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WHAT WOULD NET DOMESTIC PRODUCT HAVE BEEN IN AN ENVIRONMENTALLY SUSTAINABLE ECONOMY ?

PRELIMINARY VIEWS AND RESULTS *

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Abstract

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, which is may not be sustainable. Other economic variables like government expenditures, investments and exports will then also be affected. These phenomena are here investigated through simulations with a simple multiplier model describing the effects a of relocation of industry outputs on environmental burdens and on the economy. This model is based on a National Accounting Matrix including Environmental Accounts (NAMEA). Preliminary results are presented for different kinds of environmental protection regimes. In addition, a further development of the model is outlined, including an extension with technical environmental protection measures and the incorporation of more realistic model assumptions.

Contents

1. Indicating economic performance and environmental losses

National income is often used as the sole indicator for a society's economic success. The increasing scarcity of available possibilities to use the environment, commonly known as environmental functions, is hardly reflected in the national income concept.

Hueting et al. (1992) propose to calculate a Sustainable National Income, an indicator that takes into account the increasing scarcity of environmental functions. In their opinion, the valuation of environmental functions must be based on society's preferences for sustainability and the maintainance costs which are used to express the supply of environmental functions.

The methodological difficulties that appeared during the further development of this indicator motivated us to follow an alternative approach. The result of this *modeling* approach, a Net Domestic Product in an Environmentally Sustainable Economy (NESE), is presented in this paper. Arguments in favour of this approach are also provided by Keuning (1993).

2. Sustainable use of the environment

Loss of environmental functions amounts to a deterioration of the physical, chemical and biological state of the environment. This is the result of an increased pressure on the environment caused by human behaviour. When species or unique ecosystems disappear, these losses can not be restored. Compensation, i.e. the re-building of environmental functions is often not possible because of the uniqueness of these functions. It may be possible to stop a further deterioration of the environment, but only when the pressure on the environment is reduced to a certain level and the environmental quality is correspondingly increased. At these levels, commonly known as sustainability standards, regeneration processes within ecosystems are able to deal with human pressure without the disappearance of environmental functions. These standards can only be assessed under conditions of uncertainty. Economic activities that comply with such conditional sustainability standards can therefore be expected to use the environment in a sustainable way.

Sustainable use of the environment is recognized by the Dutch Government as a policy goal (Tweede Kamer, 1990-1991). It may thus be assumed that this decision reflects a societal preference. One can then roughly assume that sustainable development implies a sustainable use of the environment. Sustainability standards may be translated economically into a complete inelastic demand for environmental functions (Hueting et al., 1992).

An alternative rationale for the use of sustainability standards also starts from their relevance to the policy goal mentioned above. Achieving the standards probably has profound effects on the economy and other aspects of society and this effects other policy goals. Simulation of these effects can elucidate public discussion and political decision-making on environmental issues. This approach is specially expedient when the model is run for different values of the exogenous sustainability standards so as to demonstrate the interdependence of policy goals.

A reduction of environmental pressure is possible by technical adjustments of production and consumption processes or by shifts from environmentally burdening processes to more environmentally sound ones. Technical measures can vary from "end of pipe" measures to the use of cleaner inputs and process integrated measures.

3. General choices in modeling a NESE

3.1 Comparative static analysis

The outcome of our model should answer the following question:

What maximum net domestic product (NDP) is generated in an economy in which the burden on the environment is reduced to a sustainable level and which has re-entered an equilibrium state.

The period of transition is not reflected in our model. The social efforts accompanying the transition to the state of sustainability are not taken into account either. Many difficulties such as time preferences and the financing of changes in capital stocks are left out. The results of a dynamic model would be influenced by many more uncertainties, given the current state of knowledge. A major problem occurring in a dynamic model is that the length of the transition period may influence the level of NDP, both during the transition and in the final equilibrium state. Therefore we will narrow our view to a comparative static analysis.

The differences between model results and the actual state of the economy should only be the outcome of measures implemented to reduce environmental burdens ceteris paribus all other exogenous variables in our model. An important aspect in the formulation of the model is which variables should be taken as exogenous.

The environmental protection measures proposed in our model should be based on current technical knowledge. Our simulated sustainable world is therefore hypothetical in the sense that it will never be achieved. The state of knowledge and available technical measures will most probably be influenced by the proposed changes in the economy during the period of transition.

For a comparison in real terms with actual national income, calculated national income in a sustainable situation should be expressed in prices of the reference year.

A consequence of working with a static model is that costs of clean-up actions are not taken into account, because they are supposed to take place during the period of transition. Our calculation is confined to changes in flows (e.g.environmental pressure), so it does not consider changes in stocks, like clean-up actions.

3.2 Interpretation of the indicator

The environmental protection measures cause simultaneous changes in output volumes, output prices and generated value added. The decrease in net domestic product, i.e. the difference between NDP and the NESE, may be interpreted as the hypothetical social costs of the implementation of measures to reduce environmental burdens. The NESE itself is an indicator of net production or expenditure, from which the mentioned social costs are subtracted. This interpretation of the NESE comes close to the intentions of Hueting et al. (1992).

3.3 Level of aggregation

The major purpose of the model is to estimate the changes in commodity flows and prices resulting from the implementation of measures to reduce the environment burden. Production is expected to shift to activities which provide the economy with the inputs needed to achieve a sustainable situation and to activities that are less burdening to the environment. Concomitant changes in intermediate use will lead to a general adjustment of the economy. These changes can only be modeled if the model provides for a sufficient level of detail. The proper level of detail is a matter of practice. In this respect, our first modeling exercise is based on the National Accounting Matrix including Environmental Accounts (NAMEA); see De Haan et al. (1993).

4. The NAMEA

In table 1, an aggregated NAMEA is presented which gives an overview of all the macro indicators in the NAMEA. These indicators reflect the Dutch economy and various environmental variables in 1989. Accounts 1 to 8 are in billions of guilders and for each account the receipts are presented in the rows and outlays are presented in the columns. For each account, total outlays equal total receipts. This part of the matrix is based on the National Accounts Matrix published in the Dutch National Accounts (CBS, 1992). It reflects the goods and services account, the production account, the income generation, distribution and use accounts, the capital account, the financial balance and a rest of the world account. In account 2, the consumption of households is presented separately in order to connect these expenditures with the pollution that is caused by consumption activities. The balancing items of accounts 3 - 6 and 8a are the following: net domestic product, net generated income, net saving, net lending from the rest of the world and the deficit on the current account of the balance of payments.

Because the accounts related to the environment only reflect un priced quantities, these accounts do not influence the monetary column and row totals of accounts 1 - 8. This aspect is emphasized by placing the figures in accounts 9 - 11 in slightly different positions. The row sums of the environmental accounts also correspond with the totals in the columns.

Account 9 contains ten environmentally burdening substances. The columns reflect the origin of the substances, the destination is reflected in the rows. Consumers' pollution is presented in sub-matrix (2,9). In the row of the production account, total output is extended with the production of pollutants (3,9). The total domestic supply of pollution is reflected in these two sub-matrices. Trans-boundary pollution is presented in the rest of the world account. Vector (8a,9) reflects the imports of pollutants and vector (9,8a) the exports.

Table 1. A NAMEA illustrated for the Netherlands, 1989 (account 1 - 8 in billion guilders)

ACCOUNT (Classification)	Goods & Services (Prod. Groups) 1	Consumption (Purposes) 2	Production (Production Activities) 3	Income Generation (Prim.Inp.Cat.) 4	Income Distribution and Use (Nat. Sectors) 5	Capital 6	Rest of the World Current 8a	Rest of the World Capital 8b	Emissions (in million kg, CFCs and halons in 1000 kg) CO2 9a	N2O 9b	CH4 9c	CFCs & Halons 9d	NOx 9e	SO2 9f	NH3 9g	P 9h	N 9i	Waste 9j	Themes Greenhouse 10a	Ozone Depl. 10b	Acidificat. 10c	Eutrphic. 10d	Waste 10e	Depositions Acidification PAE 11	TOTAL
Goods & Services (Product Groups) 1	Trade and Trans.Margins 0.00	Household Consumpt. 284.49	Intermediate Consumption 460.19		Government Consumption 71.77	Gross Capital Formation 108.54	Exports 267.68																		Commodity Use 1192.66
Consumption (Purposes) 2					Household Consumption 284.49				'Free' Emissions, Consumption 32133	2	13	3157	151	4	10	13	103	7226							Consumption Use 284.49
Production (Production Activities) 3	Output (basic prices) 903.81								'Free' Emissions, Production 125886	31	557	12626	425	207	238	153	1213	18239							Output (basic prices) 903.81
Income Generation (Primary Input Categories) 4			NDP (basic prices) 388.74				Wages from ROW 1.12																		Generated Income 389.86
Income Distribution and Use (National Sectors) 5	Product Taxes - Subsidies 40.09			NGI (market prices) 388.59	Property Income, Current Transfers 948.43	Net Investment Taxes 0.97	Property Inc& Transf.fr.ROW 60.33																		Current Income 1438.41
Capital 6			Consumption of Fixed Capital 54.88		Net Saving 71.54	Capital Transfers 86.01		Cap.Transfers fr. ROW 0.93																	Fin.of Gross Worth Accum. 213.36
Financial Balance 7						Net Lending from ROW 15.62		Net Lending to ROW -15.62																	Financial Balance 0.00
Rest of the World (ROW) Current 8a	Imports 248.76			Wages to ROW 1.26	Property Income, Transfers to ROW 62.19				'Free' Emissions from ROW				109	101	24	a)	a)	-							Current Payments to ROW 312.21
Capital 8b						Capital Transfers to ROW 2.22	Bal. Payments Curr.Acc.Def -16.91																		Capital Payments to ROW -14.69
Emissions (in mln kg, CFCs and halons in 1000 kg)			Incineration				'Free' Emission to ROW												Allocation to Themes						Absorption of Emissions
CO2 9a																			158019						158019
N2O 9b																			33						33
CH4 9c																			570						570
CFCs and Halons 9d																				15783					15783
NOx 9e							504														181				685
SO2 9f							166														146				312
NH3 9g							146														126				272
P 9h							a)															166			166
N 9i							a)															1316			1316
Waste 9j			10728				-																14737		25465
Themes						Emission-Indicators																		Depositions	Stress Equivalents
Greenhouse Effect (GWP) 10a						1.02																			173199
Ozone Depletion (ODP) 10b						1.56																			12451
Acidification (PAE) 10c																								15918	15918
Eutrophication (PEE) 10d						2.83																			298
Waste Production (KG) 10e						2.94																			14737
Deposition Account Acidification (PAE) 11						Deposition Indicator 1.95																			Depositions 15918
TOTAL	Commodity Supply (market prices) 1192.66	Household Consumption 284.49	Input (basic prices) 903.81	Allocation of Generated Income 389.86	Current Outlays 1438.41	Gross Worth Accumulation 213.36	Current Receipts from ROW 312.21	Capital Receipts from ROW -14.69	Supply of Emissions 158019	33	570	15783	685	312	272	166	1316	25465	Stress Equivalent Conversions 173199	12451	15918	298	14737	Depositions 15918	

a) These data are available but not recorded in the NAMEA because the concomitant policy objectives have been formulated for emissions and not for depositions

-: Data are not available

In theory, a presentation of the relation between environmental pressure and changes in environmental quality is possible in a NAMEA framework. Here this relationship is operationalised by using the concept of environmental themes (Adriaanse, 1989). Several themes are presented in account 10: the greenhouse effect, depletion of the ozone layer, acidification, eutrophication and the accumulation of waste. Other environmental problems like the accumulation of toxic substances in the environment, nuisance from stench and noise, extensive use of natural resources and space are not (yet) presented. In sub-matrix (9,10) agents are clustered per theme, i.e. column-wise. With the help of so-called theme-related environmental stress equivalents, different agents are weighted and then aggregated column-wise by theme. This weighted summation is reflected in the column totals of account 10. Five theme-related environmental indicators are presented in the column of the capital account, in vector (10-11,6). These indicators relate current burdens on the environment to the policy targets formulated for the year 2000. For most themes only domestic environmental pressure is reflected in the indicator value. For acidification also trans-boundary flows are taken into account. As depositions are more closely related to actual changes in the environment, they are presented in a separate account (11). The waste-indicator is only reflecting the amount of waste disposed at dumping sites. The amount of waste which is incinerated is re-routed into the economy (cell 9j,3). The emission of pollutants that coincides with this incineration is included in sub-matrix (3,9).

5. The model

Because of its internal coherence, NAMEA is a suitable data system for modeling analyses. These can range from 'quick and dirty' experiments to advanced general equilibrium model simulations. As a first approach we adopted a model in which a shift to more environmentally friendly technologies is not incorporated.This quick analysis relies completely on a relocation of production and consumption activities using the existing technology.

The analysis is based on an extended input-output model, constructed by converting not only the production account but also a major part of the accounting system of the NAMEA as well into a coefficient matrix (see also Keuning and Thorbecke, 1992). Each coefficient is calculated by expressing the corresponding outlay as a fixed proportion of the total outlays in each column. The model is largely supply driven, that is, final expenditure adjusts, to a degree, to reductions in output. These adjustments concern gross capital formation (investments), government expenditures and exports, as well as intermediate input, albeit indirectly. Consumption expenditures of households are determined as a function of net generated income. This means that changing incomes do not influence the allocation of household consumption expenditures over commodities. In the model two domestic categories of polluters are defined, consumers and producers. Pollutants are described in physical units only.

Given a number of constraints, the model considers which production or consumption activities should reduce their pollution. This problem is formulated as an optimisation of a single policy target, NDP. Other targets are inserted by way of inequality constraints. In this respect, the condition that environmental burdens do not exceed their maximum allowable levels is particularly important. These restrictions may be sustainability standards and can in any case be regarded as emission rights which are optimally allocated in the model, given the objective function. The equations of the extended input-output model are of course included as equality constraints. They safeguard the adjustment of all other connected activities (buyers, sellers), when a certain change in an account is made. All restrictions are linear; the problem can therefore be solved with the aid of linear programming.

Figure 1 presents the reformulation of the NAMEA into a model format and defines various relevant symbols.

Figure 1. Partitioning of the NAMEA into the model format.

		goods and services	consump-tion	produc-tion	income genera-tion	income distrib. and use	other	total	pollu-tants
		1	2	3	4	5a-5c	5d,6,8		9
goods and services	1								
consumption	2								
production	3			Do			Fo	Zo	Ro
inc. generat.	4								
inc. distrib. and use	5								
other				Wo'			to	Zto	Go'
total				Zo'			Zto'		To'

The numbers correspond to the accounts in the NAMEA. An accent denotes a transpose, a subscript o the original data from the NAMEA (observed situation). In account 5 the government is excluded. Government expenditures are included in F_o. The sub-matrices in figure 1 are modeled as follows:

D : The elements of this matrix are determined as a fixed proportion of the concomitant column totals Z_o (n*n). This matrix contains all sub-matrices of account 1 to 5c.

F : The elements of this vector adjust to reductions from the supply-side (n*1).

W : The elements of this vector are determined in the model as a fixed proportion of the concomitant column totals Z (n*1).

t : Total of transactions not relevant to the model.

R : Matrix of domestically generated pollutants (n*p)

G : Vector of foreign pollutants accumulating in the Netherlands (1*p). This pollution is exogenous to the model. This also applies to exports of Dutch pollutants.

Z : Vector of column totals of accounts 1 to 5c (n*1).

Zt : Column totals of accounts 5d, 6 and 8.

T : Vector of total environmental pressures in the Netherlands (p*1).

Now the model equations can be specified. The base year values, indicated by a subscript o, are obviously exogenous. Other exogenous variables will be denoted by a bar. The objective function is the Net Domestic Product Y, i.e., the sum of the corresponding elements in sub-matrix (4,3). These elements are determined for each primary income category f and production activity j as functions of the output vector Z:

$$\max_{Z} \quad Y = \sum_{f}\sum_{j} a_{fj}Z_j, \quad a_{fj} \in \text{sub-matrix } (4,3) \text{ of } A \tag{1}$$

A is the coefficient matrix:

$$A = D_o\hat{Z}_o^{-1} \tag{2}$$

in which $\hat{Z}$ is the diagonal matrix of Z. In accordance with input-output practice, the model contains the following equality restriction:

$$F = (I-A)Z \tag{3}$$

where I is the unity matrix. The total domestic production of pollutants $R'i$ is determined in the model as a linear function of column totals of consumption and production activities. Pollution per unit of activity is obtained from the base-year NAMEA in the following manner:

$$R' = B\hat{Z} \tag{4}$$

where B is the matrix of emission coefficients:

$$B = R'_o\hat{Z}_o^{-1} \tag{5}$$

The domestic production of pollutants is restricted in the model by given maximum allowable levels:

$$b = BZ \leq \bar{b}_{max} = (R'i)_{max} \tag{6}$$

The elements of F which correspond to the rows of accounts 2 and 3 are kept empty during the optimisation,because they do not have an economic interpretation. The same holds for the commodity hotel, restaurant and repair services. Income transfers received from abroad are kept constant:

$$F_{2,3} = 0 \tag{7}$$

$$F_{1\ \text{hotels etc.}} = 0 \tag{8}$$

$$F_{4,5} = F_{o4,5} \tag{9}$$

The sustainability of the economy is not only determined by a maximum level of environmental burdens but also by a miminum level of government expenditures (provision of collective goods), investments (as a source of future sustainable production possibilities) and exports. Therefore, the elements of F which are related to exports, investments and government expenditures are constrained to a minimum acceptable level:

$$F_1 \geq \bar{c}F_{o1}, \quad 0 < \bar{c} \leq 1 \tag{10}$$

The value of c can be varied in sensitivity analyses. Another constraint concerns the balance of trade. This is operationalised here as a restriction that total imports are not allowed to exceed total exports. Exports are determined as fixed proportions of the corresponding commodity totals in vector F. The sum of exports is calculated as:

$$E = \sum_{i=1}^{m} E_i = \sum_{i=1}^{m} \phi_i F_i = \phi' F \tag{11}$$

where ϕ is defined by

$$\phi_i = E_{oi}/F_{oi} \quad \text{for every i with } F_{oi} \neq 0$$

$$\phi_i = 0, \text{ else} \tag{12}$$

and

$$\phi = [\phi_1, \phi_2, \ldots, \phi_m] \tag{13}$$

The imports per product group are determined as fixed proportions of the corresponding elements of Z, so total import amounts to:

$$M = \sum_{i=1}^{m} M_i = \sum_{i=1}^{m} \alpha_i Z_i = \alpha' Z \tag{14}$$

where

$$\alpha = \hat{Z}_o^{-1} M_o \tag{15}$$

With the aid of equations (11)-(15) the restriction on the balance of trade can be expressed as:

$$\alpha' Z \leq \phi' F \tag{16}$$

6. Simulations

For a first test of the model's performance we have imposed small restrictions on the emissions of individual pollutants. A 5% reduction of all emissions causes a remarkable decrease in generated value added in most production activities. An 8% decrease of value added occurs in chemical and basic metal industries. With the exception of construction, all production activities are reduced more than the emissions; the result is a 6.6% drop in NDP.

Table 2. The calculated change in Net Value Added and consumption expenditures as a result of pollution reductions of 1% and 5% per environmental theme.*

	Net Value Added in 1989		Private Consumption in 1989		1%-reduction Net Value Added	1%-reduction Consumption.	5%-reduction Net Value Added	5%-reduction Conumption
	Billion guilders	%	Billion guilders	%	procentual change			
Production activities								
Agriculture	15.51	4			-3.8		-6.3	
Refineries	1.23	0			-4.2		-6.7	
Chemical Industries	13.54	3			-5.1		-7.3	
Basic Metals	3.48	1			-5.0		-7.3	
Other Manufacturing	61.45	16			-3.1		-6.2	
Electricity Generation	2.51	1			0.5		-4.7	
Construction	24.41	6			2.9		-3.1	
Transport	18.99	5			-2.8		-6.3	
Services and Other activities	247.61	64			3.9		-3.3	
Total	388.74	100			1.7		-4.2	
Consumption purposes								
Transport			18.01	6		0.9		-3.0
Other purposes			266.48	94		1.1		-2.8
Total			284.49	100		1.1		-2.8

* The C-value is in both simulations equal to 0.9.

Next, all pollutants were linearly converted into theme-equivalents that express total environmental pressure per environmental theme. In these simulations, pollution restrictions were reformulated per environmental theme. The optimum NDP typically exceeds the optimum of the model with equal restrictions on all individual pollutants. This is possible because a 5% reduction of pollution for each theme does not necessarily lead to a 5% reduction of each pollutant contributing to that theme. Table 2 shows that a 5% reduction in the environmental burden for all themes leads to a 4.2% NDP decrease. This is a major improvement compared to the 6.6% decrease calculated earlier. The allocation of pollution permits would thus be improved if permits were formulated per environmental theme. A restriction on pollution of 1% leads in this way even to a 1.7% increase in NDP.

The changes in value added over industries and the changes in consumption purposes show a remarkable pattern. While services and other industries generate an increase in net value added by 3.9%, chemical industries' value added is reduced by 5.1%. In spite of a very high pollution-value added ratio for some pollutants (CO_2, NO_x and SO_2), electricity generation increases its' value added by 0.5% in the 1% reduction scenario. This outcome reflects the major importance of electricity generation in an economy. In the 5% reduction scenario, value added is reduced in all production activities.

A restriction on total dumped wastes leads to an increase of services value added, according to the model. This is because waste incineration is part of the production activity "services" and influences the waste emission coefficient of this production activity to a large extent. Because of the processing of waste by incineration, the net waste emission coefficient for services is even negative. The model assumes a proportional relation between emission and value added, and thus calculates a relatively large increase of value added in the activity services per unit expansion of waste incineration output. The model can be improved by separating waste incineration from other services. However, in any case the removal of waste will generate employment and will therefore also contribute to NDP. Obviously, the level of the incineration activity also effects the levels of emissions of (air) pollutants attached to it.

In the first National Environmental Policy Plan for the Netherlands, goals are stated for the year 2000. These goals are formulated as maximum allowable burdens per environmental theme. Some of them are used in the model in order to calculate possible effects of reaching these targets on the economy. The same goals are used in NAMEA for the construction of the environmental indicators (Table 1). Though the model will most probably not give very realistic results, it provides the orders of magnitude when calculating a hypothetical national income under severe restrictions to the environmental pressure. In these simulations, the effects of technical environmental protection measures are not taken into account. The model directly starts with a reduction of the environmentally most burdensome production and consumption activities.

The results of the simulations show a relatively small reduction of NDP when only the standard for the greenhouse effect must be met. This is caused by the modest emission target for this theme in the year 2000, as can be deduced from the low corresponding indicator value. If all standards had to be implemented simultaneously, the resulting NDP would be significantly reduced in this model. However, this also leads to quite implausible levels of government expenditures, exports and investment. So a mere relocation of production among industries is unlikely to be sustainable. In any case, the model is too premature to justify any firm conclusion.

7. Improving the model

The simple model discussed above reduces the environmental burden by shrinking environmentally damaging activities and occasionally increasing more environmentally friendly activities (e.g. waste incineration). Further, the model does not distinguish price changes from volume changes, and it is linear. The reliability of the results is very limited. A number of stepwise improvements is proposed in the sequel.

7.1 Step 1: incorporation of technical measures

Today, more and more data on the cost-effectiveness of various technical measures to eliminate environmental burdens become available (see for instance Blok et al. 1990). These measures range from "end of pipe" solutions to improvements of production processes and substitution of environmentally burdening goods by less burdening ones. Many measures have been proposed, usually specified by type of environmental burden and economic activity. Data for such measures are typically confined to feasible reductions of the burden from the activity and the costs involved. A problem is that in the literature it is often not specified which industries supply these technologies. However, Statistics Netherlands has access to supply and use tables on the entire production structure which may enable us to fill in the gaps.

With these limitations in mind, it seems appropriate to describe each possible measure as a new product in the supply and use system. The suppliers of the measures may be classified as members of either existing industries or new ones. The model should then assess the most cost-effective combination of measures to reach the environmental pressure targets. A disadvantage of this approach is the large number of products and the possibly large number of activities to be incorporated in the model.

If existing knowledge appears to be insufficient to supply the data needed, or if products and producers reach impracticable numbers, a solution may be found in a grouping of similar measures.

Technical measures cause changes of product flows and prices. Like the simple model, the extended model calculates the effects of the measures being implemented on product flows throughout the economy, keeping track of deliveries by intermediate suppliers and demands of intermediate buyers.

The extended model should compute new prices of products as the sum of their original prices and the costs of the measures employed per unit of output. This process is repeated for all production activities.

Higher product prices will reduce the volume of net domestic product, ceteris paribus. On the other hand, the production of environmental protection devices will increase output and NDP. The point is that the proposed model calculates an equilibrium in which enough technical environmental protection measures and "production shift measures" have been taken to arrive at the (sustainability) standards for the environmental burdens. In the first instance, the optimisation can still be restrained to a form of linear programming, eventually affecting all flows, prices, values and 'volumes' of goods and services. This amounts to assuming unit elasticities throughout the system. Corresponding to the values and volumes of product flows, the model calculates the nominal and real values of the net domestic product in the new (sustainable) situation. With the latter, a real change of NDP relative to the original situation can be computed.

7.2 Step 2: improving the representation of producer behaviour

Linear "Leontief" production functions may not be adequate when major changes in production result from the model. Producers expanding their outputs could be confronted with diminishing marginal productivities in reality, and shrinking firms may experience increasing marginal productivities. This effect can be simulated by using appropriate non-linear production functions for the relevant industries. Intermediate supplies, capital and labour are the arguments in these functions.

However, not enough data may be available for the estimation of these functions. Therefore we suggest to test the feasibility of several approximations in practice. For instance, log-linear (Cobb-Douglas type) production functions could be used if the relative marginal productivities are assumed to be constant. In that case data for the Dutch economy are available from the so-called "Keller model" (Zeelenberg et al., 1991).

7.3 Step 3: improving the representation of consumer behaviour

In order to improve the realism of the model, consumer behaviour should also be described in a non-linear way. Zeelenberg et al. (1991) show how a social welfare function can be defined for a number of characteristic consumer groups, including the government. They confine themselves to the use of a linearised welfare function for relative changes of the product quantities. Doing so may be interpreted as using a log-linear welfare function.

The welfare function describes society's preferences for environmental functions in the year of investigation, as far as they are reflected in the consumption of final products. Environmental functions, being collective goods, could be incorporated in the welfare function as arguments, at least in theory. It is generally even more difficult to derive "ex ante" demand functions from this augmented welfare function, as environmental functions have no market prices.

We propose to avoid these problems by using standards for (sustainable) environmental burdens instead of a welfare function, just as in our simple model. Running the extended model with various values for the standards can give additional insight into the model's results.

8. Conclusions and recommendations

Even the very simple model presented amplifies the importance of using a consistent framework for the analysis of relations between the environment and the economy. The model indicates that a sustainable use of the environment can only be achieved by a substantial decrease of the net domestic product. This coincides with a corresponding drop in final demand. Reduction of environmentally burdening production and consumption thus needs to be weighted politically against environmental, economic and other goals. Consequences on income distribution and employment are important as well, but are not yet computed in the present model. These aspects can be related to the NAMEA and thus be included in the model as the Social Accounting Matrix for the Netherlands becomes available (cf. Keuning, 1994).

The model uses a static approach to describe the relations between the flow variables. The consequence is that stock variables like capital stocks or debts are not included, and that time does not play a role in the model. The simulation refers to the year of investigation. The observed reference situation is the economy in this year, and the simulated environmentally sustainable economy is assumed to be feasible in the same year using the same technological knowledge. In practice, attaining sustainability would take a considerable number of years. This already illustrates that the simulated situation is hypothetical; yet a situation depicted with a realistic static model could have existed if history had taken another course.

Linear programming forces the model to select the most cost-effective measures. The resulting shadow prices represent the social costs of one extra unit reduction of an environmental burden. Double counting of measures is automatically avoided. The outcomes can be regarded as the effects of the abatement of environmental degradation on the entire economy. For, when the environmental burden is abated in some industries, the repercussions for other actors like buyers and suppliers are incorporated in the model solution.

The simple model might give a first impression of the intended sustainability indicator, the Net Domestic Product in an Environmentally

Sustainable Economy (NESE). As expected, NDP decreases when the standards for burdening are made more restrictive. Besides, the model demonstrates that reduction of a particular type of environmental burden reduces the possibilities to deal with other environmental problems.

The serious limitations of the presented preliminary model necessitate a careful interpretation of the results. The linear approximation seems to be appropriate for the description of small changes only. Large scale interventions in the economy inevitably lead to price effects which have not yet been specified in the model. The imposed restrictions to environmental burdens do not evoke anticipation by consumers and producers in the simple model. Producers do not look for alternative production methods rendering better opportunities to profit under the stringent environmental policy. They continue to use the production methods that were efficient when no restrictions were imposed. The pressure on the environment can therefore only be reduced by cutting output. In this respect the simple model is restrained to the most pessimistic scenario, where there is no question of any technological changes.

Recommendations intended to overcome these difficulties have been proposed in paragraph 7. The formulation of producer behaviour has to be extended with choices of technical measures for the reduction of environmental burdens. Moreover, the linear description of production has to be abandoned. The production of technical measures and other specialised forms of pollution abatement have to be formalised as separate activities, mainly delivering to already existing activity branches. The representation of consumer behavior can be improved likewise, using more realistic price elasticities for final demand categories.

The coefficients relating the production and consumption activities to pressures on the environment are another important element in the model. The applied linear approximation may require improvement.

A more detailed NAMEA is of considerable importance too, because the model results are highly sensitive to the level of disaggregation applied in the description of production and consumption processes. The drastic impact of reducing waste flows on the model outcome is typical in this respect. In addition, calculation of NDP under sustainability conditions requires extension of the NAMEA with a number of environmental problems (themes), such as the depletion of natural resources including water resources (disiccation), dissimination of toxic substances, space allocation and soil contamination.

The main conclusion is that the NAMEA data system can indeed serve as a suitable data framework for modeling the relations between the environment and the economy.

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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 employ--ment 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).

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