CENTRAL BUREAU OF STATISTICS
The Netherlands
National Accounts Research Division

NATIONAL ACCOUNTS AND THE ENVIRONMENT:

THE CASE FOR A SYSTEM'S APPROACH

Steven J. Keuning*)

*) The author is chief of the National Accounts Research Division. The contribution of Cor Gorter, Peter Bosch and Bram de Boo to some of the ideas in section 3 of this paper is gratefully acknowledged. I would like to thank Frits Bos, Peter Bosch, Cor Gorter and Mark de Haan for their comments on an earlier version. Of course, I remain solely responsible for this text.

Nr. NA-053
1992

NATIONAL ACCOUNTS AND THE ENVIRONMENT: THE CASE FOR A SYSTEM'S APPROACH

Abstract

The present set of main economic indicators should be extended with one or a few indicators on the state of the environment. This paper lists various reasons why a so-called Green Domestic Product is not suitable for this purpose.

Instead, a system's approach should be followed. A National Accounting Matrix including Environmental Accounts (NAMEA) is presented. This matrix serves as a satellite framework to the central national accounts, thereby bridging the gap between environmental and economic statistics. In its most condensed form, the NAMEA presents macro-economic indicators like Gross (or Net) Domestic Product, Net National Income, balance on current account of the balance-of-payments and one or more separate indicators on the state of the environment. The latter indicators are derived from physical data. At a meso-level, the extended matrix shows the inter-relations among all these indicator values.

Finally, the paper discusses how the multitude of physical data on the environment in the NAMEA might be condensed into one or a few aggregate indicators.

Contents

1. Introduction

In many countries, macro-economic policy is guided by a number of measurable objectives such as balanced economic growth, near-full employment, price stability, external equilibrium and an acceptable income distribution. The score on these objectives is determined by the value of aggregate indicators like Gross Domestic Product (GDP), Net National Income (NNI), the number of unemployed, Consumer Price Index (CPI) and the balance on current account of the Balance of Payments. Recently, the objective of a sustainable use of the environment has been added to this list. Concomitantly, the need for one or a few aggregate indicators on the state of the environment has become more pressing.

Ideally, all socio-economic indicators are derived from one consistent system of statistics. At present, the System of National Accounts (SNA; United Nations, 1968) contains the concepts which are necessary for a computation of GDP, NNI, the CPI and the external balance. It is expected that in 1993 the United Nations' Statistical Commission will adopt a revised version of the SNA. The new SNA advocates that special satellite accounts on the environment are compiled as a supplement to the central system. One of the purposes of these supplementary accounts is the construction of an aggregate environmental indicator on the basis of a consistent statistical system.

This paper continues with a critical appraisal of various methods which have been proposed to adjust the conventional concepts of Gross Domestic Product and National Income in order to arrive at an Environmentally adjusted net Domestic Product (also called: Eco-Domestic Product) and a so-called 'sustainable' national income (also called: green national income). Subsequently, an alternative approach will be set out, whereby an aggregate indicator is derived from a consistent statistical system that combines the SNA flow accounts and environmental statistics. A blueprint of such a system is provided in section 3, while the final section discusses the uses of this system and provides some ideas for an aggregate physical indicator on the environment.

2. A Review of the Green ('Sustainable') Income Concept

The use of the environment for economic activities such as production and consumption is an important issue that is only very partially reflected in present-day National Accounts. Environmental degradation and depletion of natural resources only have a direct effect on the set of conventional macro-economic indicators if a price was actually paid. For instance, if a manufacturing establishment repairs a filter using imported parts this is seen as intermediate costs which reduce GDP.[1] [2]

If a usage of the environment did not fetch a price in reality, it is not incorporated in the National accounts. In fact, the National accounts take a very pragmatic view at the concept of value: each good or service is worth what is paid for it. This applies to a loaf of bread, a diamond and just as well to a labour contract and a government service. The value system is thus based on the outcomes of myriads of markets for private goods and the government budget mechanism for public goods. Especially in a democratic society, it could therefore be argued that eventually environmental services will fetch an actual price which is as much in accordance with public preferences as any scientist's estimate. This price may be revealed through an excise tax on harmful products, a levy on polluting production processes, and a quota system or even a ban upon certain products or production processes. The economic effects will then be reflected in the standard national accounts.

A consequence of this value system is that the national accounts are a fully consistent system, that is, total supply equals total demand, total output equals total input, total income equals total expenditure, etc. Evidently, it also means that National Income should not be equated

1. Note that if these parts were wholly produced in the country itself, these environmental protection costs would be equal to the income generated in the producing establishments, so that GDP would not be affected, on balance. In practice, however, such 'defensive' expenditures will have resulted in some reduction of the GDP volume change.
2. Most expenditures to prevent or repair environmental damage are classified as fixed capital formation, so that in this case GDP will even increase if not all these investments are imported. This is one reason why it is preferable to use Net Domestic Product (NDP) as an indicator of aggregate material performance and Net National Income as an indicator of financial strength.

with National Welfare. Apart from the services provided by the environment, there are several other non-market benefits which are not incorporated (unpaid housekeeping services, do-it-yourself, leisure, etc.). In addition, social welfare may be affected by the extent of poverty, the income distribution, net worth of the nation, the unemployment level, average life expectancy, average educational attainment, etc. and these aspects are also not taken into account. Instead, non-monetary aspects are usually summarized by means of a separate indicator so that the changes in all indicators can be juxtaposed. The weighing of all these objectives can then be done in the course of a political process.

Sometimes, it is advocated to use artificial prices when accounting for the services of the environment and to merge the resulting values and NDP into a single indicator. Basically, three different methods have been proposed for this purpose. These methods will now be discussed in turn.

First, valuing environmental services might be done on the basis of willingness-to-pay or willingness-to-accept, or with the help of hedonic pricing methods (see e.g., Pearce and Turner, 1990). In theory, such a contingency valuation approach could be followed if one wanted to combine a valuation of environmental services and of material goods and services. For instance, the willingness-to-pay method starts from the premise that services provided by environmental assets such as habitat, climatic balance, a location for waste disposal, etc. contribute to welfare and should therefore be taken into account when calculating Net Domestic Product (Peskin, 1989). It is obvious that environmental degradation resulting in a decreased quality of bathing on a public beach or less enjoyment of a certain scenery should then imply that the value of the environmental services to be added to conventional NDP is reduced. It can never entail that on balance something is subtracted from NDP, as the minimum enjoyment is zero. Only the environmental damage to assets whose services were already included in the accounting system may thus lead to a lower NDP.

In conclusion, it is important to note that if one wanted to incorporate environmental aspects in conventional economic variables, this would probably lead to higher values of these variables (refer to Michaels, Grambsch and Peskin (1991) for a case study). Simultaneously, the growth rates may very well be reduced. Unfortunately, the willingness-to-pay method has various shortcomings, especially if the interest of future generations is at stake (Hueting, 1991). In these cases, individuals may not be able to make an informed judgment about the relative weights to be attached to various alternatives.

Secondly, there is the approach followed by Repetto and others (1989) who emphasize that current increases in net output of a country are often achieved at the expense of potential future output. This applies in particular to developing countries where the future consequences of deforestation, soil erosion, over-fishing etc. are not accounted for, while the wood, the crops, the fish etc. fully contribute to present GDP. In fact, the familiar 'externality' problem plays a role here, or, in other words, it is largely due to a lack of well-defined property rights. Repetto con suis propose to capitalize this future loss of income and to record it in a similar way as the depreciation of produced capital goods. They realize that in their approach only that part of the loss can be estimated which would affect future Net Domestic Product as it is presently defined: "However, only part of the loss could be estimated. For forests, it was only the loss of immediate and future timber value. Other services provided by Costa Rican forests - wildlife habitat, tourist attraction, ecosystem regulator, and supplier of non-timber commodities - are important but their value has yet to be estimated." (World Resources Institute, 1991).

There is yet another problem connected to putting environmental degradation on a par with the depreciation of fixed capital assets. The latter value loss has been 'internalized' by economic subjects, that is, companies do reckon with these costs when determining their dividend policy and when planning new investments. Analogously, tax rates are based on profits excluding depreciation costs. In other words, economic behaviour in the reference period has been founded on the notion of

depreciation as a cost item. Unfortunately, this is not the case for resource depletion and other environmental degradation.[3] Nobody has received less income and nobody has actually set aside money for reduced future output due to environmental damage when weighing consumption against savings. Perhaps, it would have been wise if economic subjects had taken this into account, and evidently it is crucial that policy-makers obtain a systematic review of imminent dangers. However, we doubt the usefulness of subtracting something we should perhaps not have earned from what we have actually earned, to arrive at an Eco-Domestic Product. A similar argument applies to the 'willingness-to-pay' approach, which adds what we might have been willing to pay for something we got free of charge to what we have actually paid. In both cases, the relationship between micro-economic facts on income and consumption on the one hand and macro-economic indicators on the other is distorted. Moreover, an inconsistent value system is introduced as these methods do not propose a revised, more welfare-oriented valuation for the other goods and services.[4] In that respect, there exists no fundamental difference between an Eco-Domestic Product estimation and a computation in which kilogrammes of apples and kilogrammes of pears are added.

A third method to arrive at an environmental indicator is the 'avoidance cost' approach (e.g. Hueting, 1991). This method tries to define physical standards for environmental functions, based on their sustainable use. Subsequently, measures are formulated which are needed to meet these standards and the amounts of money involved in putting the measures into practice are estimated. These amounts of money are summed and subtracted from National income to arrive at a summary indicator which is supposed to unite the objectives of material welfare and a

3. There is an exception to this rule. If environmental assets are subject to ownership and if their depletion or degradation has been taken into account in the balance sheet statements of these owners, this should be booked as depreciation of non-produced assets. That implies that it is recorded like the consumption of fixed capital and unlike a holding loss in the national satellite accounts for the environment. For instance, mining companies may have included in their books a reduction in asset value due to depletion of their stock of mineral resources. In the practice of business accounting, however, this approach is still in its infancy (Reich, 1991).
4. It follows from the argument in this paragraph that the Repetto approach could in fact usefully be incorporated in social cost-benefit analyses, that is, in computations on the basis of future opportunity costs instead of costs actually paid in the past.

sustainable use of the environment.

In addition to the problems mentioned above when discussing the second approach, this method suffers from several other complications.[5] First, instead of the costs of the damage caused to the environment, the costs of preventing or redeeming this damage are proposed as a yardstick for the use of the environment. This may lead to quite misleading policy-prescriptions: in the case of enormous damage which can be prevented or restored with little costs, the policy-maker wanting to maximize this indicator is not guided to applying this measure, precisely because it hardly improves 'green income'. Furthermore, restoration costs will change over time because of new techniques and differ between countries due to specific local circumstances which have nothing to do with the extent of the damage. This implies that the same damage leads to quite different GDP-adjustments in different periods or different countries.

Secondly, 'direct' costs are not an adequate proxy of total costs, even in a national accounts sense. For instance, the direct costs of closing down a factory, and employing the production factors in a less polluting but less productive alternative activity, may be only a fraction of the total (discounted) income foregone. If one doesn't want to incorporate these future costs in this year's adjusted accounts, there arises an intricate problem of how to incorporate them in the adjusted accounts of a whole lot of years to come. It goes without saying, though, that one cannot simply neglect all costs which are not borne instantaneously.

Thirdly, this method subtracts costs to maintain environmental functions whose services are not incorporated when estimating National income.[6] This leads to counter-intuitive results, as shown by the following example. Suppose that NDP was 400 mld. three years ago, 408

5. Some of these drawbacks are also realized by the authors themselves; refer to e.g. Hueting and Bosch (1990).
6. Neither the 'contingency valuation' method nor the 'advancing future output reduction' method suffer from this deficiency. As stated above, the former method estimates the net value of environmental services to be added to conventional NDP and the latter method deducts only that part of the loss which would affect future NDP as it is presently defined.

mld. two years ago and 416.16 mld. last year; that is, in both most recent years the NDP growth rate was 2%. Besides, presume that the services provided free of charge by the environment amounted to 70 mld. three years ago, 60 mld. two years ago and 55 mld. last year. Finally, it is assumed that three years ago sustainable use was made of the environment, two years ago the 'avoidance costs' were estimated at 6 mld. and last year at 15 mld. Note that it is quite realistic to assume that these 'costs' increased more than proportionally with a further decrease in the services provided by the environment. The hypothetical Eco-Domestic Product of the avoidance cost approach now becomes 400 mld. (400-0) three years ago, 402 mld. (408-6) two years ago and 401.16 mld. (416.16-15) last year; this results in growth rates of +0.5% two years ago and -0.2% last year. However, a more correct hypothetical Eco-Domestic Product would have been 470 mld. (400+70) three years ago, 468 mld. (408+60) two years ago and 471.16 (416.16+55) last year; consequently, the growth rate was -0.4% two years ago and +0.7% last year. This example demonstrates that not even the sign of the rates of change is necessarily the same in both computations. In practice, any deviation between a more correct hypothetical Eco-Domestic Product and the one computed according to the avoidance cost approach can occur.

Fourthly, there exists a timing problem with this approach, as it does not take into consideration when the damage will occur. In fact, a non-durable use of the environment which is likely to lead to significant damage next year should be taken more seriously than the same non-durable use which is expected to lead to the same damage in one hundred years time. Naturally, in the latter case it is more likely that technological solutions are found or other alternatives are developed. The implication is that any 'addition' of present and future effects is only possible with the help of some discount rate. This discount rate is however not necessarily uniform for all kinds of environmental effects.

Fifthly, this method completely hinges on the physical sustainability standards for environmental functions, which often cannot be assessed in an objective way. The method implicitly assumes that the price to be paid for the use of an environmental function is zero if this use is

below the standard, while the price becomes infinite as soon as this use hits the limit. In various instances, the definition of these standards cannot be done on the basis of physical sciences. For even if one were able to estimate some sort of probability function for future events, it is unknown how much risk the population is willing to accept. For instance, if one were to set a norm for the application of nuclear energy, this aspect would play a crucial role. It is clear that defining standards is a political task and not something which should be left to statisticians or environmental institutes. In turn, this implies that the use of standards in statistical practice should not prejudge the outcome of those political processes.[7]

Another difficult issue relates to the existence of 'international externalities'. Durable use of the environment abroad cannot be reckoned with in a national accounts framework; even if the citizens in one country are worried about the extinction of species in another country, it seems not justified to incorporate this in the national accounts when simultaneously the starvation of innumerable human beings across the globe remains out of sight.

Sixthly, this method subtracts hypothetical costs from GDP without realizing that in the system of national accounts costs are mirrored by benefits. Naturally, some of these benefits may actually accrue to non-residents and in other cases supply-bottlenecks may lead to inflationary pressure so that in volume terms the benefits are not fully realized. However, if a measure of "national income minus avoidance cost" is to serve any use for national policy-makers, it would have to make an estimate of the benefits from environmental protection measures.[8]

This brings us to a more general point. Contrary to the de-facto measurement which is applied in conventional national accounts, the

7. Evidently, it is quite useful if the policy-makers have at their disposal some sensitivity analyses regarding the implications of the standards they are about to select. However, these analyses are then explicitly ex ante scenarios and not ex post registrations.
8. A parallel can be drawn with defense expenditures. In many cases, policy-makers opt for home-made equipment, even if this is more expensive than an imported equivalent. Nevertheless, from a national perspective this may be a sound economic decision, namely when positive static and dynamic secondary effects make up for the difference in direct expenditures.

construction of an adjusted NDP or National Income is not accounting but modelbuilding.[9] If the (substantial) costs subtracted in these approaches had been charged in reality, we would have lived in a totally different world and it is quite naive to assume that all economic subjects would have swallowed these costs without an adjustment of their behaviour. In fact, environmentalists often argue for certain protection measures just because of their dynamic substitution and supply effects. This implies, obviously, that the negative effects of such measures on NDP are probably less than the simple computations of 'Eco-Domestic Product' or 'sustainable national income' would suggest. In fact, GDP may even increase if a vigorous environmental policy creates competitive advantages which are cashed when other countries follow suit. Anyhow, these consequences can only be approximated with the help of a formal model. Replacing GDP by a figure which is an erratic combination of a statistic and the outcome of an (implicit) model thus amounts to throwing out the baby with the bath-water.

In conclusion, we think that the use of concepts like "green GDP" and "sustainable income" as yardstick for the contribution of member countries to international organizations (EC, UN, etc.) and for a comparative evaluation of the financial deficit, national debt, and so on is grossly misleading.[10] Even the joint publication of a "green national income" and an "ordinary national income" is not advisable, as this creates the faulty impression that both indicators are comparable. It would also put a completely hypothetical index on a par with the existing ones, which are all based on observable facts.[11] Finally, what

9. This was the core of Eurostat's comments on an early draft of the section on environmental accounting in the next SNA. Refer also to Blazejczak and Edler (1991), Richter (1991) and Nyborg (1991). Note that even fairly simple models combining input-output and (non-)linear programming features might yield more reliable results than just subtracting hypothetical costs from NDP. Moreover, such models allow for a sensitivity analysis, which is indispensable in this case. Finally, it means that the concepts used for assessing the past can also be applied in scenario's that estimate the future effects of various policies; cf. e.g. Meadows et al. (1991).

10. This is not a purely academic discussion. For instance, a recently published action programme of the European community advocates "modification of key economic indicators, such as GNP, so as to reflect the value of natural and environmental resources in generating current and future incomes and to account for environmental losses and damage on the basis of assigned monetary values." (European Commission, 1992).

11. Notice that there exists great conceptual similarity between a 'green national income' and a national income figure which is adjusted for an inequitable income distribution. Attempts to construct the latter composite indicator have long been abandoned.

is really needed is not an adjusted income figure but a systematic data set which allows for the computation of one or a few summary indicators on the state of the environment that can be juxtaposed with other macro-economic indicators. This objective can be achieved if environmental data are integrated into a national accounts satellite system. Such a system is set out in the next section of this paper.

3. An Environmental Module linked to the System of National Accounts[12]

In our view, an environmental module should be an extended accounting system whereby the relations between conventional national accounts and environmental flows and stocks are explicitly shown. This system should only record facts, that is, those environmental flows and stocks which did not fetch a price in reality are valued at a zero-price. In other words, these flows and stocks are very real in volume terms, but because of their zero price their value is also equal to zero. As a consequence, all accounts still present complete balances, whether in value terms or in volume terms. This system then constitutes the basis for all kinds of model simulation experiments showing what might have happened if some of these prices had not been equal to zero.

The environmental module centres around a set of tables which give an overview of all relevant relations between the SNA-flow accounts and data on environmental changes. As the burden on the environment originates from the emission of a multitude of agents into a whole range of ecosystems on the one hand, and from the extraction of many different resources on the other, a detailed picture cannot be given in one table. Therefore, a coherent, generally applicable system should be designed where specific tables for each relevant substance can easily be related to aggregate ecological and economic flows.

For this purpose, it is most suitable to put the national accounts in a matrix format. The whole system at the macro-level can then be shown on one sheet of paper. In turn, this facilitates the understanding of interrelations between various types of (monetary and physical) flows and the balancing items (NDP, NNI, Savings, Changes in Net Worth, etc.) distinguished within the system.

Subsequent, more detailed tables then serve to elaborate a single vector or cell in the macro-matrix. These tables are labelled according to their position (row and column account number) in the reference matrix. In this way, the link between detailed figures and the overall

12. This section is largely based on de Boo, Bosch, Gorter and Keuning (1991). That paper also contains an illustrative example of this module.

system remains transparent throughout the whole set of tables. The sub-tables use the type of classifications given in parentheses in the row and column headings of the main matrix.

Another advantage of a matrix format is that it reveals which entities and which accounts are involved at both ends of each set of monetary and physical flows (origin and destination), and this has clear advantages if the data in the environmental module are to be used in subsequent (general equilibrium) modelling exercises (cf. Pyatt, 1988). Finally, a matrix delivers data in the required format for 'tracing back' the origins of certain transactions and for some 'quick and dirty' simulation experiments with the help of (fixed) multiplier analysis (cf. Keuning and Thorbecke, 1992).

The module has been based on the Social Accounting Matrix (SAM) approach. Originally, SAMs were designed to incorporate concerns of inequality and poverty within the production-oriented national accounts and input-output tables.[13] Later, it was shown that in fact a complete system of national accounts can be transformed into a SAM-format. This allows for more flexibility than the traditional format, especially regarding the application of various statistical units and classifications thereof (Keuning, 1991). This flexibility is particularly important in an environmental accounting system with its enormous variation in measurement units. In our framework, this diversity poses no problem when showing the relations between environmental flows and various types of economic transactions. An additional advantage of a SAM-system with its detailed links between production, incomes and expenditures is that the effects of introducing prices for the use of environmental services on the income distribution can be simulated. In addition, the analysis of employment issues in conjunction with the environmental accounts comes within reach.

13. For an introduction to SAMs see: Pyatt and Thorbecke (1976); Pyatt and Round (1986); Keuning and de Ruijter (1988); Alarcón, van Heemst, Keuning, de Ruijter and Vos (1991). The SAM-approach is the subject of a separate chapter in the draft revised System of National Accounts (SNA); see United Nations (1992: Chapter XX). Treating the environment in a SAM framework is also advocated by Barker (1990).

The core of our module is a so-called National Accounting Matrix including Environmental Accounts (NAMEA), as shown in table 1. The NAMEA extends the SAM presentation proposed earlier by the present author (Keuning, 1991). It integrates a) the (1993) SNA sequence of accounts as well as a set of supply and use tables, and b) separate accounts for the relations between economic flows and changes in the environment. A crucial aspect of these interactions is that the eventual effects on ecosystems are transmitted through all kinds of environmental 'agents': pollutants on the one hand and resources on the other. This means that a special account for all kinds of environmental 'agents' must be inserted in between the conventional accounts and the account for environmental assets (i.e. ecotopes and several types of natural resources). Agents is to be read here as substances as well as noise, radiation and species.

The distinction between an environmental agents account (#16 in table 1) and an environmental assets account (#17) is expedient to both the supply and the use of data. Often, emission and waste statistics can be detailed by discharging industry or final demand category, but it is almost always impossible to attribute the degradation of ecosystems directly to certain economic activities (United Nations, 1990: 22). In addition, environmental policy instruments will generally also focus on certain environmental agents and not directly on ecosystems.

Therefore, account #16 in our framework serves to register the emissions and extraction of all kinds of environmental agents, while account #17 serves to sketch the effects on ecosystems and provides a general description of changes in the state of the environment.[14] Eventually, this may yield a rough indication of the effects of economic activities on environmental assets which are not absorbed during the current period: changes in net worth of ecosystems. In principle, these changes should be recorded in physical terms. A weighting function should then lead to one or a few indicators which can be juxtaposed with the conventional aggregates to arrive at an evaluation of socio-economic

14. In order to facilitate the understanding of this matrix, account #16 might be split into two subaccounts, one for emissions and one for extraction (see also the first three equations in section 3.6 below). This subdivision is not shown here, in order to keep the size of this matrix within manageable limits.

Table 1. NAMEA: A National Accounting Matrix Including Environmental Accounts

ACCOUNT (Classification)			Goods and Services (Commodities)	Goods and Services (Consumption Purposes)	Production (Production Activities)	Production (Household (Waste) Prod. Activities)	Income Distribution and Use a. National (Sectors) Primary Inc. Distribution	Income Distribution and Use a. National (Sectors) Secondary Inc. Distribution	Income Distribution and Use a. National (Sectors) Use of Income	Income Distribution and Use b. Rest of the World (ROW)	Indirect Taxes (Tax/Subsidy Type)	Worth Generation a. National (Sectors)	Worth Generation b. Rest of the World (ROW)	Other Accumulation a. National (Sectors)	Other Accumulation b. Rest of the World (ROW)	Financial (Financial Assets)	Other Asset Changes (Asset Types)	Environmental Agents (Agents/Resources)*)	Environmental Assets Change (Ecotopes/Res)	Changes in Balance Sheet (Sectors)	TOTAL
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	
Goods and Services	Commodities	1	Trade&TransportMargins		Intermediate Consumption	Housesh.Cons. Expenditures			Government Consumption	Exports				GrossCapital Formation							CommodityUse (mp,exVAT)@)
	Consumption Purposes	2							FinalHouseh Consumption												Final Within Househ. Use
Production	Production Activities	3	Output (basic prices)															'Free'Emission by Production			Total Output (basicprice)
	Household (Waste)Prod	4		Within Hh.Output														'Free'Emission by Consumption			Total Prod. WithinHouseh
Income Distrib. & Use	Net-tional (Sectors) Primary Distrib. of Income	5			NDP (factor costs)		Property Income Flows			Wages and Property Income from Abroad	Net Indirect Taxes										Primary Income Origin
	Net-tional (Sectors) Secondary Distrib. of Income	6			Consumption of Fixed Capital		NNI (market prices)	Current Transfer Flows #)		Current Transfers from Abroad #)									Current Effects,Past Emissions		Secondary Income Origin
	Net-tional (Sectors) Use of Income	7						Gross Disposable Income and Future Effects											Natural Cleansing		Total Income
	Rest of the World	8	Imports				Wages&Property Inc.toROW	Current Transfers to ROW #)										'Free'Emission from Abroad			Current Payments to ROW
Indirect Taxes (Tax/Subsidy Type)		9	Net General Product Tax		Net Other Tax on Production	Consumption Taxes, Net				Specific Taxes on Exports, Net				Investment Taxes, Net							Net Indirect Taxes
Worth Generation	National (Sectors)	10							Net Saving			Capital Transfer Flows #)	Capital Transfers from ROW								Finance of Generated Worth Change
	Rest of the World (ROW)	11								Bal. of Payments Current Account Deficit		Capital Transfers to ROW									FinanceofROW Generated Worth Change
Other Accumulation	National (Sectors)	12							Consumption of Fixed Capital					Transactions in Non-prod. Assets	Sales of Non prod. Assets to Abroad	Borrowing	HoldingGain & Economic Appearance			NetWorthChanges,Saving & Cap.Transfer	Finance of Gross Worth Accumulation
	Rest of the World (ROW)	13												Purch.of Non prod. Assets from Abroad		Net Lending to Abroad	Holding Gains			NetWorthChanges,Curr.Acc &CapTransfer	Capital Payments to Abroad
Financial (FinancialAssets)		14												Lending							Increase in Assets
Other Changes in Assets (Asset Types)		15												Holding Losses and Destruction	Holding Losses and Destruction					NetWorthChanges, Other AssetChanges	Oth.Assets' Changes in Gross Worth
Environmental Agents (Agents/Resources)		16			'Free' Extraction (Net)				Current Consumption of Pollutants	'Free' Emission to Abroad				Net Losses due to Natural Causes			ReferableDamage,due to EnvironmEff		Immission		Extraction & Destination of Emissions
Changes in Environmental Assets (Ecotopes/Res.)		17							Current Effects, Past Emissions					Non-referable Degradation				Net Depletion		Changes in Worth of Ecosystems	Depletion and Degradation
Changes in Balance Sheet (Sectors)		18										NetWorthChange,Sav&CapTr incl.Env.Eff	NetWorthChanges,Curr.Acc &CapTransfer	NetWorthChange,OthChange incl.Env.Eff	NetWorthChanges, Other AssetChanges						Total Changes in Net Worth
TOTAL			Commodity Supply (mp, excl.VAT)@)	Within Household Supply	Input (at basic prices)	Input into Production Within Housh	Primary Income Destination	Secondary Income Destination	Total Expenditures	Current Receipts from Abroad	Net Indirect Taxes	Generated Worth Change	Generated Worth Change by ROW	Gross Worth Accumulation	Capital Receipts from Abroad	Increase in Liabilities	Oth.Assets' Changes in Gross Worth	Origin of Extraction & Emissions	Depletion and Degradation	Total Changes in Net Worth	

*) 'Free' Emissions refer to positive volume flows at a zero price (in reality) or at a negative price (in simulation experiments).
@) mp,excl.VAT = Valued at market prices, but excluding indirect taxes which apply only to some specific (final) demand categories (like VAT).
#) Including the transfer of 'free' emissions.

performance in the reference period.

Separating these accounts is also advantageous because part of the environmental effects do not have any influence on asset values (e.g. noise), while another part precipitates on (the value of) assets already distinguished in the standard national accounts. In our system, this is catered for by recording first all kinds of emissions by a certain activity, air transport say, and then their impact on a) current accounts - in this example, the 'consumption' of noise by household groups neighbouring the airport, b) conventional assets - such as a decrease in the value of houses as a consequence of the enlargement of a nearby airport, and c) environmental assets - like air quality.

Notably, the environmental assets in the NAMEA do not include those assets which are already incorporated as economic assets in the standard accounts (e.g. account #15). The next SNA ".. recognizes as assets those naturally occurring assets over which ownership may be established and transferred." (United Nations, 1992: Chapter XII). Changes in the value of those assets are already incorporated in the core concept of total Changes in Net Worth of the Nation. This includes ".. the reduction in the value of deposits of sub-soil assets as a result of the physical removal and using up of the assets." (ibid.). In principle, such a reduction is recorded in the other changes in assets account in our module (cf. #15 of the NAMEA), although part of it may be shown as depreciation of non-produced assets in the production accounts (cf. foot note 3 above and subsection 3.5 below), with a concomitant effect on NDP, NNI, etc.

Generally, the main premise in table 1 is that the interrelations between national accounts and the environment are not limited to the production accounts, and that these effects should be shown where they actually occur. This means that in a model simulation with a non-zero price for some uses of the environment all national accounts balances would be maintained. In practice, this implies that if a balancing item is affected, these effects cascade down the subsequent balancing items until finally, in the Total Changes in Net Worth, all (lasting) effects

have been incorporated. In table 1, all important balancing items have been framed.

The following subsections will provide a more detailed description of the content of this matrix.

3.1 **Goods and services account**

The first row and column of table 1 contain the 'traditional' goods and services account. The row presents the upper part of a consolidated use matrix, split into intermediate consumption, household consumption, government consumption, exports and gross capital formation. All these elements are valued at purchasers' prices excluding net indirect taxes which apply to specific demand categories only, like VAT. Trade and transport margins add up to zero, row-wise.

In the first column, the third cell contains the consolidated make matrix (in basic prices). A more detailed, subsequent table should show the value of all commodities generated by each production activity. Imports (at c.i.f. prices) originate from the current account for the rest of the world. General taxes less subsidies on products (excise taxes etc.) are put on a separate account for (various types of) indirect taxes.

This indirect account has been inserted because it is of importance to show the incidence of specific instruments of government regulation in this module. For a tax or a subsidy has a different impact (at least temporarily) depending on the base to which it applies. In this respect, the distinction between net taxes on <u>products</u> (e.g. an excise tax on fuels) on the one hand and taxes on <u>production processes</u> on the other (e.g. a levy on the discharge of oxygen-demanding materials) is well-known.

In order to arrive at total domestic supply at market prices, trade and transport margins must still be settled. This is done in the

submatrix in the top left-hand corner of this table. In a macro-matrix, total margins are evidently equal to zero (cf. Keuning, 1991: table 3, for more details).

The total of the first column now corresponds with domestic commodity supply at market prices excluding VAT etc., and this is equal to the concomitant row sum representing the value of total use. This equality naturally applies to all row and column totals.

It is generally felt that the pollution caused by final consumption should be seen as the outcome of a kind of production process taking place within households.[15] In the environmental module, this amounts to a transformation of their consumption into household output plus various types of 'free' emissions. These emissions are delivered to the environment and the other household 'output' accrues to the producing households as final consumption. Apart from the emissions, the physical appearance of the input and output of the within-household transformation processes is the same. However, there is no need to apply the same classification twice. It is even expedient to show household consumption not only by commodity type but also by purpose. In that case, comparisons (between household groups, countries or periods) can be made concerning the consumption patterns by purpose (e.g. budget share spent on transport) and concerning the allocation to goods and services for each purpose (e.g. riding a bicycle or driving a car).

This is worked out in the second and fourth account of table 1. The second row registers the use of this household output and the second column how it is produced. Whereas the first row registers consumption expenditures excluding VAT etc., the second row contains the values at purchasers' prices. The fourth account is discussed in the next subsection.

For the moment, this system does not register unpaid services generated by the environment, as advocated by Peskin (1991).

15. Since final consumption of government and private non-profit institutions only consist of goods and services they produce themselves, all their 'free' emissions can be ascribed to a (conventional) production process.

Conceptually, it does not pose a problem to include the production and consumption of these services, whereby the full imputed income out of this production should then accrue to the consumers. However, on the one hand, it is quite complicated to measure these service flows in physical terms and, on the other hand, our statistical system does not allow for a contingency valuation method. Nevertheless, these services could be taken into consideration when experimenting with price systems in model simulations.

3.2. **Production account**

The production account (#3) registers output as receipts of production activities, and intermediate consumption, consumption of fixed capital, indirect taxes less subsidies on production processes and net value added as their outlays. In addition to the output for sale, most production processes also generate less wanted 'by-products' in the form of substances which are dumped into the environment (including discarded capital goods). Usually, there is no direct relationship between the amount of a certain pollutant emitted by a certain firm and any monetary settlement. This means that the value in cell (3,16) is equal to zero in this case. In this way, the equality of the totals of row and column #3 is maintained.

At the same time the emission in physical terms is registered too. The essence of our accounting method lies in subsequent disaggregations, not only by production activity and type of agent emitted, but also into volumes and prices. Cell (3,16) is thus blown up into two separate submatrices, one of which is filled with volumes using units which are relevant to the type of emittant under consideration, and the other is filled with prices. The latter submatrix is actually not at all interesting in our *statistical* system, since it contains only zeros. However, this submatrix plays a crucial role in simulation experiments whereby various sets of hypothetical prices are used to analyze the economic and environmental effects. Naturally, an essential consequence of replacing the zeros in row and column 16 by negative numbers is that

all balancing items in table 1 are adjusted as well, in order to maintain the equality of row and column totals.

The third column registers the inputs in production. Apart from intermediate inputs obtained from other firms, the environment delivers unpaid resources which are used up in production processes. These amounts appear in cell (16,3) in this matrix. It is probably most convenient to book this extraction of depletable resources net of the natural growth which may be expected under average circumstances. In this way the net depletion of fish etc. is recorded in this cell.[16] As in the case of emissions, their monetary value is typically equal to zero and the balancing items are then not affected.

The fourth account shows the transformation of household consumption expenditures into household output (i.e. the same products as were bought) plus 'free' emissions. In the column of this account, net consumption taxes (like VAT) are added. The treatment of consumption taxes in this matrix serves to provide the data required for simulation experiments with (changes in) specific consumer subsidies or taxes. Those policy instruments may in fact aim at shifting expenditure patterns into a more environment-friendly direction. Moreover, our registration opens up the opportunity to re-route some compulsory fees paid by households. In the SNA, these are all seen as direct taxes (United Nations, 1968: 6.89-6.90 and 7.65). In this module, environmental levies can be re-routed to the consumption of a (subsidized) service, e.g. in the case of refuse collection, or to consumption taxes, if no actual service is provided.

3.3. **Income distribution and use accounts**

The balancing item of the production accounts equals net value added. Since indirect taxes less subsidies have already been subtracted, this

16. If total extraction is surpassed by growth of natural resources, a negative number should not be filled in here. Instead, this net expected positive change should be subtracted from net losses due to natural causes, as recorded in the second capital subaccount (see cell (16,12) and subsection 3.4 below).

item is recorded here at factor cost. Total value added equals Net Domestic Product and this is booked on the primary distribution of income account.[17] In that account, institutional sectors receive several types of primary income: NDP at factor cost, property income received from other (domestic) institutional units, wages and property income received from abroad, and indirect taxes less subsidies, which accrue to the government.

In the columns of the income account, outlays on account of having incurred liabilities (i.e. payments of property 'income') are settled for each sector. Moreover, wages and property income may have flown abroad. The residual equals Net National Income (NNI), at market prices. NNI reappears on the credit side of the secondary distribution of income account. Further, flows of transfers from and to other institutional units and the rest of the world are shown here. Transfer outlays are recorded on the debit side and the balance is known as Disposable Income (of each sector).

In the income accounts one should focus on the current effects. This implies that current effects of past emissions should be added, as a kind of transfer from the past to the present (cell 6,17), and that future effects of present emissions and extraction should be singled out (in cell 7,6), because they entail a transfer from the present to the future. In this way, one arrives at an adjusted Disposable Income concept. To remain consistent, this procedure should also be followed for the 'ordinary' intertemporal transfers. This implies that consumption of fixed capital (production in the past, consumption now) is added (cell 6,3) and that the future effects of present investments (production now, but consumption in the future) are also shown separately (in cell 7,6). Notice that this adjusted, Gross Disposable Income concept is not necessarily equal to total final consumption (i.e. total expenditures minus net saving) in the present period. One may

17. In order to restrict the proliferation of accounts, a subdivision of the primary distribution of income account into a generation of income account and an allocation of primary income account is not shown here. However, if one wants to take into account labour market aspects or if this framework is to serve as a basis for a full-fledged (general equilibrium) modelling exercise, this subdivision is indispensable. It will allow for the modelling of factor markets as a link between production and institutional incomes (cf. Keuning, 1991).

still have decided to consume either more or less, or, in other words, net saving is not necessarily equal to net investment.

Next, the use of income account records how Gross Disposable Income is 'spent'. The government and household groups have outlays on consumption, and the balance, (net) savings, is put on the capital account. In the case of corporations, all disposable income is saved. In addition, the environment absorbs some of the pollution by means of natural cleansing. Here this is shown in the row (cell 7,17), with a negative sign. Finally, column #7 also contains items called 'current consumption of pollutants' (cell 16,7), originating from the environmental agents account, and naturally the absorption of the current effects of past emissions (cell (17,7), which is equal to cell (6,17)).

These cells may need some further explanation. Most environmental effects of economic actions have a capital character, in the sense that the impact is not, or not only, felt during the current period. A notable exception is noise, where at least part of the effect disappears when the noise stops. Noise can be seen as a particular kind of environmental 'agent', emitted by production and consumption processes. This is included in column 16 and in the row of the causing activity (e.g., cell 3,16). Subsequently, value added of this activity (e.g., cell 5,3) is 'augmented' with the amount of noise caused and the same (physical) supplement is recorded for primary income of the owners of the activity (cell 6,5). If sufficient information on the identity of the victims were available, this noise could then be recorded as a 'free' delivery in kind to them in the secondary distribution of income account - it is then included in 'current transfer flows' from the culprits to the victims (cf. cell 6,6). It is part of the latter's Gross Disposable Income (cell 7,6) and finally consumed by them in the use of income account (cell 16,7). Noise and other emissions with a non-capital character (e.g. stench) can thus be seen as an unwanted gift from the producers to the consumers, without an effect on saving.

This way of recording presumes that currently experienced nuisance

can be measured. Actually, this may be less complicated than an estimation of the total expected nuisance of current economic activities. Note that once consumed nuisance should not re-appear again in a later year. For example, the presently recorded grief over the deteriorating water quality should refer to this year's change in water quality only.

It will obviously be difficult to separate changes in the environment induced by pollution in the previous years from those in the current year. Usually one only knows the total environmental burden which is currently 'consumed', i.e. cell (16,7) + cell (17,7). In a few situations, such as the release of pollutants in the soil, it is possible to judge changes in the quality of groundwater as the effect of past emissions, while the current pollution is still under way in the soil above the aquifer.

In accordance with international practice, the income distribution and use accounts for the rest of the world (in table 1 sometimes abbreviated as ROW) have been combined. The traditional registration method of national accounting systems is followed here: current receipts of the rest of the world appear in the row and current outlays in the column. The balance is transferred to the capital account for the rest of the world. The framework in table 1 can easily accommodate physical flows of pollutants across the border. In row 8 various emissions, emitted abroad, float into the national territory (cell 8,16). The counterpart item is a 'gift' from the rest of the world (cell 6,8). Reversely, pollutants are exported too, as shown in cell (16,8), and this is counterbalanced by a 'gift' to abroad (cell 8,6).

As explained above, indirect taxes are specified in a separate account. The classification of this account will have to pay special attention to various types of environmental levies and subsidies. This mainly refers to the row of this account. In the column, all indirect taxes less subsidies are collected by the government.

3.4. **Capital accounts**

Because the registration of all effects on the balance sheets is an important objective of this matrix, the capital account is quite extensive. The first capital subaccount describes the generation of net worth due to net savings and capital transfers received (from other sectors and from abroad) minus capital transfers paid. Capital transfers include the flow of 'free' emissions with a capital character, from the dumping sector (in the column) to the stricken sector (in the row). If the latter cannot be identified, it may be assumed that the national common heritage is affected and this may or may not be combined with the government sector. Like ordinary saving, the net environmental effects of present activities which are not completely absorbed during the present period, are transferred to the changes in balance sheet accounts (cell 18,10).

The second capital account (#12) records the use of funds for the accumulation of assets as defined in the standard accounts. The row adds depreciation, sales of land and other non-produced (non-financial, non-environmental) assets, borrowing (i.e. incurring various types of liabilities), and not elsewhere classified increases in the volume and price of assets to the balancing item of the first capital subaccount excluding the environmental effects. Those environmental effects are not taken up in row #12, but in the rows of the other changes in assets and changes in environmental assets accounts (#15 and #17, respectively). All elements of row #12 taken together yield total funds available for gross worth accumulation, which is presented in the column. It consists of: gross capital formation, purchases of non-produced assets (from other institutions and from abroad), lending (net purchases of financial assets), not elsewhere classified decreases in the volume and price of non-environmental assets, net (abnormal) losses of environmental agents due to natural causes, non-referable degradation of environmental assets, and the net worth changes due to 'other' changes in assets (including 'other' changes in environmental assets).

The item net losses of environmental agents due to natural causes

(cell 16,12) refers to capital gains and losses not resulting from human activities, or which are an unexpected result of human activities. It also includes net growth of wild species (cf. foot note 16). The item non-referable degradation of environmental assets (cell 17,12) has been added because demonstrable deterioration of an ecosystem may not be attributable to *specific* economic activities or even to a specific period. Therefore, it has not been included in the environmental effects of any activity. Examples are the unexpected detection of polluted soil, or a reduction in the number of seals in the North Sea. However, this deterioration should be incorporated when assessing total changes in net worth. The solution is to put this damage in cell (17,12) for the moment, with counterbalancing figures in the Changes in Net Worth of Ecosystems (cell 17,18) and in the Changes in Net Worth due to Other Changes, including Environmental Effects (cell 18,12).[18]

Similar accounts are drawn for the rest of the world. Foreign saving, which may bear a negative sign, agrees with the deficit on current account of the balance of payments of the national economy. The rest of the transactions are analogous to those for the domestic sectors.

3.5. **Financial and other changes in assets accounts**

Subsequently, the financial accounts (#14) are presented. These indicate which sector (including the rest of the world) has acquired which types of assets and liabilities during the reference period.

The next row and column of table 1 contain the other changes in assets account. Not elsewhere classified changes in the volume and price of assets claimable by institutional sectors and the rest of the world are recorded here, as well as the balance of those adjustments, called Changes in Net Worth due to Other Changes in Assets. On the credit side, it concerns economic appearance of non-produced assets (e.g. discovery of subsoil resources), nominal holding gains of all kinds of assets etc.

18. It is possible that the non-referable degradation refers to a specific type of agents (in our example: seals). In that case this may be booked first in cell 16,12 (+), then in cell 17,16 (+), and finally in the cells 17,18 (-) and 18,12 (-).

On the debit side, the destruction of assets by non-insurable risks, disappearance of non-produced assets, nominal holding losses, etc. are recorded.

In the standard national accounts, changes in national worth due to environmental effects are already partially shown here. For instance, this concerns holding losses and destruction of capital goods which are demonstrably due to pollution. This implies that those losses exceed depreciation due to normal wear and tear. Examples are: destruction of assets as a consequence of a nuclear disaster, or a fall in house prices when the enlargement of a nearby airport has been approved. In the environmental module, those losses are removed from cell (15,12) and shown as a separate, negative item, called referable damage due to environmental effects, in the column of this account (cell 16,15). This does not change the balance of this account.

An interesting consequence of this registration method is that if a) the size of the damage to these non-environmental assets (i.e. assets subject to ownership) can be estimated from actual data, and b) this damage can clearly be attributed to a certain economic activity, this value can be re-routed within the statistical framework of the environmental module. What is considered a holding loss (cell 15,12) in the core accounts now becomes a (negatively valued) 'free' emission by e.g. production (cell 3,16). In the matrix, this implies putting a negative value in cell (3,16), and concomitantly reducing NDP (cell 5,3), NNI (cell 6,5), Future Effects (cell 7,6), Net Saving (cell 10,7), capital transfer flows (cell 10,10), Net Worth Changes due to Saving and Capital Transfers including Net Environmental Effects (cell 18,10), and holding losses and destruction (cell 15,12). The same negative value then appears in cell (16,15), while the balancing item Net Worth Changes due to Other Changes in Assets including Net Environmental Effects (cell 18,12) is concomitantly increased. It can easily be checked that in this sequence all account numbers appear just as frequently in the rows as in the columns, except for accounts #12 and #18 where a negative adjustment is compensated by an equally large positive adjustment. This ensures that the equality of all row and column totals is maintained in this re-

routing. Therefore, the consistency of the system is not affected by the adjustment of balancing items.

This procedure is nothing more than recording actual values in a different way. In the core national accounts, assessed environmental damage to economic assets is always seen as 'other changes in assets', recorded in account #15, so that it does not affect the balancing items 'higher up' in the system (GDP, NNI, etc.). In our environmental module, assessed damage to owned assets that can be ascribed to particular economic activities leads to a lower value added in those activities, so that GDP, NNI, etc. are lower in this case. Concomitantly, the balancing item Net Worth Changes due to Other Changes in Assets is higher because this loss is now incorporated in the system in the balancing item Net Worth Changes due to Saving and Other Transfers, including Net Environmental Effects. As a result, Total Changes in Net Worth are the same in the core accounts and in the module. It should be emphasized that this adjustment is limited to 'facts', that is assessed changes in values which have been internalized by specific economic subjects. The module is therefore still a statistic and not a model, though it will contain balancing items which deviate from those in the core national accounts.

A similar approach can be followed for the appraised value of the depletion of natural resources which are subject to ownership (e.g. standing wood, some mineral resources). Only in this case the capital loss is usually not thrust upon another party (cell 10,10 remains empty). Here, cell (16,3) contains a positive value followed by a subsequent reduction of all the balancing items through Net Saving (cell 10,7) and of Net Worth Changes due to Saving and Capital Transfers including Net Environmental Effects (cell 18,10). Concomitantly, holding losses, destruction and disappearance of non-produced assets in cell (15,12) are reduced. Again, a negative value appears in cell (16,15) while Net Worth Changes due to Other Changes in Assets including Net Environmental Effects (cell 18,12) is increased, so that consistency is restored. In this way, a depletion of natural resources which is explicitly accounted for in an economic subject's income statement is

not anymore booked as 'other changes in (non-produced) assets' (cell 15,12), but as a depreciation of non-produced capital (cell 16,3).

Environmental damage to the standard assets which is not referable to specific economic activities in the present period remains included in cell (15,12) (holding losses and destruction).

3.6. **Environmental changes and changes in balance sheet accounts**

Above, all interrelationships between the economy and the environment have been discussed where they actually occur. This means that now it suffices to sum up the balances which are implicit in the accounts 16 and 17. In principle, these balances hold in physical measurement units. In addition, the sign of the values in simulation experiments with non-zero prices is given in parentheses in front of each term. The balancing items, which are computed residually, have been printed in bold letters. In order to ensure that in each equation the balancing item appears on the right-hand side, only equation 1) below gives the row first and then the column. In the other equations the variables in a column of the NAMEA are listed first. We start with account #16:

1) for natural resources (e.g. fish, trees of various kinds, mineral deposits):

   (+)net 'free' extraction (cell 16,3) + (+)net losses due to natural causes (cell 16,12) + (-)referable damage of owned assets due to environmental effects (cell 16,15) =

   (+)**net depletion of (not owned) environmental assets (cell 17,16)**

Notice the difference between natural resources subject to ownership, whose depletion is absorbed in cell (16,15), and natural resources not subject to ownership, whose depletion is absorbed in cell (17,16). It may be recalled that in our system 'economic' assets include all assets subject to ownership, so that environmental assets are by definition not subject to ownership. The second equation implicit in account #16 is:

2) for environmental agents without a capital character (e.g. noise):
(-)'free' emissions by production (cell 3,16) + (-)'free' emissions by consumption (cell 4,16) =
(-)**current consumption of pollutants (cell 16,7)**

3) for environmental agents with a capital character (e.g. acid rain, carbon dioxide, waste):
(-)'free' emissions by production (cell 3,16) + (-)'free' emissions by consumption (cell 4,16) + (-)'free' emissions from abroad (cell 8,16) =
(-)'free' emissions to abroad (cell 16,8) + (-)referable damage of owned assets due to environmental effects (cell 16,15) +
(-)**immission into (not owned) ecosystems (cell 16,17)**

It is clear that in simulation experiments all (shadow) values in the first equation are positive, with the exception of the referable damage, while all values in the last two equations are negative. When measured in physical units, only positive numbers appear in all equations, of course. Finally, the equalities underlying account 17 are given here:

4) for national ecosystems (e.g. air, seas etc.):
(-)current effects of past emissions (cell 6,17) + (+)natural cleansing (cell 7,17) + (-)immission (cell 16,17) =
(-)current effects of past emissions (cell 17,7) + (+)non-referable degradation (cell 17,12) + (+)net depletion (cell 17,16) + (-)**changes in worth of ecosystems (cell 17,18)**

Current effects of past emissions appear both on the left-hand side and on the right-hand side of this equation. For the rest, it can be seen that total worth of national ecosystems decreases in proportion to an absolute increase of all other elements in this equation, except natural cleansing. It goes without saying that filling in this equation is a lot easier said than done, if only because the total effect on an ecosystem may deviate from the sum of the individual effects. For that matter, it is probably to be preferred to use a non-linear aggregation function to arrive at total Changes in Worth of Ecosystems.

At the bottom and at the right-hand side, changes in the balance sheets close the full sequence of accounts and balancing items. The totals of this account reflect in principle all changes in net worth, including changes in worth of ecosystems, however measured. In the module, Total Changes in Net Worth will not be expressed as a single number, but as a monetary amount plus various indicators for the degradation of ecosystems. Total changes in net worth should be added to the opening balance sheets to arrive at the closing balance sheets. Of course, balance sheets for environmental assets are then also expressed in physical units. In general, stocks should not be shown in the NAMEA-matrix proper, but in supplementary tables (not included in this paper).

Although at present the NAMEA cannot yet be filled in completely, it can still serve as an operational framework to construct environmental satellite accounts on the basis of whatever data are available. To begin with, an abbreviated table focusing on a few environmental agents with a known origin and destination may be most practical (see de Boo, Bosch, Gorter and Keuning, 1991: table 3).[19]

19. The draft section on environmental accounting in the next SNA (United Nations, 1992: Chapter XXI, Section D) includes several references to our approach, which is dubbed 'a SAM approach prepared for a developed country'. However, the main emphasis in the UN draft lies with an extended Supply and Use Table (similar to an Input-Output table) instead of a full-fledged SAM (United Nations, 1992: table XXI.6).

4. In Search of an Aggregate Indicator Based on a Statistical System

Now that we have gone at some length to sketch a statistical system which integrates national accounts and environmental statistics, we can return to our point of departure: why do we need such an integrated system of statistics if we want to estimate one or a few summary indicators on the state of the environment?

Several arguments can be listed:

1. A system of statistics guarantees consistency through a set of balances. It goes without saying that consistency is a necessary, though not sufficient requirement for any statistic. In the NAMEA-module, this consistency is reflected in, among other things: a) a single valuation principle (assessed monetary value) so that apples are not compared with oranges, b) a consistent asset classification ('ecotopes' subject to ownership are not environmental assets as they are already incorporated as non-produced, 'economic' assets), and c) all balances related to production, income, consumption, saving, investment, net worth changes, etc. are maintained.
2. A system of statistics enables formal modelling, including feed-backs from non-monetary to monetary variables. If one aimed at maximizing an environmental objective operationalized by an isolated indicator (e.g. 'sustainable income'), one might come up with some measures which supposedly lead to a better value of this indicator. However, it would be impossible to assess the repercussions of another value of this indicator on other macro-economic objectives. This shortcoming is remedied if an indicator is based on an integrated statistical system. In fact, the system sketched above enables model simulation experiments in which the trade-offs between one or more environmental objectives and most other objectives of macro-economic policy are made explicit.
3. One or more indicators which are embedded into a consistent system can be defined more precisely, namely by explicit reference to other parts of the system. As a consequence, they are usually better comparable across nations and periods than a foot-loose indicator. In addition, their definition may be less liable to change as such an

adjustment might have repercussions on the rest of the system. In turn, such a stability will probably enhance public acceptance of the indicator(s).

4. If an indicator is derived from a system, this allows for all kinds of analyses into the causes and consequences of the value of this indicator, e.g. on the basis of micro-economic insights.

Finally, we would like to develop some ideas for one, or perhaps a few environmental indicators.[20] First, it is referred to table 1 and more specifically to cell (17,18) in this table which contains all changes in the national environment which have not been currently consumed. In a more detailed table, this cell becomes a submatrix in which these changes are classified by ecotope, including various natural resources not subject to ownership. For the purpose of the indicator, a cross-classification by institutional sector is probably irrelevant, so that this submatrix turns into a column vector. In all cases, the changes are expressed in physical measurement units. In our view, the figures in this vector should serve as the basis for the construction of an aggregate indicator on the environment.[21]

Secondly, concerning the actual definition of the index we propose an aggregate indicator which is a non-linear, concavely increasing, multivariate function of the quotient between the actual and a sustainable use of all kinds of environmental assets.[22] Evidently, this implies that one should want to minimize this indicator (just like the CPI). The weight attached to a certain resource should decrease with the

20. The physical indicators approach is also favoured by Kuik and Verbruggen (1991). Refer also to Opschoor (1990) and den Hartog and Maas (1990). A useful link could perhaps be established with the literature on Physical Quality of Life Indicators (see e.g., Eyles, 1990).
21. The indicator thus focuses on changes in the state of the environment which have not disappeared at the end of the reference period (e.g. noise is not included and a correction is made for 'natural cleansing'). Moreover, it only relates to changes in environmental assets which are not subject to ownership. Changes in assets subject to ownership are already reflected in NAMEA's set of monetary balancing items. Another feature is that only changes within national boundaries are considered relevant.
22. Notice the difference with the 'avoidance cost' approach to arrive at 'green national income'. In that approach, the weights are either zero or infinite, while in the physical indicator approach the weights are gradually increasing when the use of the environment becomes less sustainable. Nevertheless, the remark made above about the political nature of sustainability standards equally applies to the physical indicator method.

possibility to substitute the environmental asset in question for another one which generates about the same quantity and quality of services. In some cases, these substitution possibilities are expected to be available in the foreseeable future. Other criteria which should play a role in the estimation of weights for each asset are the degree of irreversability of the damage and the scale of the risks (den Hartog and Maas, 1990). Due to lack of information, it will be necessary to work with 'representative' assets in several instances.

Sometimes, the standards have not been set for the use of environmental assets, but one stage earlier, namely for the emission of environmental agents. In terms of the NAMEA, this means that the indicator is based on the data in cell (16,17) and not on the data in cell (17,18). The indicator is then not so much related to environmental effects, but to the pressure on the environment. A major advantage of using agents instead of assets to compile the indicator(s) is that more statistical information is available (e.g. OECD, 1991).

The aggregation of sub-indicators may in fact proceed in stages whereby a successive clustering occurs. The actual aggregation function should be such that a relatively large weight is attached to sub-indicators with high values (Kuik and Verbruggen, 1991).

References

Alarcón, J.V., J. van Heemst, S.J. Keuning, W. de Ruijter and R. Vos, 1990, The Social Accounting Framework for Development: Concepts, Construction and Applications (Gower, Aldershot, England).

Barker, T., 1990, The Treatment of the Environment in a SAM for Europe. Paper presented at the Conference A SAM for Europe, Valencia, Spain.

Blazejczak, J. and D. Edler, 1991, Modelling in Order to Calculate Avoidance Costs. Paper presented at the special IARIW-conference on Environmental Accounting, Baden, Austria.

Boo, A. de, P. Bosch, C.N. Gorter and S.J. Keuning, 1991, An Environmental Module and the Complete System of National Accounts. National Accounts Occasional Paper, No. NA-046. (Netherlands Central Bureau of Statistics, Voorburg).

European Commission, 1992, Towards Sustainability: A European Community Programme of Policy and Action in relation to the Environment and Sustainable Development. (European Commission, Brussels).

Eyles, J., 1990, Objectifying the Subjective: The Measurement of Environmental Quality. In: Social Indicators Research, Volume 22, pp. 139-153.

Hartog, H. den and R.J.M. Maas, 1990, Sustainable Economic Development: Macroeconomic Aspects of a Priority for the Environment. (in Dutch). In: P. Nijkamp and H. Verbruggen (eds.), The Dutch Environment in European Perspective. 1990 Report to the Royal Netherlands Economics Society. (Stenfert Kroese, Leiden).

Hueting, R., 1991, Calculating a Sustainable National Income: a practical solution for a theoretical dilemma. Paper presented at the special IARIW-conference on Environmental Accounting, Baden, Austria.

Hueting, R., and P. Bosch, 1990, On the Correction of National Income for Environmental Losses. In: Statistical Journal of the United Nations ECE, Volume 7, pp. 75-83.

Keuning, S.J., 1991, A Proposal for a SAM which fits into the next System of National Accounts. Economic Systems Research, Volume 3, Number 3, pp. 233-248.

Keuning, S.J. and W.A. de Ruijter, 1988, Guidelines to the Construction of a Social Accounting Matrix. In: The Review of Income and Wealth,

Series 34, pp. 71-101.

Keuning, S.J. and E. Thorbecke, 1992, The Social Accounting Matrix and Adjustment Policies: The Impact of Budget Retrenchment on Income Distribution. In: E. Thorbecke and associates, Adjustment and Equity in Indonesia (Organization for Economic Cooperation and Development, Paris).

Kuik, O. and H. Verbruggen, 1991, Indicators of Sustainable Development. Paper presented at the special IARIW-conference on Environmental Accounting, Baden, Austria.

Meadows, D.H., D.L. Meadows and J. Randers, 1991, Beyond the Limits. Confronting Global Collapse; Envisioning a Sustainable Future (Earthscan Publications, London/Chelsea).

Michaels, R.G., A.E. Grambsch and H.M. Peskin, 1991, Neither Fish nor Fowl? Can Environmental Accounts Guide Economic Policy, Environmental Policy, Both or Neither? Conclusions from a United States Case Study. Paper presented at the special IARIW-conference on Environmental Accounting, Baden, Austria.

Nyborg, K., 1991, "Eco Domestic Product": The Answer to Which Question? Mimeographed. (Norwegian Central Bureau of Statistics, Oslo).

OECD (Organization for Economic Cooperation and Development), 1991, Environmental Indicators: a Preliminary Set. (OECD, Paris).

Opschoor, J.B., 1990, Ecologically Sustainable Economic Development: A Theoretical Idea and an Unruly Practice. (in Dutch). In: P. Nijkamp and H. Verbruggen (eds.), The Dutch Environment in European Perspective. 1990 Report to the Royal Netherlands Economics Society. (Stenfert Kroese, Leiden).

Pearce, D.W. and R.K. Turner, 1990, Economics of Natural Resources and the Environment. (Harvester Wheatsheaf, Hertfordshire, England).

Peskin, H.M., 1989, Accounting for Natural Resource Depletion and Degradation in Developing Countries. Environmental Department Working Paper, No. 13. (World Bank, Washington D.C.).

Peskin, H.M., 1991, National Accounting for Resource and Environmental Degradation: Alternative Approaches and Concepts. Paper presented at the special IARIW-conference on Environmental Accounting, Baden, Austria.

Pyatt, G., 1988, A SAM Approach to Modelling. Journal of Policy

Modelling, Volume 10, Number 3, pp. 327-52.

Pyatt, G. and J. Round, 1985, Social Accounting Matrices: A Basis for Planning (World Bank, Washington D.C.).

Pyatt, G. and E. Thorbecke, 1976, Planning Techniques for a Better Future. (International Labour Office, Geneva).

Repetto, R., W. Magrath, M. Wells, C. Beer and F. Rossini, 1989, Wasting Assets: Natural Resources in the National Income Accounts. (World Resources Institute, Washington D.C.).

Reich, U.-P., 1991, Implications for the National Accounts of the Treatment of Depletable Resources in Business Accounts. Paper presented at the special IARIW-conference on Environmental Accounting, Baden, Austria.

Richter, J., 1991, Environmental Accounting: Some Non-Technical Remarks. Paper presented at the special IARIW-conference on Environmental Accounting, Baden, Austria.

United Nations, 1968, A System of National Accounts. Studies in Methods, Series F, No. 2, Rev. 3 (United Nations, New York).

United Nations, 1990, SNA Handbook on Integrated Environmental and Economic Accounting. Preliminary draft of part I: General Concepts (United Nations, New York).

United Nations, 1992, Revised System of National Accounts. Provisional version. Document number ST/ESA/STAT/SER.F/2/Rev.4 (United Nations, New York).

World Resources Institute, 1991, Accounts Overdue. (World Resources Institute, Washington D.C.).

Statistics Netherlands
National Accounts Occasional Papers

NA/01 Flexibility in the system of National Accounts, Van Eck, R., C.N. Gorter and H.K. van Tuinen (1983).
This paper sets out some of the main ideas of what gradually developed into the Dutch view on the fourth revision of the SNA. In particular it focuses on the validity and even desirability of the inclusion of a number of carefully chosen alternative definitions in the "Blue Book", and the organization of a flexible system starting from a core that is easier to understand than the 1968 SNA.

NA/02 The unobserved economy and the National Accounts in the Netherlands, a sensitivity analysis, Broesterhuizen, G.A.A.M. (1983).
This paper studies the influence of fraud on macro-economic statistics, especially GDP. The term "fraud" is used as meaning unreporting or underreporting income (e.g. to the tax authorities). The conclusion of the analysis of growth figures is that a bias in the growth of GDP of more than 0.5% is very unlikely.

NA/03 Secondary activities and the National Accounts: Aspects of the Dutch measurement practice and its effects on the unofficial economy, Van Eck, R. (1985).
In the process of estimating national product and other variables in the National Accounts a number of methods is used to obtain initial estimates for each economic activity. These methods are described and for each method various possibilities for distortion are considered.

NA/04 Comparability of input-output tables in time, Al, P.G. and G.A.A.M. Broesterhuizen (1985).
It is argued that the comparability in time of statistics, and input-output tables in particular, can be filled in in various ways. The way in which it is filled depends on the structure and object of the statistics concerned. In this respect it is important to differentiate between coordinated input-output tables, in which groups of units (industries) are divided into rows and columns, and analytical input-output tables, in which the rows and columns refer to homogeneous activities.

NA/05 The use of chain indices for deflating the National Accounts, Al, P.G., B.M. Balk, S. de Boer and G.P. den Bakker (1985).
This paper is devoted to the problem of deflating National Accounts and input-output tables. This problem is approached from the theoretical as well as from the practical side. Although the theoretical argument favors the use of chained Vartia-I indices, the current practice of compilating National Accounts restricts to using chained Paasche and Laspeyres indices. Various possible objections to the use of chained indices are discussed and rejected.

NA/06 Revision of the system of National Accounts: the case for flexibility, Van Bochove, C.A. and H.K. van Tuinen (1985).
It is argued that the structure of the SNA should be made more flexible. This can be achieved by means of a system of a general purpose core supplemented with special modules. This core is a fully fledged, detailed system of National Accounts with a greater institutional content than the present SNA and a more elaborate description of the economy at the meso-level. The modules are more analytic and reflect special purposes and specific theoretical views.

NA/07 Integration of input-output tables and sector accounts; a possible solution, Van den Bos, C. (1985).
The establishment-enterprise problem is tackled by taking the institutional sectors to which the establishments belong into account during the construction of input-output tables. The extra burden on the construction of input-output tables resulting from this approach is examined for the Dutch situation. An adapted sectoring of institutional units is proposed for the construction of input-output tables.

NA/08 A note on Dutch National Accounting data 1900-1984, Van Bochove, C.A. (1985).
This note provides a brief survey of Dutch national accounting data for 1900-1984, concentrating on national income. It indicates where these data can be found and what the major discontinuities are. The note concludes that estimates of the level of national income may contain inaccuracies; that its growth rate is measured accurately for the period since 1948; and that the real income growth rate series for 1900-1984 may contain a systematic bias.

NA/09 The structure of the next SNA: review of the basic options, Van Bochove, C.A. and A.M. Bloem (1985).
There are two basic issues with respect to the structure of the next version of the UN System of National Accounts. The first is its 'size': reviewing this issue, it can be concluded that the next SNA should contain an integrated meso-economic statistical system. It is essential that the next SNA contains an institutional system without the imputations and attributions that pollute the present SNA. This can be achieved by distinguishing, in the central system of the next SNA, a core (the institutional system), a standard module for non-market production and a standard module describing attributed income and consumption of the household sector.

NA/10 Dual sectoring in National Accounts, Al, P.G. (1985).
Following a conceptual explanation of dual sectoring, an outline is given of a statistical system with complete dual sectoring in which the linkages are also defined and worked out. It is shown that the SNA 1968 is incomplete and obscure with respect to the links between the two sub-processes.

NA/11 Backward and forward linkages with an application to the Dutch agro-industrial complex, Harthoorn, R. (1985).
Some industries induce production in other industries. An elegant method is developed for calculating forward and backward linkages avoiding double counting. For 1981 these methods have been applied to determine the influence of Dutch agriculture in the Dutch economy in terms of value added and labour force.

NA/12 Production chains, Harthoorn, R. (1986).
This paper introduces the notion of production chains as a measure of the hierarchy of industries in the production process. Production chains are sequences of transformation of products by successive industries. It is possible to calculate forward transformations as well as backward ones.

NA/13 The simultaneous compilation of current price and deflated input-output tables, De Boer, S. and G.A.A.M. Broesterhuizen (1986).
A few years ago the method of compiling input-output tables underwent in the Netherlands an essential revision. The most significant improvement is that during the entire statistical process, from the processing and analysis of the basic data up to and including the phase of balancing the tables, data in current prices and deflated data are obtained simultaneously and in consistency with each other.

NA/14 A proposal for the synoptic structure of the next SNA, Al, P.G. and C.A. van Bochove (1986).

NA/15 Features of the hidden economy in the Netherlands, Van Eck, R. and B. Kazemier (1986).
This paper presents survey results on the size and structure of the hidden labour market in the Netherlands.

NA/16 Uncovering hidden income distributions: the Dutch approach, Van Bochove, C.A. (1987).

NA/17 Main national accounting series 1900-1986, Van Bochove, C.A. and T.A. Huitker (1987).
The main national accounting series for the Netherlands, 1900-1986, are provided, along with a brief explanation.

NA/18 The Dutch economy, 1921-1939 and 1969-1985. A comparison based on revised macro-economic data for the interwar period, Den Bakker, G.P., T.A. Huitker and C.A. van Bochove (1987).
A set of macro-economic time series for the Netherlands 1921-1939 is presented. The new series differ considerably from the data that had been published before. They are also more comprehensive, more detailed, and conceptually consistent with the modern National Accounts. The macro-economic developments that are shown by the new series are discussed. It turns out that the traditional economic-historical view of the Dutch economy has to be reversed.

NA/19 Constant wealth national income: accounting for war damage with an application to the Netherlands, 1940-1945, Van Bochove, C.A. and W. van Sorge (1987).

NA/20 **The micro-meso-macro linkage for business in an SNA-compatible system of economic statistics**, Van Bochove, C.A. (1987).

NA/21 **Micro-macro link for government**, Bloem, A.M. (1987).
This paper describes the way the link between the statistics on government finance and national accounts is provided for in the Dutch government finance statistics.

NA/22 **Some extensions of the static open Leontief model**, Harthoorn, R.(1987).
The results of input-output analysis are invariant for a transformation of the system of units. Such transformation can be used to derive the Leontief price model, for forecasting input-output tables and for the calculation of cumulative factor costs. Finally the series expansion of the Leontief inverse is used to describe how certain economic processes are spread out over time.

NA/23 **Compilation of household sector accounts in the Netherlands National Accounts**, Van der Laan, P. (1987).
This paper provides a concise description of the way in which household sector accounts are compiled within the Netherlands National Accounts. Special attention is paid to differences with the recommendations in the United Nations System of National Accounts (SNA).

NA/24 **On the adjustment of tables with Lagrange multipliers**, Harthoorn, R. and J. van Dalen (1987).
An efficient variant of the Lagrange method is given, which uses no more computer time and central memory then the widely used RAS method. Also some special cases are discussed: the adjustment of row sums and column sums, additional restraints, mutual connections between tables and three dimensional tables.

NA/25 **The methodology of the Dutch system of quarterly accounts**, Janssen, R.J.A. and S.B. Algera (1988).
In this paper a description is given of the Dutch system of quarterly national accounts. The backbone of the method is the compilation of a quarterly input-output table by integrating short-term economic statistics.

NA/26 **Imputations and re-routeings in the National Accounts**, Gorter, Cor N. (1988).
Starting out from a definition of 'actual' transactions an inventory of all imputations and re-routeings in the SNA is made. It is discussed which of those should be retained in the core of a flexible system of National Accounts. Conceptual and practical questions of presentation are brought up. Numerical examples are given.

NA/27 **Registration of trade in services and market valuation of imports and exports in the National Accounts**, Bos, Frits (1988).
The registration of external trade transactions in the main tables of the National Accounts should be based on invoice value; this is not only conceptually very attractive, but also suitable for data collection purposes.

NA/28 **The institutional sector classification**, Van den Bos, C. (1988).
A background paper on the conceptual side of the grouping of financing units. A limited number of criteria are formulated.

NA/29 **The concept of (transactor-)units in the National Accounts and in the basic system of economic statistics**, Bloem, Adriaan M. (1989).
Units in legal-administrative reality are often not suitable as statistical units in describing economic processes. Some transformation of legal-administrative units into economic statistical units is needed. This paper examines this transformation and furnishes definitions of economic statistical units. Proper definitions are especially important because of the forthcoming revision of the SNA.

NA/30 **Regional income concepts**, Bloem, Adriaan M. and Bas De Vet (1989).
In this paper, the conceptual and statistical problems involved in the regionalization of national accounting variables are discussed. Examples are the regionalization of Gross Domestic Product, Gross National Income, Disposable National Income and Total Income of the Population.

NA/31 The use of tendency surveys in extrapolating National Accounts, Oudde-ken, Frank and Gerrit Zijlmans (1989).
This paper discusses the feasibility of the use of tendency survey data in the compilation of very timely Quarterly Accounts. Some preliminary estimates of relations between tendency survey data and regular Quarterly Accounts-indicators are also presented.

NA/32 An economic core system and the socio-economic accounts module for the Netherlands, Gorter, Cor N. and Paul van der Laan (1989).
A discussion of the core and various types of modules in an overall system of economy related statistics. Special attention is paid to the Dutch Socio-economic Accounts. Tables and figures for the Netherlands are added.

NA/33 A systems view on concepts of income in the National Accounts, Bos, Frits (1989).
In this paper, concepts of income are explicitly linked to the purposes of use and to actual circumstances. Main choices in defining income are presented in a general system. The National Accounts is a multi-purpose framework. It should therefore contain several concepts of income, e.g. differing with respect to the production boundary. Furthermore, concepts of national income do not necessarily constitute an aggregation of income at a micro-level.

NA/34 How to treat borrowing and leasing in the next SNA, Keuning, Steven J. (1990).
The use of services related to borrowing money, leasing capital goods, and renting land should not be considered as intermediate inputs into specific production processes. It is argued that the way of recording the use of financial services in the present SNA should remain largely intact.

NA/35 A summary description of sources and methods used in compiling the final estimates of Dutch National Income 1986, Gorter, Cor N. and others (1990).
Translation of the inventory report submitted to the GNP Management Committee of the European Communities.

NA/36 The registration of processing in supply and use tables and input-output tables, Bloem, Adriaan M., Sake De Boer and Pieter Wind (1993).
The registration of processing is discussed primarily with regard to its effects on input-output-type tables and input-output quotes. Links between National Accounts and basic statistics, user demands and international guidelines are examined. Net recording is in general to be preferred. An exception has to be made when processing amounts to a complete production process, e.g. oil refineries in the Netherlands.

NA/37 A proposal for a SAM which fits into the next System of National Accounts, Keuning, Steven J. (1990).
This paper shows that all flow accounts which may become part of the next System of National Accounts can be embedded easily in a Social Accounting Matrix (SAM). In fact, for many purposes a SAM format may be preferred to the traditional T-accounts for the institutional sectors, since it allows for more flexibility in selecting relevant classifications and valuation principles.

NA/38 Net versus gross National Income, Bos, Frits (1990).
In practice, gross figures of Domestic Product, National Product and National Income are most often preferred to net figures. In this paper, this practice is challenged. Conceptual issues and the reliability of capital consumption estimates are discussed.

NA/39 Concealed interest income of households in the Netherlands; 1977, 1979 and 1981, Kazemier, Brugt (1990).
The major problem in estimating the size of hidden income is that total income, reported plus unreported, is unknown. However, this is not the case with total interest income of households in the Netherlands. This makes it possible to estimate at least the order of magnitude of this part of hidden income. In this paper it will be shown that in 1977, 1979 and 1981 almost 50% of total interest received by households was concealed.

NA/40 Who came off worst: Structural change of Dutch value added and employment during the interwar period, Den Bakker, Gert P. and Jan de Gijt (1990).
In this paper new data for the interwar period are presented. The distribution of value added over industries and a break-down of value added into components is given. Employment by industry is estimated as well. Moreover, structural changes during the interwar years and in the more recent past are juxtaposed.

NA/41 The supply of hidden labour in the Netherlands: a model, Kazemier, Brugt and Rob van Eck (1990).
This paper presents a model of the supply of hidden labour in the Netherlands. Model simulations show that the supply of hidden labour is not very sensitive to cyclical fluctuations. A tax exempt of 1500 guilders for second jobs and a higher probability of detection, however, may substantially decrease the magnitude of the hidden labour market.

NA/42 Benefits from productivity growth and the distribution of income, Keuning, Steven J. (1990).
This paper contains a discussion on the measurement of multifactor productivity and sketches a framework for analyzing the relation between productivity changes and changes in the average factor remuneration rate by industry. Subsequently, the effects on the average wage rate by labour category and the household primary income distribution are studied.

NA/43 Valuation principles in supply and use tables and in the sectoral accounts, Keuning, Steven J. (1991).
In many instances, the valuation of transactions in goods and services in the national accounts poses a problem. The main reason is that the price paid by the purchaser deviates from the price received by the producers. The paper discusses these problems and demonstrates that different valuations should be used in the supply and use tables and in the sectoral accounts.

NA/44 The choice of index number formulae and weights in the National Accounts. A sensitivity analysis based on macro-economic data for the interwar period, Bakker, Gert P. den (1991).
The sensitivity of growth estimates to variations in index number formulae and weighting procedures is discussed. The calculations concern the macro-economic variables for the interwar period in the Netherlands. It appears, that the use of different formulae and weights yields large differences in growth rates. Comparisons of Gross Domestic Product growth rates among countries are presently obscured by the use of different deflation methods. There exists an urgent need for standardization of deflation methods at the international level.

NA/45 Volume measurement of government output in the Netherlands; some alternatives, Kazemier, Brugt (1991).
This paper discusses three alternative methods for the measurement of the production volume of government. All methods yield almost similar results: the average annual increase in the last two decades of government labour productivity is about 0.7 percent per full-time worker equivalent. The implementation of either one of these methods would have led to circa 0.1 percentage points higher estimates of economic growth in the Netherlands.

NA/46 An environmental module and the complete system of national accounts, Boo, Abram J. De, Peter R. Bosch, Cor N. Gorter and Steven J. Keuning (1991).
A linkage between environmental data and the National Accounts is often limited to the production accounts. This paper argues that the consequences of economic actions on ecosystems and vice versa should be considered in terms of the complete System of National Accounts (SNA). One should begin with relating volume flows of environmental matter to the standard economic accounts. For this purpose, a so-called National Accounting Matrix including Environmental Accounts (NAMEA) is proposed. This is illustrated with an example.

NA/47 Deregulation and economic statistics: Europe 1992, Bos, Frits (1992).
The consequences of deregulation for economic statistics are discussed with a view to Europe 1992. In particular, the effects of the introduction of the Intrastat-system for statistics on international trade are investigated. It is argued that if the Statistical Offices of the EC-countries do not respond adequately, Europe 1992 will lead to a deterioration of economic statistics: they will become less reliable, less cost effective and less balanced.

NA/48 The history of national accounting, Bos, Frits (1992).
At present, the national accounts in most countries are compiled on the basis of concepts and classifications recommended in the 1968-United Nations guidelines. In this paper, we trace the historical roots of these guidelines (e.g. the work by King, Petty, Kuznets, Keynes, Leontief, Frisch, Tinbergen and Stone), compare the subsequent guidelines and discuss also alternative accounting systems like extended accounts and SAMs.

NA/49 Quality assessment of macroeconomic figures: The Dutch Quarterly Flash, Reininga, Ted, Gerrit Zijlmans and Ron Janssen (1992).
Since 1989-IV, the Dutch Central Bureau of Statistics has made preliminary estimates of quarterly macroeconomic figures at about 8 weeks after the end of the reference quarter. Since 1991-II, a preliminary or "Flash" estimate of GDP has been published. The decision to do so was based on a study comparing the Flash estimates and the regular Quarterly Accounts figures, which have a 17-week delay. This paper reports on a similar study with figures through 1991-III.

NA/50 Quality improvement of the Dutch Quarterly Flash: A Time Series Analysis of some Service Industries, Reininga, Ted and Gerrit Zijlmans (1992).
The Dutch Quarterly Flash (QF) is, just like the regular Quarterly Accounts (QA), a fully integrated statistic based on a quarterly updated input-output table. Not all short term statistics used to update the QA's IO-table are timely enough to be of use for the QF, so other sources have to be found or forecasts have to be made. In large parts of the service industry the latter is the only possibility. This paper reports on the use of econometric techniques (viz. series decomposition and ARIMA modelling) to improve the quality of the forecasts in five parts of the service industry.

NA/51 A Research and Development Module supplementing the National Accounts, Bos, Frits, Hugo Hollanders and Steven Keuning (1992).
This paper presents a national accounts framework fully tailored to a description of the role of Research and Development (R&D) in the national economy. The framework facilitates to draw macro-economic conclusions from all kinds of data on R&D (also micro-data and qualitative information). Figures presented in this way can serve as a data base for modelling the role of R&D in the national economy.

NA/52 The allocation of time in the Netherlands in the context of the SNA; a module, Kazemier, Brugt and Jeanet Exel (1992).
This paper presents a module on informal production, supplementing the National Accounts. Its purpose is to incorporate informal production into the concepts of the SNA. The relation between formal and informal production is shown in the framework of a Social Accounting Matrix (SAM). To avoid a controversial valuation of informal production, the module constists of two SAMs. One expressed in actual prices with informal labour valued zero, and one which expresses the embedded informal labour input measured in terms of hours worked.

NA/53 National Accounts and the environment: the case for a system's approach, Keuning, Steven J. (1992).
The present set of main economic indicators should be extended with one or a few indicators on the state of the environment. This paper lists various reasons why a so-called Green Domestic Product is not suitable for this purpose. Instead, a system's approach should be followed. A National Accounting Matrix including Environmental Accounts (NAMEA) is presented and the way to derive one or more separate indicators on the environment from this information system is outlined.

NA/54 How to treat multi-regional units and the extra-territorial region in the Regional Accounts?, De Vet, Bas (1992).
This paper discusses the regionalization of production and capital formation by multi-regional kind-of-activity units. It also examines the circumstances in which a unit may be said to have a local kind-of-activity unit in the extra-territorial region and what should be attributed to this "region".

NA/55 A historical Social Accounting Matrix for the Netherlands (1938), Den Bakker, Gert P., Jan de Gijt and Steven J. Keuning (1992).
This paper presents a Social Accounting Matrix (SAM) for the Netherlands in 1938, including related, non-monetary tables on demographic characteristics, employment, etc. The distribution of income and expenditure among household subgroups in the 1938 SAM is compared with concomittant data for 1987.

NA/56 Origin and development of the Dutch National Accounts, Den Bakker, Gert P. (1992).
This paper describes the history of national accounting in the Netherlands. After two early estimates in the beginning of the nineteenth century, modern national accounting started in the 1930s on behalf of the Tinbergen model for the Dutch economy. The development spurred up after World War II to provide data to the government for economic planning purposes. In the 1980s, the development was towards a flexible and institutional approach.

NA/57 Compiling Dutch Gross National Product (GNP); summary report on the final estimates after the revision in 1992, Bos, Frits (1992).
This summary report describes the sources and methods used for compiling the final estimate of Dutch Gross National Product after the revision of the Dutch National Accounts in 1992. Attention is focused on the estimation procedures for 1988. A more extensive report is also available.

NA/58 The 1987 revision of the Netherlands' National Accounts, Van den Bos, C and P.G. Al (1994).
The 1987 revision that was completed in 1992 has improved the Dutch National Accounts in three ways. First, new and other data sources have been used, like Production statistics of service industries, the Budget Survey and Statistics on fixed capital formation. Secondly, the integration process has been improved by the use of detailed make- and use-tables instead of more aggregate input-output tables. Thirdly, several changes in bookkeeping conventions have been introduced, like a net instead of a gross registration of processing to order.

NA/59 A National Accounting Matrix for the Netherlands, Keuning, Steven and Jan de Gijt (1992).
Currently, the national accounts typically use two formats for presentation: matrices for the Input-Output tables and T-accounts for the transactions of institutional sectors. This paper demonstrates that presently available national accounts can easily be transformed into a National Accounting Matrix (NAM). This may improve both the transparency and analytic usefulness of the complete set of accounts.

NA/60 Integrated indicators in a National Accounting Matrix including environmental accounts (NAMEA); an application to the Netherlands, De Haan, Mark, Steven Keuning and Peter Bosch (1993).
In this paper, environmental indicators are integrated into a National Accounting Matrix including Environmental Accounts (NAMEA) and are put on a par with the major aggregates in the national accounts, like National Income. The environmental indicators reflect the goals of the environmental policy of the Dutch government. Concrete figures are presented for 1989. The NAMEA is optimally suited as a data base for modelling the interaction between the national economy and the environment.

NA/61 Standard national accounting concepts, economic theory and data compilation issues; on constancy and change in the United Nations-Manuals on national accounting (1947, 1953, 1968 and 1993), Bos, Frits (1993).
In this paper, the four successive guidelines of the United Nations on national accounting are discussed in view of economic theory (Keynesian analysis, welfare, Hicksian income, input-output analysis, etc.) and data compilation issues (e.g. the link with concepts in administrative data sources). The new guidelines of the EC should complement those of the UN and be simpler and more cost-efficient. It should define a balanced set of operational concepts and tables that is attainable for most EC countries within 5 years.

NA/62 Revision of the 1987 Dutch agricultural accounts, Pauli, Peter and Nico van Stokrom (1994).
During the recent revision of the Dutch national accounts, new agricultural accounts have been compiled for the Netherlands. This paper presents the major methodological and practical improvements and results for 1987, the base year for this revision. In addition, this paper demonstrates that a linkage can be established between the E.C. agricultural accounting system and the agricultural part of the standard national accounts.

NA/63 Implementing the revised SNA in the Dutch National Accounts, Bos, Frits (1993).
This paper discusses the implementation of the new United Nations guidelines on national accounting (SNA) in the Netherlands. The changes in basic concepts and classifications in the SNA will be implemented during the forthcoming revision. The changes in scope will be introduced gradually. Important changes scheduled for the near future are the incorporation of balance sheets, an environmental module and a Social Accounting Matrix.

NA/64 Damage and insurance compensations in the SNA, the business accounts and the Dutch national accounts, Baris, Willem (1993).
This paper describes the recording of damages to inventories and produced fixed assets in general, including damages as a result of legal product liability and of the liability for damage to the environment. In this regard, the 1993 System of National Accounts and the practice of business accounting are compared with the Dutch national accounts.

NA/65 Analyzing economic growth: a description of the basic data available for the Netherlands and an application, Van Leeuwen, George, Hendrie van der Hoeven and Gerrit Zijlmans (1994).
This paper describes the STAN project of the OECD and the Dutch national accounts data supplied to the STAN database, which is designed for a structural analysis of the role of technology in economic performance. Following an OECD analysis for other industrial countries, the importance of international trade for a small open economy such as the Netherlands is investigated. The STAN database is also available on floppy disk at the costs of DFL. 25, an can be ordered by returning the order form below (Please mention: STAN floppy disk).

NA/66 Comparability of the sector General Government in the National Accounts, a case study for the Netherlands and Germany, Streppel, Irene and Dick Van Tongeren (1994).
This paper questions the international comparability of data concerning the sector General Government in the National Accounts. Two differences are distinguished: differences due to lack of compliance with international guidelines and institutional differences. Adjustments to National Accounts data are reflected in a separate module which comparises Germany versus The Netherlands. The module shows that total General Government resources as well as uses are substantially higher in the Netherlands.

NA/67 What would Net Domestic Product have been in an environmentally sustainable economy?, Preliminary views and results, De Boer, Bart, Mark de Haan and Monique Voogt (1994).
Sustainable use of the environment is a pattern of use that can last forever, at least in theory. This pattern is likely to render a lower net domestic product than the present economy. The coherence between reductions in pressure on the environment and changes in net domestic product is investigated with the help of a simple multiplier model. This model is based on a National Accounting Matrix including Environmental Accounts (NAMEA).

NA/68 A Social Accounting Matrix for the Netherlands, conceptual issues and results, (forthcoming) Timmerman, Jolanda (1994).
In this paper a Social Accounting Matrix (SAM) for the Netherlands is presented. Two years are covered: 1988 and 1990. The SAMs integrate statistics on the distribution of income, and consumption expenditure among various household groups in a national accounts framework. Simultaniously, labour income and employment are disaggregated into several labour categories.

NA/69 Analyzing relative factor inputs of Dutch exports: An application of the 1990 Social Accounting Matrix for the Netherlands (forthcoming), Reininga, Ted (1994).
In this paper the validity of neoclassical trade theory for explaining Dutch international trade patterns is studied. The analysis is carried out with the use of a Social Accounting Matrix for The Netherlands. This study corroborates the outcome of other recent analysis in this field: classical trade theory offers a better starting-point to understand Dutch trade patterns than neoclassical trade theory. Moreover, these recent studies point to the increasing relevance of insights derived from modern trade theory. The results presented here seem to support this point of view.

NA/70 SESAME for the evaluation of economic development and social change, Keuning, Steven J. (1994).
This paper elaborates on the concept of a System of Economic and Social Accounting Matrices and Extensions, or SESAME for short. The SESAME-concept serves to meet the criticism that conventional national accounts take a too limited view at social, environmental and economic development. SESAME details the monetary accounts and couples non-monetary information in an integral system approach. SESAME is meant as a synthesis of national accounts and the social indicators approach.

NA/71 New revision policies for the Dutch National Accounts, Den Bakker, Gert P., Jan de Gijt and Robert A.M. van Rooijen (1994).
This paper presents the (new) revision policy for the Dutch National Accounts. In the past, several major revisions of national accounting data have been carried out in the Netherlands. In the course of time, the policy has changed several times. Recently, the aim has become to publish relatively long time-series shortly after the publication of the revised benchmark year data.

NA/72 Labour force data in a National Accounting framework, Den Bakker, Gert P. and Jan de Gijt (1994).
This paper deals with the Dutch interwar labour force data. Starting with census data the estimation of the working and non-working labour force by industry and by occupational type is described and the results are discussed. The data have been estimated within the national accounts framework. It is the first time that labour market figures at a meso-level have been estimated which are linked to other national accounting figures.

Statistics Netherlands
National Accounts
Occasional Papers

Please send me the following paper(s): .....

..... (For each copy DFL. 20 will be incurred as a contribution to the costs).

Name: .....

Address: .....

Country: ..... Organization:.....

Return to: Statistics Netherlands, National Accounts
P.O. Box 959, 2270 AZ Voorburg
The Netherlands
