further elements, but full implementation of the 1993 SNA is not expected until the next change of base year in 2004.

Agriculture, forestry & fishing, and mining and manufacturing are estimated using the production approach. Output is obtained by extrapolating the output of the same quarter of the previous year using the related indicators such as the industrial production indices and the rate of increase of cultivation area, etc. Value added is estimated by multiplying the output by the value-added ratio.

Electricity, gas and water, transport, storage and communication, finance & insurance and other service industries are estimated using the income approach, or the double deflation method. Output and intermediate consumption are obtained from financial statements of related government agencies and enterprises. Value added is estimated by deducting intermediate consumption from output.

Expenditure on GDP such as final consumption expenditure of households and gross fixed capital formation are basically estimated through the commodity flow method (CFM).

Government final consumption expenditure is estimated using central and local government fiscal data. Estimates for exports and imports of goods and services are based on balance of payments and foreign exchange statistics.

Quarterly national accounts (QNA) are less reliable than annual national accounts (ANA), because the basic statistics from which QNA are derived tend to be less complete than those used in preparing annual estimates. Major revisions to QNA are made each year when ANA become available. However, minor revisions are made every quarter mainly for government sector.

A Korean seasonal adjustment method, BOK-X-12-ARIMA was developed in 1999 by adjusting the X-12-ARIMA of the U.S. Bureau of the Census to remove seasonality from Korean time series, which contain
variations specific to Korea. Using this method, seasonally - adjusted statistics of the national accounts started to be compiled from November of 1999.

Previous quarterly estimates within the same calendar year are revised when the figures for the next quarter are first published. We are subject to further revision when the figures for the full year are released. The annual and quarterly figures can also be revised when the annual estimates for the following year are published. After this, we are normally only revised at the time of the five-yearly rebasing.

2. Data Sources

The KNSO undertakes monthly or quarterly surveys for some industries, as noted below. Proper sampling techniques are used in all surveys. Financial statements collected by the BOK are used for those industries which are dominated by large enterprises, e.g., financial intermediaries.

- **Agriculture** As regards the production of grains, the basic sources for the quarterly estimates are planted area prepared by the Ministry of Agriculture and Forestry and the prices received by farmers obtained from the National Agricultural Co-operatives Federation. The number of livestock, broken down by year and by sex, is obtained quarterly from the Ministry of Agriculture and Forestry. Monthly data on prices of livestock are prepared by the Ministry of Agriculture and Forestry. The Production Cost Survey of Agriculture Products collects a breakdown of purchase costs by household farmers for a range of specific crops.

- **Forestry and Fishing** Tree-planting area statistics and felling permits data are provided by the Korea Forest Service, respectively. Since price data are not available for quarterly estimation, the unit costs of planting trees and price indices received from farmers are used to estimate price levels. The KNSO conducts a monthly survey called the Fishery Production Survey, which covers all types of fishing activity undertaken by households, co-operatives and enterprises. It collects data on the quantity and value of production.

- **Mining and quarrying and manufacturing** There is a monthly sample survey of these industries which is conducted by the KNSO. Data on the quantity produced, quantities of raw materials and inventory data are collected. This survey is used to construct the Industrial Production Index (IPI).

- **Electricity, gas and water supply** Quarterly data for electricity are obtained from financial statements of the Korea Electric Power Corporation. For those firms which generate electricity for their own final use, the only data collected relate to the quantity generated each quarter. For the gas and water producers, quarterly figures for sales values and quantities are obtained directly from the companies.

- **Wholesale and retail trade** there is a monthly KNSO survey, the Current Wholesale and Retail Trade Survey, which collects data on values of sales.

- **Financial intermediation and insurance** These enterprises supply the BOK with quarterly financial statements.

- **Transport and communications** Quarterly data on sales values are collected either from the enterprise, e.g., National Railroad Office, or from trade organisations.

- **Other services** Quarterly sales data are supplied by a number of sources. For some sub-industries the data are from the BOK’s own quarterly survey which also uses the KNSO register as the sample frame. Monthly data from the KNSO are available for certain of the other sub-industries. Also, data are obtained from trade organisations and the MOFE for government operations.
The KNSO operates a monthly household survey, called the Family Income and Expenditure Survey (FIES). It covers 72 cities in Korea, but excludes farmers’ and fishermen’s households; single person households; households which manage restaurants, inns or boarding houses and cannot separate consumption from production expenditure; and resident aliens’ households. The coverage of the survey is about 60 percent of the total population. It uses proper sampling and processing techniques, and collects information on income, occupation and detailed expenditure.

The BOK undertakes ad-hoc surveys whenever necessary. An example was a telephone survey of manufactures to update the split between household and business purchases of motor vehicles, PCs and mobile phones.

3. Compilation/estimation methods

A. Production approach

1. At current prices

The procedures followed for compiling current measures of QGDP for each industry are as follows:

- **Agriculture** For crops, the preliminary quarterly figures for output are based on changes in the area planted and prices paid to farmers obtained from the National Agricultural Co-operatives Federation. Intermediate consumption is based on growth in output and prices of seeds and fertiliser. Data on livestock numbers and those sent for slaughter are obtained from the Ministry of Agriculture and Forestry (MAF). They also supply a volume index for dairy products. These quantity figures are multiplied by the relevant prices obtained from the National Agricultural Co-operatives Federation to provide estimates of value of output. Value added is estimated using the previous year’s value-added ratio. These quarterly estimates are adjusted when annual data are supplied by the MAF.

- **Forestry** Preliminary current price output is estimated by applying the relevant component of the PPI to the constant price value. Intermediate consumption at current prices is derived by reflating the constant price value of the component.

- **Fishing** Monthly output figures are obtained from the KNSO’s Fishery Production Survey. Intermediate consumption is derived from the product breakdown at constant prices reflated using components of the PPI and CPI.

- **Mining and quarrying** Preliminary quarterly estimates for output are obtained from the constant price figures using the PPI for some products and actual prices from the Korea Mining Association for others. There is no need to make a special adjustment for exports, as is done for manufacturing, since little of the output is exported. Value added is derived using the value-added ratio to output from the quarterly and annual financial statements collected by the BOK.

- **Manufacturing** Preliminary quarterly estimates for value of output are obtained from the constant price figures using the PPI. However, the PPI does not cover exports, so these are subtracted first and deflated separately using the export price index. Value added is derived using the ratio to output from the quarterly and annual financial statements collected by the BOK.

- **Electricity, gas and water supply** Financial statements from KEPCO are used to derive quarterly and annual figures for output, intermediate consumption and value added. However, for those firms which
generate electricity for their own final consumption, only data on the quantity of electricity produced are available. In these cases, estimates of output for own final use are obtained by multiplying quantities by the unit price charged by KEPCO. Intermediate consumption is calculated by using the ratios from the 1995 product breakdown. Annual and quarterly financial statements, containing a full set of data, are available for the suppliers of gas and water.

- **Construction** The value of real output for the construction of new buildings is estimated using the area of new buildings. Area estimates are obtained by applying the average construction period to the floor area of authorised permits and allocating the estimated area for the project to the current period. The data on permits are adjusted to reflect work which is suspended. Current price output is derived by using a price index based on weighted input prices. For civil engineering, current price output is obtained from survey data. In all cases, intermediate consumption is estimated by applying changes in input prices to the constant estimates. Data for construction by the government are obtained from the budget.

- **Wholesale and retail trade** Preliminary quarterly output figures are derived by applying the margin mark-up from the 1995 I-O tables to the transaction amounts of agricultural and manufactured goods. Quarterly value added is obtained by extrapolating the value-added ratio to output from the same quarter of the previous year, using the change in the ratio from financial statements.

- **Transport and communications** For the annual estimates, either financial statements reported to the BOK are used, or the KNSO survey. These sources give output, intermediate consumption and value added. Quarterly sales are collected for each sub-industry, but coverage is not complete. Therefore, the growth over the same quarter of the previous year is used to derive output. Intermediate consumption is then estimated by applying appropriate price indices (components of the PPI and CPI) to the constant price breakdown. Adjustments are made to the quarterly estimates when the annual figures are derived, but by simply prorating the differences.

- **Financial intermediation and insurance** The output of financial intermediation is made up of commissions and financial intermediation services indirectly measured (FISIM). FISIM is calculated by deducting interest paid from property income received. The data, together with that for insurance, comes from quarterly financial statements provided to the BOK by each corporation.

- **Government services** Annual figures come from the MOFE. The detailed breakdown of the figures allows the BOK to build up the production estimates using the cost approach. Less detail is available quarterly, so some of the figures are based on the structure of the annual budget. Annual estimates for consumption of fixed capital are derived using the PIM approach; quarterly estimates are assumed to be one fourth of the annual figures. Quarterly figures for payments of indirect taxes are also taken as one fourth of the annual value.

- **NPISHs** Output estimates at current prices are derived by reflating the constant price estimates with components of the PPI and CPI. The wage index is applied to the number of employees in each year to derive estimates for compensation of employees. Consumption of fixed capital comes from the PIM calculation.

- **Other services.** Quarterly output figures are obtained by applying sales growth to the value in the same quarter of the previous year. Preliminary value added figures are calculated using the value added ratio from the previous year. The final annual results are used to adjust the quarterly figures.
2. At constant prices

The procedures followed for compiling volume measures of QGDP for each industry are as follows:

- **Agriculture** Output at constant prices is based on changes in quantities for each type of product. Value added is derived using the chained weighted method.

- **Forestry** The only quarterly data available for standing timber are tree-planting area statistics and permits to extract timber, supplied by the Korea Forest Service. These data are used to construct the preliminary figures for output at constant prices. Value added is derived using the chained weighted method.

- **Fishing** Monthly quantity figures are obtained from the KNSO’s Fishery Production Survey. Value added is derived using the chained weighted method.

- **Mining and quarrying** Preliminary quarterly estimates for output at constant prices are derived using volume indicators such as the IPI, or quantities of mining products provided by the Korea Institute of Geology, Mining and Materials. These are updated when annual quantity figures are available from the KNSO survey. Value added is calculated by applying the base year value-added ratio.

- **Manufacturing** Preliminary quarterly estimates for output at constant prices are derived using the IPI. These are updated when annual quantity figures are available from the KNSO survey. Value added is calculated by applying the base year value added ratio.

- **Electricity, gas and water supply** Output for the electricity industry at constant prices is derived by deflating with the unit price index from KEPCO. Intermediate consumption is also deflated, but using components of the PPI. For gas and water, the preliminary quarterly output figures are derived by applying growth in quantities to the value in the same quarter of the previous year. Value added is then obtained by applying the value-added ratio from the previous year. When the annual current price data on output and intermediate consumption are received, double deflation is used to derive constant price value added. The quarterly estimates are then adjusted to agree with the annual total.

- **Construction** Output of new buildings is calculated by applying the base year unit costs to the area of new construction. Output for repairs is obtained by extrapolating the output for the same quarter of the previous year by the number of residential and non-residential buildings. Government expenditure is deflated using a price index built up from the PPI and the construction wage index. Value added is derived from output using the base year ratio from the 1995 I-O tables.

- **Wholesale and retail trade** The quarterly figures for output are obtained by applying the margin rate from the 1995 I-O tables to the constant price output of agricultural and manufactured goods. Actual quantity data obtained from some large enterprises are used as volume extrapolators for some components. Value added is derived using the base year value-added ratio.

- **Transport and communications** Good quality volume indicators are available for some sub-industries, so these are used to derive constant price estimates for output. However, for other transport sub-industries current price output has to be deflated by the PPI for total transport. Total intermediate consumption is derived using the ratio to output from the previous year. It is broken down by product so that it can be reflated to obtain the current price figures. However, this breakdown is updated annually using financial statements or the KNSO survey. This is done because the structure of this industry is subject to large changes.
• **Financial intermediation and insurance** The commissions received by financial intermediaries are deflated by the total services component of the CPI. To derive FISIM, real interest payments are deducted from real property income received. Real interest payments are obtained by applying the growth rate of deposits or interest-bearing liabilities, deflated by the PPI, to the figure for the same quarter of the previous year. Real property incomes received are calculated similarly, but using loans or interest-bearing assets deflated by the CPI. Intermediate consumption is deflated using the PPI. Output for life insurance is deflated using the CPI, while for non-life the insurance component of the PPI is used. Intermediate consumption is deflated using the PPI.

• **Government services** Compensation of employees at constant prices is based on growth in the number of employees. Consumption of fixed capital at constant prices is obtained as a by-product from the PIM calculation.

• **NPISHs** Constant price figures are based on the growth in related volume indicators, such as the number of students or the number of patients.

• **Other services** For those industries where it is available, the specific component of the CPI is used to deflate output. For the other industries, the specific wage index is used. Value added is derived by applying the base year ratio to output.

• **Taxes less subsidies on production** Constant price estimates are constructed commodity by commodity. For some commodities they are derived by deflation using the relevant output deflator. For others they are obtained by extrapolation of the base year figure using growth in output.

**B. Expenditure approach**

1. **At current prices**

The expenditure approach is compiled using the structures of the I-O tables. Therefore, the estimates for the expenditure components of GDP are compiled from the 402 product groups used in those tables. Additionally, household final consumption is compiled at the 3-digit level of COICOP and general government final consumption is compiled at the 1-digit level of COFOG. Gross Fixed Capital Formation (GFCF) is compiled by activity and type of asset and changes in inventories are compiled by type of inventory.

In general, household final consumption expenditure is not derived independently, though for some products independent estimates are compiled. Food grain consumption is derived from a KNSO survey; meat consumption is obtained from the MAF; purchases of cars is supplied by the Automobile Manufacturers Association; and consumption of electricity and gas are provided by the respective utilities. Data for certain personal services and non-durable goods are derived directly from the production data. For all other products purchased by households and enterprises (such as computers, TVs, and furniture), household final consumption is calculated using the product’s share in total domestic final consumption from the I-O tables. These ratios were updated recently for mobile phones and personal computers (PCs) using a special survey of manufacturers. The ratios are applied to the constant prices estimates which are then converted to current prices using the CPI or, for some services not covered by the CPI, the appropriate implicit output deflator. The base year estimates for household final consumption were derived using various 5-yearly surveys, such as the Family Income and Expenditure Survey and the Wholesale and Retail Trade Survey.
Final consumption expenditures for general government and NPISHs are derived by deducting receipts from the sale of goods and services from their output values. Expenditure on goods and services by Korean residents abroad are collected directly and included in imports. So, conceptually they are also included in household final consumption, as this is calculated using commodity flow techniques. Holdings of gold are included in GFCF, but data for other valuables are not separately identifiable.

The buildings component of GFCF is obtained directly from output of the construction industry after applying some adjustments, such as deducting repairs. The data for livestock are also extracted from the production figures. The rest of GFCF (amounting to around 32 percent) is derived first at constant prices using commodity flow techniques, as for household final consumption, and reflated by appropriate components of the PPI.

Changes in livestock inventories are obtained directly from the production data. For other agricultural products, the figures are calculated by residual from the supply and demand figures, with intermediate consumption derived using commodity flow techniques. Data for inventories of mineral and manufactured goods are estimated by reflating the constant price values using the relevant components of the PPI. Oil inventories are obtained from the Korea National Oil Corporation. Changes in inventories of other imported goods are based on commodity flow techniques. Changes in inventories of goods for resale are derived directly from survey data.

Imports and exports in US dollars are taken from the BOP figures. In the BOP, trade with North Korea is deducted because it is seen as part of Korea. However, in the national accounts these transactions are added back to the figures. The data are converted to Korean won using weighted average daily exchange rates for commodities and weighted average monthly exchange rates for services.

2. At constant prices

Volume figures for household final consumption are mainly derived using commodity flow techniques. Final consumption at constant prices by general government and NPISHs are derived from production data in exactly the same way as are the current price figures.

Production data or the results of the commodity flow exercise, as appropriate, are used to compile changes in inventories for agricultural products, just like the current price values. The inventory figures for mining and manufacturing are calculated using ratios obtained from the KNSO. The estimates for changes in inventories of oil are obtained by deflating the current price figures using the relevant component of the PPI. Inventories for other imported goods are based on the ratio from the 1995 I-O tables. Inventories of goods for resale are derived by residual in the same way as the figures at current prices.

The BOK constructs proper import and export price indices for a range of goods using surveys of importers and exporters. Other special import and export indices are constructed for semiconductors, aircraft and ships. For semiconductors, the index comes from the BOK. For aircraft it is compiled in the BOK using year-on-year changes in actual prices. The index for ships is obtained from Lloyds of London. Other imports and exports of goods are deflated using unit value indices. Imports of services are mainly deflated using the implicit deflator for imports of goods. Exports of transport services are extrapolated using various volume indicators such as ton-kilometres. Exports of insurance are deflated using the implicit deflator for exports of goods. Other exports of services are deflated using the PPI.

There is no official information on the size of the informal economy. External analysts have undertaken such studies, coming up with estimates that it is around 10 percent of GDP. Even so, the BOK does not adjust estimates for informal activities that might go unrecorded outside of normal administrative and survey data sources.
4. Benchmarking and seasonal adjustment

A. Benchmarking

Quarterly national accounts (QNA) are less reliable than annual national accounts (ANA), because the basic statistics from which QNA are derived tend to be less complete than those used in preparing annual estimates. Major revisions to QNA are made each year when ANA become available. However, minor revisions are made every quarter mainly for government sector.

The adjustment of the quarterly figures is made mainly for the purpose of making their sum equal to the annual figures, because the annual data are based on more reliable sources than the quarterly estimates. This adjustment can therefore be regarded as either a further improvement of the quarterly estimates by incorporating annual information as well, or as a subdivision of the annual figures into quarters using the preliminary quarterly estimates as indicators.

The reconciliation of QNA and ANA is carried out first at each sub-economic activity level and then move to more aggregated level using relevant economic indicators. The first step is to check the differences between the sum of the quarters and the annual value, and then distribute them between the quarters. Next step is to keep the growth rate of each economic activity consistent with other economic indicators.

B. Seasonal adjustment

A Korean seasonal adjustment method, BOK-X-12-ARIMA was developed in 1999 by adjusting the X-12-ARIMA of the U.S. Bureau of the Census to remove seasonality from Korean time series, which contain variations specific to Korea. Using this method, seasonally-adjusted statistics of the national accounts started to be compiled from November of 1999.

Korean economic time series contain variations specific to Korea, due to Seol (Lunar New Year’s Day), Chuseok (Korean Thanksgiving Day), election days, national holidays, changes in the social or economic system, and so on. These are unlike those of the West, and thus we have great difficulty in adequately removing seasonality from Korean time series using either the rate of change from the year before or a popular Western seasonal adjustment method - X-12-ARIMA. It is necessary to use a seasonal adjustment method suitable for Korean economic time series.

The Bank of Korea developed the menu-driven program for a Korean style seasonal adjustment method based on X-12-ARIMA and SAS. We call it BOK-X-12-ARIMA. In the program, dummy variables can be generated to estimate the effects of Seol, Chuseok, national holidays, etc. Users can make flexible dummy variables according to type of weight and the effect of the spread over period. In addition, the program provides various summarised results and graphs.

The method we use when the total amount of seasonally adjusted GDP is calculated is indirect seasonal adjustment, which is done at the most detailed level. Seasonally adjusted estimates for total GDP at current and constant prices are derived by aggregating the seasonally adjusted estimates for 77 components, according to the types of economic activities. Moreover, seasonally adjusted estimates for 24 expenditure components are derived.

Forecasted seasonal factors are used to produce current seasonal adjustment of data as new data comes. According to our revisions policy, we revise seasonally adjusted data for history of series every year for all past series.
Seasonally adjusted estimates for GDP deflators are calculated by dividing seasonally adjusted estimates for GDP at current prices by seasonally adjusted estimates for GDP at constant prices.

5. The present situation of Publication series in our country.

<table>
<thead>
<tr>
<th>Original series of GDP(amount)</th>
<th>Published (yes, no)</th>
</tr>
</thead>
<tbody>
<tr>
<td>YES</td>
<td>Raw/unadjusted series are included in the actual publication.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Seasonally adjusted series of GDP(amount)</th>
<th>YES</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Percent change compared with the same quarter of the previous year of original GDP series</th>
<th>YES</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Quarter-to-quarter growth rate of seasonally adjusted GDP series</th>
<th>YES</th>
</tr>
</thead>
</table>

| Annualised quarter-to-quarter growth rate of seasonally adjusted GDP series | NO |

6. Revisions, publication and user forum on GDP

Previous quarterly estimates within the same calendar year are revised when the figures for the next quarter are first published. We are subject to further revision when the figures for the full year are released. The annual and quarterly figures can also be revised when the annual estimates for the following year are published. After this, we are normally only revised at the time of the five-yearly rebasing.

Preliminary annual and quarterly figures are indicated by putting the letter ‘p’ next to the data. Similarly, the letter ‘r’ is used to indicate revised estimates. When releasing the final annual figures, factors contributing to the difference between preliminary and final data are analysed and explained in Quarterly National Accounts.

The BOK compiles and disseminates quarterly and annual estimates of GDP by production and expenditure components at both current and constant prices. This meets SDDS requirements. GDP by income category is also available, but only annually and at current prices. Capital and financial accounts are also produced annually, by sector and sub-sector.

Quarterly GDP estimates are published within 60 days after the end of the relevant quarter. Preliminary annual estimates are published within three months of the end of the year with the final figures released 12 months later.

The BOK provides an advance release calendar for a whole year on a ”no-later-than” basis. The exact release date is announced one week prior to release, and statistics are released according to the pre-announced schedule.
Processes to monitor the relevance and practical utility of existing statistics in meeting users’ needs are in place. In December 2000, a meeting with users took place to identify user needs. The BOK plans to hold at least two such meetings a year.

7. Future plans for improvement

The BOK is gradually introducing further elements of 1993 SNA, but full implementation of the 1993 SNA is not expected until the next change of base year in 2004. The BOK is planning to implement, first of all, the more important elements of 1993 SNA that would have to be included in a country’s accounts for us to be considered broadly as “1993 SNA compliant”. The extension of the assets boundary, the extension of consumption of fixed capital on government assets to include roads, harbours, breakwaters and so on, introducing the chain volume indexes, allocating FISIM, widening of the scope of social insurance will be implemented at that time.

Also, the detailed plan for adopting the System of National Accounts 1993 (1993 SNA), scheduled to be implemented in 2004, has been published.
MALDIVES

Fathmath Hana Mansoor,

Ministry of Planning and National Development, Maldives

1. Introduction

With Technical Assistance (TA) from the Asian Development Bank (ADB) and the consultancy services from the NAMES (Consultants in National Accounting, Modelling, Economic and Social Statistics) of the Netherlands, the Statistics Section of the Ministry of Planning and National Development (MPND) is currently implementing a project “Maldives- Further Development of a System of National Accounts” (TA No. 2988-MLD).

This report provides a description of the procedures used in the Macro-economic Budget (MEB) and the sources and methods used in the compilation of the annual national accounts estimates of Maldives. The procedures used for the compilation of annual national accounts estimates are referred to as “Macro-economic Budget Extrapolation (MEB) Approach”.

At present, the annual national accounts (by industry and final expenditure components) are still prepared at constant prices with base year 1995. However, the compilation of annual national accounts at current prices will become feasible and available in the near future with the ongoing efforts to build credible series of price and unit-value indices. Evidently, this approach will provide the foundation for the preparation of quarterly national accounts.

At the end of the first phase of the project, a prototype Supply and Use Table (SUT) was prepared for Maldives for the year 1995, based on the available data. This SUT is currently being used as a benchmark for the compilation the national accounts estimates.

2. Macro-economic Budget Extrapolation approach

A. The Macro-economic Budget Equation

As point of departure in our approach we use the macro-economic supply and demand equation:

\[ O + M = IC + C + GFCF + ChS + X \]

- \( O \) = output
- \( M \) = import
- \( IC \) = intermediate consumption
- \( C \) = Final consumption expenditure
- \( GFCF \) = Gross Fixed Capital Formation
- \( ChS \) = Change in Stocks
- \( X \) = Export
The macro-economic budget consist of two parts:

- The origins of the realized supply of products
- The realized demand of supplied products.

The realised total value of supply of products (O+M) has to be equal to realised total value of demand. This identity will be achieved in economic reality through the price mechanism (price adaptations and volume adaptations) and changes in stocks.

Equation (1) gives a non-consolidated description of the economy in a certain period. In the consolidated description the variable IC is omitted. Subtracting IC gives:

\[ O + M - IC = C + GFCF + ChS + X \]

In economic theory, the difference between Output (O) and Intermediate consumption (IC) is called, "Value Added", see equation (3)

\[ Y = O - IC \]

\[ Y = Sum\ of\ Value\ Added\ or\ GDP \]

Substitution of equation (3) in (2) gives:

\[ Y + M = C + GFCF + ChS + X \]

For the economy as a whole Y it is called “Gross Domestic Product” (GDP). The term gross has here the meaning of Domestic Product including the “Consumption of fixed capital”\(^{19}\). NDP (Net Domestic Product) is GDP minus consumption of fixed capital. The expenditure categories (right hand side) of Equation 4 are often named final expenditure categories. The term final indicates that the expenditures are not designated for direct and complete use in the production process. Therefore, also gross fixed capital formation belongs to the final expenditures.

\[ B. \ The\ Macro-economic\ Budget\ Extrapolation\ Approach \]

The Macro-economic Budget Extrapolation approach is presented in Table 1, the industry extrapolation sheet and Table 2, the macroeconomic budget extrapolation sheet. In the Table 1 presents the extrapolation of value added at constant basis prices by industrial sectors. In the Table 2, the same categories are depicted as in Equation 4, but some details have been added to comply with the NA-definitions and to enrich the budget equation. To comply with the accounting concepts the taxes and subsidies on production have been added such as import duties, sales taxes, excise duties, etc. This enables to arrive at GDP at market prices. Furthermore, GDP at basic prices has been detailed in gross value added of enterprises and value added of government.

For additional analytical purposes, the Value added of enterprises has been split in its major components: Compensation of employees, Other taxes on production\(^{20}\) and Operating surplus (gross). The last item in

\[ 19.\ The\ value\ of\ capital\ goods\ deteriorates\ through\ the\ use\ of\ these\ goods\ in\ the\ process\ of\ production.\ Therefore,\ a\ part\ of\ the\ value\ of\ the\ stock\ of\ capital\ goods\ is\ debited\ against\ the\ GDP.\ This\ part\ is\ called\ consumption\ of\ fixed\ capital. \]

\[ 20.\ Other\ taxes\ on\ production\ are\ taxes\ directly\ related\ to\ production\ but\ not\ levied\ on\ products.\ Examples\ are:\ road\ taxes,\ some\ registration\ fees,\ taxes\ on\ pollution\ etc. \]
the supply part is import valued at free on board\(^{21}\) (fob)\(^{22}\). GDP at market prices plus imports gives total supply at market prices.

The next group of variables in Table 2 describes the final expenditures. The exports are valued at fob. The final expenditure category “final consumption” has been split in final consumption of government\(^{23}\) and final consumption of households. The latter contains also the “final consumption of private non-profit institutions serving households”\(^{10}\) (PNPISH) that is rather small in the Maldives. The last final expenditure category is the change in stocks.

The sequence of columns in Table 1 and 2 depicts the extrapolation of the values at constant prices for the year (t) to the year (t+1) in prices of (t). In effect, these procedures reflect the adoption of chained volume indexes in the approach as recommended by the System of National Accounts.

C. The System of Short-term Indicators and its Use

The benchmark value data for 1995 are available from the SUT 95. A system of short-term volume indicators is applied that contains the available time series to prepare annual estimates at constant prices of 1995.

The Statistics Section of the Ministry of Planning and National Development (MPND), has brought together a set of short-term indicators to be used for this purpose (as an example, see Annex 1: Table 1. Tourist bed-nights and Table 4. Fish catch). Applying these short-term indicators in a chained procedure extrapolates the industry value added forward in time. The base year values as obtained from the SUT 95.

These monthly short-term output, expenditure and trade indicators collected are volume indicators. The advantage of volume indicators is, that, in the short term, these indicators might be used as a proxy for the volume development of the value added of the respective industries\(^{24}\) and final expenditure categories. The sum of the extrapolated value added at basic prices of all industries is the GDP at basic prices. In addition, the projection of the GDP estimates for a future year is allowed with this approach by forecasting the updated time series of the available short-term volume indicators.

Presently, only very limited information about prices is available. Hence the Macro-economic Budget Extrapolation approach is limited to constant price estimates\(^{25}\). It is reiterate that with the ongoing preparation of price and unit value indexes, current prices’ estimates will become available in the near future.

\(^{21}\) In reality we will use a valuation cif (value of the goods at the border of the importing country thus including costs of transport and insurance)

\(^{22}\) fob is the value of the exported goods at the border of the exporting country (thus excluding costs of transport and insurance)

\(^{23}\) In economic analysis it is assumed that government and PNPISH consume the part of their own output that is not sold on the market or used for gross fixed capital formation.

\(^{24}\) Under the assumption of constant production technology is the percentage change of the output indicator for an industry identical to the percentage change of the volume of value added for that industry.

\(^{25}\) Further research on price indicators is ongoing and the extrapolation in future should encompass volumes and values.
### 3. General methods used in GDP

#### Table 1

**INDUSTRY VALUE ADDED EXTRAPOLATION SHEET (volumes)**

<table>
<thead>
<tr>
<th>Industry/item</th>
<th>Gross Val. ad 1995</th>
<th>Ch. vol</th>
<th>Vol. 96 in</th>
<th>Ch. vol</th>
<th>Vol. 97 in</th>
<th>Ch. vol</th>
<th>Vol. 98 in</th>
<th>Ch. vol</th>
<th>Vol. ..in</th>
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<tbody>
<tr>
<td></td>
<td>min Rf</td>
<td>%</td>
<td>pr 95</td>
<td>%</td>
<td>pr 95</td>
<td>%</td>
<td>pr 95</td>
<td>%</td>
<td>pr 95</td>
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<tr>
<td><strong>MARKET INDUSTRIES</strong></td>
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<tr>
<td>1:2 Agriculture</td>
<td>58.3</td>
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<td></td>
<td></td>
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<td></td>
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<tr>
<td>3 Forestry</td>
<td>96.3</td>
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<tr>
<td>4 Fishery</td>
<td>335.1</td>
<td></td>
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<tr>
<td>5 Mining</td>
<td>30.9</td>
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<tr>
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<td>Manufacturing</td>
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<td>6 - Fish preparation</td>
<td>111.6</td>
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<td>7 - Food products</td>
<td>20.6</td>
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<td>8 - Beverages</td>
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<td>9 - Tobacco</td>
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<td>10 - Apparel</td>
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<tr>
<td>- Export market</td>
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<td>- Local market</td>
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<tr>
<td>11&amp;12 - Wood planing &amp; Furniture</td>
<td>69.7</td>
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<td>13 - Paper, Printing &amp; publishing</td>
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<td>14 - Soaps &amp; Detergents</td>
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<td>15 - Cement products</td>
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<td>16 - Electrical equipment</td>
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<td>7.8</td>
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<td>18 - Other manufact.</td>
<td>25.2</td>
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<td>19 - Electricity Generation &amp; distribution</td>
<td>84.8</td>
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<td>20 Collection, purific.&amp;distr. Water</td>
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<td>21 Construction</td>
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<td>- Resorts</td>
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<tr>
<td>- Other hotels &amp; rest.</td>
<td>191.7</td>
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<td></td>
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<tr>
<td>25 Land transport</td>
<td>20.0</td>
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<td>26 Water transport</td>
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<td>27 Air transport</td>
<td>-23.9</td>
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<tr>
<td>28 Aux. Transport</td>
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<td>29 Post &amp; telecom.</td>
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<td>- Dhiraagu</td>
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<td>- Maldives Post</td>
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<td>30 Mald. Mon. Auth.</td>
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<td>31a Deposit &amp; other banks</td>
<td>98.7</td>
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<td>31b Insurance</td>
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<td>33 Rent of Transport, mach.&amp;equip</td>
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<td>o.w. with indicator (forward)</td>
<td>3195.9</td>
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<td>32b Imputed rent of owner-occupied dwellings</td>
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<td>36 Education</td>
<td>26.6</td>
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<td>37 Health</td>
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<td>38 Oth.com.soc&amp;pers serv.</td>
<td>34.8</td>
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<tr>
<td>b Total Non-business</td>
<td>710.2</td>
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<tr>
<td>c Fisim</td>
<td>-174.9</td>
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<tr>
<td>d=a:c GDP basic prices</td>
<td>4269.2</td>
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Table 2  MACRO ECONOMIC BUDGET EXTRAPOLATION SHEET (volumes)

<table>
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<tr>
<th></th>
<th>Value 1995 mln Rf</th>
<th>Ch. vol</th>
<th>Vol. 96 in pr 95</th>
<th>Ch. vol</th>
<th>Vol. 97 in pr 95</th>
<th>Ch. vol</th>
<th>Vol. 98 in pr 95</th>
<th>Ch. vol</th>
<th>Vol. .. in pr 95</th>
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<td>ORIGINS OF SUPPLY</td>
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<tr>
<td>1=2+3-4 GDP market prices (gross)</td>
<td>4713.6</td>
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<td>2 Import duties</td>
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<tr>
<td>3 Taxes on products</td>
<td>0.0</td>
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<tr>
<td>4 Subsidies on products</td>
<td>0.0</td>
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<tr>
<td>5=6+9 GDP basic prices</td>
<td>4289.2</td>
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<td>6 o.w. Gross value added enterprises</td>
<td>3889.7</td>
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<td>7 o.w. Compensation of employees</td>
<td>1175.8</td>
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<td>8 o.w. Other tax on production</td>
<td>224.9</td>
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<td>9 o.w. Other sub. on production</td>
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<td>10=6-7+8+9 o.w. Operating surplus (gross)</td>
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<td>11 o.w. Gross value added Government</td>
<td>399.5</td>
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<tr>
<td>12=13+14 o.w. Compensation employees</td>
<td>366.6</td>
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<tr>
<td>13 o.w. apparel for re-export</td>
<td>86.2</td>
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<td>14 o.w. other import of goods</td>
<td>3038.4</td>
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<tr>
<td>15=12+14 o.w. other import of services</td>
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<tr>
<td>15=12+14 Total avail. for final expenditure</td>
<td>8338.9</td>
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<td>FINAL EXPENDITURE</td>
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<tr>
<td>16 Exports of goods &amp; services (f.o.b.)</td>
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<tr>
<td>17 o.w. Goods</td>
<td>572.9</td>
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<td>18 o.w. apparel</td>
<td>148.2</td>
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<td>19 o.w. processed fish</td>
<td>313.7</td>
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<td>20 o.w. Services</td>
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<td>21 o.w. Hotels and restaurants</td>
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<td>23 Households' final expenditure</td>
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<td>24=25=26 Gross fixed capital formation</td>
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<td>25 o.w. Construction</td>
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<td>26 o.w. Ship building</td>
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<tr>
<td>27 o.w. Machinery and Equipment</td>
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<tr>
<td>28 Change in stocks</td>
<td>-9.5</td>
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<tr>
<td>22=24 Total final expenditure</td>
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<td>Discrepancy in percentage</td>
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CCNM/STD(2002)1

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Estimates and forecasts

A. Introduction

The GDP estimates have been prepared from the base year 1995. The data for this year consist of the estimates prepared for the prototype Supply and Use Table (SUT).

The MEB approach has been developed in an Excel spreadsheet environment for the 1996 estimates, and has subsequently been refined and expanded over the past few years to include new information whenever it became available. The increased systematic use of the short-term indicators available has enabled the improvement in these estimates. Improvements and revisions of estimates have also made using the results of SES 1999 and first results of pilot LES 1995 to 1997. Once the final results of the LES 1998 and 1999 have been processed further improvements and revisions will be made.

The base-line 1995 figures had been taken from the pilot-SUT for that year. With the passing of time, new information became available in various areas and the base-line GDP estimates have been adjusted accordingly. This related, for instance, to air transport, resorts and textile manufacturing. It is now believed that the 1995 base-line data are as accurate as they can be made.

B. General procedures

The estimates have been compiled in a spreadsheet format with links to all the relevant short-term indicators. In case further changes in the base-line SUT estimates are made, as well as when additional information for the short-term indicators becomes available, their input results in automatic updates to the estimates. The results of the calculations themselves, in turn, have been linked to the base year conversion from 1995 to 1985 in a separate spreadsheet.

For economic activities that are not estimated independently, two generalised procedures have been incorporated in the process. The first one is based on the change in population, possibly refined with income elasticities. The second procedure pertains to use of the average growth rate for the reference year or period of the ‘Business’ part of the production account. The latter includes all activities except the Government, education, health and other social services and the imputed rent of owner-occupied dwellings.

The first procedure is based on the population growth estimates published in the Statistical Yearbook. As the extrapolation periods are relatively short-term, the procedure will provide fair estimates for the years involved. In general, the income elasticities have been kept constant (at 1.0) as no information is available on their levels. However, where information is available, or it is thought likely that production changes also with changes in income, that information can be directly incorporated. In the estimates presented in Tables 1 and 2, the use of this procedure is indicated by the presence of a number in the first column ‘Elasticities’.

A number of industries given in the tables 1 and 2 are in fact aggregates of parts that show a different growth path and dependency. For instance, beverage production is partly consumed by the local population and partly by the tourists visiting the country. Similarly, the manufacture of fishery products comprises tuna canning, fish drying and fish paste preparation. These three product lines have different markets and therefore will show different growth paths. For these cases, and to the extend information is available, these line-items have been disaggregated and the estimates shown in tables 1 and 2 are the aggregates (and weighted averages) of these lower-level estimates. The use of this disaggregated approach has been described against each of the estimates prepared in the following chapter.
Extensive use is also made of import and exports statistics. These are, of course, reported in current prices by Customs. Due to frequent changes in item HS codes assigned to imported items over the years, the computation of average changes in unit-values by product group has proven to be cumbersome. However, to the extent possible unit values have been prepared and applied. Further work is undertaken to improve those estimates.

Regarding the extrapolation procedures for the current reference year for which only a limited amount of months of short-term indicators are available, in first instance the year-to-year change is calculated. In corollary, seasonally adjusted estimates are obtained. These seasonally adjusted estimates are then subject to a correction factor to reflect the three to four year trend developments.

Similarly, in order to prevent the unrealistic next year forecasts, the extrapolations for projections are based on the average percentage change over the previous three or four years, depending on the available data. This reduces the effects of the big jumps observed in various series from year to year (both upward and downward). These movements tend to be more pronounced when only a few months data is available for the current year, as the number of individual transactions covered in many monthly series is relatively small.

4. Specific methods used in GDP estimates and forecasts

A. Industrial value added extrapolation

Specific methods used in GDP estimates are outlined in this chapter. The industry value added extrapolation sheet (volumes) given in Table 1 gives a detailed breakdown of the industries. The prototype SUT for 1995 is the basis for the derivation of the gross value added figures for 1995 given in Table 1. The methodology used in the derivation of this column is explained in the following text as baseline estimates. The short-term indicators used as sources of information and the method applied for the extrapolation of GDP for the years 1996 onwards are outlined under the heading extrapolations.

The aggregation of GDP estimates by specific industries given in Table 1 leads to the derivation of Total GDP for the country at constant basic prices.

B. Macro-economic budget extrapolation

Specific methods used in GDP estimates are outlined in this section. The Macro-economic budget extrapolation (in volumes) given in Table 2 gives a detailed breakdown of specific methods used for the derivation of GDP at market price and estimates of GDP by final expenditure components. The prototype SUT for 1995 is the basis for the derivation of these figures for 1995 given in Table 2. The methodology used in the derivation of this column is explained in the following text as baseline estimates. The short-term indicator used and the method used for the extrapolation of final expenditure components of GDP for the years 1996 onwards are also treated.

The estimate for GDP derived through the production approach as outlined in section 4.1 above by means of the industry value added extrapolation (volumes) in Table 1 is independent from the estimate for GDP based on expenditure approach as outlined in this section 4.2 below. Therefore, the two estimates can be different. This difference is reflected in the discrepancy (given in section 4.3 below), which is measured as total use minus resource.
C. GDP at market prices

In order to derive GDP at market prices, it is necessary to add import duties and taxes on production to GDP in basic prices, and deduct subsidies on products from GDP in basic prices.

D. Discrepancy

The estimate total resource from GDP at market prices and imports of goods and services, as consolidated in the total available for final expenditure in item 15 of table 2 is independent from the estimates on of total use from final expenditure components in item 28. Therefore, the two estimates might be different. This difference is reflected in the discrepancy, which is measured as expenditures minus resources. By definition, there is no discrepancy in the base year. For later years, the estimates show maximum discrepancies up to 2.3% of the total. Moreover, the discrepancy moves positively and negatively from year to year and even becomes virtually zero in some years. This indicates a fairly good consistency between the two estimates.

E. Current-price adjustments

A simple price model has been presented. This model was discussed with staff from the Central Bank, Maldives Monetary Authority MMA. At that time, assumptions about the annual developments of the exogenous variables were also made and using the model, the implied GDP deflator was calculated.

At the bottom of Table 2 (the Macro-Economic Budget Extrapolation Sheet) these GDP price deflators have been applied (inversed, that is) to obtain current-price estimates of GDP for the years 1996 to 1999.

The current-price estimates have been converted to per-capita terms using the mid-year population data given on the top line of Table 2. The conversion to GDP per capita in US Dollars was carried out using the exchange rate of Rf. 11.77 per dollar, which was in effect the same throughout this period.

5. Plan for quarterly National accounts.

The plan is to extend the existing annual national accounts compilation framework towards quarterly national accounts. For that it is important to improve the coverage of the existing short-term indicators and also to develop the price indices. During this year development of Producer Price Index (PPI) and also Unit-Value Indices has been attempted. In the mean time improving the coverage of the short-term volume indicators work is also ongoing.

The aim is to start producing the quarterly national accounts compilation in the near future. However, given the fact that the ongoing national accounts project will be completed in June 2002, it is not certain, how the implementation plan will be realised. The statistics system as a whole is still at the early stages of development and the education and the experience of the staff is not adequate.

There is indeed need of technical assistance to develop the system to quarterly accounts as well as to develop the human resources. The Government has already proposed to ADB for financial assistance to go for another phase the existing national accounts project, as well as a human resource plan to enhance the skills and knowledge of the staff.
MALAYSIA

Zainuddin bin Ahmad and Mr Mohd. Yazid bin Kasim,

Department of Statistics, Malaysia

1. Introduction

National accounts estimates have been produced by the Department of Statistics, Malaysia (DOSM) since 1955. Up until 1969, only annual estimates in current prices, both by activity and expenditure were published. The first constant price series was published for the year 1970 using 1970 input-output tables as the base year. This series was maintained until 1983. A new series was established for year 1978 using 1978 input-output tables. The 1978 based series was maintained until 1998. In this series, DOSM was compiling and publishing annual estimates of GDP by expenditure at current and constant 1978 prices and quarterly estimate of GDP by activity in constant prices. The annual and quarterly estimates were released 10 months after the end of reference year. (The quarterly estimates were not release on a quarterly basis).

Late 1993, DOSM undertook to change and upgrade the existing Malaysian national account system. It consisted of:

- Benchmarking annual and quarterly accounts to the 1987 input-output tables;
- Developing estimates of GDP by activity at current prices;
- Developing new and more detailed compilation system that uses source data more effectively; and
- Incorporating new source data, which has not been possible to be incorporated in the 1978 based series.

This exercise was completed in 1996. In early 1997, Malaysia subscribed to the IMF SDDS program. Under this program, DOSM was offered technical assistance to assess and if necessary, to further improve on the methodologies used in the estimation procedures of both the annual and quarterly series. The technical assistance program was concluded in early 1999 and DOSM commenced releasing the quarterly series from the first quarter 1999 with 1987 as its base year.

The conceptual basis for the 1970, 1978 and the 1987 is the 1968 SNA recommendations. While these have been superseded by the 1993 recommendation, DOSM has not changed to the 1993 recommendation.

Malaysia publishes its quarterly GDP eight weeks after the reference quarter. A press release is held to announce the quarterly GDP. Quarterly GDP publication is available one day after the press release. Users also can access the information through Department of Statistics, Malaysia (DOSM) web site (http://www.statistics.gov.my) after the embargo time.

Major users of the quarterly GDP are:
- government agencies (e.g. Economic Planning Unit, Ministry of Finance and Central Bank)
- private sector
• universities (public and private)
• researchers
• foreign agencies (e.g. World Bank, United Nation and IMF)

The quarterly GDP data for Malaysia is not seasonally adjusted.

2. Manufacturing Industry

A. Data sources, data availability and coverage

For this industry, value added is estimated using Monthly Manufacturing Survey (MMS). The survey is conducted by DOSM. MMS covers about 78% of the total output of this industry. MMS is available between six to seven weeks after reference quarter. It meets the timeliness requirement.

B. Method of compilation

MMS provides information on production, sales and stocks from which to generate the current and constant price value added. Sales (adjusted with change in stocks) and production data are used to estimate current and constant prices output respectively.

C. Problems, issues and future improvement

In calculating value added for manufacturing, MMS data is used directly instead of Industrial Production Index because it allows flexibility (in term of wider coverage) and enables the use of more recent weight.

However, there is a gap between sales and production figures and efforts are being made to reconcile it. Another difficulty with this data is also the unexplained differences between the annual and the monthly collection for some industries.

3. Agricultural sector

A. Rubber

• Data sources, data availability and coverage

The sources are from the Monthly Census of Rubber Estates (DOSM), the Monthly Census of Rubber Dealers (DOSM) and the Malaysian Rubber Board and Biennial Census of Rubber Estates (DOSM). Quarterly data from the above sources are made available 6 weeks following the reference quarter and hence meets the timeliness requirement. It covers 100% rubber industry in Malaysia.

• Method of Compilation

Production quantum by types of rubber in estates is obtained from the Monthly Census of Rubber Estates and is summed up to get quarterly production quantities. The Monthly Census of Rubber Dealers collects purchases of smallholders’ rubber by type and thus is an indirect measure of the production of smallholding rubber. The monthly data is summed up to get quarterly totals. Data on prices of various grades of rubber are obtained from the Malaysian Rubber Board.
The quantum of rubber produced by type are converted to values using the price data mentioned above. Thus production in constant and current prices are used to move the gross output in constant and current prices. Intermediate inputs in constant prices are assumed to move in tandem with constant price gross output. This is then inflated to current prices using an input price index computed using the annual regimen of inputs which account for 80% of total inputs. The annual regimen of inputs are derived from the Biennial Census of Rubber Estates. The bench program (Denton method) is used to bench the quarterly movers of gross output and intermediate inputs to the annual estimates of gross output and intermediate inputs. Value Added for quarters are derived as the difference between gross output and intermediate inputs.

**Problems, Issues and Future Improvements**

The method used is conceptually sound. It produces the best estimate possible with the data available and the quarterly estimates can be regarded as reasonably robust. The quantum statistics of rubber production is very reliable and so are the prices of the various grades of rubber. The input price index is constructed using the Producer Price Indices (PPI) at the detail level and for a few service items the appropriate Consumer Price Indices (CPI) is used. Thus with regular censuses and good data sources this sector poses little problems. The only snag is the lack of information on the cost structure of smallholdings which account for about 80% of total production. Currently, the 1987 Inter Industry Study estimate of the ratio of costs per unit by estates with that of other rubber producers is being used. There is therefore a need to update this on a regular basis with a more direct measure of this ratio.

**B. Oil Palm**

**Data sources, data availability and coverage**

DOSM obtains oil palm statistics from Malaysian Palm Oil Board. Production quantum statistics of crude palm oil and palm kernel and the corresponding prices are provided by the board on a timely basis. It covers 100% of oil palm industry in Malaysia.

**Method of Compilation**

As for Rubber, production values which are derived using the quantum statistics and prices from the Malaysian Palm Oil Board are used to move gross output in current and constant prices. Intermediate inputs in constant prices are assumed to move in the same direction as constant price gross output. Quarterly input indices are computed to rate up constant price inputs to current prices. These quarterly movers are benched to the annual estimates of gross output and intermediate inputs and value added is derived as a residual.

**Problems, Issues and Future Improvements**

This method is conceptually sound. It produces the best estimate possible with the data available. However, while there is good quality production data, the same cannot be said of data on cost of inputs. The Annual Census of Oil Palm estates undertaken by DOSM up to 1989 provided a firm basis to measure costs per unit of production for estate grown oil palm. It also provided a reliable annual pattern of expenditure to use as weights for the price index of intermediate consumption. Since the Malaysian Palm Oil Board took over the conducting of the annual census, data on costs have not been forthcoming. Hence, subsequent years estimates have had to assume that the ratio of intermediate inputs to gross output have remained the same as 1989. With the rapid growth in the industry in recent years this is unlikely to be the case. Whilst the value added estimate is not overly sensitive to this ratio the long term impact could be significant in terms of the measure of the oil palm industry’s contribution to GDP. Efforts are being made to obtain updated cost data from the Board. Failing which the DOSM will have to conduct a limited survey every few years to provide enough information on unit costs to prevent the current price estimates
deviating significantly. The same source could also provide timely information for weighting price indices of intermediate inputs.

C. Cocoa

- **Data sources, data availability and coverage**
  a. Annual Census of Cocoa Estates (Malaysian Cocoa Board)
  b. Quarterly Production Data (Malaysian Cocoa Board)
  c. Price of Dry Cocoa Beans (Ministry of Primary Industries)

Quarterly production and price data are obtained from the above sources on a timely basis. It covers 100% of cocoa industry in Malaysia.

- **Method of Compilation**
  Gross output for the cocoa industry is calculated using the quantity and value of cocoa beans produced as movers. Intermediate inputs in constant prices are assumed to move with gross output. A price index based on the annual pattern of expenditure as weights is used to inflate this to obtain current price mover of intermediate inputs. The quarterly movers are aligned to the annual estimates of gross output and intermediate inputs using the bench program and value added is derived as a residual.

- **Problems, Issues and Future Improvements**
  While there is good production data and a continuous update of the input mix for the computation of the input price index which is based on the Annual Census of Cocoa Estates, there is a need to obtain a measure of costs per unit of production of the smallholding sector. Efforts will be made to enlist the help of the Malaysian Cocoa Board to conduct a limited survey of smallholders every three years or so.

D. Livestock

- **Data sources, data availability and coverage**
  Recorded slaughter of animals and milk collection (ex-post quarterly data); Limited coverage of recorded slaughter of animals in abattoirs under the jurisdiction of the Veterinary Department (current quarters); limited coverage of poultry processing by private enterprises (current quarters) are obtained from the Veterinary Department.

Exports and Imports of Livestock and Eggs (DOSM)

Attempts at obtaining recorded slaughter data covering all abattoirs (obtained ex-post at the moment) on a current quarter basis failed. However, a sub-set of this data (abattoirs under the jurisdiction of the Veterinary Department) and a subset of data from large poultry processors is obtained on a timely basis.

- **Method of Compilation**
  There is a lack of statistical data on the livestock industry. The estimates are based entirely on estimated production quantum and price indices. The main data source is data compiled by the Veterinary Services Department.

Value Added is moved directly using quantum movers based on recorded slaughter, exports and imports. Producer price indices are used to inflate this to current prices. These movers are aligned to the annual estimates of value added using the bench program.
• **Problems, Issues and Future Improvements**

The national accounts estimates accept the gross output valuation, product mix and cost structure adopted by the 1987 Inter Industry Study. The livestock industry then, although self-sufficient in meeting domestic demand for pork, poultry and eggs, was not well documented. However, these activities have since developed further and are catering to the export market and yet there are no surveys to track production and costs in a formal manner. This has to be remedied in the near future to cover at least the big players so that there are regular updates on the cost structure and production trends.

**E. Other Agriculture**

• **Data sources, data availability and coverage**

This industry group covers those commodities produced by the agriculture sector and which are not included in the other groups above. The main products are coffee, tea, coconut, tobacco, paddy, pepper, fresh vegetables and fruits and flowers. Data are obtained from:

a) BERNAS (a private company which main activity engage in processing paddy)
b) Department of Agriculture
c) National Tobacco Board
d) Malaysian Pineapple Industry Board
e) External Trade Statistics (DOSM)
f) Monthly Manufacturing Survey (DOSM)
g) Quarterly Survey of Tea Estates (DOSM)

Timely quarterly quantum data are made available from the above sources except for the Department of Agriculture, National Tobacco Board and the Malaysian Pineapple Industry Board where, the time lag is much longer.

• **Method of Compilation**

For the significant commodities, the approach is to use a quantum measure to move value added. The PPI or a relevant price is used to inflate this to current prices. The commodities which are less significant or for which no indicators can be obtained are moved by the movement of those that are measured. The quarterly movers are benched to the annual estimates of value added using the bench program.

• **Problems, Issues and Future Improvements**

Even for some of the more significant commodities such as paddy, vegetables, fruits and coconut there are no direct measures of quarterly production. While annual production of paddy is estimated from the Paddy Production Survey conducted by the Department of Agriculture, quarterly movers are based on the purchase of paddy by millers. Annual production quantum of fresh vegetables, fruits and coconut are also not available and movers are based on indirect estimates of household consumption, intermediate consumption of manufacturers, exports and imports. Quarterly movers are based on exports which are rated up to the national level based on the ratio of domestic demand to exports derived from the Inter Industry Study of 1987. The only direct measures of quarterly production are for pineapple, tea and tobacco. For pepper, the quarterly quantum mover is the export quantum which is acceptable as 90% of total production is exported.

The national accounts estimates accept the gross output valuation, product mix and cost structure adopted by the 1987 Inter Industry Study. This sector is largely dominated by small-scale production units and as such data collection is a formidable task. However, recent developments may see the emergence of large private sector involvement and consolidation of small units into economic size entities. Thus in the near
future some of the large players will be covered so that there are updates on production costs and production trends.

4. Trade, accommodation and real estate sector

A. Wholesale and Retail Trade

- **Data sources, data availability and coverage**
  Value added is estimated using the value added related to wholesale/retail service and intermediate input for Government. Information from survey data (that is based on non-probability sampling) is also used. These data are received on timely basis.

- **Method of Compilation**
  The estimates for this industry are moved by the economic activity in the industries and the final expenditure categories that use the wholesale and retail trade. This method relies on the assumption that the proportions of output of the wholesale and retail trade used by each industry and expenditure group remain the same.

- **Problems, Issues and Future Improvements**
  Wholesale and retail trade estimate can be improved with wholesale and retail trade survey. This lack of data is being addressed with the commencement of a Quarterly Distributive Trade survey, and once there is regular and controlled quarterly collection, this method will be changed.

B. Hotels and Restaurants

- **Data sources, data availability and coverage**
  To estimate value added for hotels and restaurants, revenue data from Quarterly National Account Survey are used. The data are available on timely basis (major establishments).

- **Method of Compilation**
  This industry is divided between the activities of hotels and that of restaurants and caterers. For the larger hotels and restaurants, a quarterly survey provides the basis for estimation of the activity in current price. This assumes that the contribution to economic activity of the smaller hotels and restaurants moves at the same rate as the larger ones and that value added is assumed to move with gross output for both the current and constant price estimates. The CPI provides the measure of price change in the output of both the hotel and restaurant industry.

- **Problems, Issues and Future Improvements**
  For hotel, QNA survey on revenue gives a reasonable robust estimate. However, the major problem with hotels is not knowing the coverage of the annual survey and the recent occupancy rate. Coverage is assumed to be constant with small and large hotels assumed to move together. The constant price method also makes no allowances for improved quality. An occasional controlled survey of the whole industry, e.g. every five years, to establish the size of the industry would improve the estimates.
5. Other services and other sectors

A. Crude Petroleum and Natural Gas

• Data sources, data availability and coverage
Petroleum Nasional Berhad (PETRONAS) is the source of information for this industry and data is received on time. It covers more than 90% of value added in mining and quarrying activity.

• Method of Compilation
Quarterly production of crude petroleum and natural gas together with price information has been used to obtain current and constant price output. The latest available constant price input-output ratio has been used to derive constant price input; inflating this gives current price input. Value added is obtained as the residual.

• Problems, Issues and Future Improvements
Sometimes the quarterly data on quantity and prices are difference compared with annual figure but it is still in the acceptable range.

B. Other Mining (metal mining and quarrying)

• Data sources and data availability
For metal mining, the industry includes the extraction of tin, gold, copper, iron ore, ilmenite and other metals. Data is provided by the Department of Mines. However, movement in the construction industry is used to estimate value added in quarrying activity.

• Method of Compilation
Quantity information by type of metal is supplied by the Department of Mines. Relevant price indicators Data sources, data availability and coverage are used to estimate current and constant price output. It has been necessary to use a fixed input-output ratio in constant price to arrive at intermediate inputs. Value added is obtained as a residual.

There is a lack of any good measure on the quarterly production data of quarrying. Hence, quarterly estimates rely on the movement in the construction industry.

• Problems, Issues and Future Improvements
Efforts have been made to get co-operation from the Mines Department to give information as required by DOSM.

C. Electricity and Gas

• Data sources, data availability and coverage
DOSM collects monthly information (i.e. quantity electricity generated) from the producers and distributors of electricity as well as from the gas distribution industry on a quarterly basis. The data meets the timeliness requirement. This information cover 80-90% of value added for electricity and gas.

• Method of Compilation
Quantum measures of production and distribution of natural gas and of electricity generated provide firm indicators of constant price output. These are used to interpolate and extrapolate constant price value added based on fixed input-output ratios. Current price quarterly values are inflated using reasonably reliable price indicators.
D. Water

- **Data sources, data availability and coverage**
  DOSM collects quarterly quantum information (quantity of water produced) from the various water boards, private sector producers and distributors of water. This covers about 80-85% of value added in water production.

- **Method of Compilation**
  Quantum measures of water distributed provide firm indicators of constant price gross output. This is used to interpolate and extrapolate quarterly constant price value added. Current price quarterly values are obtained by inflating price indicators.

- **Problems, Issues and Future Improvements**
  The annual value added is derived as residual of output less input. Quarterly value added is obtained using quantity of water produced. There are small differences between quarterly and annual figure.

E. Construction

- **Data sources, data availability and coverage**
  DOSM conducts a quarterly survey on value of work put in place. There are about 1400 establishments covered. Timely response rate is about 35%.

- **Method of Compilation**
  Value of work put in place, collected quarterly on a sample basis, provides the mover to interpolate and extrapolate quarterly gross output of the total construction activity. Appropriate deflators are applied to arrive at constant price gross output. The latest available annual constant input-output ratio, is applied to arrive at constant intermediate inputs. Inflating the inputs allows for a measure of current value added to be calculated.

In addition, estimates of constant output are also made using measures of quantities of major commodities used by the industry. This allows for an informed decision on the level of construction activity to be made.

- **Problems, Issues and Future Improvements**
  The estimates for this industry are not as robust as one would like. The measures available are not always consistent leaving some judgement to be made by the national accountant. Difficulty to get at least 70% responses has always been the problem faced by DOSM. Suggestion has been made to reduce the frame and thus, to cover only big companies.

F. Forestry and Logging

- **Data sources, data availability and coverage**
  The data used in this estimate is saw logs (from the Forestry Department), production of sawn timber and plywood production (from the Monthly Manufacturing Survey) and data on the exports of saw logs (from the monthly trade statistics). The data are received on timely basis.

- **Method of Compilation**
  These data are used as movers to estimate value added at constant price for this industry. Relevant price indices are used to inflate constant price value added to arrive at current price value added.
• Problems, Issues and Future Improvements
There is no information available on the cost structure of this industry. Hence, it has been necessary to assume that input to output ratio is unchanged in constant price since 1987. As in the annual estimates, the lack of information on the cost structure of this industry has made it necessary to assume that the ratio of input to output in constant prices has remained constant over the years. Lack of data on output and input on quarterly basis makes it difficult to estimate value added. Sum of four quarters tends to be different from annual figure (estimated using annual data).

G. Fishing

• Data sources, data availability and coverage
Fisheries Department provides data on fish landing and wholesale value by species. It meets the timeliness requirement. The quarterly information covers about 70% of value added in this industry.

• Method of Compilation
The quantity of marine catch and prices of fish are used to estimate constant and current price value added. Lack of information on inputs necessitated the assumption that input-output ratio has remained constant over the years.

• Problems, Issues and Future Improvements
The 1987 Input-Output Study values are moved by measures of quantity and value of fish caught and produced in aquaculture. Relatively reliable information is available on the value and quantity of the marine fish catch. However, there is only limited information on the activities of small-scale fishermen. A small contribution to value added has been included for aquaculture. No information is available on the cost structure of the industry and it has been necessary to assume that the input to output ratio is unchanged in constant price since 1987. Calculating the value added using double deflation method would give a robust estimate. However, this is unable to be done due to lack of data on output and input. Improvement also can be made with extending the coverage by including land fish and ornamental fish.

H. Transport and Communications

• Data sources, data availability and coverage
DOSM conducts a regular survey which covers major establishments engaged in transport, telecommunications and postal/courier services. This survey provides quarterly current price estimates. Generally, the data is obtained on a timely basis. It covers about 80-90% of transport and communication industry in Malaysia.

• Method of Compilation
This industry is divided into transport, telecommunications and postal and courier services. The quarterly current price estimates are used in association with price relatives taken from the CPI and the PPI to get constant price movers. In some cases, constant price estimates are based on quantum movers such as cargo loaded and discharged, ship arrivals and departures, number of passenger journeys by rail and tonnage of paying goods by rail. These methods assume that value added moves with gross output for both the constant and current price until annual benchmark data becomes available.

• Problems, Issues and Future Improvements
There is tendency for respondent to overstate revenue information. Hence, information on revenue (less current expenditures) is incorporated into the estimate to give more reasonable trend estimate. Another problem is that late recipient for some data such as ship arrivals and departures. It is also important to revised sample size occasionally.
I. Finance and Imputed Bank Service Charges

- **Data Source, data availability and coverage**
  Quarterly information on the banking industry is published by Central Bank and it covers a very high proportion of the industry and allows for reliable current price national accounts estimates. It covers about 88% of total value added in finance and imputed service charges. The data compiled are total loans and advances, average lending rate and total savings and fixed deposits.

- **Method of Compilation**
  Quarterly estimates of activity in the finance industry use a mover derived from interest paid and received by the main banks. This information is used to estimate the net interest received by the banks each quarter, which is then used to interpolate and extrapolate current price value added. To derive constant price value added, the current price estimate is deflated by an index constructed using the reference rate principle.

  Imputed bank service charge is equal to interest received less interest paid by finance enterprises. The deflation of the imputed bank service charges use the same value added deflator.

- **Problems, Issues and Future Improvements**
  The quarterly estimates now do not include financial intermediation for offshore banks and development financial institutions which are covered in annual estimates. Efforts are being made to include these institutions to avoid major revision.

J. Insurance

- **Data Source**
  Quarterly information on the insurance industry is provided by Central Bank and it meets the timeliness requirement. The collection of the insurance data is comprehensive as Central Bank act makes it compulsory for the insurance industry to submit their report to the central bank.

- **Method of Compilation**
  Quarterly measures use information on premiums received less claims made each quarter. Net premium received for general business and life insurance is used to extrapolate current price value added. The current price estimate on life insurance is deflated using the CPI to arrive at constant price value added, while a composite index of the CPI is used for general insurance. The ratios used reflect the extent to which household and business sectors use general insurance services.

- **Problems, Issues and Future Improvements**
  More detailed data (e.g. types of premiums and income from investment) are required to estimate value added as outlined in SNA 1993. The dynamic development in insurance industry with the introduction of new insurance products (e.g. annuity scheme) is a new challenge especially in determining the input-output structure.

K. Real Estate

- **Data Source and Method of Compilation**
  Quarterly estimates for this sector use a variety of indicators, which include movements in the main industries served by real estate industry.
• **Problems, Issues and Future Improvements**
This industry is one of the weakest industries in estimating the services sector of GDP. The main problem is to identify the `player` of the industry. Effort to improve the estimate is still going on as to find the reliable result.

*L. Business Services*

• **Data Source**
The indicators used are varied and depend on the activities. For accountants, lawyers, advertising agents, stock brokers, employment agencies and security services, QNA survey data is used. News agency services use total average daily sales of newspaper published by DOSM. Surveyors, engineering, architects and leasing activity to construction use value added of construction sector.

Management consultancy fees, leasing activity to manufacturing and wholesale retail commission use value added of manufacturing sectors. For leasing activity to forestry, value added of forestry sector is used. Leasing of vehicles use bank service charge and non-residential building operation uses value added of real estate sector.

• **Method of Compilation**
Business services is an industry with a wide variety of activities. As mentioned above, it includes services of accountants, lawyers, advertising agents, architects, engineers, surveyors, stockbrokers, management consultants, news agencies, security firms, employment agencies, etc. Methods used and data sources are as varied as the activities. Revenue information from a quarterly survey of the larger establishments together with movements in related or supplying industries are used as indicators to move constant and current price value added.

• **Problems, Issues and Future Improvements**
This sector is growing importance in terms of its contribution to GDP. Hence this industry will be monitored closely to keep in touch with its development.

*M. Ownership of Owner Occupied Dwellings*

• **Data Source and Method of Compilation**
The quarterly estimates in constant price are extrapolated using population change with a factor to allow for increases in home ownership. Selected items of the CPI are used to inflate constant price value added to arrive at current price value added.

• **Problems, Issues and Future Improvements**
The contribution of this sector to Malaysian GDP is quite significant. However, lack of data gives less satisfactory result on the estimates. Efforts are being made to find a reliable indicator for the sector. The recently concluded Population and Housing Census of 2000 will allow us to obtain a fresh benchmark estimate on owner occupied houses.

*N. Private Services*

• **Data Source and Method of Compilation**
There is limited information available on activity in this industry which includes health, education, cinemas, advertising, television and radio broadcasting, gaming, sanitation, motor vehicle repairs, laundries, beauty parlours and barbers, photographic studios and funeral parlours.
Movers are as varied as the activities and include data on gaming duty, number of motor vehicle registrations, number of pupils, estimates of employment from the Labour Force Survey and number of deaths. A quarterly survey of some of the large establishments/institutions provides additional data. These are used to interpolate and extrapolate the quarterly series.

The CPI is the main source of prices for converting constant price estimates to current price and vice versa.

- **Problems, Issues and Future Improvements**
  In Malaysia, private education and health are expanding rapidly. Efforts have been made to improve the estimate on this sector. Example, QNA survey now has covered private education and health to give more accurate estimate on these two industries. Other industries such as sanitary services, laundry & cleaning services, radio & television, cinemas and etc, current contribution to the Malaysian economy is small. But there are also gaining importance and hence need to be monitored closely.

**O. Government Services**

- **Data Source, data availability and coverage**
  Government value added is estimated using Federal Government expenditure on compensation of employee where it covers 75% of Government value added. The data received meet the timeliness requirement.

- **Method of Compilation**
  Current price value added of government services equals the sum of compensation of employees and depreciation. This economic activity of the government in current prices is well supported by information taken directly from the accounts of the four levels of government, namely Federal, State, Local Government and Statutory Bodies. For quarterly estimates, the Federal Government accounts are used as surrogate movers for the whole government sector.

  The current price estimate on government services is deflated using a wage index of Federal Government to arrive at constant price value added. Intermediate inputs are deflated using the PPI and CPI.

- **Problems, Issues and Future Improvements**
  Malaysia encountered a problem when it used total emolument as an indicator to estimate quarterly Government value added. By using total emolument, the estimates were very volatile with positive and negative growth in constant price. After studying the problem, it was found that arrears for annual increment, bonus and salary revision were also included in the total emolument. To solve this problem, DOSM did some study and found that using current salary and allowances gave more accurate estimate.

**P. Import Duties**

- **Data Source, data availability and coverage**
  Monthly data is obtained from Customs and Excise Department. It meets timeliness requirement. The data covers 95% of total import duties.

- **Method of Compilation**
  The monthly accounts from Customs and Excise Department are used for extrapolating the quarterlies. Once the definitive measure comes from the annual report of the Accountant General, the quarterlies are realigned to the annual estimates.

  The current price import duties are deflated by the relevant PPI to arrive at constant price import duties.
6. Consumption Expenditure Component of GDP

A. Private Final Consumption Expenditure

- **Data Source**
  Quarterly retail trade survey
  Information from Balance of Payments i.e. for residence and non-residence expenditure
  Value added from supply side

- **Method of Compilation**
  The main indicator used in the quarterly estimate of final consumption expenditure is obtained from quarterly retail trade survey which give current estimates. CPI is used to deflate to arrive at constant price. Purchases by non-residents in Malaysia and by Malaysian residents overseas are provided by the Balance of Payments statistics. The current/constant price measures for each commodity group are deflated/inflated by the CPI to obtain price relevant estimates of expenditure by households.

- **Problems, Issues and Future Improvements**
  Generally, revenue in retail trade industry is used as mover to estimate some household consumption items. In some cases particularly for large establishments where revenue tend to be overstated, revenue (less current expenditure) information is used as an indicator. Another problem is that of late response especially from the big companies. Sample size also is being revised when necessary to incorporate new big companies.

B. Government Final Consumption Expenditure

- **Data Source**
  Indicator used in this sector is the Federal Government expenditure on compensation of employee and input, and its revenue. The data is received from Accountant General (a government department) within the time frame required by DOSM.

- **Method of Compilation**
  Government final consumption expenditure is calculated as the sum of value added and intermediate consumption, less revenue from sales of goods and services produced by government. Government enterprises are excluded. Value added is calculated as government wage cost plus consumption of fixed capital. The estimate of intermediate consumption is obtained by calculating the value of goods and services used up in the production of government services.

  For the quarterly series, the Federal Government accounts are used as a surrogate mover for the whole government sector. This assumes that the proportion of Federal Government to total Government remains the same as the last year for which annual estimates have been made.

  The constant price estimates of value added are obtained by deflating the current price value added by a wage index of Federal Government while intermediate input is deflated using an index based on price relatives drawn from the PPI and CPI.
7. Exports and Imports of Goods and Services Component of GDP

A. Exports and Imports of Goods and Services

- **Data Source and data availability**
  - Customs declaration
  - Survey (for services item)
  - The data is obtained from Balance of Payment Division on timely basis.

- **Method of Compilation**
The current price series for these items are based on the balance of payments estimates. The merchandise trade is the major item of value for both imports and exports and customs records provide a reliable measure of the current value. Service trade flows are estimated from a quarterly survey conducted by DOSM.

Several indices are used to deflate the current price series to constant price values. Imports are deflated by the imported component of the PPI while exports are deflated by the domestic production component of the PPI. Exceptions to these are transport equipment (ships and aircrafts) and computers where the United States PPI adjusted for exchange rate is used. In the service area, the CPI has been the main deflator; the exception being for travel and education where an index based on the exchange rates of major currencies is used.

- **Problems, Issues and Future Improvements**
Merchandise trade data is firm. For services transaction, Malaysia has taken some steps to improve the estimate especially on `other services transaction' and `investment income. This is also to comply with BPM5 requirement.

8. Other GDP components

A. Change in Stocks

- **Data Source and data availability**
  - Monthly Manufacturing Survey (DOSM)
  - Data from selected government and private agencies e.g. rubber, palm oil and crude petroleum.
  - The data is received within the time frame requirement.

- **Method of Compilation**
Measures of change in stocks have been built up from the monthly survey of manufacturing industries and a quarterly survey of other industries. Changes in stocks of major agriculture commodities have been obtained from the statistical and administrative records of the Department and relevant agencies.

Some measures of stock change are in quantum terms while others are in value terms. Relevant price relatives from the PPI and other price collections have been used to derive current and constant price measures of each component of stocks.
• **Problems, Issues and Future Improvements**
  This estimate can only be regarded as providing a reasonable indication of the direction and general order of the size of the change in stocks.

**B. Gross Fixed Capital Formation**

• **Data Source and Timeliness**
  - imported capital goods (from External Trade Statistics)
  - domestic production (from Monthly Manufacturing Survey)
  - output of construction
  - Data is obtained according to the time frame required.

• **Method of Compilation**
  Quarterly expenditure estimates are made for four types of asset groupings:
  - Major imported items of ships, aircrafts and oil exploration equipment,
  - Selected imports representing all other capital goods,
  - Selected commodities representing all domestically produced commodities going into capital formation, and Construction.

A high proportion of the construction output is included in the measure of capital formation. A measure of the value of merchandise trade from monthly Customs Declarations provides information on value of imports and exports. For large items such as aircrafts, ships and equipment associated with oil exploration, an analysis is made on the ownership status. Those on lease are excluded while the rest are included. Deflators to obtain constant price estimates use CPI and PPI and for major transport items, internationally available price indices are used. The latter are adjusted for exchange rate changes where appropriate.

For all other imported capital goods, the import value of selected items are used as movers of the current value going into capital formation. Similar movers are set up for domestically produced commodities going into capital formation. Price relatives from the PPI are used to deflate the current price values.

• **Problems, Issues and Future Improvements**
  Method adopted does not allow for estimates to be made by sector/industry and public/private. To improve the estimate, Malaysia has decided to conduct a regular survey on capital stock (planning stage).

**9. Revision Policy and Frequency of publication**

**A. Revision Policy**

For quarterly estimates that involve annual figure, year `y-2` will be revised. When quarter 2, 3 and 4 are estimated, only previous quarter will be revised. However, if there are changes on firm data, revision will be made accordingly.
B. Frequency of publication

Quarterly GDP is published every quarter within 8 weeks after reference quarter.

Acronyms:
BPM5: Balance of Payments Manual 5th edition
CPI: Consumer Price Index
DOSM: Department of Statistics, Malaysia
GDP: Gross Domestic Product
PPI: Produces Price Index
NEW ZEALAND

Nick Treadgold, Statistics New Zealand

1. Introduction

Statistics New Zealand currently produces two measures of quarterly GDP:

- Chain-volume production-based measure of GDP
- Chain-volume and current price expenditure-based measure of GDP

These series are based on the 1993 System of National Accounts. The chain-volume series are expressed in the average prices of 1995/96. Chain-volume series were first released in November 2000 and were also the first presentation under the Australian and New Zealand Standard Industrial Classification (ANZSIC). The shift to chain-volume measures has removed the necessity for periodic rebasing as weights are now updated on an annual basis.

Statistics New Zealand produced its first quarterly GDP series (production measure) in 1984. This was a constant price series with a base year of 1977/78. It was later rebased at 1982/83 prices and this was the base year for the expenditure measure when it was first introduced. Both measures were later rebased to 1991/92 prices.

Histories of the quarterly series are summarised in the table below.

<table>
<thead>
<tr>
<th>Base/Expression year</th>
<th>Start of series</th>
<th>First release date</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Constant price series</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GDP (P) 1977/78</td>
<td>June 1977</td>
<td>November 1984</td>
</tr>
<tr>
<td>1982/83</td>
<td>June 1977</td>
<td>October 1987</td>
</tr>
<tr>
<td>1995/96</td>
<td>June 1988</td>
<td>1</td>
</tr>
<tr>
<td>GDP (E) 1982/83</td>
<td>June 1982</td>
<td>June 1990</td>
</tr>
<tr>
<td>1995/96</td>
<td>June 1988</td>
<td>1</td>
</tr>
<tr>
<td><strong>Current price series</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GDP (E) not applicable</td>
<td>June 1982</td>
<td>July 1994 (experimental)</td>
</tr>
<tr>
<td>not applicable</td>
<td>June 1988</td>
<td>June 2001</td>
</tr>
</tbody>
</table>

1. First release under the SNA93 framework, the adoption of Australian and New Zealand Industry Classification, and chain-volume real measures.

Quarterly GDP is a key measure of New Zealand’s short-term change in economic activity. The series are widely used for monitoring and forecasting economic variables. In particular, the quarterly GDP series are used for measuring current economic capacity and the implications on monetary policy as set of the
governor of the Reserve Bank of New Zealand. Consequently, there is a wide range of users of the quarterly GDP statistics. These include:

- government departments for policy formation
- economic analysts for forecasting
- researchers interested in understanding economic trends
- overseas investors and agencies
- business accountants

2. Data sources

The most important base statistics for the quarterly calculations are the primary food production statistics, quarterly surveys of manufacturing, building, employment, and wholesale trade, Balance of Payments statistics, and the monthly Retail Trade Survey.

Where price deflation is used, deflators are sourced from Statistics New Zealand’s published price indexes, including: the Producers Price Indexes (PPI), the Consumers Price Indexes (CPI), Overseas Trade Price Indexes (OTI), Capital Goods Price Indexes (CGPI) and Labour Cost Indexes (LCI).

More detailed data sources (along with methods) for the production and expenditure measures of GDP are listed in Section 7.1.

Major data source gaps in quarterly surveys include:

- non-building construction activity
- services (e.g. telecommunications and business services)
- software

These are being addressed by extending the coverage of the current sub-annual surveys into those industries not currently covered.

Survey data is generally taken unadjusted directly from the published survey outputs. The National Accounts Division deflates (where appropriate), benchmarks the quarterly series an annual level, and then seasonally adjusts the data to produce industry value added or expenditure estimates. Survey data is most commonly adjusted where it has been affected by industry reclassifications that are not reflected in the National Accounts estimates. Economic coherence adjustments are also made when the production-based GDP estimates are analysed against the expenditure series.

3. Compilation/estimation methods

The chain-volume measures of GDP are obtained by weighting together the individual industries or expenditure components to produce a Laspeyres volume index for each quarter. The resulting indexes are linked to produce the quarterly GDP time series. The annual weights used to derive the chain-volume measures are derived from the current price supply-use tables.

Quarterly volume estimates are compiled using volume extrapolation, quantity revaluation or price deflation of the survey data. Where volume indicators are used on the expenditure side, the current price components are calculated using price reflation.

The methods for each of the production and expenditure groups are documented in further detail in Section 7.1.

The main quality issues with quarterly GDP methodologies are:
• labour input measures used in services area and the assumption of zero productivity gains
• real measures of non-market services assumes inputs cost of service provision equals output
• quality of travel credits and travel debits estimates
• coverage of tourist expenditure compared to the coverage of total resident and non-resident expenditure in New Zealand used in the calculation of household final consumption expenditure.

These issues are being addressed by the extension of sub-annual surveys into services area while a separate project is investigating the use of output indicators for non-market services. Ongoing quality improvements are also made to data sources and methodologies.

Separate constant price methodologies for the annual production-based measure of GDP are in place for many industries. These are generally compiled by using single or double price deflation of the balanced industry accounts or using annual volume estimates.

Quarterly nominal expenditure estimates are benchmarked to balanced annual expenditure accounts. In general, there are no separate constant price methodologies for the annual expenditure accounts.

4. Benchmarking and seasonal adjustment techniques

A. Seasonal adjustment:

Statistics New Zealand uses X-12-ARIMA (predominately version 0.2.6) to estimate the trend, seasonal and irregular component components of the seasonal model. X-12-ARIMA is a seasonal adjustment program developed at the United States Bureau of the Census.

The production- and expenditure-based chain-volume GDP aggregates are both directly seasonally adjusted. A general summary of the method of seasonal adjustment for the components of both the expenditure and production based series are listed in Section 7.2:

Other notes on quarterly GDP seasonal adjustment:

• trend estimates of quarterly GDP or its components are not published
• extremes values are removed before seasonal adjustment. For example, a prior adjustment of $563m in the second quarter of 1997 was made for the purchase of a frigate
• Statistics New Zealand does not use the benchmarking X-12-ARIMA option that forces the adjusted series to have the same annual totals as the unadjusted series
• the decomposition components are fully revised with each additional data point.


B. Benchmarking

In many cases, the most appropriate data is only available on an annual basis. This is particularly the case where data is derived from the current price series. In these cases the preferred method is to derive an annual estimate of constant price value added. Quarterly estimates are then derived, consistent with the annual estimates, using one of two basic approaches.
1. Reconciliation and extrapolation

In this method a quarterly indicator series is obtained and is reconciled to the annual value. The quarterly indicator may be derived by any of the three methods for deriving constant price series (quantity revaluation, price deflation or volume extrapolation). As a general rule, the quarterly indicator will represent a subset of the series that is being measured. The assumption underlying the use of quarterly indicators is that the quarterly changes in the indicator reflect the quarterly patterns inherent in the annual measure.

The reconciliation process is a generalised mathematical algorithm that forces the quarterly series into consistency with the annual values, while at the same time retaining the movements in the quarterly series as much as possible. Where the annual value is not available for the latest periods, the movements in the quarterly series are adjusted to the level established by the last available annual estimate. As each new annual value becomes available this involves interpolation between the latest annual values using the quarterly indicator.

2. Interpolation and extrapolation

Where no quarterly data is available, a quarterly series is derived from the annual estimates by a process of interpolation. This fits the smoothest quarterly line between the annual points. Where annual estimates are not yet available for the latest periods, an extrapolation is made of the annual values for the required periods. Unless there is evidence of a strong trend in the annual series, or other data is available on which to base a forecast, a conservative approach of holding the last annual constant is generally taken.

Interpolation and extrapolation of an annual value without an indicator series is the least desirable method of deriving quarterly estimates. The method is generally used only for areas with a minor contribution to published statistics, where little short-term variation in value added is expected or where no quarterly data is obtainable. Examples are:

- vegetable production in agriculture;
- mining and quarrying other than coal mining, oil and gas extraction;
- water supply; and
- the general insurance industry.

All annual accounts are compiled on a year ended 31 March basis.

5. Publication, revision and user forum on GDP

A. Publication

Statistics New Zealand publishes quarterly GDP within 13 weeks following the end of the reference quarter. Data is published in an information release "Gross Domestic Product qqqyy quarter” (SNZ catalogue number 08.522). This release contains commentary on the latest data, summary tables, technical notes, and explanations for revisions. The information release is available in both hard copy and also on the Statistics New Zealand website. Users can also access the latest data online through the time-series application INFOS.

The data are embargoed until 10:45am (Auckland, New Zealand time) on the day of release. Statistics New Zealand allows media, Treasury officials and economists access to the data in a lock-up environment from 10.00am on the day of the release.

The release dates are published six months in advance in the Statistics New Zealand ‘Hot off the Press (HOTP) Release Dates’ publication, and also on the website.

B. Revisions

Revisions to the previously published series may be made each quarter. The frequency and cause of these revisions is for a number of reasons:

1. Quarterly

Additional data becoming available for the latest quarters, which is used to replace existing estimates; revisions to quarterly data (e.g. revisions to the Balance of Payments or Retail Trade Survey), which will be incorporated as soon as possible to maintain consistency between published macroeconomic statistics.

In addition, the addition of a new point in the quarterly series has the potential to alter seasonal factors, and thus may lead to a revision in the seasonally adjusted series.

2. Annual

Introduction of annual data, following the release of the latest annual national accounts (for the year ending 31 March) in November each year.

Revisions also occur from chain-linking. Re-weighting is part of the annual revisions cycle and is timed to coincide with the introduction of other new annual data from the current price GDP accounts. These changes are normally incorporated into the December quarter release, which occurs at the end of March in the following calendar year.

3. Irregular

An example of an irregular revision would be a methodological change. Revisions of this nature are, in so far as it is possible, incorporated to coincide with the annual cycle of revisions outlined above.

A summary table for revisions is included in Section 7.3

6. Future plans for improvement

A. Quarterly income measure

At present, Statistics New Zealand produces no sub-annual economy-wide measure of wages and profit. The development of surveys to collect these data would allow an income measure of real GDP to be calculated. This would contribute to improving the accuracy and coherence of the production and expenditure measures of quarterly GDP. The development of quarterly income measures is strongly supported by key users and as a result is being factored into the current sub-annual survey redevelopment.
B. Real measures of services

There are current concerns with robustness of the methodologies to estimate both market and non-market services. These inaccuracies result from the use of labour input methods and the zero productivity gain assumption based around their use. Weaknesses in methodologies with market service industries (e.g. business, personal and community) is being solved by extending the coverage of the sub-annual surveys enabling the adoption of methodologies based around the deflation of output or value added.

Non-market services include those services provided free or at minimal price by central and local government, and by non-profit organisations. Service industries now make up a predominant percentage of New Zealand’s industry value added, and as non-marketed services are a major component of the total services produced. Current measurement inaccuracies are having an increasingly adverse impact on the accuracy of real GDP measures. As a result, new output measures are currently being developed for some services (health and education) based around the use of output measures.

C. Backdating accounts

The current quarterly GDP series have only been backdated to 1988. Prior to this only fixed-weight series based on the 1968 System of National Accounts are available. Statistics New Zealand is currently in the process of producing backdated quarterly production series to 1977/78 and expenditure series to 1982/83.

D. Re-engineering of systems

Quarterly GDP is currently compiled using the SAS system. The current systems are inefficient, complex and not integrated with many other parts of the New Zealand System of National Accounts. A major re-engineering of the systems has started based around a single, comprehensive database of all national accounts series.
# Appendix

## Quarterly Sources and Methods: Production- and expenditure-based GDP

<table>
<thead>
<tr>
<th>Industry</th>
<th>% of GDP</th>
<th>Data Source</th>
<th>Quarterly Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture</td>
<td>5.3</td>
<td>Volume of livestock slaughtering from Ministry of Agriculture and Forestry</td>
<td>Extrapolation by an output volume index</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Wool sales from Wool's of New Zealand</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Milk-fat production from New Zealand Dairy Board</td>
<td></td>
</tr>
<tr>
<td>Fishing</td>
<td>0.3</td>
<td>Fish catch volume statistics</td>
<td>Quantity Revaluation</td>
</tr>
<tr>
<td>Forestry &amp; Logging</td>
<td>1.3</td>
<td>Roundwood removals from Ministry of Agriculture and Forestry</td>
<td>Extrapolation by an output volume index</td>
</tr>
<tr>
<td>Mining &amp; Quarrying</td>
<td>1.2</td>
<td>Gas and condensate extraction and metres drilled in petroleum exploration</td>
<td>Extrapolation by an output volume index</td>
</tr>
<tr>
<td></td>
<td></td>
<td>from Ministry of Economic Development</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Coal production statistics from Quarterly Survey of Coal Sales</td>
<td></td>
</tr>
<tr>
<td>Primary Food Manufacture</td>
<td>2.1</td>
<td>Volume of dairy products processed from New Zealand Dairy Board</td>
<td>Extrapolation by an output volume index</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Volume of livestock slaughtering from Ministry of Agriculture and Forestry</td>
<td></td>
</tr>
<tr>
<td>Manufacturing other than primary food</td>
<td>15.2</td>
<td>Sales and inventories from Quarterly Manufacturing Survey</td>
<td>Extrapolation by an output volume index based on deflated sales and inventories</td>
</tr>
<tr>
<td>Electricity, Gas &amp; Water</td>
<td>2.6</td>
<td>Electricity generated from Ministry of Economic Development</td>
<td>Double deflation. Gross output is extrapolated using total electricity generated.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Intermediate consumption is extrapolated by a quarterly volume indicator</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>using thermal generation for fuel inputs, and total electricity generated</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>for the remainder.</td>
<td></td>
</tr>
<tr>
<td>Building &amp; Construction</td>
<td>4.0</td>
<td>Quarterly Survey of Building Activity</td>
<td>Extrapolation by an output volume index using deflating building activity</td>
</tr>
<tr>
<td>Wholesale Trade</td>
<td>7.9</td>
<td>Quarterly Wholesale Trade Survey</td>
<td>Extrapolation by an output volume index using deflated wholesale sales</td>
</tr>
<tr>
<td>Retail Trade, Accommodation,</td>
<td>7.4</td>
<td>Monthly Retail Trade Survey</td>
<td>Extrapolation by an output volume index using deflated sales</td>
</tr>
<tr>
<td>Restaurants &amp; Hotels</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transport &amp; Communication</td>
<td>0.3</td>
<td>Direct surveying of major service providers including; air and rail freight</td>
<td>Extrapolation by an output volume index</td>
</tr>
<tr>
<td></td>
<td></td>
<td>and passenger volumes; postal and telecommunication volumes</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Road User Charges</td>
<td></td>
</tr>
<tr>
<td>Finance, insurance and Business Services</td>
<td>3.5</td>
<td>Reserve Bank of New Zealand monetary aggregates</td>
<td>Extrapolation by an output volume index</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Premium income from Insurance Association of New Zealand</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Number of private property rented dwellings</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Hours paid from Quarterly Employment Survey</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>for business services</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Property sales from Quotable New Zealand</td>
<td></td>
</tr>
<tr>
<td>Government Administration &amp;</td>
<td>3.3</td>
<td>Salaries and wages from Crown Financial Information System</td>
<td>Extrapolation by an input volume index</td>
</tr>
<tr>
<td>Defence, Education, and</td>
<td></td>
<td>Numbers employed from the Quarterly Employment Survey</td>
<td></td>
</tr>
<tr>
<td>Industry</td>
<td>% of GDP (95/6)</td>
<td>Data Source</td>
<td>Quarterly Method</td>
</tr>
<tr>
<td>--------------------------------</td>
<td>-----------------</td>
<td>-----------------------------------------------------------------------------</td>
<td>-----------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>health</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Personal &amp; Community Services</td>
<td></td>
<td>House paid from Quarterly Employment Survey</td>
<td>Extrapolation by an input volume index</td>
</tr>
<tr>
<td>Household Final Consumption</td>
<td>57.8</td>
<td>Monthly Retail Trade Survey and Balance of Payments overseas travel statistics</td>
<td>Deflated Retail Trade data is allocated to commodities using (3 yearly) Household Economic Survey point-of purchase information. Travel credits are deducted and travel debits added for private travellers.</td>
</tr>
<tr>
<td>Government Final Consumption Expenditure</td>
<td>15.2</td>
<td>Crown Financial Information System, Quarterly Employment Survey</td>
<td>Price deflation for most components of Government FCE</td>
</tr>
<tr>
<td>Change in Inventories</td>
<td>1.3</td>
<td>Monthly livestock slaughtering statistics, Quarterly Manufacturing Survey, Quarterly Wholesale Trade Survey, and Monthly Retail Trade Survey</td>
<td>Deflation/revaluation using quarterly and monthly surveys. Livestock and forestry models calculate inventory change.</td>
</tr>
</tbody>
</table>
Mineral exploration calculated using metres drilled indicator |
| Exports & Imports              | 29.3            | Merchandise trade statistics, Balance of Payments statistics, Overseas Trade Price Indexes | Price deflation and quantity revaluation                                                                                                       |
## Quarterly GDP Seasonal Adjustment Summary

<table>
<thead>
<tr>
<th>Expenditure Aggregate Industry</th>
<th>Direct or Indirect Adjustment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture and hunting</td>
<td>Indirect</td>
</tr>
<tr>
<td>Fishing, forestry and mining</td>
<td>Direct</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>Indirect</td>
</tr>
<tr>
<td>Electricity, gas and water</td>
<td>Indirect</td>
</tr>
<tr>
<td>Construction</td>
<td>Indirect</td>
</tr>
<tr>
<td>Wholesale trade</td>
<td>Direct</td>
</tr>
<tr>
<td>Retail trade</td>
<td>Direct</td>
</tr>
<tr>
<td>Restaurants and hotels</td>
<td>Direct</td>
</tr>
<tr>
<td>Transport and communication</td>
<td>Indirect</td>
</tr>
<tr>
<td>Finance, insurance, real estate and business services</td>
<td>Direct</td>
</tr>
<tr>
<td>Community, social and personal services</td>
<td>Indirect</td>
</tr>
<tr>
<td>General government services</td>
<td>Indirect</td>
</tr>
<tr>
<td>Owner-occupied dwellings</td>
<td>Direct</td>
</tr>
<tr>
<td>Unallocated</td>
<td>Indirect</td>
</tr>
<tr>
<td><strong>GDP(P)</strong></td>
<td><strong>Direct</strong></td>
</tr>
<tr>
<td>Private final consumption expenditure</td>
<td>Indirect</td>
</tr>
<tr>
<td>Government final consumption expenditure</td>
<td>Indirect</td>
</tr>
<tr>
<td>- central government</td>
<td>Direct</td>
</tr>
<tr>
<td>- local government</td>
<td>Direct</td>
</tr>
<tr>
<td>Increase in stocks</td>
<td>Direct</td>
</tr>
<tr>
<td>Gross fixed capital formation</td>
<td>Direct</td>
</tr>
<tr>
<td>Exports</td>
<td>Indirect</td>
</tr>
<tr>
<td>- goods</td>
<td>Direct</td>
</tr>
<tr>
<td>- services</td>
<td>Direct</td>
</tr>
<tr>
<td>Imports</td>
<td>Direct</td>
</tr>
<tr>
<td>- goods</td>
<td>Direct</td>
</tr>
<tr>
<td>- services</td>
<td>Direct</td>
</tr>
<tr>
<td><strong>GDP(E)</strong></td>
<td><strong>Direct</strong></td>
</tr>
</tbody>
</table>
National Accounts revision policy

<table>
<thead>
<tr>
<th>Group</th>
<th>Current price series</th>
<th>Constant price series</th>
</tr>
</thead>
</table>
| GDP (P) | Annual
Annual revisions are released in October. Industry analysis is up to year $t+3$ only.
Quarterly
Not produced. | Annual
As for the current price series, except released with the following September or December quarter QGDP(P) series.
Quarterly
Revised each quarter, back to the last annual. |
| GDP (E) | Annual
Major revisions with the release each October of the annual consolidated accounts. May be revised each quarter to align with quarterly series.
Quarterly
Revised each quarter back to the last annual reconciled with the latest Input-Output study. | Annual
As for the current price series. |

Quarterly
As for the current price series.
1. Introduction

The Singapore Department of Statistics (DOS) compiles annual estimates of GDP using all three approaches, viz. output, expenditure and income. Historical series of annual real and nominal GDP estimates using the output and expenditure approaches are available from 1960, while annual nominal income-based GDP estimates are available from 1980.

Since the mid-1970s, DOS has also compiled the quarterly estimates of real GDP using the output approach. A complementary quarterly series of real GDP using expenditure approach was compiled since the late 1980s. Quarterly estimates of output-based nominal GDP were introduced in 2000.

This paper outlines the data sources and methodology adopted by DOS for the compilation of timely, quarterly estimates of GDP.

2. Data Sources

Since detailed information from comprehensive annual surveys are not available during the compilation of quarterly GDP estimates, the approach to the compilation of quarterly GDP estimates differs from that for the compilation of annual GDP estimates. This is particularly so for output-based GDP.

Since quarterly GDP estimates have to be timely, a practical approach to their compilation has to be based on short-term economic indicators. Where direct indicators are unavailable, proxy indicators that correlate well with the level of economic activity in the particular industry have to be found or developed.

DOS makes use of a vast and diverse range of administrative and survey data to derive suitable and appropriate indicators for use in the compilation of quarterly GDP estimates.

The main data sources for the compilation of quarterly GDP estimates include the following:

**GDP by output approach:**
- External trade statistics
- Construction statistics
- Transportation and telecommunication statistics
- Employment and remuneration statistics
- Monthly Surveys of Industrial Production
- Monthly Surveys of Retail Trade
- Monthly Surveys of Catering Trade
- Quarterly Surveys of Wholesale Trade
- Quarterly Business Expectations Surveys
Quarterly Surveys of Financial Institutions
Survey of Quarterly Business Receipts
Survey of Quarterly National Income Estimates

**GDP by expenditure approach:**
- External Trade Statistics
- Income and Expenditure Accounts of Statutory Boards
- Government Financial Statements
- Balance of Payments Statistics
- Public Sector Capital Expenditure on Machinery and Equipment Survey

The survey of Quarterly National Income Estimates is a survey designed specifically to collect additional data required for the compilation of quarterly GDP estimates. The scope and coverage of this survey was expanded in 1997 to cater to the development and compilation of quarterly estimates of nominal output-based GDP.

3. Methods of Compilation

Quarterly GDP estimates are compiled using a mixture of volume and value indicators. Volume indicators measure the quantity of output produced, materials inputs or employment. Some examples of volume indicators used in our compilation of output-based GDP are: index of industrial production, utility sales, air and sea cargo tonnage etc. Value indicators measure the value of the output, material inputs or the wages of the workers employed. Some examples in this category are: certified progress payments of construction works, value of stocks and shares transaction, value of loans and advances etc.

Estimates of nominal and real GDP estimates make use of these volume and value indicators differently. In compiling nominal GDP estimates, volume indicators are extrapolated directly to obtain quarterly estimates of constant price value-added. These are inflated to current price value-added using appropriate price indices. Conversely, in compiling real GDP estimates, value indicators are used directly to obtain quarterly estimates of current price value-added, but are deflated with appropriate price indices to obtain estimates of constant price value-added.

GDP estimates for expenditure approach are compiled mainly using a commodity flow approach. Constant price GDP estimates are compiled through the deflation of the current price components with appropriate price deflators drawn from components of a wide range of price indices, including the consumer price index, wholesale price indices, construction price index, property price index and tender price index.

4. Benchmarking and Seasonal Adjustment Techniques

Since the approach and data sources used in the compilation for quarterly and annual GDP are not the same, the quarterly GDP estimates are re-aligned or benchmarked annually with the annual GDP estimates. These annual GDP estimates are considered to be more reliable, as they are based on more comprehensive data. Benchmarking of quarterly estimates with annual estimates ensure that the sum of the quarterly estimates is the same as the annual estimate, while preserving as far as possible the trend and growth rates of the original quarterly estimates.

DOS adopts the proportional Denton benchmarking method. Unlike the simple pro rata distribution approach, the Denton procedure avoids the problem of discontinuities between fourth quarter and the first
quarter of the following year. This is done through quadratic minimisation of the differences between the re-aligned and original series, subject to the constraint that the yearly sums of the re-aligned estimates are equal to the annual estimates. The benchmarked series are seasonally adjusted using the X-11 procedure.

Seasonal adjustments of GDP series are performed quarterly using seasonal factors established in the annual re-analysis of the benchmarked quarterly estimates. During the process, the components of GDP are analysed separately. Seasonally adjusted total GDP is obtained by aggregating its components.

The seasonal patterns of overall GDP as well as some of the industries such as manufacturing are very stable and strong. Seasonal adjustment removed the dip consistently recurring in the first quarter of the year caused by the Chinese New Year falling at that time of the year. Traditionally, many firms close during the long Chinese New Year holidays, resulting in the fall of output during the first quarter of the year. (This is the Chinese New Year effect.) Similarly, seasonal effects exhibited in fourth quarter each year due to increases in production to meet year-end festive demand were also removed.

On the type of expenditure on GDP, the components on transport equipment, increase in stocks, net exports of goods and services do not exhibit any stable seasonal pattern and are therefore not seasonally adjusted. Components on private consumption expenditure, government consumption expenditure and gross fixed capital formation are found to be influenced by seasonal variations and adjusted accordingly.

5. Revision and Publication of Quarterly GDP

Singapore releases advance estimates of output-based GDP within 10 days from the end of the reference quarter. Preliminary estimates of both output- and expenditure-based GDP are released in the Quarterly Economic Surveys of Singapore within 9 weeks from the end of the reference quarter. Revisions to these preliminary quarterly estimates as a result of annual benchmarking are released with the annual GDP estimates in the Annual Economic Survey of Singapore within two months from the end of the reference year. Complete historical series are available in TREND, which is an on-line time series database available for public subscription.
SRI LANKA

R.M. Fernando, Department of Census and Statistics, Sri Lanka

1. Introduction

The Department of Census and Statistics (DCS) is the central authority of the Government responsible of collection compilation and dissemination of data. The DCS also has a decentralised network throughout the country. DCS has the statutory obligations for the compilation of National Accounts for the country. The Compilation of National Accounts was introduced in 1947. The UN system of National Accounts 1953 was used as a guide to release NAE tables for the period 1960 onwards until 1970’s with considerable improvements in NAE. The first annual publication of National Accounts of Sri Lanka was released to comply with the present format in mid 1950’s. Now DCS has already started to introduce SNA1993 and Production Account was compiled according to SNA1993 for the years 1998 to 2001. The Central Bank of Sri Lanka also releases its annual report including NAE giving priority for financial statistics.

2. Data Sources

The estimates of Agriculture sector is being compiled indicating its 13 sub sectors namely Tea, Rubber, Coconut, Minor export crops, Paddy, Other food crops, Tobacco, Betel and Arecanuts, Miscellaneous Agricultural Products, Live stock, Firewood and Forestry, Fisheries and Plantation Development. The Estimates are mainly based on the production approach in addition to other two approaches for annual and by annual estimates. The data collection Formats are introduced for Quarterly estimates since last three years to obtain data from relevant institutions. In the case of main seasonal crops production data is available in two seasons for each year namely Maha season and Yala season related to the weather pattern of the country. This same pattern can be seen in most cases for vegetables too. In certain cases, it is more than two crops. The exports crops data is available in the trade statistics, which is published monthly by the Department of Customs. Subsidiary food crops, vegetables and fruits and other farming activities with informal nature, information on the activities in these areas are available from DCS statistical network. However, these data are also collected seasonally or twice a year only. The monitoring of quarterly production is really based on with the other indirect and direct indicators. Those are fertiliser issues, imports and production of agricultural chemicals, weather performance and forecasts, and Implementation Programme Reports from Agriculture fields staff of the Agriculture Department.

Livestock data, which is collected by DCS annually, cannot be obtained quarterly Hence indicators should be derived to arrive at the value-added. Data for the fisheries production can be obtained quarterly from the Ministry of Fisheries.

For the Mining and Quarrying sector Quarterly data can be collected or derived from the relevant indicators. The major contributor to this sector is from Precious and Semi Precious stones which can be taken from the monthly Custom Statistics.
For the Manufacturing sector data is collected only by annually and biannually. There are practical problem of collecting data by quarterly even though it was introduced to continue by the Department of Census and Statistics (DCS). Therefore, this is monitored by getting monthly export statistics of industrial products by Custom Department such as Tea, Rubber, Garment Textiles etc..

Construction value added is based mainly on the material approach. Since there are only few major producers of cement and related building materials, the output of those can be obtained from those institutions. Similarly major portion of building materials are imported goods. So, those can be obtained from monthly Custom Statistics.

Electricity generation can be obtained from the Ceylon electricity board where as gas production from the shell gas company and water production from the water supply and drainage board. This information is available in time due to the monopolistic nature of these activities. Electricity generation and water supply are state-controlled monopoly.

In the telecommunication sector getting information in time is becoming a problem with increasing competition, with the opening up of the industry to the private sector. Earlier Sri Lanka Telecommunication company which belongs to the government controlled the telecommunication service. This was a fast growing industry over the last few years. Hence, this information collection mechanism has become complicated since more operators especially foreign operators are reluctant to provide financial information in time.

Transport sector consists of road, rail and air transportation. In the road transport the Central Transport Board provides passenger transport services, which is owned by the government. The private sector road transport information can be obtained from the Sri Lanka Transport Commission. However, there are lag of getting information due to lack of proper mechanism to collect information. The information about the goods transport by lorries is also very difficult, because it is almost under the private sector operators.

Domestic trade is also dominated by the private sector.

3. Method of compilation.

The GDP estimates are done by using production approach and it is considered as the more reliable estimate on the basis of availability of data on production. Therefore, this is the control total for other estimates of GDI based on income approach and GDE on expenditure approach. There might be issues on why we do use GDP as control total for others without using independent three approaches. The DCS also compiles and release biannual GDP Estimates for each current year in advance to assist the planers, policy makers and especially for budgetary works etc. Quarterly, GDP estimates are also computed for the three sectors of Agriculture, Industry and Services for Sri Lanka using indicators for limited use.

With the liberalised economic policies, the expansion of the private sector participation in economic activities can be seen. So, the share market also became an active. These developments created a more competitive environment and thereby creating an increasing demand for the information on performance of economic activities in short intervals. Compilation of QGDP is out come of the efforts to meet this demand. Since QGDP estimate is still at initial stage there are some areas to be improved over the time and within another one and a half years time it DCS hope to release quarterly estimates in detail as a Publication.
A. Quarterly GDP estimates by Expenditure Approach

Quarterly GDP estimates are very useful for the users such as Policy makers, Businessmen, Manufactures, and Investors etc.

Main components of GDE;

i. Private Consumption Expenditure (PCE)

ii. General Government Consumption Expenditure (GCE)

iii. Gross Capital Formation (GCF)

iv. Changing Stocks (CS)

v. Exports

vi. Imports

Quarterly GDP by expenditure approach is more difficult to compute due to lack of required information. Of course, the exports and imports can be estimated by using the monthly Custom Statistics. Similarly, the GCF can be estimated by using the similar data set. The imported content is larger in the GCF. Therefore, Custom data can be use for this purpose too. Even though budget estimates of government seems to be good source for GCE estimates, but it is not available or reported in quarterly. In the case of PCE, which is the main component of the GDE cannot be measured directly. So, indirect indicators have to be developed by using import statistics and domestic production data. But, the factors such as price changes and the demand pattern of the commodities will have a direct impact on PCE. Price changes can occur due to factors like the supply and demand of commodity, transport cost and weather conditions etc..

B. Quarterly GDP estimates by Mixture of three Approaches

1. Introduction:

Economic indicators are statistical time series measuring activities in key sectors of the economy. By following the movements of such statistical series, we are able to obtain economic and business information that is up-to-date, comprehensive, relatively objective, and capable of being read and understood with minimum expenditure of time. The concept of an indicator is to obtain and indication of the movement in the economy in general. It is possible to identify and define types of transactions and areas of activity in which changes have an important and relatively predictable effect on broader segment of the economy.

2. Classification of Indicators:

Within the economy, certain activities tend to occur in a cyclical fashion over time and can be identified in respect to their relationship with the broad movement of the Gross Domestic or National Product. These activities can be quantified and specific economic time series and those can be constructed that tend to lead, coincide with, or lag the expansion or contraction of the economy.
If these series are grouped according to their movement in relation to the aggregate economy, then those can be used as tools for analysing current economic conditions and forecasting economic movement.

The behaviour of these selected groups of economic time series, or indicators, can be shown as an average or an index of their movements. These series that tend to lead at expansion or contraction turns of the aggregate economy are grouped into one index, those that coincide into another index, and those that tend to lag into a third group.

The components of the indices are drawn from any different economic process or groups and are combined to form the measures. Two basic criteria are applied in determining which time series to be used. The first is timeliness, and the second is accuracy.

Since the purpose of the indicators are to provide this information promptly and with reasonable accuracy only monthly series are available on a timely basis and are not subject to large revisions and are considered when selecting component for the index.

3. Economic Process:

The following economic process or classes can be used to identify activities and time series:

- Employment and unemployment
- Production and Income.
- Consumption, trade, orders and deliveries.
- Fixed Capital Investment.
- Inventories.
- Prices, costs, profits.
- Money and credit.

The type of series, which reflects the specific class, is given below. There may be others, in which some cases, may be more relevant indicators.

1. Employment and Unemployment:

- **Leading Indicator**: Under the classification of employment and unemployment, a leading indicator is the average weekly hours worked. As an economy begins to expand businesses will resort to overtime for existing labour force rather than hire new people. This result in an increase in the average weekly hours worked. But this sort of information is hardly difficult to collect at present. There are quarterly employment data which cannot be used properly.

- **Coincident Indicators**: As businesses continues to expand, firms will hire more workers. This is a signal that businesses are getting better, and the aggregate economy is expanding. At this point, the numbers of workers increase and the expansion of the economy is getting stronger. This coincident indicator is the number of employees on payrolls.

If employment data are not available for the total economy, there may be one or two important segments of industries that can be used. The apparel industry, which produces clothing for export, would be an indicator of the economic health of the country. Employment, hours worked, lay-offs,
new hires, production, and shipments for this industry would be useful indicators of the broader activity of manufacturing for the total economy.

2. Production and Income:

These two areas reflect a coincident relationship to the economy. At a level of full production, an index of industrial production can give the information about the aggregate economy. At times, measures of the aggregate economy are not available. Indicators such as industrial production indices can identify what is happening in the economy.

As an example, in Sri Lanka, the cement industry consists of few major producers. Because of the small number of producers, their output could be measured readily on a monthly basis and used as an indicator for construction industries. Cement production is an integral part of the activities of construction industry, which in turn reflects an increase in capital stock expansion. This growth in capital stock expands the production capability of the country, and indicates a potential for an increase in industrial output, and indicates a potential for an increase in industrial output.

3. Money and Credit:

Another area to consider is the movement of money and credit. A measure of the money supply (M-2) in constant price values can be used as an indicator of future production changes either increases or decreases. There is a positive correlation between increases in the money supply and increases in economic activity.

If firms want to expand their business, a sufficient available of funds are necessary. As M-2 increases, we can expect business activity to improve. As the money supply decreases, we can expect a contraction in new business activity and hence a slow down in the economy.

These data are available from the Central Bank on a monthly basis from their monthly bulletin.

4. Other Measures:

Within the economy, there are other measures that could be used to project future economic movement.

One such source of data that can be used in developing economic indicators is the import of capital goods. As the imports of capital goods increases, the capacity of the capital stock increases, and the potential for growth in output is evident.

Other indicators can be developed within the economy. A review of data that are available on a monthly basis will provide the sources of data for such indicators.

- **Composite Index**: The indicators can be grouped and standardised, and an average composite index developed for each groups, leading, coincident, and lagging. However, emphasis should be placed on the development of leading and coincident indicators at present. These indicators provide insight of what is happening in the economy before the final aggregate measures Gross Domestic Product are compiled.

- **Data needs for Short Term Estimates**: These economic indicators can be used to extrapolate the annual national accounts estimates on a quarterly basis. The following lists of variables have been
selected for the development of the relevant sectoral indicators. Those indicators were selected after practical application to check the validity of those indicators.

- **Imports Data**: Monthly data series are available and used for major consumer and capital goods. The major imported consumer goods should be showed in separately (Rice, Dhal, Onions, etc.). Capital goods should be presented by major category of goods (e.g. machinery, transportation equipment, construction materials etc.) Intermediate goods, such as fertiliser, have been identified as the time (quarterly) series.

  The imports data reflect the demand for consumer goods as well as the investment pattern of the business community and the Government. Capital goods reflect the increase in the capital stock, which in turn identifies the capacity for production and growth.

- **Export Data**: Export data by type of goods exported on a quarterly basis for the Agriculture products, apparel, gems and other major export items have been selected separately.

  The export data are used as measures of the production or output of the Agriculture Sector, Manufacturing Sector and the Mining and Quarrying Sector. Changes in these series, increases or decreases reflect changes in the economy.

- **Consumer Price Index**: Monthly price series of the All-Items Index and the major components of the price index are available and this can be used for the deflation purposes of relevant sectors.

- **Money Supply (M1 and M2)**: Monthly and quarterly series of the two major measures of the money supply M1, which is the narrow definition and includes demand deposits, and M2, which is a broader definition and includes demand deposits and time and saving deposits as well. There is a positive correlation between the money supply and the expansion of the economy.

- **Tourism**: Quarterly series on tourism are used more than Tourism sector, which is an important segment of the economy. Tourism reflects specifically in the hotels and restaurants of the Country. It also has a strong influence on employment, both direct and indirect. As the arrival of number of tourists changes we can expect similar changes in demand for goods and services in hotels, restaurants, transportation, retail stores, etc.

- **Tea, Rubber and Coconut Production**: Monthly or quarterly time series on production of these goods have been used as indicators for Plantation Agriculture Sector. Much of the production of these goods is exported and can be obtained from export data and from Colombo auctions as identified above, or from the various institutions responsible for these goods.

- **Paddy Production**: Monthly and quarterly series may not be available for Paddy, but series can be developed on a half-yearly basis to reflect the two growing seasons.

  Nearly 38 percent of the employment of Sri Lanka is in Agriculture. The Sector contributes about 18 percent of the total Gross Domestic Product of the Country and therefore, these items are important on explaining what is happening in the economy.

- **Cement Production**: Since cement is a major input into construction and it is an important indicator of construction output, as well as the amount of capital investment occurring in the economy.
• **Employment Data by Industry**: Quarterly time series of employment by industry are available and the labour force surveys are providing the data on employment by broad industrial categories but it has been revealed that the limitations of using this information for quarterly estimates of GDP.

4. **There are few Major issues and problems on quarterly estimates**

• Selection of base year was a problem. For quarterly NAE a normal year was selected and the base year was divided into four quarters equally. But this has certain issues on its levels basically as we considered in the annual NAE.

• Those indicators are basically used to move the base year quarterly GDP data, after testing the validity of leading indicators for each important sub-sectors of the GDP.

• Seasonal crops which fall into two cropping seasons is having considerable share in agriculture sector. These harvests are divided into two relevant quarters on the basis of crop output.

• Agriculture sector in the economy plays a vital role and its share to the GDP is around 18 percent and contribution to the total employment is around 38 percent. The weather factor is more important for the economic performance. Similarly, the electricity generation is prominent from hydropower and its impact to the industries is very significant. So, the total economic performance is highly volatile to the weather factor. Therefore, the maintaining of accuracy of the quarterly estimates, on GDP is really difficult with this environment.

• This situation has been found for the last few years and there were little differences in annual growth rates derived on the basis of quarterly estimates and the annual GDP estimates based on full year data.
THAILAND

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National Economic and Social Development Board (NESDB), Thailand

1. Introduction

Thailand has started to publish the quarterly national accounts (QNA) statistics since 1999. There was no regular QNA compilation before 1996. The office of National Economic and Social Development Board (NESDB) and the Bank of Thailand (BOT) decided to subscribe to the SDDS program of the IMF since 1996. Quarterly Gross Domestic Product (QGDP) is one of the recommended data that should be included in this program. Since it had never been compiled before and it involved many agencies, NESDB who is in charge of national accounts statistics compilation has co-operated with the Bank of Thailand and other concerned agencies to set up a project, so called “QGDP Compilation Program”. Representatives from related agencies were appointed as members of the steering committee of the program and the IMF provided some occasional technical assistance during the preparation stage. The program has already finished with the first release of quarterly national accounts based on the SDDS since 1999, the series started from the first quarter of 1993. There are only two approaches compiled, production and expenditure.

The major users of QGDP are the Bank of Thailand, the Ministry of Finance, the commercial banks, the stock market, the research institutes and the IMF.

2. Data sources

Indicators and data used in the QGDP compilation are as follows:

- Entrepreneur revenue declared for value added tax estimation, classified by ISIC, Department of Revenue, Ministry of Finance.

- Electricity consumed by business classified by TISC (Thailand standard Industry Classification), Metropolitan Electricity Authority and Provincial Electricity Authority.

- Manufacturing Production Index, Production and sale of important commodities, Bank of Thailand.

- Prices of important commodities, Bank of Thailand.

- Import and export statistics, Bank of Thailand.
• Price indices (consumer prices, wholesale prices and producer prices), Office of Price Indices, Internal Trade Department, Ministry of Commerce.

• Permitted construction area, National Statistical Office, Ministry of Interior and the Bank of Thailand.

• General government expenditure, Comptroller General Department, Ministry of Finance.

• Quarterly socio-economic survey, National Statistical Office.

• Labour force survey, National Statistical Office.

• Production and sale of manufacturing goods statistics, Office of Industrial Economics, Ministry of Industry.

• Production and sale of excise goods, Excise Department, Ministry of Finance.

• Crops, livestock and fisheries forecast (production and price), Office of Agricultural Economics, Ministry of Agriculture and Co-operatives.

• Data collecting directly from sources: for example, Bangkok Mass Transit System Public Company Limited (BTS).

• Other production statistics:
  - Mineral products statistics
  - Electricity, water supply and gas production statistics
  - Selling, buying and transferring real estate statistics
  - Production of BOI’s promoted industry.

3. Quarterly National Accounts Compilation of Thailand

In the past, Thai QNA was estimated by the quarterization technique, by which the annual GDP was broken down into desired four quarters or twelve months. However, the present compilation is based on the current information since 1999.

A. Concepts of Quarterly National Accounts

There are two basic main aims of QNA estimation. First, QNA must be able to indicate the direction of economic movements, including turning points. It should also be reliable and timeliness. The latest release should not later than one quarter after the reference quarter. QNA estimation in most countries is not carried out for all of the accounts in the system. The fact is that not all quarterly data are obtainable. Therefore, only main accounts can be compiled.

In the case of Thailand, the main features of the QNA are as follows:
• Compilation is carried out only on the production (QGDP) and on the expenditure (QGDE) approaches in accordance with the data availability. The production approach is the core approach as the annual estimation.

• Definition, coverage and valuation used are similar to the annual estimation.

• The estimation is compiled both at current market and constant 1988 prices. The seasonally adjusted figures are also done.

B. Classification

The classification used in the QNA compilation is in line with the 1993 SNA. The production approach follows the International Standard Industrial Classification Rev. 3 (ISIC Rev.3) by which there are 16 sectors of production compared with 11 sectors in the annual estimation. In addition, the simple agricultural products are all included in the manufacturing sector instead of the agricultural sector as in the annual estimation. The Central Product Classification (CPC) is used on the expenditure approach leading to a significant difference of products groupings for consumption and capital formation from the annual estimation which now the household consumption expenditures are classified by COICOP.

C. Methodology

Ideally, both quarterly and annual national accounts compilation should use the same technique. Nevertheless, different methods are unavoidable in many cases. Estimation method is directly based on the characteristic of the obtained statistics.

The compilation methods of Thailand’s QGDP are as follows:

1. Direct Method:

This method is similar to the method used in estimating annual GDP. It can be used in the case that quarterly and annual data are in the same or similar format of details. The summation of four quarters of GDP should be equal to its annual figures. This method are used in the cases of good supplied data items such as state enterprises, manufacturing goods government expenditure, export and import, and household expenditure on some items like vehicles, tobacco, and beverage.

2. Indirect Methods

• Extrapolation Method: Each item of QGDP is extrapolated from a benchmarking quarter with its relevant indicators. This method is a standard and the most popular one. The precise of each item depends on the consistency between the indicator and its related QGDP item. The results obtained from this method need to be equalised to the annual GDP figures when they are available. The revised figures will be then used as a benchmark of the next period of the following year. Therefore, the indicators used in each item should reflect the movement of the reference subjects and should be changed when it is found that did not fit.

• Commodity flow technique: The commodity flow method is used in many items especially in the case of incomplete data among each side, supply and demand, for example change in inventories.
• Past trend adjustment method: It is used for small items estimation. The adjustment may be based on the average growth rate of the previous year or on the results obtained from dividing the annual figures by 4. However, this method can lead to a step-change problem between the last quarter of the previous year and the first quarter of the current year. Therefore, it is not recommended to use in the major items.

3. Proportion of direct and indirect methods

• Direct estimation: There is about 71 percent of the total compilation that use this method, production and expenditure approaches 67 percent and 75 percent, respectively.

• Indirect method: About 29 percent, production and expenditure 33 and 25 percent respectively (see Table 1).

Table 1: Percentage Share of Direct and Indirect Estimation

<table>
<thead>
<tr>
<th>Method/Approach</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Direct compilation</td>
<td></td>
</tr>
<tr>
<td>1.1 Production Side</td>
<td>67</td>
</tr>
<tr>
<td>1.2 Expenditure Side</td>
<td>75</td>
</tr>
<tr>
<td>Average</td>
<td>71</td>
</tr>
<tr>
<td>2. Indicator based compilation</td>
<td></td>
</tr>
<tr>
<td>2.1 Production Side</td>
<td>33</td>
</tr>
<tr>
<td>2.2 Expenditure Side</td>
<td>25</td>
</tr>
<tr>
<td>Average</td>
<td>29</td>
</tr>
</tbody>
</table>

D. Compilation of QGDP on selected items

1. Crops

A crop year is normally longer than a quarter (3 months), SNA 1993 suggests that QGDP of crops should include “work in progress” as part of their output. In the case of Thailand initially the work in progress was estimated but after a public consultation most users prefer the estimates without work in progress saying that they can reflect the real situation. Thus, gross output of crops does not include work in progress. Later on, when the SNA 1993 is completely applied the work in progress of crops will be included in QGDP as part of the crop output.

It should be noted that estimation of crops’ gross output is based on the crop forecast. The actual information on the output will be available when the annual GDP estimation is carried out. Thus, the
correctness of crop forecast depends on various factors like rainfall volume, pest and disease etc. The crop forecast is done by the Ministry of Agriculture and Co-operatives.

2. Manufacturing Sector

The manufacturing sector has a highest share of about 37 percent or one third of the GDP. Its growth rates are always used to compare to the Manufacturing Production Index (MPI) compiled by the Bank of Thailand. Even though the manufacturing sector is compiled by mainly based on MPI, the movement of the sector may not be in the same direction as MPI because only about 70 percent of the manufacturing sector is based on MPI and the less (30 percent) is based on the revenue of entrepreneurs declared for the value added tax (VAT) estimation, and other indicators (see Table 2 and Table 3).

### Table 2: Manufacturing Sector and MPI Growth Comparison

<table>
<thead>
<tr>
<th></th>
<th>1999</th>
<th>2000</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Q1</td>
<td>Q2</td>
</tr>
<tr>
<td>QGDP : Manufacturing Sector</td>
<td>4.7</td>
<td>9.0</td>
</tr>
<tr>
<td>- Estimates based on MPI</td>
<td>7.6</td>
<td>10.4</td>
</tr>
<tr>
<td>- Estimates based on revenue declared and other indicators</td>
<td>-1.4</td>
<td>6.0</td>
</tr>
<tr>
<td>Manufacturing Production Index</td>
<td>4.8</td>
<td>10.6</td>
</tr>
<tr>
<td>MPI (Liquor Production Excluded)</td>
<td>3.2</td>
<td>7.7</td>
</tr>
</tbody>
</table>

Table 3: Shares of MPI and other Indicators in Manufacturing Sector Estimates.

<table>
<thead>
<tr>
<th></th>
<th>1999</th>
<th>2000</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Q1</td>
<td>Q2</td>
</tr>
<tr>
<td>QGDP : Manufacturing Sector</td>
<td>100.0</td>
<td>100.0</td>
</tr>
<tr>
<td>- Estimates based on MPI</td>
<td>70.1</td>
<td>69.7</td>
</tr>
<tr>
<td>- Estimates based on revenue declared and indicators</td>
<td>29.9</td>
<td>30.3</td>
</tr>
</tbody>
</table>

There is the difference in the structure of manufacturing sector and MPI. In the estimation of manufacturing sector, the value-added compilation is carried out at the detail level (ISIC, 4 digits) in every quarter thus the structure will vary from quarter to quarter. On the contrary, the MPI structure is fixed as of 1995. The MPI works well if the economy structure is stable. If there is a significant change like in 2000, sharp increase in liquor production, then the MPI is over-estimated due to the 1995 structure of MPI (see Table 2).
E. Professional Judgment (PJ) Method

In many cases, if the estimates from the available data are not reasonable due to the incomplete or high fluctuation data, the professional judgments will be applied based on their experience accompanied with other related indicators.

4. Benchmarking and seasonal adjustment techniques

A. Benchmarking techniques

Generally, quarterly data and preliminary QGDP estimates will not be completely consist with the corresponding annual GDP. The summation of four quarters may differ from annual GDP. There are several reasons for this difference. For example, usually more comprehensive and more detailed data are available annually, while the preliminary QGDP estimates are derives from simplified survey data or relevant indicators due to the time limitation. Moreover, in the case of Thailand, the quarterly and annual GDP compilation methodology in many items are not the same. The annual accounting system is more detailed and more complete set of accounts, facilitating a reconciliation of the estimates.

In theory, the QGDP should consist with the annual estimate, the summation of the four quarters of QGDP equal to the annual estimate. The annual GDP normally are based on more reliable data than the quarterly estimates. Therefore, if they are not equal, the adjustment has to be done. The ideal method is to investigate in the detail compilation to identify the causes of the difference. However, this is considered too labour-intensive. In practice, the mathematical benchmarking technique is used for removing the difference by allocating the difference over the various quarters, leaving the quarterly pattern within the year as much as possible, and without a discontinuity in the series between the last quarters of the previous year to the first quarter of following year, later called “the step problem”.

There are various mathematical benchmarking techniques that used for removing the difference as follow:

- Pro rata distribution which introduces the step problem
- The Bassie method presented by OECD
- The Denton’s least square method recommended by IMF

In the case of Thailand, the Denton’s least square method with the D4 assumption, for linear and non-seasonally adjusted series, is applied to remove the difference between QGDP summation and annual GDP. The Canadian Bench Program and extrapolation is used. The method relies on the minimisation of the difference between the adjusted and the original rates under the condition that the sum of the quarter values is equal to the annual value. It intends to spread the difference over a number of years.

B. Seasonal Adjustment

QGDP figures are presented not only in the original preliminary series but also in the seasonally adjusted form. Seasonally adjusted figures can reflect the real changes in production and expenditure in each quarter since seasonal effects are removed from the estimates leading to capability to compare between two consecutive quarters.
In practice, the X-12 computer program in which the moving average technique or multiplication is applied to previous 5 quarters performs the seasonal adjustment.

5. Revision, publication and user forum on GDP

A. Revision

There are 3 steps of QGDP publication including revision.

- **First release**: The preliminary QGDP estimates based on the existing data availability and related indicators including professional judgment will be presented to the public. The announcement is important because it reveals the economic situations in the previous quarter. The public pay very high attention to this information. Therefore, it is not only to present the result of the estimation quickly but at least it should also give the right direction of the economic movement.

- **Second release or first revision**: This is a backward adjustment from the current quarter due to a revision of the basic information by the data sources.

- **Second revision**: QGDP estimated by the indirect method is usually different from the annual figures even though the indicators are good and correct. Therefore, when the annual figures have been estimated, the summation of the QGDP needs to be equalised to be the same as the annual. The second revised QGDP can be used as the benchmark for the next quarters’ estimation. The revision can be carried out as many times as the backward change happened to the annual figures.

This revision is processed by using the mathematical technique i.e. Denton Least Square with the D4 assumption, called the Canadian Bench Program and Extrapolation.

B. Publication of QGDP

NESDB will release the Quarterly GDP estimates on the third Monday of the third month after the reference quarter through 3 channels:

- Press release made by NESDB’s Secretary General
- Publications
- Website ([www.nesdb.go.th](http://www.nesdb.go.th))

Quarterly Gross Domestic Product Statistics comprises 16 tables as follows:

1) Expenditure on Gross Domestic Product at current market prices (original)
2) Expenditure on Gross Domestic Product at constant prices (original)
3) Gross Domestic Product at current market prices (original)
4) Gross Domestic Product at constant prices (original)
   - Percentage change from same period at constant prices
   - Percentage change from previous period at constant prices
5) Private Consumption Expenditure at current market prices (original)
6) Private Consumption Expenditure at constant prices (original)
   - Percentage change from same period at constant prices
- Percentage change form previous period at constant prices

7) General Government Consumption Expenditure at current market prices (original)
8) General Government Consumption Expenditure at constant prices (original)
   - Percentage change from same period at constant prices
   - Percentage change form previous period at constant prices

9) Gross Fixed Capital Formation at current market prices classified by type of capital (original)
10) Gross Fixed Capital Formation at constant prices classified by type of capital (original)
   - Percentage change form same period of Gross Fixed Capital Formation at constant prices classified by type of capital (original)
   - Percentage change from previous period of Gross Fixed Capital Formation at constant prices classified by type of capital (original)

11) Gross Fixed Capital Formation at current market prices classified by private and public institutions (original)
12) Gross Fixed Capital Formation at constant prices classified by private and public institutions (original)
   - Percentage change from same period of Gross Fixed Capital Formation at constant prices classified by private and public institutions (original)
   - Percentage change from previous period of Gross Fixed Capital Formation at constant prices classified by private and public institutions (original)

13) Gross Domestic Product at constant prices (seasonally adjusted)
   - Percentage change from previous quarter of Gross Domestic Product at constant prices (seasonally adjusted)

14) Private Consumption Expenditure at constant prices (seasonally adjusted)
   - Percentage change from previous quarter of Private Consumption Expenditure at constant prices (seasonally adjusted)

15) General Government Consumption Expenditure at constant prices (seasonally adjusted)
   - Percentage change from previous quarter of General Government Consumption Expenditure at constant prices (seasonally adjusted)

16) Gross Fixed Capital Formation classified by type of capital at constant prices (seasonally adjusted)
   - Percentage change from previous quarter of Gross Fixed Capital Formation classified by type of capital at constant prices (seasonally adjusted)

Users can observe the movement of QGDP immediately and directly by tables 4.1 and 13.1 which the comparison is shown not only the growth from the same quarter of the previous year but also the growth from the previous quarter, respectively.

In the presentation, the alphabet P shown on the top of the indicated year means that QGDP has already revised following the preliminary reference annual GDP. The alphabet P1 means that the reference annual GDP is not yet compiled.

The release will start at 8.30 am on the referred day at the Conference room of NESDB, Klungkasem Road, Bangkok. After the public release the users can also contact the National Accounts Division at 128, 21st Floor Payatui Plaza Building, Payathai Road, Rajatevee, Bangkok 10400 for more information.
6. Future plans for improvement

A. Data Development

In the future, the data obtained from surveys will be used to replace the administrative records in order to speed up the calculation and also to improve the QGDP quality. Furthermore, close co-operation with the NSO to establish the retail survey, the BOT to conduct the capital expenditure survey and with the Trade and Economic Indices Bureau--Ministry of Commerce and BOT to produce import & export price index are being encouraged.

B. Database Construction

In order to facilitate and to increase the efficiency in data using, the following databases of quarterly indicators have been already established as follow

- Business Revenue from Department of Revenue;
- Price Indices;
- Imports & Exports of Goods;
- Manufacturing production index; and
- Household Socio-economic survey

However, NESDB plan to construct more database of indicators not only for QGDP compilation but also for annual GDP compilation.

C. Compilation by Computer Program

A consultant was hired to produce a computer program that can automatically compile QGDP by using information from the databases. This project has been finished in April 2000. However, the program is run on Microsoft Access that is not suitable for network system. NESDB initiated the second phase to hire a consultant to enhance the computer program that can be run on the ORACLE 8i Enterprise. At this time, it is on the process of “fine tuning” and expected to be able to start from the second quarter 2002 compilation onward. The system of the QGDP automatic compilation is on the following page.
Introduction

Quarterly GDP shows the trend of increases of the economy, by each kind of economic activity. It describes growth rate of reference quarter compared with the same quarter of previous year and with previous quarter. Estimating of quarterly GDP helps the Government to assess production situation by quarter, is there any advantage or disadvantage on production, selling of products? Does the performance of economy fall in line of government’s target? In order to achieve economic target that was set up by the National Assembly, what kind of policies and decision should be done for development of coming quarters?

The General Statistical Office of Vietnam has just started to estimate quarterly GDP since the year of 1999. These days, under the technical assistance project: "Improving National Account Statistics in Vietnam" sponsored by the Asian Development Bank (ADB) (TA's project), especially on quarterly GDP has been developed under the "ADB TA’s 3330 project" with the help of Mr Rodney Lewington of Statistics New Zealand, Dr Aburar Asra and Mr V.N Gnana Thurai of ADB, Dr Vu Quang Viet of United Nation Statistics Division (UNSD). Estimating of quarterly GDP attracts attention not only Government but also economic managers, policy makers, researchers, foreign investors and international organisations as well.

In the years 2000 and 2001, under the ADB TA’s 3330 project, the General Statistical Office conducted sample survey for estimating quarterly GDP (four quarters of years 1999, four quarters of 2000 and four quarters of 2001 and the first quarters of year 2002).

Production approach is used to estimate quarterly GDP in Vietnam, it means GDP equals to Gross output minus Intermediate consumption by kinds of economic activity plus import duty and expenditure approach has not applied in estimation of quarterly GDP yet and Seasonal adjustment issue is still one in future.

Compilation of quarterly national account must be based on the following General stipulations:

- Compilation of quarterly national accounts must be followed international standards.
- Compilation of quarterly GDP must be revised data 2 times after they are announced at the first time on 25 of month at the end of quarter; the second time on the third month of next quarter and the third time on September of next year.
- Summing up GDP of the four quarters must be equal annual GDP.
- Quarterly GDP is estimated at current and constant price.
- It may need estimating quarterly GO, VA of 3 previous years to make the benchmark time series for basing on quarterly GO, VA estimation of reference year.
Result of experimental estimate quarterly GDP in Vietnam is shown in the following tables of appendix:

- Table 1 (1a, 1b, 1c, 1d): Quarterly GDP at current price for the years of 1999, 2000, 2001 and the first quarters of the year 2002;
- Table 2 (2a, 2b, 2c, 2d): Structure of quarterly GDP by kinds of economic activity;
- Table 3 (3a, 3b, 3c): Quarterly GDP at constant price for the years of 1999, 2000, 2001 and the first quarters of the year 2002;
- Table 4 (4a, 4b): Growth rate of quarterly GDP (compare with the same quarter of previous year).

2. Information source, methodology of estimation of quarterly GDP and Problems.

1. Industrial sector:

Value added of this sector is calculated separately for three sub-sectors as below:

- Mining and quarrying;
- Manufacturing; and
- Electricity, gas and water supply.

a. Information source:

- **State - owned enterprises :**
  - Monthly statistical report (form No.01 of this report was attached): enterprises submit monthly this report to provincial statistical office (PSO), (90% of state -owned enterprises provide statistical report to PSO). PSO makes tabulation and send to Industrial Statistics Department in GSO every month.
  - Quarterly accounting report on finance of enterprise: enterprises submit quarterly financial accounting report (Loss and Profit statement) to PSO (90% of state owned enterprises provide this report to PSO).
  - Result of censuses of enterprises and household production of industrial sector of 2000

- **Non-state owned enterprises and household run enterprises :**

Result of censuses of enterprises and household production of industrial sector of 2000

Monthly sample survey (Form No.01 was attached): every month, GSO conducts monthly sample survey with sample size of 5% total number of industrial non-state owned enterprise and household run enterprise. PSO is responsibility for collecting, processing, making tabulation and sending data to Industrial Statistics Department in GSO.

Data from General Department of taxation (under the Ministry of Finance) including the following monthly data:
• Number of units that pay tax.
• Tax - calculated turnover.
• Tax on production.

However, the type of information from the General Department of Taxation will be used in our estimate from the year of 2003 onward.

**Monthly information from industrial statistics department in GSO**

Present quarterly information on one digit (Mining and quarrying; manufacturing; Electricity, gas and water supply).

- Information is only available in value (at constant price - price of 1994 year) (form No.02A was attached), and
- Information in volume (form No.02B was attached) only integrated data is available.

**Information from Trade and Price statistics department in GSO :**

Reports from Trade and Price Statistics Department (form No.04A is attached).
- Information on consumer’s price index (CPI, Form No.03A of this index is attached).
- Information on producer’s price index of some major products (PPI form No.05 of this index is attached).
- Information on export and import of some major industrial commodities.
  - Information on CPI is integrated one, it does not break down by CPI of service and CPI of industrial products.

- Expected information from year of 2003 onward.
  - Report from Trade and Price Statistics Department will be in more detail (form No.04B is attached).
  - To transform price index into year of 2000 (new base year).
  - To conduct "The business tendency survey".

**Information from special survey** that was conducted by National Accounts Statistics Department in year of 2000 and 2001 under the framework of TA’s project.

- Provincial reports on industrial gross output at constant price by some major sub-sector.
- Sample survey on industrial units for calculation of quarterly ratio of intermediate consumption.

In the year of 2000 and 2001, under the framework of TA’s project sponsored by ADB, National Accounts Statistics Department conducted quarterly sample survey to obtain data for estimate of quarterly GDP and calculating quarterly ratio of intermediate consumption in 15 provinces and cities.

**b. Methodology of estimation :**

Basing on present information source, quarterly value added of industrial sector is estimated separately for sub-sector with one digit (Mining and quarrying; Manufacturing; and Electricity, gas and water supply).

- Estimation at constant price is done firstly as below:
\[
\text{GVA}_{i,t,ss} = \frac{\text{GO}_{i,t,ss} \times \text{GVA}_{t-1,ss}}{\text{GO}_{t-1,ss}}
\]

Here:  
- \(\text{GVA}_{i,t,ss}\) is value added of quarter \(i\) in year \(t\) at constant (\(ss\)) prices (1994 price).  
- \(\text{GO}_{i,t,ss}\) is gross output of quarter \(i\) in year \(t\) at constant price.  
- \(\text{GVA}_{t-1,ss} / \text{GO}_{t-1,ss}\) is ratio of gross value added over gross output of previous year at constant price.

- Estimation at current price:

\[
\text{GO}_{i,t,hh} = \frac{\text{GO}_{i,t-1,hh} \times \text{PPI}_{i,t}}{} 
\]

Here:
- \(\text{GO}_{i,t,hh}\) is gross output of quarter \(i\) in year \(t\) at current (\(hh\)) prices;  
- \(\text{GO}_{i,t-1,hh}\) is gross output of quarter \(i\) in year \(t - 1\) at current price;  
- \(\text{PPI}_{i,t}\) is producer's price index of quarter \(i\) in year \(t\) compare with the same quarter of previous year.

\[
\text{GVA}_{i,t,hh} = \frac{\text{GO}_{i,t,hh} \times \text{GVA}_{i,t,hh}}{\text{GO}_{i,t,hh}}
\]

Here:  
- \(\text{GVA}_{i,t,hh}\) is value added of quarter \(i\) in year \(t\) at current price  
- \(\text{GVA}_{i,t,hh} / \text{GO}_{i,t,hh}\) is ratio of gross value added over gross output of previous year at current price (this ratio comes from annual sample survey).

2. Agricultural, forestry and fishery sector:

Estimation is done separately for sub-sectors as below:
- Agriculture sub-sector;  
- Forestry sub-sector;  
- Fishery sub-sector.
**a. Information source:**

- **Sample survey is conducted by Agriculture, Forestry and Fishery Statistics Department:**
  - Sample survey for paddy (Form No. 06 is attached).
  - Sample survey by harvest season: Winter-Spring; Summer-Autumn; Autumn-Winter.
  - Sample survey on animal husbandry (Form No. 07 is attached).
    - For herd of Pig: sample survey is conducted two times in one year: on 1 April and 1 October. 15 provinces over 61 provinces is selected in sample survey on 1 April; and most provinces is carried out sample survey on 1 October.
    - For herd of cattle: sample survey is conducted on 1 October in most provinces.
    - Poultry and other animal husbandry: sample survey is conducted on 1 October in 61 provinces and cities.

- Forestry sub-sector, information comes from quarterly and annual sample survey on:
  - Number of quarterly planted trees (concentrated and scattered plant, form No. 08 is attached).
  - Forestry harvested output in year (form No. 09 is attached).

- Fishery sub-sector, information comes from annual sample survey on:
  - Situation of Agriculture of fishery (form No. 10 is attached)
  - Situation of fishery exploitation (form No. 11 is attached)

PSO processes and makes tabulation of the said annual sample surveys then sending result to Agricultural, forestry and fishery Statistics Department in GSO. Agricultural, forestry and fishery Statistics Department makes estimation of quarterly indicators and provide to National Accounts Statistics Department (NASD) (form No. 12A is attached).

In future (from 2003 onward) It is required that Agricultural, forestry and fishery Statistics Department in GSO will conduct quarterly sample survey on Agriculture, Forestry, Fishery for benchmark year. Quarterly information of benchmark year will be used to estimate separately structure of gross output by Agriculture, Forestry, Fishery sub-sectors. In addition, Agricultural, forestry and fishery Statistics Department should calculate gross output by major plants and animals for the year of 2000 (new base year of National Accounts Statistics, form No. 12B is attached).

- **Information from Trade and Price Statistics Department, including:**
  - Information on consumer's price index (CPI) of primary products. Presently, information on CPI is integration form.
  - Information on producer's price index of some major primary products.
  - Information on export and Import of major primary products

In future (from 2003 onward)
- Report of Trade and Price Statistics Department will be available in more detail.
- To calculate price index with base year of 2000.
• Ad hoc survey conducted by NASD in years of 2000 and 2001 under the framework of TA’s project.
  - Provincial report on gross output of agricultural, forestry and fishery sub-sectors at constant price by some major plants and animals.
  - Sample survey on quarterly intermediate consumption.

b. Methodology of estimation:

1. Some stipulations:

Due to natural characteristic of agricultural production with seasonal differences, so it may need estimation of quarterly gross output of previous years to make the benchmark time series (at least 3 years) for basing of quarterly GO estimation of reference year. For example, to estimate quarterly agricultural GO of year 1999, first of all it must estimate quarterly agricultural GO of 1995, 1996, 1997, 1998 (form No. is attached as below).

Quarterly gross output is value by harvested products, harvested output mainly falls in quarter will be estimated for that quarter. For example, in province A harvest season of Winter- Spring crop falls in both March and April, but mainly in March, in this case it is stipulated that output of Winter-Spring crop of province A is calculated for the first quarter. Harvested output is also estimated by concentrated area, for example province A has 10 paddy planted districts, of which most paddy area is concentrated in 6 districts and harvest time of these 6 districts falls in March, it is stipulated that harvested output of residual four districts also falls in March.

The following harvest seasons are stipulated for estimating quarterly gross output:

<table>
<thead>
<tr>
<th>Crops of region and season</th>
<th>Harvest time (Harvest season)</th>
<th>Stipulation of quarterly gross output</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. PADDY</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Winter-Spring paddy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Red River Delta</td>
<td>May and June May and June</td>
<td>quarter II quarter II</td>
</tr>
<tr>
<td>- Mekong River Delta</td>
<td>March and April June and July</td>
<td>quarter I (mainly fall March) quarter II (mainly fall June)</td>
</tr>
<tr>
<td>- North East and North West</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Central Coast</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Central Highland and North East South</td>
<td>April and May May and June</td>
<td>quarter II quarter II</td>
</tr>
<tr>
<td>2. Summer-Autumn</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Red River Delta</td>
<td>July and August - -</td>
<td>quarter III quarter III (mainly fall November)</td>
</tr>
<tr>
<td>- Mekong River Delta</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- North East and North West</td>
<td>September and November</td>
<td>quarter III quarter III (mainly fall November)</td>
</tr>
<tr>
<td>- Central Coast</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Central Highland and North East South</td>
<td>July and August September and November</td>
<td>quarter III quarter III (mainly fall November)</td>
</tr>
<tr>
<td>3. Autumn-Winter paddy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Red River Delta</td>
<td>November and October</td>
<td>quarter IV quarter I of next year (mainly fall)</td>
</tr>
<tr>
<td>- Mekong River Delta</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
- North East and North West
- Central Coast
- Central Highland and North East South

December and January
November and December
October and November

Jan.) quarter IV (mainly fall Dec.)
quarter IV
quarter IV

B. OTHER CEREAL CROPS

1. Spring and Winter crops
February, March, April, May
September, October, November
quarter I, quarter II
quarter III, quarter IV

2. Autumn crops

C. ANNUAL INDUSTRIAL CROPS

1. Spring and Winter crops
March, April, May
September, October, November
quarter II
quarter III, quarter IV

2. Autumn crops

Vegetable is planted and harvested in whole year, in this case output is quarterized by quarterly sown area of vegetable.

In the case of fruit tree, harvest time falls in whole year (banana, coconut) quarterly output equals to annual output divided by four.

2. Basing on present information source,

Gross output, value added of agriculture, forestry and fishery is estimated separately at constant price by the following methods:

- Gross output at constant price

\[ G_{O,ss} = \sum Q_{j,t} \times P_{j,ss} \]

Here: \(Q_{j,t}\) is quarterly produced volume of product \(j\) of reference year
\(P_{j,ss}\) is price of product \(j\) at base year (1994 year).

- Value added at constant price:

\[ G_{VA_{lt-1,ss}} = \frac{G_{VA_{lt,ss}} \times G_{O_{lt-1,ss}}}{G_{O_{lt-1,ss}}} \]
Here:

- \( \text{GVA}_{i,t,ss} \) is valued added of quarter \( i \) in year \( t \) at constant price (1994 price)
- \( \text{GO}_{i,t,ss} \) is gross output of quarter \( i \) in year \( t \) at constant price
- \( \text{GVA}_{i,t-1,ss} / \text{GO}_{i,t-1,ss} \) is ratio of value added over gross output of quarter \( i \) of previous year at constant price.

- **Estimation at current price:**

  - Gross output at current price

    \[ \text{GO}_{i,t,hh} = \text{GO}_{i,t-1,hh} \times \text{PPI}_{i,t} \]

  Here:

  - \( \text{GO}_{i,t,hh} \) is gross output of quarter \( i \) in year \( t \) at current price
  - \( \text{GO}_{i,t-1,hh} = \text{GO}_{i,t,ss} \times \text{GO}_{i,t-1,hh} / \text{GO}_{i,t-1,ss} \)
  - \( \text{GO}_{i,t-1,hh} \) is gross output of quarter \( i \) in year \( t-1 \) at current price.
  - \( \text{PPI}_{i,t} \) is producer’s price index of quarter \( i \) in year \( t \) compare with the same quarter of previous year.

  - Value added at current price:

    \[ \text{GVA}_{i,t,hh} = \text{GO}_{i,t,hh} \times \text{GVA}_{i,t-1,hh} / \text{GO}_{i,t-1,hh} \]

  Here:

  - \( \text{GVA}_{i,t,hh} \) is value added of quarter \( i \) in year \( t \) at current price.
  - \( \text{GVA}_{i,t-1,hh} / \text{GO}_{i,t-1,hh} \) is ratio of value added over gross output of quarter \( i \) of previous year at current price (this ratio comes from quarterly sample survey of previous years).

3. **Construction sector:**

1. **Information source:**

   A. Information from Construction, Transportation and Communication Statistics Department (Form No.13 is attached)

   - Presently, only indicator of implemented capital investment is available, this indicator is divided by source of capital as below:

     - State capital investment: this information is provided by the Ministry of Finance monthly and quarterly;
     - Foreign capital investment: this information comes from the Ministry of Planning and Investment monthly and quarterly;
     - Other capital investment (owned capital investment of enterprise, household capital) was based on special survey that was conducted in the year 2000.

   Result of survey of gross capital formation for the total economy of 2001
B. Information on price index of building materials is provided monthly and quarterly by Trade and Price Statistics Department in GSO.

C. Under the framework of TA’s project: VIE 3330, Ad-hod survey conducted by NASD in year of 2000 and 2001 on gross output of construction activity.

2. Methodology of estimation:

- Estimation at current price is done firstly:

1. To split out capital investment for building from state and foreign capital investment by source of capital.
2. Using ratio of gross output (GO) over capital investment for building of state and foreign sectors of the same quarter of previous year to estimate gross output of reference quarter.
3. Using ratio of GO of construction activity of non-state sector (from ad-hod survey conducted by NASD) over total capital investment of non-state sector (from special survey in year 2000 conducted by GSO) to calculate annual and quarterly GO of non-state sector for reference year.
4. GO of construction activity at current price equals to GO of state and foreign sector plus GO of non-state sector.
5. Gross value added of construction activity at current equals to GO of construction activity at current price multiples ratio of gross value added over GO (from ad-hod survey of NASD for the year of 2000).

- Estimation at constant price:

6. Price index of building materials is used to deflate gross output and intermediate consumption (IC) at current price of reference quarter to the price of the same quarter of previous year.
7. Using implicit GO and IC deflator to deflate GO and IC in section b6 into price of base year (1994 price).
8. \[ \text{GVA}_{t,ss} = \text{GO}_{t,ss} - \text{IC}_{t,ss} \]

4. Transportation and Communication sector:

1. Transportation sector:

- Information source:
Construction, Transportation and Communication Statistics Department in GSO provides quarterly information on freight and passenger transport by types of road (form No.14 & 15 is attached). Price index of freight and passenger comes from Trade and Price Statistics Department. Basing on GO of base year and information on freight and passenger transport by types of road, average price of freight and passenger transport of base year was calculated as the following:
Average price of freight transport by types of road of base year (year of 1994) = \frac{GO_{\text{of freight transport by types of road of base year}}}{\text{Volume of freight transport by types of road of base year}}

Average price of passenger transport by types of road of base year (year of 1994) = \frac{GO_{\text{of passenger transport by types of road of base year}}}{\text{Volume of passenger transport by types of road of base year}}

- Methodology of estimation:

+ At constant price: GO of quarter i (i=1,2,3,4) year t at constant price is estimated by the following formula:

\[ GO_{r_{i,t,ss}} = \text{Volume of freight or passenger transport by types of road of quarter } \text{i in year } t \times \text{Average price of freight or passenger transport by types of road of base year} \]

Here: \( GO_{r_{i,t,ss}} \) is Gross output of quarter i of year t at constant price of each type of road R.

\( GO_{i,t,ss} \) equals to summation of GO of quarter i of all types of road at constant price (\( GO_{i,t,ss} = \sum GO_{r_{i,t,ss}} \)).

Intermediate consumption: Using ratio of IC over GO from quarterly ad-hoc survey of National Accounts Statistics to estimate by the following formula:

\[ IC_{i,t,ss} = GO_{i,t,ss} \times \text{Ratio of IC over GO from quarterly ad-hoc survey of National Accounts Statistics.} \]

Here: \( IC_{i,t,ss} \) is intermediate consumption of quarter i of year t at constant price.

Value added is calculated by the following formula:

\[ GVA_{i,t,ss} = GO_{i,t,ss} - IC_{i,t,ss} \]

+ At current price: GO of quarter i (i=1,2,3,4) year t at current price is estimated by the following formula:

\[ GO_{r_{i,t,hh}} = GO_{i,t,ss} \times \text{Price index of transport by types of road of quarter } i \text{ year } t \text{ compare with base year.} \]
Here: $GO_{i,t,hh}^R$ is gross output of quarter i of year t at current price of each type of road R.

\[
GO_{i,t,hh} = \sum R GO_{i,t,hh}^R.
\]

Intermediate consumption of quarter i of year t at current price is estimated basing on ratio from quarterly ad-hod survey of National Accounts Statistics by the following formula:

\[
IC_{i,t,hh} = GO_{i,t,hh} \times \text{Quarterly ratio of IC over GO from ad-hod survey of National Accounts Statistics}
\]

Quarterly GVA of quarter i year t is residual between gross output and intermediate consumption.

2. Communication sector:

- **Information source**: General Post Corporation provides data on forecast of quarterly turnover of Communication activity (form No. 16 is attached). Data is provided in term of total value and percentage growth rate of reference quarter compare with the same quarter of previous year. Information also comes from Quarterly ad-hod survey of National Accounts Statistics.

- **Methodology of estimation**:
  + At current price: Gross output equals to total turnover of General Post Co-operation. Using ratio of IC over GO from Quarterly ad-hod survey of National Accounts Statistics to estimate intermediate consumption.

GVA equals to GO less IC.

  + At constant price: Estimation of GO at constant price of quarter i in year t is done basing on the forecast of percentage growth rate of turnover of quarter i year t compare with quarter i, year t-1 by General post Co-operation and on result estimate of GO at constant price of quarter i in year t-1.

Using quarterly intermediate consumption ratio from ad-hod survey of National Accounts Statistics to calculate quarterly IC at constant price.

Gross value added at constant price is residual between GO and IC.

5. Trade, real estate, business service, hotel and restaurant, service serving community and tourism sectors:

GVA is estimated separately for each sub-sector.

1. **Information source**:

   1. Information from Trade and Price Statistics Department (form No.04A & 17).

   + Total retail turnover and its structure by month and quarter.
   + Number of tourists by quarter.
2. Quarterly ad-hoc survey of National Accounts Statistics of the year 2000 and 2001 under the framework of TA’s project.

2. Methodology of estimation:

- Trade sub-sector:

\[
\text{GO}_{i,t,hh} = \frac{\text{GO}_{i,t-1,hh}}{\text{TMB}_{i,t-1,hh}} \times \text{TMB}_{i,t,hh}
\]

Here: \(\text{TMB}_{i,t-1,hh}\) and \(\text{TMB}_{i,t,hh}\) are total retail turnover of quarter \(i\) at current price of year \(t\) and \(t-1\). \(\text{GO}_{i,t,hh}\) is gross output of quarter \(i\), year \(t\) at current price.

- Tourism and residual sub-sectors:

\[
\text{GVA}_{i,t,hh} = \frac{\text{GO}_{i,t,hh}}{\text{GVA}_{i,t,ss} \times \text{CPI}_{i,t,ss}}
\]

Here: \(\text{CPI}_{i,t,ss}\) is consumer’s price index of quarter \(i\) compare with the same quarter of base year.

- Estimates of residual sub-sectors is used the following formula:

\[
\text{GO}_{i,t,hh} = \frac{\text{GO}_{i,t-1,hh}}{\text{DT}_{i,t-1,hh}} \times \text{DT}_{i,t,hh}
\]

Here: \(\text{DT}_{i,t-1,hh}\) and \(\text{DT}_{i,t,hh}\) is turnover of hotel and restaurant and turnover of other services (Real estate, business service serving community etc.).
GVA_{i,t,hh} = GO_{i,t,hh} \times \text{Quarterly ratio of GVA over GO at current price from ad-hod survey of National Accounts}

GVA_{i,t,ss} = \frac{GO_{i,t,hh}}{\text{CPI}_{i,t,ss}}

- **Own-occupied dwelling**:

  - **Information source**: Based on result of quarterly ad-hod survey of national accounts statistics
  + Based on special survey of implemented capital investment

  - **Methodology of estimation**:
    \[ GVA_{i,t,hh} = GVA_{i-1,t,hh} \times \text{the ratio of other capital investment of reference quarter compare with the same quarter of previous year} \]
    \[ GVA_{i,t,ss} = GVA_{i,t,hh} \times \text{Implicit gross output deflator of construction sector.} \]

6. **Financial sector**:

1. **Information source**:

   Monthly, quarterly reports on business operation of financial sector are provided to GSO by the State Bank of Vietnam, by Vietnamese Insurance Corporation (Form No.18 is attached).

   Quarterly ad-hod survey of National Accounts statistics that was conducted in the years of 2000 and 2001, under the framework of TA’s project.

2. **Methodology of estimation**:

   - **Banking sub-sector**:

     \[ GO_{i,t,hh} = \frac{GO_{i-1,t,hh}}{\text{TSDCV}_{i-1,t,hh}} \times \text{TSDCV}_{i,t,hh} \]

     Here: TSDCV_{i-1,t,hh} and TSDCV_{i,t,hh} is denoted the stock of loan of quarter i of year t-1 and t respectively.

     \[ GVA_{i,t,hh} = GO_{i,t,hh} \times \text{Quarterly ratio of GVA over GO of the same quarter of year which had ad-hoc survey.} \]

     \[ GVA_{i,t,ss} = GVA_{i,t,hh} \times \text{CPI}_{i,t,ss} \]

   - **Insurance sub-sector**:
- Information source: Vietnamese insurance corporation (Form No.19).

- Methodology of estimation:

\[
GO_{i,t,hh} = \text{Net turnover of business operation of insurance activity} \\
+ \text{VAT} \\
+ \text{Receive from compensation of allowance for reinsurance} \\
+ \text{Receive from the third party} \\
+ \text{Decrease of provision for payment of claim} \\
- \text{Increase of provision for payment of claim} \\
+ \text{Claim payment from big oscillated fund} \\
- \text{Claim payment of original insurance} \\
- \text{Claim payment for re-insurance} \\
- \text{Provision for big oscillated fund.}
\]

\[
GVA_{i,t,hh} = GO_{i,t,hh} \times \text{Quarterly ratio of GVA over GO of the same quarter of year which had ad-hoc survey.}
\]

\[
GVA_{i,t,ss} = GVA_{i,t,hh} / CPI_i
\]

- Lottery sub-sector:

\[
GO_{i,t,hh} = \frac{GO_{i,t,hh} \times \text{Growth rate of population}}{4} \times \text{CPI of reference quarter compare with the same quarter of previous year.}
\]

\[
GVA_{i,t,hh} = GO_{i,t,ss} / CPI_{i,t,ss}
\]

7. Public service sector:

This sector includes:
- State management and Defence
- Scientific activity and technology
- Training and Education
- Health care
- Culture and Sport
- Association.

1. Information source:

Monthly and Quarterly report on State Revenue and current Expenditure by items from the Ministry of Finance (form No.20 is attached).

Quarterly Ad-hoc sample survey of National Accounts statistics that was conducted in the years of 2000 and 2001, under the framework of TA's project.
2. **Methodology of estimation:**

Estimation of GO, VA of public service sector at current price

\[
GO_{i,t,hh} = \frac{GO_{i,t-1,hh}}{CNS_{i,t-1,hh}} \times CNS_{i,t,hh}
\]

Here: \(CNS_{i,t-1,hh}\) and \(CNS_{i,t,hh}\) is current expenditure at current price of quarter \(i\), of the year \(t-1\) and year \(t\) by kinds of activity, respectively.

\[
GVA_{i,t,hh} = GO_{i,t,hh} \times \text{Quarterly ratio of GVA over GO at current price of sample survey's year}
\]

Estimation of VA at constant price:

\[
GVA_{i,t,ss} = GVA_{i,t,hh} / CPI_{i,t,ss}
\]

8. **Import duty:**

1. **Information source:**

data of import duty comes from Custom Office.

2. **Methodology of estimation:**

- **At current price:** Value of import duty is estimated basing on the value of imports by group of commodity.
- **At constant price:** Information on value of import duty of reference quarter and of base year are available by group of imports. Using import duty rate of base year to calculate import duty of reference quarter at constant price.

3. **Conclusion, future plans and recommendation for improvement of national accounts**

1. **Conclusion:**

So far, the GSO has initiated a comprehensive data collection program funded by the government budget beginning with the year 2000. That program includes the following censuses and surveys which are supplemented by administrative records:

- **Census and surveys:**
  * Census of population (1999) : every 10 years at year 9 of a circle of 10.
  - Census of agriculture (2002) : every 5 years at year 2 and 7 of a circle of 10
- Census of enterprises and household production (2001) : every 5 years at year 1 and 6 of a circle 10.
- Survey of gross capital formation for the total economy (2000).
- Survey of household income and expenditure (2000) : every two years at an even year with a sample size of 75,000.
- Quarterly and monthly surveys on manufacturing, services and producer and consumer price.
- Survey of I/O for the total economy with 125 products (2001): every 5 years at year 1 and 6 of a circle of 10.

- Administrative records :
  - Financial statements of state-owned and FDI enterprises which are currently available to the GSO.
  - Financial statements of private financial institutions which are collected by the State Bank of Vietnam.
  - Financial statements of private non-financial enterprises which are collected by Bureau of Taxation of the Ministry of Finance.
  - Exports and imports statistics classified by HS which are collected by the custom.
  - Government revenues and expenditure : available only in aggregate form.

The program of data collection currently carried out by GSO is a major change in the statistical activities of the GSO and will allow for a significantly improvement of national accounts compilation, annual, quarterly, regional accounts, specially quarterly accounts have been successfully implemented by the GSO. Given that 13 quarterly data (either backward and forward) is available.

2. Future plans and recommendation for improvement of national accounts :

The GSO may need technical assistance on the implementation seasonal adjustment and reviewing the benchmarking of quarterly data to annual data and estimating quarterly GDP by type expenditure approach (from 2003 onward).

Compiling the use and supply table (SUT) classified by products, industries and institutional sector of year 2001, which will be published in year 2003.

Compiling institutional sector accounts by 5 sectors (financial, non financial, household, general government and the rest of the world).

Using the supply and use table (SUT) classified by products, industries and institutional sector for estimating GO, IC, VA at current price and constant price.

Developing base year weight for producer price indexes, consumer price indexes and export and import price indexes that are used in quarterly and annual national accounts.

Reviewing and making recommendation on the set of PPIs that will be used for annual and quarterly accounts.

Rebasing previous national accounts aggregates of previous years to 2000 on the basis of the results of supply and use table of 2000.

However, the GSO may need technical assistance from international experts and organisations to implement the above mentioned plans.
On the occasion, we would like to thank for the technical assistance of ADB, especially the help and recommendation of Dr V.N Gnana Thurai, Dr Abuzar Asra of ADB; Mr Rodny Lewington of Statistical New Zealand, Dr Vu Quang Viet of UNSD. We also would like to thank and appreciate highly for helping and co-operating of ESCAP, UNSD, UNDP, OECD, WB, IMF and statistical bureaus of Australia, Indonesia, Philippine, New Zealand, etc.
BENCHMARKING AND INTERPOLATION
BENCHMARKING THE QUARTERLY ESTIMATES TO ANNUAL DATA AND METHODS OF INTERPOLATION

Fenella Maitland-Smith, Statistics Directorate, OECD

1. Introduction

This paper discusses the processes involved in producing optimal monthly/quarterly estimates consistent with annual data (or monthly with quarterly). The general term for this is ‘temporal disaggregation’ and the common variants of this are benchmarking and interpolation. The terms calendarisation and quarterisation are also used. The paper will deal mainly with benchmarking in relation to quarterly and annual national accounts estimates.

Benchmarking refers to the case where there are two sources of data for the same target variable, with different frequencies, and is concerned with correcting inconsistencies between the different estimates, e.g. quarterly and annual estimates of value-added from different sources. It is essential that quarterly national accounts (QNA) are consistent with the annual accounts (ANA) so that a clear view of economic developments is presented - differences in growth rates between quarterly and annual GDP would confuse and irritate users. Benchmarking is generally done retrospectively as annual benchmark data are available some time after quarterly data. Benchmarking does have a forward-looking element however, in that the relationship between benchmark and indicator data (benchmark:indicator ratio) is extrapolated forward to improve quarterly estimates for the most recent periods for which benchmark data are not yet available.

Interpolation refers to the case where no genuine quarterly (or monthly) measurements exist, and annual totals are distributed across quarters (months), using a proxy indicator for the quarterly pattern where possible, otherwise using a simple curve-fitting algorithm. A common example of this is the quarterly estimation of NPISH output from annual data. A quarterly pattern for interpolation may be derived:

- from previous (discontinued) survey data
- from proxy variables
- as a smooth mathematical function.

It is important that seasonal factors are not simply applied to annual totals as this will lead to steps between years. Correct benchmarking techniques must be used – in other words, individual years must not be treated in isolation from their neighbours, rather the time series of quarterly data over several years should be processed using benchmarking software. Also, where a seasonal indicator series is used, it should be pre-adjusted (using seasonal adjustment software) to remove trend and cyclical components, i.e. the seasonal factors only are used.
## 2. The need for benchmarking

For any year, it is important to have consistency between annual and quarterly (or monthly) estimates of levels of any variable, e.g. GDP:

\[
\sum_{i=1}^{4} Q_i^{GDP} = AGDP
\]

or rates of change:

\[
\frac{\sum_{i=1}^{4} Q_i^{GDP}}{\sum_{i=1}^{4} Q_{i-1}^{GDP}} = \frac{A^{GDP}}{A^{GDP}}
\]

Differences are inevitable, however, as a result of the different data sources used for QNA and ANA, but they must be reconciled.

Commonly, comprehensive (high accuracy) and detailed information is only available at a fairly low frequency, e.g., an annual or ten-yearly enterprise census, due to the expense of collecting and processing large volumes of data. Also, the data are often available only after a considerable lag because of the time needed for collection and processing. These comprehensive benchmark data may form the basis for the ANA but it is usually necessary to use more timely, but less complete, data for QNA (and even for the most recent ANA years in some cases), e.g., sample surveys of enterprises. These more frequent, timely data are generally less accurate but they give an indication of how the comprehensive data would behave if they were available.

The common feature of such indicators is that their coverage is less complete than is the case for the less frequent benchmark data, i.e. coverage of establishments, variables, commodities, industries or geographical areas. Thus, indicators suffer from bias in comparison to the more comprehensive data, arising from factors such as sampling error, differences in use of the business register (different versions of the register, grossing methods, reclassifications of establishments), different quarterly and annual accounting methods used by respondents, and respondent error. Other causes of bias are weak assumptions about the relationships between proxy indicators and target variables (e.g. constant IO ratios), and failing to account for quality change or changes in product mixes.

As a result of indicator bias, quarterly source data are viewed as serving only to determine short-term movements (quarterly path), whereas annual data determine the overall levels and the medium- to long-term trends. Chart 1 shows differences in medium term trends shown by annual and quarterly data. Thus, quarterly data and QNA estimates are adjusted as necessary so that they correspond with the trends shown by annual estimates, i.e. once benchmark (annual) data become available, the indicators need to be brought into line (benchmarked) with the long-term trends shown by the benchmarks. Indicators will also need to be subsequently revised in line with any later revisions to the benchmark data.

Some of the causes of bias are likely to have systematic and thus predictable effects so that it is possible to make adjustments each quarter, i.e. “real-time” adjustments. Of course, it would be better to determine the causes of the bias and remedy them, but this type of analysis may be too expensive to carry out in practice. However, it will inevitably be the case that these “real-time” adjustments will not be sufficient, and that once the benchmark data are available retrospective adjustment of the quarterly data will also be needed.
3. The benchmark to indicator (BI) ratio

The benchmark to indicator (BI) ratio for any benchmark period is a measure of indicator bias, and adjustments are made so that the BI ratio becomes one.

\[\text{Adjust } Q^i GDP \Rightarrow \frac{AGDP}{\sum_{i=1}^{4} Q^i GDP} = 1\]

The BI ratio usually changes from year to year, as shown in Chart 2 where the large change between 1997 and 98 should be noted for future reference.

The BI ratio may also be an expression of the relationship between sample survey levels and annual population levels. For example, a sample of enterprises is selected to cover 20% (sm) of population sales (SM) each month. So, for any month, population totals are estimated as:

\[SM = \text{sm} \times \frac{100}{20}\]
The BI ratio is therefore 100/20 or 5.0. But, the coefficient of 100 / 20 will become outdated as the sample becomes unrepresentative. So, when comprehensive data (SA) from an annual enterprise census become available it is likely that:

\[ \sum_{i=1}^{12} SM^i \neq SA \]

\[ \frac{SA}{\sum_{i=1}^{12} sm^i} \neq \frac{100}{20} \neq \frac{SA}{\sum_{i=1}^{12} sm^i} \]

So, although it was assumed at the start of the year that:

\[ \frac{SA}{\sum_{i=1}^{12} sm^i} = \frac{100}{20} \]

In fact, benchmark data show that, for example:

\[ \frac{SA}{\sum_{i=1}^{12} sm^i} = \frac{100}{15} = 6.67 \]

So the BI ratio for the year in question is 6.67, and not 5.0

4. Pro-rata distribution and the ‘step problem’

For any benchmark period (e.g. a year for which ANA are available) the BI ratio can be calculated. Since this can be viewed as a measure of the indicator bias it would be tempting to simply adjust for the bias by distributing the annual level data for each year according to the distribution of the quarterly indicator, i.e. some means of pro-rata distribution across quarters.

\[ Adjusted \ \frac{Q \ gDP^*}{Q \ gDP} = \frac{\sum_{i=1}^{4} Q \ gDP}{\sum_{i=1}^{4} Q \ gDP} \times AGDP \]

This would be fine in cases where the BI ratio is constant from year to year. If, however, BI ratios for adjacent years are different, and pro-rata adjustments are used in each year, a discontinuity in the growth rate from the last quarter of one year to the first quarter of the next will be introduced. This is known as the “step problem”. In other words, the growth between Q4 of one year and Q1 of the next will reflect the change in the BI ratio (adjustment) between the years as well as any genuine growth between Q4 and Q1. This can be seen in Chart 3 and Table 1 where the distortion (step) of the quarterly path between Q4 97 and Q1 98 should be noted.
Table 1 also highlights the fact that all the correction for bias in the growth rate of the indicator data is concentrated in the Q4-Q1 growth rate:

<table>
<thead>
<tr>
<th></th>
<th>Indicator data</th>
<th>Pro-rata adjusted</th>
<th>Difference in growth rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>q1 1995</td>
<td>26.7</td>
<td>26.7</td>
<td>0.0</td>
</tr>
<tr>
<td>q2 1995</td>
<td>24.6</td>
<td>24.6</td>
<td>0.0</td>
</tr>
<tr>
<td>q3 1995</td>
<td>-1.4</td>
<td>-1.4</td>
<td>0.0</td>
</tr>
<tr>
<td>q4 1995</td>
<td>-7.1</td>
<td>-4.9</td>
<td>2.3</td>
</tr>
<tr>
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<td>20.0</td>
<td>0.0</td>
</tr>
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<td>19.2</td>
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<td>15.1</td>
<td>0.0</td>
</tr>
<tr>
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<td>-0.8</td>
<td>0.0</td>
</tr>
<tr>
<td>q4 1997</td>
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<td>-13.7</td>
</tr>
<tr>
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<td>15.0</td>
<td>0.0</td>
</tr>
<tr>
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<tr>
<td>q4 1998</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

**Table 1**

<table>
<thead>
<tr>
<th></th>
<th>Indicator data</th>
<th>Pro-rata adjusted</th>
<th>Difference in growth rate</th>
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<tr>
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</tr>
<tr>
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</tr>
<tr>
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</tr>
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<td>q4 2000</td>
<td>-5.7</td>
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<tr>
<td>q2 2001</td>
<td>10.3</td>
<td>10.3</td>
<td>0.0</td>
</tr>
</tbody>
</table>

**5. Benchmarking techniques to avoid the step problem**

The step problem is solved by smoothing the changes in BI ratios. In other words, the BI ratios themselves are treated as a quarterly time series which initially appears as a series of steps with each year (step) consisting of four equal data points. This stepped series is smoothed, to give a series made up of BI ratios (see Chart 4) which are then applied to the indicator data to give a smoothly benchmarked series (Chart 5).
So smoothing methods aim to produce a series of quarterly BI ratios that change smoothly from one period to the next, whilst averaging to the annual BI ratios within each year. They try as far as possible to maintain the original quarterly growth rates (quarterly path) under the constraints of a smooth transition between years (Q4-Q1 growth) and the need for the annual totals to reconcile (ΣQGDP=AGDP).

All quarterly growth rates will be adjusted by gradually changing but relatively similar amounts. This can be seen in Chart 5 and Table 2 where the series has been benchmarked using the Denton least squares approach. Note that the change in BI ratio between 1997 and 98 is accommodated throughout all quarters in 1997 and 98 rather than in a single step at Q4 97 – Q1 98 as in the pro-rata approach.
6. Extrapolation

Benchmark data will not be available for current and recent periods. For example:

1. in May 2001, there are no benchmark data for months in 2000 and 2001 (annual enterprise census data for 2000 become available in June 2001),
2. so, BI ratios of years pre-2000 should be used in 2000 and 2001 monthly estimates, i.e. the relationships are extrapolated
3. then, in June 2001, the 2000 benchmark data become available
4. and the resulting BI ratio for 2000 is extrapolated and used for the months of 2001.

Extrapolation can be viewed as the linking of quarterly source data onto previous annual estimates, or, as constructing forward series by adjusting the last available benchmark level according to movements in an indicator.

For forwards extrapolation, the BI ratio from the last benchmarked quarter may be applied to all new quarterly data, i.e. the BI ratio is projected forwards ‘flat’ and applied to each new quarterly indicator estimate in “real time”. This can have the undesirable result, however, that the annual BI ratio for this extrapolated year is different to the average annual BI ratio in the previous year. If there is a large amount of noise in the indicator’s annual rate of change relative to systematic bias, there is danger of a “wagging tail effect”.

<table>
<thead>
<tr>
<th></th>
<th>Indicator data</th>
<th>BENCH adjusted</th>
<th>Difference in growth rate</th>
</tr>
</thead>
<tbody>
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<td>q1 1995</td>
<td>26.7</td>
<td>26.9</td>
<td>0.2</td>
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<tr>
<td>q2 1995</td>
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<td>q3 1995</td>
<td>-1.4</td>
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<td>-7.1</td>
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<td>q3 1996</td>
<td>19.2</td>
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<tr>
<td>q4 1996</td>
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<td>0.3</td>
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<td>-7.9</td>
<td>-7.7</td>
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<tr>
<td>q4 1998</td>
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<td>0.0</td>
</tr>
</tbody>
</table>
So, in fact, effective benchmarking has both a retrospective and a forward-looking dimension, derived from common principles, and combined in the more sophisticated QNA software applications. In other words, extrapolated series generally need to be retrospectively benchmarked at a later date. Thus, two phases can be envisaged:

1. In the operational phase, there will be no annual benchmarks for the most recent quarters. So, the challenge is to extend the series beyond the last benchmark period, anticipating future ANA estimates so that future revisions are minimised, whilst preserving, as far as possible, the short-term movements in the quarterly source data. Most extrapolation techniques are based on the idea that the last BI ratio based on actual data is projected forwards (flat) for each quarter and applied to each new quarterly estimate in real time. Further real-time adjustments are made to quarterly data if and when particular bias issues arise.

2. Following the operational phase, quarterly data will be treated retrospectively and subjected to continuing cycles of revisions. These revisions will arise from:
   - the arrival of annual benchmarks for the most recent year
   - revisions to the quarterly source data
   - revisions to the annual benchmarks of the previous year

   Any new information needs to be incorporated into the QNA estimates as quickly as possible.

In order to satisfy the need for constant yet smoothed, updating and reconciliation, sophisticated models, such as the proportional Denton technique are available. These provide an integrated means of dealing with extrapolation, alignment and updating and give superior results to methods that treat these phases separately.

7. Denton, and other smoothing methods

This smoothing of the BI ratios can be achieved to some extent using straightforward techniques such as a Henderson moving average. Another alternative is to use a least squares method to minimise the difference in the first difference between the pro-rata adjusted quarterly series and the original quarterly series, subject to
the constraint that the sum of the quarters equal the annual estimate\textsuperscript{27}. This method is applied to estimates for two years each time new annual estimates become available, so each year is adjusted twice.

The more sophisticated approaches to benchmarking may be classified as purely numerical, or statistical modelling, approaches. The numerical approach does not specify a time series model for the series, but instead uses least squares minimisation, e.g. the methods proposed by:

- Denton and others (1971) – least squares methods to minimise the difference between the pro-rata adjusted quarterly series and the original quarterly series, subject to the constraint that the sum of the quarters equal the annual estimate. The additive Denton version (D1) minimises (least squares) the absolute differences in absolute adjustments to neighbouring quarters subject to the constraints of the benchmarks (binding or non-binding). The proportional Denton version (D4) minimises the absolute differences in relative adjustments to neighbouring quarters (better when multiplicative seasonality present). D4 requires positive values only (so, pre-adjustment may be needed),
- Bassie (1958) – a stepwise benchmarking method, working on two consecutive years at a time (otherwise steps are introduced). It does not allow extrapolation.

The statistical modelling approaches include:

- ARIMA model based methods (Hillmer and Trabelsi, 1987),
- state space models (Durbin and Quenneville, 1997),
- series of generalised least squares regression models, e.g. BENCH (Statistics Canada). These take account of information about the stochastic properties of the error-generating process (ARMA),
- Chow and Lin (1971) have proposed a multivariate additive generalised least squares regression approach with binding benchmarks, i.e. several indicators are related to a single benchmark. The result is not benchmarking in the strict sense, but rather an approach for interpolation, distribution and extrapolation (Eurostat’s ECOTRIM follows the same approach).

For good indicators, the results are fairly insensitive to the choice of technique, but where significant bias exists different techniques are better suited to differently behaved biases, i.e. it is important to understand the nature of the bias.

A detailed explanation of the theory behind the Denton technique and other methods can be found in the IMF’s \textit{Handbook on Quarterly National Accounts Compilation}\textsuperscript{28}.

8. Revisions to published data

When benchmark data for the most recent year become available, that year will be retrospectively benchmarked, and quarters in the year before (and maybe for several years before that) will also be revised. This is because smoothing the series of BI ratios may require trend adjustments stretching back more than four quarters. In other words, when new annual (year t-1) data become available, quarters in t-1 are benchmarked, and quarters in t-2, t-3 are also revised as required by revision of the smoothing function. In general, the best results will be obtained if the entire time series is revised each time new annual benchmarks become available. However, with the recommended proportional Denton technique, the

\textsuperscript{27} This is the method used by Statistics Sweden.

\textsuperscript{28} The can currently be viewed at: http://www.imf.org/external/pubs/ft/qna/2000/Textbook/index.htm
impact on data for proceeding years will gradually become smaller and smaller, and will normally become insignificant after three to four years.

For the aligned back series, quarter to quarter growth rates will differ from those of the source data, and in extreme cases, new or different turning points may be introduced. This should be viewed as a necessary consequence of the reconciliation process, and users should be educated to accept this. For the forward series, quarter to quarter growth rates will be the same as those of the source data, but the annual rate will be different, as expected.

Thus, the level and movements of final QNA estimates will depend on:

- Movements in short-term indicators, which determine the quarterly path/pattern of QNA,
- Levels of ANA for the current year, which, through retrospective benchmarking, determine the sum of the quarterly levels,
- Levels of ANA estimates for several preceding and following years, which through retrospective benchmarking, determine the trend.

It should be emphasised that in the case of incorporation of revised or new benchmarks, the calculations should be based on the original non-seasonally adjusted quarterly indicator, not on the preliminary QNA estimates that have already had adjustments made to them. Otherwise, the compilation process risks deteriorating into data hashing, in which the compilers lose track of the original data, the effects of benchmarking, and the effects of other adjustments.

9. Conclusions and recommendations

- Since users will be confused and lose faith in the statistical office if estimates of the same variable at different frequencies show inconsistencies, the estimates should be benchmarked (usually the more frequent data will be adjusted in line with the less frequent, more accurate benchmark data). Benchmarking adjustments should not be made blindly, however – the methods used and the effects should be regularly reviewed.
- Except in the extraordinary case where BI ratios are constant from year to year, it is important to use a system which smooths the transition between years. Do not simply distribute annual data according to quarterly patterns – when BI ratios change from year to year, such pro-rata adjustment introduces steps between years.
- Smooth BI ratio series using standard time series techniques or integrated models.
- Various benchmarking applications are available which provide an integrated approach to retrospective alignment and forward extrapolation. It is worth spending time selecting and setting up a system correctly, as different models are better suited to data with different time series characteristics.
- If possible, forecast BI ratios for current quarters based on recent trends in the ratios.
- Benchmarking can lead to lower quality seasonal adjustments, where BI ratios are changing. In this case it may be better to adjust first, and then benchmark the adjusted data.
- The importance of good benchmarking methods increases as quarterly indicators show more divergence in movements from annual data.
- QNA estimates should be aligned with ANA estimates, as soon as ANA data become available.
- QNA estimates should be revised in line with subsequent revisions to ANA data.
• Benchmark all source data before NA compilation, to reduce later benchmarking of NA aggregates.
• Benchmarking is best done in a supply-use framework to preserve balance between GDP O, E and I.