

1. INTRODUCTION TO THE RESEARCH

*Yet, for all their virtues, the national income statistics
don't tell us what we need to know about the condition of
our society.....*

(Mancur Olson 1969)

1.1 Background

The United Nations System of National Accounts (SNA) is the standard framework for measuring a country's macroeconomic performance (Repetto *et al.* 1990). The SNA includes stock accounts that identify assets and liabilities at particular points in time, and flow accounts that keep track of transactions during intervals of time. Amongst other things, purchases of goods and services by the private sector or by the government, and payments to wage and profit earners are accounted for. The Australian National Accounts (ANA) follow this well established and internationally accepted system of national accounts. Since most countries have adopted the SNA, comparisons of economic performance can be made over time and between countries.

Development planners make frequent use of Gross National Product and its variants (such as Gross Domestic Product and Net National Product, *etc*) for a variety of purposes. Oftentimes, increases in GNP are used inappropriately as an indicator of economic growth. Economic growth simply means rising levels of economic activity; overtime the levels of production and consumption rise, due to population growth and / or higher per capita material living standards. Economic growth is identified with an increase in welfare and is viewed as an indicator of economic success.

As most economists know, there are a number of controversial issues with regard to national income accounts. The treatment of leisure; the environment; household and subsistence production, and other non-market transactions; and the services of long-lived consumer durables, are examples. The fact that these issues are not properly dealt with under the current SNA represents a serious flaw from an accounting point of view. As a result, policy advice, based on measurements produced under the SNA, can be faulty, to the extent that GNP does not adequately reflect the true level of income. True income may be thought of as a maximum amount an economic agent can consume without reducing possible consumption in a future period (Daly 1986, El

Serafy 1986). Following this idea, it would seem that there is a need to redefine the income of the economic agent as the maximum value which he or she can consume during a period, and still expect to be as well off at the end of the period as he or she was at the beginning of the period.

Prudent economic management requires that governments know the maximum amount that can be consumed by the nation without eventual impoverishment. Thus, it is important that national income be measured correctly to indicate true income. Adjustments of the GNP measure appear to be necessary in two areas: the environment and leisure; as these areas are not dealt with satisfactorily.

To elaborate further on these concerns, this chapter is organised in the following manner. Section 1.2 briefly presents the development of national accounting; Section 1.3 discusses the reasons for adjusting the current national accounts; Section 1.4 describes the objectives of the study. Finally Section 1.5 presents the outline of the thesis.

1.2 Development of National Accounting

The national accounts have become so much a part of people's lives that it is hard to remember that they are scarcely fifty years old. It is therefore not surprising that during the period in which this measure has become available, countries have taken increasing responsibility for the growth and stability of their economies, and enormous investments of talents and energy have been made in understanding how economies can be better managed (ABS 1992).

The national accounts provide a systematic statistical framework for summarising and analysing economic transactions taking place within a nation. The formulation of the accounts can be traced back to Sir William Petty and Gregory King in the seventeenth century England (Studenski 1961). Since then there have been lively debates as to just what to include, how items ought to be measured and how they be put together. The early and classic discussions of some of the basic issues were led by Hicks (1940, 1948), Kuznets (1937, 1946, 1948) and Gilbert (1948). The national accounts have been modified over the years. Other giants in the early construction of the accounts include Meade and Stone. They developed the double entry national accounting system in 1939 (in a British treasury study sponsored by Keynes), at about the same time, First in Norway, Dertisan in Denmark, and Jaszi, Denison and Gilbert in the USA, were working independently on the same concept (Kendrick 1972). National

Accounts in their present form evolved from the publication of Keynes' *General Theory of Employment, Interest and Money* and the interest of governments during World War II and the early post-war period in production and allocation of resources in competing uses.

The present national accounts reflect the Keynesian macroeconomic model that was dominant when the system was developed. But Keynes and his contemporaries were preoccupied with the Great Depression and the business cycle. Specifically they were concerned with explaining how an economy could remain for long periods of time at less than full employment. They were also preoccupied with building a statistical model of the workings of the economy, using the relationship presented by Keynes, which would enable them to develop prescriptions for a high and stable level of economic activity. The least of their worries were scarcity of environmental resources and the availability of leisure time.

A complete set of national accounts includes a number of flow accounts and a balance sheet. The flow accounts measure production, the incomes flowing from that production, both real and imputed, and capital transactions over a given time. The balance sheets record the levels of assets, liabilities and net worth at a particular point in time. The flow accounts and balance sheet are linked in that the stocks of assets and liabilities are equal to accumulated past capital transactions after allowing for revaluations and the creation and retirement of assets and liabilities. Australia has a full set of production and income accounts and is currently extending its capital transaction accounts to include flows of funds. As yet, Australia has not compiled balance sheet accounts because of the significant estimation problems involved and the lack of data for some parts of the balance sheets (ABS 1990a).

At their summary level, the national income and expenditure accounts were designed to reflect the economic flow of the Keynesian system: production, consumption, investment, government expenditures and saving. Although the Keynes-Kalecki literature (Kalecki 1969) reveals that natural resources are regarded as capital stock, it largely ignored the productive role of leisure.

1.3 Need for an Adjusted National Accounts

Only a few years ago, many agreed that economic growth, as measured by rising GNP, was altogether desirable; although the ideologies differed about what policies would best attain growth and how its fruits should be shared (Olson 1977). However,

towards the end of the 1960s considerable concern began to be expressed in the developed countries about the impact that economic growth was having on the environment (Beckerman 1992) and on hours of leisure. Many of these concerns were well formulated by Mishan (1967), who enumerated various alleged shortcomings of economic growth. Similar concerns were later set out in well-known books by Schumpeter (1973) and Hirsch (1977). Nevertheless, economic growth remains a widely accepted goal. To many however, a growth of national income has become an ambiguous blessing and to a few a noisome evil (Meadows *et al* 1972).

Gross National Product is the principal indicator of economic growth and transformation (Jenkins 1993). It is a measure of the total value of the production of goods and services which occurs during the year. In economic policy and also in some of the economic literature an increase in production, as measured by GNP, is called economic growth (Hueting 1992). This growth is identified with an increase in welfare and is viewed as the indicator of economic success. However, as most economists realise there are some deficiencies associated with the GNP measure.

1.3.1 Shortcomings of the present national accounts

The system of national accounts were developed during the Great Depression, when the emphasis was upon investment and government expenditure to provide employment. At that time the impact of economic activity on the environment and on the availability of leisure hours were not recognised as issues. From today's perspective it is clear that the concept of economic growth, as measured by GNP, is inadequate. According to Peskin (1992), there are three deficiencies in the standard national accounts that result from an inadequate treatment of the environment and leisure.

1.3.1.1 Inconsistent treatment of income and wealth

The national accounts fail to treat different forms of wealth consistently. This inconsistency has to do with the definition of "income". Conventionally, income is defined as the sum of consumption expenditures plus investment (Peskin 1992). Yet the conventional definition further distinguishes between gross investment and investment less depreciation, or net investment. It further distinguishes between gross income and net income, where the latter is defined as consumption plus net investment.

Many economists follow Hicks (1946) in the belief that net income is the more relevant indicator of the welfare of society, since it better represents the amount society is willing to consume after allowing for the production of resources necessary to maintain society's stock of capital. Gross income in contrast, may not be sustainable to the extent that its level is supported by diminishing stock. As a consequence, one of the most important entries in the national accounts is "depreciation" which allows the translation of gross income to net income.

In the present system of national accounts, only-man made assets are valued as productive capital and are written off against the value of production as they depreciate. This practice recognises that a consumption level maintained by drawing down the stock of capital exceeds the sustainable level of income. However, a country could exhaust its mineral resources, cut down its forests, erode its soil, pollute its waters and hunt its wildlife and fisheries to extinction, and measured income would not be affected as these assets disappeared (Repetto *et al* 1990). This is because the current national accounts fail to account for the depreciation of other forms of capital such as natural resources and environmental wealth. As both environmental and natural resource capital are crucial to the production of goods and services, failing to value their depreciation necessarily means that net income is overstated.

In addition, the depreciation portion of the national accounts reflects the fact that, unless the capital stock is maintained and replaced, future consumption possibilities will inevitably decline. In resource dependent countries such as Australia, failure to extend this depreciation concept of capital stock embodied in natural resources, which are such a significant source of income and consumption, is a major omission and inconsistency (Jenkins 1993).

1.3.1.2 Inadequacy as a measure of economic performance

Economic performance, synonymous with national income, is conventionally measured and evaluated in terms of GNP. One frequently heard criticism of the conventional national accounts is that they respond poorly to changes in environmental conditions and work conditions. Economic performance is measured in goods and income, overlooking the effect of both on the environment and leisure time. Neither withdrawals from the stock of natural resources (energy, raw materials, water, air and land) or the destructive effects of waste and pollutants register on the national accounts. For example, the cost associated with the clean-up of an oil spill make a positive contribution to GNP, while any damage to the environment is not included. In

addition, the conventional economic indicators poorly reflect efforts to defend against environmental damage when, for example, increased expenditure on medical services or household cleaning incurred because of pollution, lead to an increase in GNP. Also, efforts to clean up the environment could lead to a decrease in real GNP to the extent that these efforts divert resources from the production of ordinary output.

Furthermore, increases in wage rates could lead to decreases in the number of hours worked by the economic agent and thus could increase hours spent on leisure. This situation however, is reflected as a decrease in GNP.

1.3.1.3 Neglect of important determinants of economic activity

An important function of the national accounts is that they serve as an information system containing those statistics that determine and define the nation's economic activity. In a sense, the national accounts provide a snapshot of the economy's "production function": an instantaneous picture of the transformation of factors of production into product and services. Neglecting environmental resources and leisure in the accounts distorts the picture of production in two ways: the oversight ignores the production of some undesirable outputs (e.g. pollution) and leaves out a number of crucial inputs in the production of both desirable and undesirable products.

Along with natural resources, other kinds of capital assets, notably knowledge and stock of skills possessed by the workforce, are enrolled in the national accounts. Furthermore, in the government sector, the goods and services produced are not directly priced as an output, but are valued at their factor cost.

These and many other deficiencies have led to a long agenda of suggested improvements. However, proponents and users of national accounts take refuge in the disclaimer that the national income accounts do not purport to measure changes in economic welfare, although, in reality, that is precisely how they are used day after day (ABS 1990a). As a consequence, policy decisions continue to be based on the implicit assumption that overall economic well-being will rise with GNP.

1.3.2 Environmental Concerns and Attitudes in Australia

The Australian Bureau of Statistics (1993a) conducted a survey on people's views and attitudes towards environmental problems, environmental protection and economic

growth. Approximately 12 470 persons were interviewed all over Australia. The results are summarised in Tables 1.1 and 1.2.

Table 1.1
**Concern About Environmental Problems, States
 and Territories: Percentage of Persons**

<i>Concern about environmental problems</i>	NSW	Vic.	Qld.	SA	WA	Tas.	NT	ACT	Australia
Yes	73.6	75.2	74.0	77.0	76.0	70.7	79.6	83.5	74.8
No	24.1	22.2	24.0	21.4	21.8	28.2	17.7	14.4	23.0
Don't know	2.3	2.6	1.9	1.5	2.2	1.1	2.7	2.1	2.2
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: ABS, Environmental Issues (1993)

It is estimated that about three quarters of the Australians in the survey group were concerned about the environment (Table 1.1). This concern was highest in the Australian Capital Territory (84%), and the Northern Territory (80%). The lowest percentage was in Tasmania (71%).

When asked about particular environmental problems, 40 per cent of the people nominated air pollution as a concern. The next two most concerning problems were the destruction of trees and ecosystems (33%) and ocean pollution (32%). Of the top five environmental problems, three relate to pollution. Of the global issues, ozone depletion rated as being of more concern (at 29%) than the greenhouse effect (at 17%). Also, the findings reveal that one in ten people had taken action to register their concerns are concern by writing a letter or telephoning a relevant agency.

A majority of people (70%) rated protection of the environment and growth of the economy as being of equal importance (Table 1.2). Only 7 per cent of people favoured economic growth ahead of environmental protection, while 19 per cent rated environment protection ahead of economic growth. As the questions were necessarily cast in somewhat simplified terms, the responses can be regarded only as indicative of general attitudes and not of fully formulated views (ABS 1993a).

Table 1.2
**Attitude to Environmental Protection and Economic Growth,
 States and Territories: Percentage of Persons**

Priority	NSW	Vic.	Qld.	SA	WA	Tas.	NT	ACT	Australia
Environment protection is more important than economic growth	19.5	17.5	8.2	20.9	19.3	13.4	19.4	24.4	18.8
Environment protection and economic growth are equally important	68.8	69.7	71.0	70.5	73.4	76.8	71.9	70.0	70.3
Environment protection is less important than economic growth	6.7	7.6	6.8	4.6	4.9	6.5	5.9	3.6	6.6
Cannot decide/ no opinion	5.0	5.2	3.9	4.0	2.4	3.2	2.8	2.0	4.4
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Source: ABS, Environmental Issues (1993)									

The survey also reveals that more young people rated environment protection as a priority. A second interesting revelation was that as age increased, so did the percentage of people who could not decide or offer an opinion.

As stated earlier, the standard national economic accounting framework omits a depreciation portion for the depletion of natural resources analogous to that which exists for the use of physical plants and equipment. Measured income growth in resource based economies such as Australia, therefore, might overstate productivity gained by including reductions in wealth as income. The ABS survey reveals that there is an increasing awareness of resource and environmental quality problems among the people of Australia. These results further support the need to have the national account reflect the costs of economic activities that are not reflected in market transactions but are felt through diminished availability of environmental resources.

1.3.3 Leisure in Australia

Changes are taking place in the working force which affect how much time people have for leisure and the ways they experience it. These changes include the proportion and categories of men and women in gainful employment; the length of the working week, working year and working life for those in employment; the trade-off between paid work-time and free-time which employees choose or wish to choose, and the significance of leisure provision and the leisure industry in Australian society as a whole (Parker and Paddick 1990).

One of the biggest changes in the Australian labour force is the number of married women now in paid employment. The proportion has increased from 6% of all married women in 1901, to 33% in 1971 and 48% in 1988. Mercer (1980) quotes evidence that supports the belief that the majority of wives are working out of necessity, that is, to supplement the husband's income and to raise the family income to an acceptable minimum level. For such women the continually invades the stock of free time, because in effect they are often doing two jobs: paid employment plus domestic household chores. Many married women, and particularly those with young children, not only don't have time for leisure but believe that it would not be right for them to have interests outside the home (Parker and Paddick 1990).

Having to do paid or domestic work is one limitation on time available for leisure; another is the length of the working week or working year for those employed. Contrary to popular belief, hours of work over the past two decades have only slightly (rather than greatly) reduced (ABS 1993c).

Although some trade unions have succeeded in negotiating shorter standard working weeks for their members, this has been offset by overtime, double jobbing and an actual increase in the hours worked by some income earners, notably employers or the self-employed. Perry (1977) showed that between 1964 and 1972 the proportion of full-time wage earners who worked more than 40 hours per week rose from 29% to 36%, and there was an ever greater increase in the minority who worked more than 60 hours per week. Although between 1975 and 1985 average weekly hours of work fell from 36.9 to 35.8, nearly all of the decline was accounted for by the hours of employers and the self-employed being reduced from 44.6 to 41.9.

A recent survey of a thousand Australian public sector employees showed that, given the choice of a 10% raise in current income or more days of annual vacation, only 20%

would trade no part of their raise for more vacation days, 36% would trade 40% of their raise, 8% would trade 70%, and 36% all of it (Wood 1987). The five main reasons given for a desire for more free time were: more time to be with families; for leisure; for education; likely improvement in health; and relief from stress and fatigue. In addition, Wood's (1987) survey revealed that what workers want longer vacations, weekends or sabbaticals.

Like all industrial societies, in recent decades Australia has seen a strong growth in the economic significance of leisure. This has taken place in two major linked respects: more people are spending more of their income on leisure goods and services, and more people are working to cater for the leisure needs of others. Brown (1985) notes that in 1984 'recreation' constituted 1.5% of total household expenditure and was the fourth greatest household expenditure after food, transport and housing costs. He also notes that in the same year ABS statistics on employment identified "recreation, personal and other services" as the eighth largest area of employment, with 430 900 workers.

All this evidence shows that leisure plays an important role in the Australian economy. People lead integrated lives in which leisure time and activities are closely interlinked with work, family and social life; thus there is a need for the national income accounts to reflect this wholeness.

1.3.4 Lack of macroeconomic studies

Macroeconomic analysis of the environment by the neoclassical and modern mainstream economists can best be regarded, as Daly (1991) described, "an empty box". Although a few have attempted (Girma 1992, Thampapillai 1993) to incorporate the environment in their study of the economy, the label of "macroeconomic emptiness" remains valid (Thampapillai 1993). A concise survey conducted by Cropper and Oates (1992), revealed that there is a singular preoccupation with a microeconomic analysis of environmental issues. The reason for the exclusion of the environment in macroeconomic analysis becomes more apparent in the exchange between Marxsen (1992) and Daly (1992). The Neo-classical and their successors have refuted the possibility of environmental limits due to their faith in technology and continuing improvements in technology. However, evidence shows that concern about the environment continues and that some environmentalists have suggested that the national accounts should take into account interactions between the economy and the environment.

1.4 Objectives of the Study

Most of the suggested approaches to modifying the standard national accounts involve an expansion of the conventional accounts either by direct modification of these accounts or by constructing separate "satellite" accounts. This study aims to determine the nature of the relationship of the environment variable to some of the macroeconomic variables of consumption, investment, government expenditures and leisure-labour ratio, and thus attempts to extend the national income accounts.

The general objective of this research is to illustrate how the environment and leisure can be analysed within the Neo-classical framework of income accounts. The specific objectives are as follows:

- (i) to develop a model that will include the environment in the Neoclassical framework of income accounts;
- (ii) to determine the macroeconomic relationship between the environment variable and the macroeconomic variables of consumption, investment, government expenditures and leisure-labour ratio;
- (iii) to understand better the relationship between economic activity and the environment at the macro level;
- (iv) to adjust the national accounts by imputing for the value of leisure; and
- (v) to attempt to extend the national accounts by incorporating the value of the environment

1.5 Outline of the Study

The remainder of the thesis is designed as follows: Chapter 2 presents a review of studies that have attempted to revise or extend the national accounts; Chapter 3 details the theoretical framework of the study; and Chapter 4 discusses the models developed for this study. The sources and nature of data are outlined in Chapter 5, while the methods of analysis are explained in Chapter 6. In the next three chapters, the empirical results are presented. In Chapter 7, the empirical results for defensive

expenditure (environment variable) are elaborated. Chapter 8 gives the result of attempts to impute for the value of leisure and in Chapter 9 the integration of the environment and leisure valuations are illustrated. Finally Chapter 10 presents the summary and the recommendations of the study.

2. LITERATURE REVIEW

It would be enormously convenient to have a single, generally accepted index of economic and social welfare....A glance at it would tell us how much better or worse off we had become each year and each decade.

(Edward Denison 1977)

2.1 Introduction

The national economic accounts summarise the flow of services, materials, and products which characterise a nation's economic activity. However, economists have emphasised the limitations of using monetary transactions to measure total economic activity, let alone to measure total social well-being. Yet the national accounts, and especially certain subtotals drawn from these accounts such as the Gross National Product (GNP), have gained popular status as key measures of a nation's economic performance.

Members of the environmental community have joined those economists that are unhappy with the status given to the national accounts as a barometer of performance. Environmentalists are especially concerned that the accounts fail to reflect pollution and environmental deterioration. In addition, conventional national accounting ignores the nation's environmental and economic resource base, and so is a poor measure of sustainable economic growth. These environmental issues are attaining worldwide prominence, particularly with the concerns about global warming, transnational damage and acid rain. Although discussed briefly in Chapter 1, before any serious effort to address the deficiencies in the standard national accounts is made, a clear understanding of the concept of national accounts is needed. Discussions as to how the national accounts react to environmental and natural resource changes, and how the accounts might be altered to reflect changes in the environment and leisure are focused upon.

This chapter is structured in the following manner. Section 2.2 reviews the theory behind the national accounting system while Section 2.3 assesses whether the current system of national accounts is an appropriate measure of welfare. The reasons for advocating change or extensions of the national accounts are listed in section 2.4 and in Section 2.5 the different approaches to extending or revising the national accounts

are described. Section 2.6 presents a survey of the revised and extended accounts based on the three approaches. A detailed evaluation of the three approaches follows in Section 2.7. Finally, concluding remarks are presented in Section 2.8

2.2 A Review of the National Accounting System

The Systems of National Accounts (SNA) is the official measurement of the flow of product and income in the economy. The product side of the national accounts measures the flow of currently produced goods and services in the economy. The income side of the accounts measures the factor incomes that are earned by the country's workers in current production.

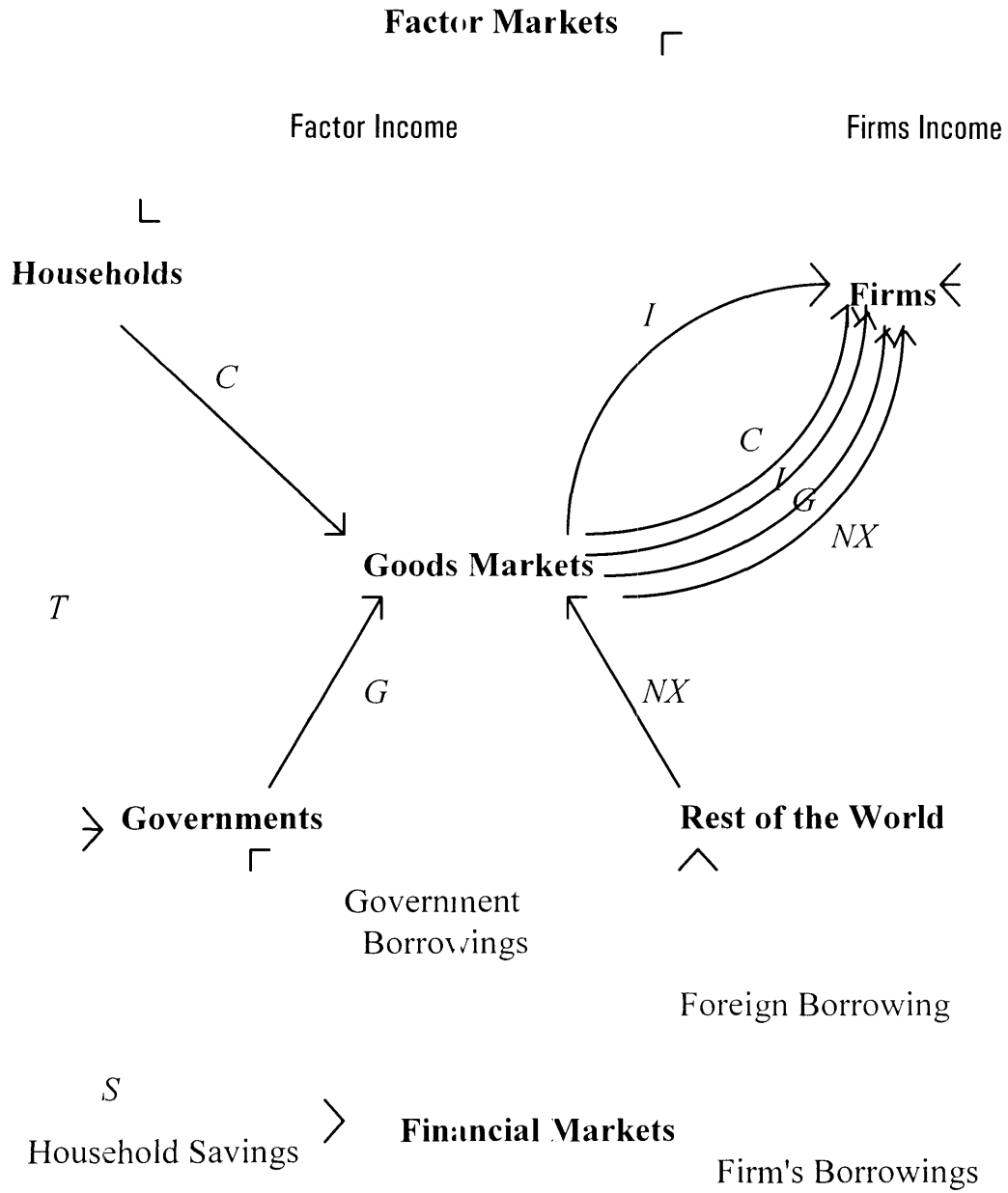
2.2.1 The circular flow of product and income

The circular flow of expenditures and income provides the conceptual basis for measuring the national income. Consider Figure 2.1.

The three types of money that flows between firms, households, the government and the rest of the world are illustrated: payments for factors of production, expenditures on final goods and services, and borrowing, lending and taxes. Firms hire factors of production and make income payments (Y) to households in exchange. Households make consumption expenditures (C). Firms undertake investment (I) – purchase new capital goods from other firms and accumulate inventories. The government purchases goods and services (G) from firms. Finally, goods and services purchased by the rest of the world plus, other transfers out result in net exports (NX). The sum of the consumption expenditure (C), investment (I), government purchases of goods and services (G), and net exports (NX) is equal to aggregate expenditure, which also equals aggregate income at equilibrium.

Aggregate expenditure equal aggregate income in this example. To see this equality, focus on the expenditures on goods and services (solid lines) received by firms and the firms' payments for factor services (dashed lines). The figure also shows four flows representing the firms' revenue from the sale of goods and services – Consumption expenditures (C), investment (I), government purchases of goods and services (G) and net exports (NX). The sum of these four flows is equal to aggregate expenditure on final goods and services. On the other hand, everything that a firm receives from the sale of its output is paid out as income to the owners of factors of

Figure 2.1
The Circular Flow of Income and Expenditure



Adapted from McTaggart *et al.* (1992)

production that it employs and to the households that have a claim on its profits. The income flow (dashed lines), therefore, equals the sum of the expenditure flows (solid lines). That is

$$Y = C + I + G + NX \quad (2.1)$$

In the same figure, consider the household sector. The figure shows that there is one flow into the households and three flows out. The flow in income is (Y) and the flows out are consumption expenditure (C), saving (S) and taxes (T). The difference between income and net taxes is disposable income. But net taxes are equal to total taxes minus transfer payments received. Thus, disposable income is income plus transfer payments from the government minus taxes. Saving is disposable income minus consumption expenditure. With this definition of savings, it is clear that

$$Y = C + S + T \quad (2.2)$$

Equations (2.1) and (2.2) result in the basic income (Y) identity that is fundamental to the study of macroeconomics

$$C + I + G + NX = Y = C + S + T \quad (2.3)$$

2.2.2 The expenditure approach

The expenditure approach measures Gross Domestic Product (GDP), which is the total of all goods and services in the country for a given period of time, by adding together all the final expenditures. On the other hand, Gross National Product (GNP) is defined as the value of all final goods and services produced by the country's nationals in a given time period. In a closed economy GDP will be equal to GNP. However not all income produced in Australia stays in Australia. There are numerous examples of Australian companies owned by parent companies in, for example, the USA. Any part of their Australian earnings sent to the American parent company represents income paid overseas. Similarly, earnings are received by Australian companies from the operations of their subsidiaries overseas. Such earnings are described as income received from overseas. Gross National Product is therefore equal to GDP less income paid overseas, plus income received overseas. The expenditure approach is illustrated by Table 2.1.

Consumption (C) enters the national accounts as private final consumption expenditure. It is the aggregate expenditure on goods and services produced by firms and sold to households. Investment (I) is the sum of private gross fixed capital expenditure and increase in stocks. It includes expenditure on capital equipment by firms and expenditure on new houses by households. It also includes changes in firms' inventories. Inventories are the stocks of raw materials, semifinished products and unsold final products held by firms. By holding inventories of finished goods, firms can respond to fluctuations in sales, standing ready to meet an exceptional surge in demand. The stock of plant, equipment and buildings (including housing) is called capital stock. Additions to capital stock are investments.

Table 2.1
The Expenditure Approach

Item	National Accounts Terminology	Symbol
Consumption	Private final consumption expenditure	C
Investment	Private gross fixed capital expenditure plus increase in stocks	I
Government expenditures	Government final consumption expenditure plus public gross fixed capital expenditure	G
Net exports	Export of goods and services less import of goods and services	NX
Statistical discrepancy		SD
Gross Domestic Product		Y

Adapted from McTaggart *et al.* (1992)

Government expenditure (G) is the sum of government final consumption expenditure and government gross fixed capital expenditure. It includes expenditure on goods, services and investment by all levels of government. Net exports (NX) are the difference between the value of exports (X) and imports (M). Statistical discrepancy (DS) is the difference between GNP measured by the expenditure approach and GNP measured by the income approach - because they use data from different sources, these two approaches do not usually give the same numerical estimate of GNP, and a discrepancy arises. This discrepancy is included on the expenditure side simply because of convention, and does not necessarily imply that the income approach is more accurate than the expenditure approach.

In Australia, the sum of private and government final consumption expenditures, and gross fixed capital expenditure, is often referred to as Domestic Final Demand. In the Australian National Accounts, the sum of domestic final demand and increase in stocks is shown as Gross National Expenditure (GNE).

2.2.3 The income approach

The income approach measures GDP by adding together the incomes paid by firms to factors of production and adding them to depreciation and net indirect taxes. Incomes paid to factors of production fall into two categories: (1) wages, salaries and supplements, and (2) net operating surplus. Table 2.2 illustrates this.

Table 2.2
The Income Approach

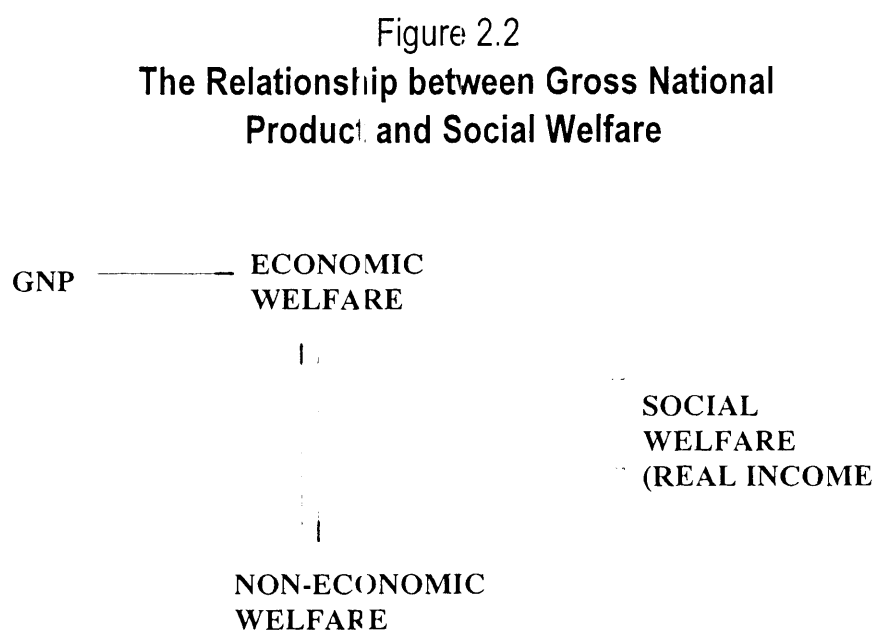
Item
Wages, salaries and supplements
Plus: Gross operating surplus
Gross Domestic Product at Factor Cost
Plus: Indirect taxes
Less: Subsidies
Gross Domestic Product
Less: Income paid overseas
Plus: Income received from overseas
Gross National Product

Adapted from McTaggart *et al.* (1992)

Wages, salaries and supplements are payments made by firms to employees. They include net wages and salaries, taxes withheld from earnings, fringe benefits such as income paid in kind, contributions to pensions and superannuation schemes and workers' compensation for injuries. Net operating surplus is the operating surplus of firms after allowing for the use of capital in the production process. Net operating surplus is calculated for private trading enterprises, public trading enterprises, general government and financial enterprises. However, in order to use the factor income approach to measure GDP at market prices, indirect taxes need to be added to GDP at factor cost and subsidies must be subtracted. An indirect tax is a tax assessed on producers when they produce or sell goods and services. Indirect taxes result in the consumer paying more than the producer receives for the good, thus it should be added to GDP at factor cost. A subsidy is a payment made by the government to producers. A subsidy lowers the market price below the factor cost - consumers pay less for the good than it cost the producer to make the good, and thus it should be subtracted.

2.3 Welfare Measurement and the National Accounts

To distinguish between 'economic welfare' and 'social welfare', consider Figure 2.2 which follows Pigou (1924).



Economic welfare maybe defined as all those items covered by GNP, while non-economic welfare refers to all other considerations, which provide utility, such as

climate, natural beauty and the quality of human relationships. Assuming Pigou's diagram (Figure 2.2) is true, one could expect to find a positive correlation between Gross National Product and social welfare (real income). Furthermore, the diagram implies that increases in GNP would lead to increases in social welfare. Such conclusions depend, however, on the existence of some systematic link between GNP and non-economic welfare (Pearce 1983). For instance, if increases in pollution or land degradation accompany increases in GNP, social welfare may not have increased.

Thus, as Denison (1977) pointed out, it would be extremely convenient to have a single, generally accepted index of the economic welfare of the people of a country. Yet such a generally acceptable index of welfare cannot be constructed. For instance, the welfare measure should encompass changes in the following components: output, real costs of production, needs, the environment, the distribution of income and other aspects. Before discussing each of these components of a good welfare measure, it is necessary to describe the present system of national accounts.

The United Nations System of National Accounts (SNA) is the standard framework for measuring a country's macroeconomic performance. It aims at providing a systematic summary of the transactions taking place in the economy, especially those that relate to the production and use of goods and services, and to transfers of income or capital between sectors of the economy.

The SNA may be a useful measure of the economic health of a nation, but concern has been expressed among social scientists in general, and by economists in particular, as to their adequacy as a measure of welfare. This concern is expressed in the following kinds of questions: Do changes in national income and product over time or differences among nations really measure changes and differences in well being? Do the current measures really fit the theoretical constructs they are presumed to serve?

The system of national accounts specifically GNP, measures output changes thoroughly and thus satisfy the first criterion. Gross National Product valued at constant prices permits measurement of changes in the quantity of output, where products are combined by use of prices in a base year. However, the system has limitations. First, it is difficult to differentiate between the value of the services a household, firm or government secures from its purchases and the actual monetary expenditures. For instance, costs of teachers' services, books and school buildings are included in the GNP computations but Gross National Product does not tell how much education is obtained per dollar of expenditure from such items (Denison 1977).

Secondly, there is a problem of change in quality. The change in GNP understates the change in the ability of output to satisfy wants because it ascribes no value to the increased range of products the economy is able to provide. For example, in 1994 medicines were available that did not exist at all in 1962. These two reasons limit the accuracy of GNP as a measure of changes of real output over time.

Thirdly, a full welfare indicator should reflect changes in working hours and working conditions. As currently practised, any decrease in working hours is reflected as a decrease in GNP value. Fourthly, there is a need to measure the changes in the needs that output satisfies. To account for changes in welfare due to population change, the output is converted to a per capita basis on the assumption that, other things being equal, twice as many people need twice as many goods to be equally well off (Denison 1977).

Measures of these 'needs' shade into measures of the human and physical environment in which an individual lives. Air and water pollution, the volume of solid waste, and other undesirable aspects of the physical environment have increased with economic growth, or more accurately with the increase in production. Unfortunately, the value of this environmental deterioration is not reflected in the conventional GNP computations. Market production is faithfully recorded in GNP while the by-products are systematically ignored.

To measure welfare fully, an index of 'goodness' of the size distribution of income is also needed. There may be a consensus that for a given total output, a distribution with fewer families in poverty would be better than the present distribution. There may be a consensus that less inequality would also be an improvement. However, there is no agreement on an ideal distribution with which a given distribution can be compared.

Accordingly, it is argued that GNP is not just a poor but a dangerously misleading guide to economic policy. It is certainly not a measure of a nation's welfare. These criticisms have provoked a variety of responses. The arguments in defence of GNP can be summarised as follows (Pearce 1978):

- (1) GNP was never intended to be a welfare measure.
- (2) GNP is only a partial measure of welfare, but there is a general presumption that differences in GNP will reflect differences in welfare.
- (3) GNP is one among a variety of interesting components of welfare, all of which should be considered together.

- (4) GNP can and should be modified to yield a similar but more comprehensive measure of welfare.

Let us consider each of these arguments in turn. The first suggests that GNP has never had normative significance. It is simply an interesting aggregate found useful in a variety of economic analyses and policy exercises, such as the business cycle. Unfortunately, a rigid separation of positive and normative significance cannot be achieved. Beckerman (1974) wrote that the basic conventions that have been adapted for the purposes of GNP measurement are still founded on some notion of measures of economic activity that can best represent the contribution of that activity to welfare. Once selected, measures such as GNP are liable to have a strong influence. For example, growth in GNP is an important objective, despite the protests of professional economists. Jaszi (1973) ended most of the objections with a value-laden suggestion that 'the production, distribution and use of output.... is what the economy is all about'.

The second argument admits that GNP is only a partial indicator of the state of welfare but maintains that increases in GNP bring increases in welfare. Supporters of this view have included Lipton (1968), Denison (1971), Heller (1972) and Beckerman (1974). Following Pigou (1924), they have argued that there exists a positive relationship between GNP and social welfare. Such conclusions depend, however, on the absence of any systematic link between GNP and non-economic welfare. Sources of non-economic welfare include clean air and good health.

The third argument seeks to supplement GNP with other indicators of social welfare, these might include indicators of distribution of income, of environmental quality and life expectancy. It is then left to the policy makers to decide what weight to attach to particular indicators. There are several difficulties associated with this procedure: there is a danger that certain aspects of welfare may be neglected, coverage of indicators may overlap, and some indicators can be misleading.

Finally the fourth argument advocates extending the coverage of GNP in a systematic way using the same principles used in the existing GNP.

Gross National Product, for all its faults, covers a well-defined area systematically, comprehensively, without duplication and according to clearly defined principles. Even if indexes of output, real costs, needs, the state of the environment and income distribution could be constructed, a welfare index could not be computed because there

is no system of weights to combine them. If a single welfare index cannot be constructed what then are the reasons for extending or revising the national accounts?

2.4 Motivations for Change

Attempts to extend or revise the national income and product accounts are principally motivated by: (1) the need to develop better measures of the economic activities that contribute to social welfare, and (2) the need for more inclusive and relevant measures of capital formation and other factors in economic growth. The need for better and/or additional data to fit concepts of consumption, investment and production relevant to economic theory and structural econometric relationships are additional reasons cited (Eisner 1988).

The other motive is to properly reflect the effects of environmental degradation in the national accounts. While GNP measures how much man-made assets such as factories and equipment depreciate as they are used in current production, it omits the effects of resource depletion and degradation. For example, national income accounts record timber output, fish harvest, and crop production as income, but ignore the costs of deforestation, overfishing and soil erosion. A nation's depletion of its natural resources can therefore masquerade as growth, even though it will clearly reduce income prospects from resource sectors in the future. Today's accounting framework is particularly inadequate for countries whose natural resources are its principal economic assets. For these reasons, it is envisioned that an extended or revised GNP would enable countries to relate economic growth to the quantities of natural resources that have to be used up or imported to make economic growth possible. Such changes would also enable the optimisation of the economic value of available natural resources, determine the fraction of GNP that should be set aside for the efficient protection of the environment, and lastly help orient economic growth so that it does not threaten ecosystems (Lutz and El Serafy 1988).

In addition, critics of GNP argue that it should be revised because it fails to account for leisure time. The omission of leisure is partly explained by the fact that leisure is purchased, not by spending and trading, but by not working. The SNA is currently undergoing intensive revision in light of the experiences of individual countries and international agencies to accommodate this shortcoming (ABS 1993a). For example, data collected in a time-budget survey will be used by the Australian Bureau of

Statistics to derive monetary values for all forms of unpaid work as part of the development of a system of satellite National Accounts for the household economy.

Such motives and the dissatisfaction with GNP as an overall measure of economic performance give rise to the need for the revision or extension of the national accounts.

2.5. Approaches to Adjusted National Accounts

The approaches used in extending or revising the national accounts are diverse. Most of the work to date has occurred in the USA, Canada, France, Norway and the Netherlands. These works have not always been actively sponsored by national governments. International organisations such as the Organisation for Economic Co-operation and Development (OECD), the United Nations Statistical Office (UNSO) and the United Nations Environmental Program (UNEP) have shown interest in the revision or extension of the national accounts. The approaches to revise or extend the national accounts can be broadly grouped into the following categories:

- (1) purely economic;
- (2) purely physical; and
- (3) a mixture of economic and physical.

2.5.1 Purely economic approach

Economic approaches have concentrated on a direct modification or expansion of the SNA and its indicators. There are two objectives behind this approach. The first objective is to make the use of natural resources and environmental services more explicit within the traditional accounting frameworks. The second is to adjust certain aggregate indicators so that they reflect social welfare more accurately.

The rationale for the purely economic approach rests on the argument that economic information is crucial to planners. Economic information is also important to the public, which probably places more importance on GNP as a measure of social well-being than do the experts (World Bank 1990). Proponents of a purely economic approach to Natural Resource Accounting argue that the resulting accounts will be more acceptable to a wide range of users.

2.5.2 Purely physical approach

The physical approach attempts to document stocks and flows in physical units. Proponents of this approach argue against the use of monetary units for a number of reasons. For example, commodities with the same monetary value, say a gram of salt and a kilogram of rice, have very different welfare contents. Thus, the use of monetary units in the accounting system implies a very limited view of welfare.

The rationale for this approach is based on the problems of dealing with externalities in economics, and inconsistencies between economic theory and fundamental physical laws. One of the aims of the approach is to remove the separation of economic theory from global processes, and thereby encourage economic activity which conforms with physical laws. The approach also recognises the fact that the market is imperfect. In addition, the physical approach uses physical units which are more consistent over time, less subjective and applicable to a variety of disciplines.

2.5.3 Mixture of physical and economic approaches

The feasibility of physical and monetary accounting in the areas of natural resources was first explored in workshops jointly organised by UNEP and the World Bank. The workshops led to the consensus that enough progress had been made to link environmental accounting to SNA. In response to this conclusion, a Framework for Integrated Environmental Economic Accounting (IEEA) was prepared by the staff and consultants of the United Nations Statistical Office. But prior to the UN's meeting France and Norway had devised and constructed such an accounting framework and Canada had undertaken work preparatory to the construction of the Natural Resource Accounting (NRA). Natural Resource Accounting is a term which includes a variety of methods which use accounting frameworks to present information on natural resources, the environment, and their use (Gilbert and James 1987). Other individuals and research groups in the US and the Netherlands had developed methodologies for mixed accounting systems.

Since there are disadvantages associated with the purely economic and purely physical approaches, the mixed accounting system is a compromise which deals with the issues cited.

This approach is characterised by the following:

- (1) modification of the SNA so that monetary flows associated with maintenance of resource stocks and environmental quality are explicit;
- (2) construction of accounts describing environmental processes and interaction in physical units; and
- (3) linkages of these via quantification in both economic and physical units of flows in the economic-environment interface.

2.6 A Survey of the Revised and Extended Accounts

2.6.1 Purely economic approach

Much work which now falls in the category of Natural Resource Accounting involves the adjustment of various indicators. The economic approach to extending or revising the national accounts has concentrated on modifying the SNA, rather than on developing an alternative economic accounting structure. For instance, there have been efforts directed towards the generation of alternative measures of social well-being, at least partially derived from the national accounts and attempting to include the disamenities of urbanisation (Nordhaus and Tobin 1972, Economic Council of Japan 1974). This subsection will discuss the work of several economists who directly revised or extended the national accounts.

2.6.1.1 The Net National Welfare (NNW) of Simon Kuznets

The first wave (1968-1973) of research into Net National Welfare (NNW) was headed by Simon Kuznets, winner of the Nobel Prize for Economics in 1971. He argued for a substantial final product orientation of GNP and inclusion of the non-market sector in the GNP computations (Leipert 1987). He was not successful however, in gaining acceptance for this welfare-oriented approach as a basis for the concept of GNP. Although Kuznets was one of the first to formulate and explore in detail those elements of criticism of GNP that are still considered essential, he never produced an empirical calculation of GNP oriented towards final production that met his main objections. He did however calculate partial aspects, such as the negative impact on national welfare of agglomeration costs of industrial countries, in the context of comparisons of economic welfare between industrial and developing countries.

2.6.1.2 The Measure of Economic Welfare (MEW) of Nordhaus and Tobin

A major estimate of extended GNP has been provided by Nordhaus and Tobin. Dubbed 'MEW' for 'measure of economic welfare', it attracted much attention and has been cited widely. To illustrate Nordhaus and Tobin's method, consider Table 2.3.

Table 2.3
Nordhaus and Tobin's Approach: GNP and MEW
1965 in 1958 Prices

Items	Billion of Dollars	As per cent of GNP	Annual Change (1947-65)
Gross National Product, BEA*	617.8	100.0	3.91
Less: Capital consumption, BEA	-54.7	8.9	6.27
Net National Product, BEA	563.1	91.1	3.72
BEA final output reclassified as			
Less :regrettables and intermediaries			
government	-63.2	10.2	6.37
private	-30.9	5.0	5.96
Imputations for items not included by BEA			
Add: Leisure	626.9	101.5	1.65
Add: Non-market activity	295.4	47.8	3.48
Less: Disamenities	-34.6	5.6	3.36
Add: Services of public and private capital	78.9	12.8	4.34
Additional capital consumption	-92.7	15.0	3.40
Growth requirements	-101.8	16.5	
Sustainable MEW	1 241.1	200.9	2.07

Source: Nordhaus and Tobin (1972). Table A. 7*BEA stands for the Bureau of Economic Analysis. The BEA figures shown are those presented by the original authors. Also see Eirner (1988) p. 1631.

In revising the GNP measure, Nordhaus and Tobin add imputations for household and government services, non-market work and leisure. They subtract output regarded as 'regrettables and intermediaries' that is, 'instrumental expenditures' for activities that are not directly resources or utilities themselves but are necessary inputs to other activities. These include the cost of commuting to work and government expenditure

for police, sanitation, work maintenance and national defence. A value for 'disamenities' of urban life was also deducted to get the total MEW.

Viewing consumption as the ultimate final product, Nordhaus and Tobin only subtracted a capital consumption allowance and the amount of investment that would be necessary to satisfy growth requirements. The net investment that is left in sustainable MEW is the excess of what would be necessary to maintain a constant capital-output ratio with consumption increasing at a rate consistent with population growth and technological progress. While including imputations for the services of tangible capital in households (consumer durables) and the government, MEW does not include the services of education and health capital. These are taken to be intermediate in character, with their fruits already shown in labour productivity and earnings.

Nordhaus and Tobin impute value non-market work at home as the hours spent multiplied by the opportunity cost of time. The other major imputation is the value of leisure which is viewed as a component of consumption. Nordhaus and Tobin calculated this value by multiplying their estimates of the number of hours of leisure by the wage rates presumed to be opportunity costs for leisure. Citing lack of data, they did not adjust for the depletion of per capita stocks of environmental capital but did adjust for the 'disamenities of urban life' which include pollution, litter, congestion, noise, insecurity, buildings, advertisements offensive to taste, etc. Furthermore, they excluded military defence expenditure because these expenditures are inputs to the final output of whatever they are intended to defend and are essentially input to produce national security.

The impact of the changes in GNP is illustrated in Table 2.3. Nordhaus and Tobin almost double the basic 1965 GNP of \$618 billion to reach a sustainable MEW of \$1241 billion. This involves, as proportions of basic GNP, subtractions of 8.9 and 15.0 per cent additional capital consumption allowances, 16.5 per cent for growth requirements, 15.2 per cent for regrettable and intermediate products, and 5.6 per cent for disamenities. There are then imputations of additions equal to 47.8 per cent for non-market work, 1.8 per cent for services of private and public capital, and 101.5 per cent more than the basic GNP, for leisure. When it comes to annual change, the basic GNP grows by 3.91 per cent while the sustainable MEW grows by 2.07 per cent.

In summary, Nordhaus and Tobin showed that changes in GNP, for all its flaws, can still reflect changes in economic welfare. They believed that, for short term

investigations, GNP growth could still function as a measure of economic welfare. As long as the annual rate of economic growth was linked to an increase in employment, the positive welfare context could not be denied.

2.6.1.3 A Consolidated Income and Product Account (Peskin)

Peskin (1975) argues that criticism of national accounting often fails to distinguish between national account aggregates and the accounts themselves. Generation of aggregate indicators is but one of the several uses of the accounts, and both are deficient in their treatment of environmental factors. Peskin's work (1975, 1976, 1981 and 1986) aims to improve the information base of the accounts, rather than to correct the aggregates so that they are better measures of output and welfare. The basic strategies which Peskin (1976) employed are as follows:

- (1) expand the list of commodity and service flows to include all physical non-market inputs and outputs, and
- (2) emphasise processes of production and consumption as the basic criterion of sector definition.

Peskin (1975) extended these two strategies and reported on efforts to impute monetary values to input and output flows that arise when any sector of the economy chooses to employ the services of the environment. Input flows were valued in terms of the least cost that society would bear when the user is denied use of an environmental service. In theory, this cost includes all losses suffered by society, if the producer was denied access to the environmental asset and was thus forced to substitute other resources for that service. In practice, Peskin found that the available data did not permit such a derivation of a broad concept of cost.

The output flow is valued in terms of the damage or dis-benefit that discharges inflicted on other sectors of the economy. In theory this equals the amount which damaged parties would be willing to pay in order to avoid such damages. In practice, the data were poorer with respect to both coverage and quality, than those used for the above cost estimates. The principal features of the Peskin accounting framework are illustrated in Table 2.4.

Table 2.4
Peskin's Consolidated National Income and Product Account

Input	Output
(1) Compensation of employees and proprietors (including rental income)	(1) Personal Consumption
(2) Profits after inventory valuation and capital consumption adjustment	(3) Gross private domestic investment
	(4) Exports
	(5) Imports
	(6) Governmental goods and services
(3) Net interest	
(4) NATIONAL INCOME = (1+2+3)	
(5) Transfer payments	
(6) Indirect taxes	
(7) Subsidies	
(8) Statistical discrepancy	
(9) NET NATIONAL PRODUCT = (4+5+6-7+8)	
(10) Environmental depreciation	
(11) Capital consumption	
(12) MODIFIED NATIONAL PRODUCT = (9-10-11)	
CHARGES AGAINST GROSS NATIONAL PRODUCT	(7) GROSS NATIONAL PRODUCT = (1+2+3+4-5+6)
Environmental services (-)	(8) Environmental damages (-)
(a) Air	(a) Air
(b) Water	(b) Water
(c) Land	(c) Land
Net Environmental Benefit	
CHARGES AGAINST MODIFIED GROSS NATIONAL PRODUCT	MODIFIED GROSS NATIONAL PRODUCT = (7+8)

Source: Peskin (1991) Table 13.2

All intra-sector flows have been eliminated. The environmental entries are included in ways to preserve the conventional account entries, enabling those who may not be interested in the modifications to simply ignore them. Thus, for example, while the modified accounts show environmental depreciation as a negative adjustment to Net National Product (NNP), it is added back in order to leave the conventional measure of GNP unchanged.

The neoclassical framework was partially implemented with US data for the years 1972 to 1978 (Peskin 1989). More importantly, data from this exercise were used for a number of policy studies by the US Department of Agriculture. Two features of the system explain its usefulness for policy namely: its complete coverage of all the economic activity; and the fact that the valuations of environmental damage are useful for benefit-cost comparisons. Because of its policy implications, the US Environmental Planning Authority decided to use the framework as the basis for developing a resource and environmental account for the Chesapeake Bay region (Eisner 1988).

In summary, the keystone of Peskin's framework is its recognition that a non-market activity does not possess a single value or price weight. Explicit recognition of multiple values for non-market activities enables the expansion of the accounts to include currently-ignored items such as environmental entries. The consolidated income and product accounts and their consolidated sector components are used to demonstrate the possible inclusion of any non-marketed good or service, but focus on environmental services and governmental in-kind transfers.

2.6.1.4 The Economic Aspects of Welfare of Xenophon Zolotas

Zolotas (1981) constructed a measure of 'economic aspects of welfare' (EAW) for the United States economy for the years 1950 to 1977. His procedure is fundamentally similar to that of Nordhaus and Tobin.

Zolotas' measure, like that of Nordhaus and Tobin, is one of consumption. It did not, however, include an entry which allowed for a comprehensive measurement of the investment necessary to sustain future consumption. Zolotas begins with private consumption expenditure, deducts private expenditures on advertising and consumer durables, and adds an imputation for the value of services from consumer durables (Table 2.5).

Table 2.5
**Zolotas' Approach: Magnitudes Forming the EAW- Index
 1977, in constant 1972 prices**

Items	Billions of Dollars	As per cent of GNP
<i>GNP at market prices</i>	<i>1 332.7</i>	<i>100.0</i>
<i>Private consumption</i>	<i>857.7</i>	<i>64.4</i>
<i>Deducted items</i>	<i>413.2</i>	<i>31.0</i>
Private expenditures on consumer durables	137.8	10.3
Private expenditures on advertising	13.5	1.0
Cost of resource depletion	55.7	4.2
Cost of environmental pollution (private)	71.0	5.3
Private cost of commuting	95.4	7.2
Private expenditures on health	29.1	2.2
Private expenditures on education	10.7	0.8
<i>Additional items</i>	<i>920.0</i>	<i>69.0</i>
Services from public buildings included in EAW-index	23.0	1.7
Imputed value of services from consumer durables	62.1	4.7
Imputed value of household services	260.7	19.6
Imputed value of leisure time	547.2	41.1
Public health and education outlays contributing to welfare	27.0	20.3
<i>EAW Index</i>	<i>1 364.5</i>	<i>102.4</i>

Source: Zolotas (1981), Tables 20 and 21

Unlike Nordhaus and Tobin, Zolotas deducts estimates of the costs of resource depletion and the private costs of environmental pollution. He also subtracts the private costs of commuting and excludes those private expenditures on health and on education that are viewed as of maintenance in nature or as not raising the level of welfare. He then adds public health and education outlays deemed to contribute to welfare, the imputed value of household services and like Nordhaus and Tobin, a major imputation for the value of leisure time. Consider 1977, with a basic GNP of \$1 333 billion in 1972 prices and private consumption expenditures of \$858 billion. Zolota subtracted a total of \$413 billion, 31 per cent of GNP, and added \$920 billion, 69 per cent of GNP, to the consumption figure to reach an EAW index of \$1 364 billion, just 2.4 per cent more than the reported GNP.

In short, Zolotas' framework is similar to that of Nordhaus and Tobin. His method of estimating the value of leisure parallels that of Nordhaus and Tobin. He accepts the Nordhaus and Tobin assumption that productivity of leisure time is constant, but applies half of the average nominal hourly wage rate in the urban sector of the economy in 1972 as the price per hour of leisure. His imputed value of leisure time came to 41 per cent of GNP by 1977, after a 1.48 per cent per annum real rate of growth over the previous 27 years. Zolota, however, had to offer rationalisations for a number of rather arbitrary decisions affecting the components of his EAW index. For instance, apparently not recognising that advertising expenditures are generally intermediate and not directly included in final product, Zolota subtracted 50 per cent of advertising expenditures on the grounds that they are 'suggestive... causing dissatisfaction with those[goods] already possessed....and are merely a factor promoting price increases and the proliferation of largely similar marketing goods.'

2.6.1.5 Accounts by Jorgenson and Associates

In a series of papers written in conjunction with Fraumeni (1980, 1987), Christensen (1969, 1973) and Pachon (1983), among others, Jorgenson has set out a system of accounts with expanded measures of consumption and investment. Their major innovations are in the measurement of investment in human capital. Jorgenson and Fraumeni (1987) took investment in any year to be the sum of the present values of 'lifetime incomes for all individuals born in that year and all immigrants, plus the imputed labour compensation for formal schooling for all individuals enrolled in school'. The value of a year of formal schooling is calculated as the difference between the present value of the projected labour earnings of a person with schooling and without it. This method

Table 2.6
**Jorgenson and Fraumeni's Gross Private Domestic
 Product and National Receipts and Expenditure,
 1982 (in billion dollars)**

Product	
Private GNP, BEA	2 882.1
+ Subsidies less surplus government enterprise	8.7
+ Imputation for physical capital services	339.2
+ other adjustments	247.5
= <i>Gross private domestic product</i>	2 922.5
+ Time in household production and leisure	4 200.7
+ Investment in human capital	8 240.1
= <i>Full gross private domestic product</i>	15 363.6
Receipts	
Gross private national income	2 980.0
+ Non-market labour income	12 440.8
= <i>Full private national income</i>	15 420.8
+ Government transfer payments other than social insurance funds	99.6
= <i>Full gross private national receipts</i>	15 520.4
Expenditures	
Personal consumption expenditures	2 050.7
- Personal consumption expenditures, durable goods	252.7
+ Services of non-human capital	339.2
= <i>Private national consumption expenditures</i>	2 137.2
+ Consumption of non-market goods and services	4 200.7
= <i>Full private national consumption expenditures</i>	6 337.9
+ Personal transfer payments to foreigners	1.3
+ Personal non-tax payments	43.5
+ Full private national consumer outlays	6 382.7
+ Full gross private national saving	9 055.9
= <i>Full private national expenditures</i>	15 438.6

Source: Jorgenson and Fraumeni (1987), Tables 1 and 9.

treats the gross investment of each year as the sum of the present values of all future gross incomes of additions to the population. No deductions are made for living costs or human 'maintenance' and the increase in the present values of projected incomes associated with formal education. It results in estimates of investment far in excess of those computed by other economists, such as Kendrick. Jorgenson's accounting procedures are clearly illustrated in Table 2.6.

In Table 2.6, the revised estimate is derived by subtracting the expenditure for durable goods (\$253 billion), from consumption in personal consumption expenditures (\$2 051 billion in 1982), and then adding the imputed values of services of non human capital of (\$339 billion) and of consumption of non-market goods and services (\$4 201 billion). The worth of non-market goods and services is taken as the opportunity cost of time spent in household work and leisure.

The table shows that 'full gross private domestic product' adds the value of subsidies, imputations for household physical services, time in household production and leisure, and investment in human capital to private GNP, resulting in a 1982 total of \$ 15 364 billion.

2.6.1.6 Kendrick's Adjusted Gross National Product

Kendrick prepared a set of expanded income and product accounts in the course of his work on *The Formation and Stocks of Total Capital* (1976). A quick overview of Kendrick's original work may be gathered from his reconciliation of the GNP with his own adjusted "GNP" shown in Table 2.5.

To an initial GNP of \$929 billion, Kendrick adds household income and product - \$92 billion for computed student compensation; \$16 billion for imputed compensation of the frictionally unemployed; \$100 billion for imputed rentals on household durables and inventories; and \$6 billion for imputed rentals on institutional plant and equipment and land in excess of NIPA depreciation and interest paid. For the business sector, he added \$2 billion for tangible investment and \$35 billion for the intangible investment conventionally charged to the current account. Finally, for the government sector, Kendrick added \$67 billion for imputed rentals on land, durables and inventories. For 1969, all these imputations increased the BEA GNP from \$929 billion to an adjusted figure of \$1 248 billion, a 34.3 per cent increase. Kendrick made no subtractions for intermediate product of government, expenses related to work, regrettables, or disamenities.

Table 2.7
**Adjustment of GNP by Kendrick (1976):
 1969 (in billion dollars)**

<i>ITEM</i>	<i>Amount</i>	<i>Per cent of basic GNP</i>
<i>GNP, commerce receipt</i>	<i>929.1</i>	<i>100.0</i>
Plus		
<i>Households and institutions</i>	<i>208.4</i>	<i>22.4</i>
Imputed student compensation (less unemployment adjustment)	92.3	9.9
Imputed compensation of the frictionally unemployed (less subsidies)	16.0	1.7
Imputed rentals (excluding maintenance and insurance) on household durables and inventories	100.1	10.8
Imputed rentals (excluding maintenance) on institutional plant and equipment and land, over OBE depreciation and interest paid	5.7	0.6
<i>Business</i>	<i>37.7</i>	<i>4.1</i>
Tangible investment conventionally charged to current account	2.3	0.2
Intangible investment conventionally charged to current account	35.4	3.8
<i>General government</i>	<i>67.0</i>	<i>7.2</i>
Imputed rentals (excluding maintenance) on land durables, and inventories	67.0	7.2
<i>GNP, adjusted</i>	<i>1 247.9</i>	<i>134.3</i>
<i>Ratio: Adjusted to Commerce GNP</i>	<i>1.343</i>	

Source : Kendrick (1976). Also, see Eisner (1988)

Kendrick's framework provides an integrated set of sector current and capital accounts. Investment included outlays of all kinds 'by all sectors that yield a flow of service over one annual accounting framework' (Kendrick 1989). Thus Kendrick provided estimates of investment in the tangible non human capital of structures, equipment, investment, inventories and land of all sectors. He also considered the rearing costs of children up to the age of 14, including the full value of their consumption, as an investment in tangible human capital.

2.6.1.7 Gillen's Adjusted Domestic Product

Gillen's (1974) computations for Australia between 1948 and 1973 follow the methods employed by Nordhaus and Tobin. Unlike them, in his calculations for disamenities to urbanisation, Gillen examined the marginal or last migrant's wage, arguing that this particular wage will just be balanced by the marginal costs involved in moving from rural to urban centre. His actual computations were based on data from then United States on disamenity adjustment, which amounts to about eight per cent of the average family's disposable income.

Gillen modified the conventional Gross Domestic Product measure in four ways:

- (1) By reclassifying certain items of personal consumption and government consumption expenditures to exclude investment and intermediate expenditures and to exclude some expenditures, such as defence, which are regarded as 'regrettable' expenditure items since it is possible that they do not indicate an increase in welfare.
- (2) By adding the services of certain capital items which are not included in the conventional system.
- (3) By adding an imputed value for leisure and non-market activities, such as housework, home repairs, gardening, etc; and
- (4) By subtracting an estimate for the negative externalities, such as those due to environmental damage and to the disamenities and congestion of urbanisation.

Like that of Nordhaus and Tobin, Gillen's presentation is an experimental measure. His attempt to measure MEW for Australia is presented in Table 2.8

Table 2.8
Gillen's Measure of Economic Welfare for Australia
\$ million at average 1966-67 prices

ITEM	AMOUNT (1972-73)
(1) Private final consumption expenditure	18 459
(2) Private intermediate expenditure	-1 491
(3) Durable goods purchases	-2 711
(4) Other household investment	-1 402
(5) Services of consumer capital imputation	5 582
(6) Imputation for leisure	18 625
(7) Imputation for non-market activities	22 623
(8) Disamenity correction	-1 655
(9) Government consumption	197
(10) Services of government capital imputation	2 160
(11) TOTAL CONSUMPTION = actual MEW	60 387
(12) MEW Net Investment	5 575
(13) SUSTAINABLE MEW	65 962

Source: Gillen (1974) Table 1.

To compute actual MEW, items (1) to (10) are added. The assumptions behind each imputation are detailed in Gillen's presidential address to the Australian Agricultural Economics Society in 1974.

2.6.1.8 Richard and Nancy Ruggles and the Integrated Economic Accounts

Long time specialists on national accounts, Richard and Nancy Ruggles published a comprehensive set of Integrated Economic Accounts (IEA) for the United States, 1947-1980 (Ruggles 1982a, 1982b). The IEA entailed an integration of income, and product and capital accounts, using basic data from the National Income and Product Account (NIPA) and the Federal Reserve Flow of Funds accounts. The NIPAs were summarised in a set of five accounts: (1) national income and product; (2) personal income and outlay; (3) government receipts and expenditures; (4) foreign transactions; and (5) gross saving and investment. There was no separate account for business. The

Ruggles' IEA included five current accounts: gross national product, household current income outlay, government current income outlay, enterprise gross product, and rest-of-the-world current account. In addition, the IEA provided five sets of capital accounts. Following others who have extended the accounts, the Ruggles also included capital formation government and household outlays for structures, durable goods and additions to inventories.

2.6.1.9 Eisner's Total Income System of Accounts

In a series of works, Eisner and associates (1971, 1978, 1980, 1982, 1985, 1988) introduced and spelled out a 'Total Income Systems of Accounts' (TISA) designed to include the income corresponding to all consumption and capital accumulation, market and non-market, in all sectors of the economy.

First, TISA expanded the production frontier to include such major items of non-market products as the services of government and household capital and unpaid household labour, and the opportunity cost of student time. Second, TISA set up new measures of final product. The services of national defense, roads and police were classified as intermediate. Expenses related to work were subtracted from income and product, while the values of employee training and human capital formation were added. Third, TISA valued output as the value of all the factor services and resources from which it flows, regardless of the form of payment or non-payment. Fourth, TISA classified the national product and income account into separate sectoral accounts of income and product for business, non-profit institutions, government enterprises, government and households. Lastly, TISA improved the measure of capital accumulation.

Like the adjusted GNP accounts of Kendrick and the IEA of Richard and Nancy Ruggles, Eisner's TISA offers a complete set of integrated national income and product accounts with debits and credits for the economy and each of the sectors.

2.6.2 Purely physical approach

There are two kinds of purely-physical approaches. The first is known as the Material Balance Approach, and the other is called the Energy Approach. This subsection will in turn discuss the two approaches, and the French Patrimonial Accounting System.

2.6.2.1 The Material Balance Approach

The material balance approach of Ayres and Kneese (1969), and Kneese, Ayres and d'Arge (1970), reformulated and presented in a general equilibrium framework by d'Arge *et al* in 1972, has been a major catalyst for current work in NRA (Gilbert and James 1987). The approach attempts to reconcile economic activity with the physical laws by developing mass balances for the economy. The approach concentrates on the production of residuals and subsequent pollution, by enlarging on the economic view of inputs to and outputs from production processes. Inputs to the system include fuels, food and raw materials, - partly converted to final goods and partly to residuals. In time, however, final goods also enter the residual stream. Consequently, goods are not consumed as such. After rendering certain services, they are transformed and may be discharged into the environment. The material balance approach attempts to document all of the outputs of production, not just those sold to the consumers. The material balance approach emphasises residual management. This, however, is only one element of economic-environmental interaction.

2.2.6.2 The Energy approach

Slessor (in Gilbert and James 1989) argued that resource accounting is an offshoot of energy analysis. There are two school of thoughts on energy analysis. One, led by Odum (1983), takes into account natural energy flows as well as stored energy. The other, advocated by the International Workshop on Energy Analysis, takes into account only energy resources taken from the earth and excludes solar fluxes and labour. Examples of this second school include the Energy Analyses of Edwards and Phillips in 1976 and Roberts in 1982 (Gilbert and James 1987).

Odum (1983) argued that stocks and flows should be compared on the basis of an ability to do work for the combined systems of humanity and nature, and that the vitality of a national economy depends on the productive work of its people and machines, and the productive work of the natural processes of the landscape. In the same paper, Odum presented an energy systems procedure and an analysis which represents systems, such as a nation. Two case studies were used to demonstrate the procedure.

2.6.2.3 The French approach

Instead of the term 'resource accounting', the French use the term 'patrimonial accounting'. This could be described as accounting for the national environmental heritage (Theys 1984). This is broader than natural resource accounting as it covers cultural heritage in addition to natural resources. The French resource accounting approach is intended ultimately to relate economic growth to the quantities of natural resources that have to be used up or imported to make economic growth possible.

The French approach is only one among several being pursued in developed countries. It aims to build up balance sheets of resources and monitor their change from year to year with emphasis on physical terms. Built into the French approach is the argument that a comprehensive physical system be in place before any changes can be proposed in national accounting methodology. This is a point of view shared by many.

2.6.3 Mixture of physical and economic approaches

There are currently several studies being conducted using this approach. They all provide data on stock availability, the economic value of current resource use, and an evaluation of resources and environmental quality. Some studies that have used this approach are now discussed.

2.6.3.1 Repetto's Account

Repetto (1988) provided some guidelines on preparing a Natural Resource Accounting System. His method involved the development of physical accounts for exhaustible resources, such as oil and renewable resources such as timber. Repetto's accounts emphasise the depletion of stocks, and hence begin to address the issue of resource sustainability. The method closely parallels that of Landfield and Hines (1982).

Repetto *et al* (1990) have applied resource accounting to fuel and forestry activities in Indonesia. For forestry, they estimated harvesting, deforestation and degradation of forestry as the net of regrowth, valued the estimates at certain rent factors, and suggested that they be treated like depreciation of man-made assets. The proposed reductions amounted to over US \$3 billion annually for the years 1979 to 1982, which represented more than 3 per cent of GDP. A similar approach was followed for valuing the depletion of fuel reserves.

Repetto identified two immediate applications of his methodology. In an extended accounting system, the depletion or appreciation of natural resources would enter a depreciation account and would affect the estimation of net national product in current prices. The first application would be a comparison of NNP growth under this and the conventional accounting frameworks. The second application compares this natural resource depreciation account with estimates of conventional net capital formation. Unless the capital formation is larger, the economy's total assets decline as resources are extracted. In short, Repetto's accounts adopt a simple input-output approach, estimating increases and decrease in resource stocks.

2.6.3.2 Hultkrantz' s Account

Hultkrantz (1991) extended the national accounting measure to account for sustainability. He expanded the national account of forest resources in Sweden, 1987 by incorporating changes in timber inventories, the production of non-marketed timber and non-timber goods, and the depletion or improvement in vital environmental stocks (such as soil nutrients, bio-diversity and carbon sinks). However, instead of computing for the value of changes in output based on the physical accounts, Hultkrantz included the cost of inputs in his assessment. Based on welfare procedures, it should be the outputs and not the inputs that should be included in determining the welfare of the representative consumer.

2.6.3.3 Integrated Environmental and Economic Accounting for PNG

The objective of the study for Papua New Guinea (Bartelmus *et al* 1991) was to assess the feasibility of integrated environmental and economic accounting (IEEA) with limited financial but abundant natural resources. The study revealed many significant data gaps which had to be bridged by numerous assumptions and rough estimates. One useful result of the study was the provision of some guidance on priorities for environmental data collection. Furthermore, it was found that an improved data base would not only provide better accounting indicators, but would permit more rational decisions in the management of natural resources and would also provide early warning signals on potentially hazardous impacts.

2.7 Evaluation of the Approaches

2.7.1 Purely economic approach

The economic approaches to adjusting or revising the national accounts have three obvious advantages:

- (1) Traditional accounting structures are firmly established as a source of economic information for decision and policy making.
- (2) The role of economic information and theory is also firmly established in decision and policy making.
- (3) They provide a consistent framework for the presentation of economic information and the correction of economic data.

Consequently, they are accepted and implemented by planners. However there are also problems associated with the revision or extension of the SNA and its indicators. These place limits upon a purely economic approach to adjusted GNP. Hueting (1980) summarised these problems as follows:

- (1) the valuation and determination of the shadow price for environmental functions;
- (2) the non-linearity associated with resource and environmental stocks versus the assumptions of linearity associated with economic production functions; and
- (3) the problem of summing elements, which do not have the same basis, into a single index.

Hueting also presented strong arguments against these objections, but it becomes obvious that the economic approach to adjusting or revising the national accounts depends on the development of techniques for valuing typically non-economic variables in monetary terms.

2.7.2 Purely physical approach

Few physical approaches to natural resource accounting have been developed beyond the conceptual design stage. One major advantage of this approach is that it can be used in input-output modelling exercises. In traditional input-output analysis, the transactions or flow matrix records the inputs to and outputs from the various sectors

of the economy in monetary units. This can, however, be adjusted to a mix of unit. Thus, the construction of natural resource accounts within this framework will facilitate their use in modelling exercises and permit further analysis of economic-environmental interactions and interrelationships.

The purely physical approach has two significant drawbacks. The first is associated with data collection and the tracing of all stocks and flows in physical units. A material balance approach was attempted for the Norwegian economy in the 1970's, but data constraints halted this activity. The second is based on the fact that the approach has little relevance to economic planners. It is extremely unlikely that economic planners will adopt an accounting system which totally excludes economic information such as the price of the resource, which is probably more important to planning than its physical quantity or quality.

2.7.3 Mixture of physical and economic approaches

The major contribution of this approach in extending or revising the national accounts is the use of accounts to describe different aspects of environmental and resource dynamics and their linkage through further accounts. A major disadvantage of this approach is the difficulty associated with choosing which physical accounts are important and how to value changes.

2.8 Concluding Remarks

The limitations of the SNA have been discussed in this chapter, and much work is currently going on to revise or extend the system. Because no international consensus has been reached on how best to incorporate the changes in the national accounts, it is appropriate to extend and clarify the existing system rather than to propose radical changes. Among the environmentalists or economists with environmental and resource concerns, there are several schools of thought. Some advocate environmental accounting in physical terms with little interest in establishing any linkage with SNA. At the other end of the spectrum are those that feel that environmental accounting would be useless unless the accounts are monetised and integrated into the SNA. Based on the economic theory presented in section 2.2 and the prevailing macroeconomic theory on national accounting, a purely monetary approach is used in this study. This choice will be discussed further in Chapter 3.