No. 103 | Discussion Papers | November 1993

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Abstract:
Quite a few economists have recently suggested that net national product should be adjusted for the value of environmental damages. One of the aims of such corrections is to establish a national income measure which is closer to the Hicksian concept of income.

The purpose of this paper is to illuminate some of the difficulties one encounters when the correcting formulae derived from simple theoretical models are transferred to applied national accounting. In particular, the paper is concerned with the question of whether a corrected national income measure will actually provide relevant information for policy formation purposes.

It is shown that a "green national product" will be very difficult to interpret. In general, it may not give any indications of the necessity of imposing stronger environmental policy actions. Nor does it indicate the hypothetical state of the economy after a change in environmental efforts.

JEL classification: Q20, Q30

1. INTRODUCTION

Quite a few economists have recently suggested that net national product should be adjusted for the value of environmental damages. (See, for instance, Mäler(1991), Hartwick(1990), Harrison(1989).) The Statistical Office of the United Nations (UNSO) has also recently pursued this line of thought. In UN (1990a) and UN (1992) they outline a satellite account to the SNA (System of National Accounts) for environmental goods and natural resources. The satellite account is based upon a framework for resource accounts measured in physical units, but monetary valuation of the depletion and degradation of natural resources and environmental goods is also proposed. One important goal for this valuation is to establish an environmentally corrected NDP, "Eco Domestic Product" (EDP).

The purpose of this paper is to illuminate some of the difficulties one encounters when the correcting formulae derived from simple theoretical models are transferred to applied national accounting. In particular, we are concerned with the question of whether an environmentally adjusted NDP will actually be suitable as a device for an integrated economic and environmental policy formation.

2. THE AIM OF A CORRECTED NATIONAL PRODUCT

In spite of the extensive discussion on whether or not to adjust NDP, the purpose of actually doing so does not, to us, seem entirely clear. We want to focus on this; the case of the statistician who collects vast amounts of data, which nobody ultimately uses, is already far too common.

The Hicksian concept of income frequently serves as background for adjusting the national accounts measures (see e.g Ahmad *et al.* (1989)). Accordingly, NDP should measure the maximum amount the inhabitants of a country could consume during the accounting period without being worse off in the end of the period than in its beginning[1]. A corrected NDP could then be regarded as as measure of a sustainable development, as Hueting, Bosch and de Boer (1992) do. In addition, however, several other aims of correcting NDP can be noticed. One is that of creating a measure which corresponds better to our perception of welfare, while another is to achieve a proper measure of value added in the economy such as in Peskin, Floor and Barnes (1992).

It is not evident that all these issues should be treated by the same method. Some authors state their aim of undertaking corrections quite explicitly, but others mention several goals, claiming that their method for correcting the national accounts figures is rather general.

The seminal article by Weitzman (1976) is often referred to as the theoretical background for measuring welfare by the net national product. Weitzman demonstrated that in a competitive,

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[1]Since Hicks' definition of income, as stated on p. 172 of his "Value and Capital", is the starting point of the debate, we would like to draw attention to the following pages in the very same book. On those pages, Hicks emphasizes that in a dynamic framework, the concept of income is very difficult to specify in an unequivocal manner, without making the concept so vague that it becomes useless for dynamic analysis. On page 177, he concludes: "By eschewing *utiltiy* we were able to sharpen the edge of our conclusions in economic statics; for the same reason, we shall be well advised to eshcew *income* and *saving* in economic dynamics. They are bad tools, which break in our hands."

closed economy with perfect foresight (i.e., conditions of intertemporal efficiency are fulfilled), NDP can be interpreted as a measure of welfare. Weitzman measures welfare by the discounted value of future consumption. He shows that the maximum welfare attainable along a competitive trajectory is exactly the same as what would be obtained from a hypothetical *constant* consumption level equal to NDP[2]. To justify consumption as an indicator of welfare, Weitzman emphasizes that all sources of economic growth must be included in the notion of "capital". Thus, natural resources and human capital should ideally be included.

Based on Weitzman's results, Solow (1986), Hartwick (1990) and Mäler (1991) extend the model to include natural resources and the environment, and hence propose corrections of NDP to account for the degradation of the wealth of natural resources and the value of the environment. However, a careful examination of the assumptions on which the results of these models are based is required before judging whether or not practical propositions to corrections of NDP are supported by the theory. As Brekke (1991) and Asheim (1991) have pointed out, several of the assumptions, such as that of a closed economy and a stationary economic policy, cannot be altered without altering the results significantly[3].

In the following, it will be important to distinguish between those resources *which are currently traded in markets* and those which are not. Quite frequently, the former are thought of as natural resources and the latter as environmental goods, but this is not always true. To simplify matters somewhat, we will use the term "natural resources" to describe those goods and services provided by nature which are currently bought and sold in markets, whereas those not traded in markets are termed "environmental goods".

3. NON-TRADED ENVIRONMENTAL GOODS

3.1 Valuation of non-traded goods

The idea of correcting net national or domestic product for the value of environmental deterioration sounds immediately plausible. However, one disturbing question arises: If we insist on evaluating non-traded environmental goods, not by the market value, which is zero, but by a positive value; how do we define that value? A common approach seems to be that the valuation of non-traded goods is a problem; but a technical one, which can be solved by introducing advanced measurement techniques, or by agreeing that all one needs is a crude approximation.

The valuation procedure suggested in UN (1990a) is to estimate "the costs which would have been necessary to keep the natural capital intact" (UN (1990a), page 123). Nevertheless, they point to several examples where this valuation routine would give seemingly unreasonable results, so that other procedures would have to be chosen. Other economists have suggested other valuation procedures, such as estimation of willingness to pay. In UN (1992) three different valuation methods, leading to three different versions of EDP, are suggested.

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[2]Note that Weitzman emphasizes that NDP does not measure the maximum constant sustainable consumption level which is currently attainable (it is easy to interprete Mäler's statement on p. 11 in Mäler (1991) in this direction). Any deviation from the *optimal* consumption path would break down the justification of using NDP as a welfare measure. A non-optimal consumption path would cause changes in the scarcity prices, and thus disqualify the use of linear scarcity prices in the accounting equation.

[3]Weitzman is quite aware of this, and starts his execise by stating, "We abstract heroically in more ways than one".

The valuation issue is not only a question of technical measurement or estimation; basicly, it is a question of defining properly what it is one wants to know.

Since markets for most environmental goods do not exist, we do not have any direct information of the marginal money value of those goods (as related to other goods). This difficulty, however, cannot be solved simply by trying to estimate the value: The problem is not only that the market does not reveal any information, but that it simply *does not work*. No mechanism is present which can be expected to move the resource allocation in a direction of optimality. Hence, there is no consensus between suppliers and demanders, nor among the different suppliers or different users, on what the marginal value of the good is. In such a situation, the estimated value of the environment will have a different interpretation depending on the measurement technique used.

Now, it is tempting to say; "let us just assume that the resource allocation is close to optimal", because if so, we can use the very practical approximation that aggregate marginal willingness to pay and marginal costs of increasing supply are in fact equal. This could, for instance, be justified by an assumption of efficient environmental authorities. Nevertheless, this corresponds rather badly to the starting point of the whole debate; namely that a lot of people are concerned about the environment because they believe it is over-exploited. That is, one does not consider the resource allocation in this field to be optimal at all. If the correction of NDP is aimed at showing how far the economy has strayed from some optimal path, one should certainly not start with an assumption of optimality. Actually, the more badly behaved the environmental policy of a country is, the more will marginal values differ.

In the correction items derived from Hartwick's and Mäler's models, the problem of defining the environmental values does not arise. The optimality criterion is clearly defined, and hence the true shadow prices can be read out of the Hamiltonian. However, any change in the formulation of the model will affect the shadow prices.

It is not straightforward to extend the formulae derived from a simplified model to national accounts, if we disapprove of the assumptions of the model. Moreover, it is not clear that these models provide a basis for a new environmental policy, since in the models, policy is already optimal by assumption.

3.2 An example: The case of the unsuccessful environmental policy

Imagine an industrial plant which emits a hazardous chemical into a river. The country in question has a very inefficient environmental policy, and so the owners of the plant do not bother to clean the emissions before they reach the river, even though the costs of doing so would have been minimal. Once emitted into the river, let us imagine that the waste kills all organisms living there, and makes the water useless to the people who live downstream.

What is the value of this environmental deterioration? According to the proposed valuation method in UN (1990a), the value is equal to the hypothetical costs of avoiding the emissions, which, in this case, were low.[4] If, on the other hand, we choose the hypothetical costs of restoring

[4]In UN (1992) this is termed "the maintenance cost concept", and is used in measuring the second version of EDP.

the actual damage as an estimate, the environmental correction would become large or even infinite, since it is very improbable that humans would be capable of restoring all damages.

Still another possibility is to estimate the value of the damage to the people living by the river. Even this approach would be ambigious, however: For example, if the people are very poor, they might well state that they are not *willing to pay* much to get back to the previous conditions (because they do not have much to pay), whereas the amount of money they would need to be *as well off as before* might be substantial[5]. *As we see, the environmental correction can take on almost any value we like, if we just define "the environmental value" in the right manner.*

In our example, the resulting corrected NDP might vary from close to current NDP to minus infinity. This was not due to inaccurate measurement, but to the fact that we were measuring different things: In a sub-optimal economy, avoidance costs, repairment costs, willingness to pay and willingness to accept will not be equal, and the worse the environment is managed, the more some of them differ. Defining properly what we want to measure is, consequently, essential if the exercise is to have any meaning at all.

In fact, the valuation method in UN (1990a) might lead to large environmental corrections in countries with a fairly successful environmental policy, and vice versa. This is possible if the marginal cleaning costs are increasing. A similar event, say the emission of one tonne of sulphur, would attain a higher value in a country where emissions have already been cut, than in a country with no previous environmental efforts. But the environment's response to the emission would probably be more severe in the latter country since the natural cleaning capacity might be exhausted. Consequently, the proposed correction does not measure the severity of environmental damage, and hence, nor the necessity of imposing a stricter environmental policy.

The lack of effort in defining what kind of "value" one wants to measure when establishing a "green national product" may, however, be caused by the link to the simplified theoretic models, which do not focus on the sub-optimality phenomenon in the real world.

3.3 Another example: The disappearing sectors

Suppose that our economy can be divided into two sectors, namely A and B. We will now define EDP (Eco Domestic Product) as net domestic product minus hypothetical costs to keep environmental standards intact within the accounting period. This corresponds to the proposal in UN (1990a) and the second version of EDP in UN (1992). EDP is then defined as

$$EDP = E_A + E_B - N_A - N_B$$

where E_i is the net product of sector *i*, and N_i is the least cost (hypothetical) of avoiding or restoring environmental degradation caused by sector *i*.

Let us now assume that both sectors emit hazardous substances which accumulate in nature. This means that a constant level of emissions is not sufficient to maintain the previous environmental standard - the emissions must stop. Both sectors are able of reducing the emissions at a certain

[5]See Hanemann (1991). Hanemann demonstrates that the fewer substitutes available for the public good, the greater the disparity between willingness to pay and willingness to accept.

cost, but only sector A is capable of eliminating the emissions entirely. For sector B, least cost of maintaining the environmental standard will then be equal to its net product. Hence

$$EDP = E_A + E_B - N_A - E_B = E_A - N_A$$

Sector B has been netted out of EDP, and consequently no contribution from this sector will be contained in EDP. Thus, if emissions from sector B of other hazardous components increased or decreased, or if actual economic activity in this sector changed, this would not have any impact on the level of EDP.

If neither sector A nor B were able to stop their CO_2 emissions, EDP would be equal to zero, regardless of all other aspects of environmental standards and the level of economic activity.

This result was obtained because the hazardous substances were accumulated in nature, so that constant levels of emissions were not sufficient to maintain current standards. Regarding substances which do not accumulate, a similar problem arises when it comes to *changes* in EDP during the year: If a firm increased its production during the accounting period, and this could not have been possible without environmental degradation, the environmental correction must be set equal to the increase in net product of that firm.

A lot of firms would not exist if they were not allowed to damage their surroundings to some extent. This does not mean that it is not of interest to monitor their environmental and economic performance. The exclusion of such firms in the EDP measure is, however, the consequence of defining the value of the envionmental changes as the costs of keeping environmental standards unchanged.

Why do we get this seemingly absurd result? It is, actually, a logical consequence of the question we have posed. By choosing the valuation described above, we got an EDP designed to measure *the part of current economic activity which can take place without degrading the environment.* If no economic activity is possible without hazardous emissions, then the correct answer to this question is, in fact, zero. If one, on the other hand, expects EDP to measure current or future welfare, the exercise above undoubtedly must appear rather odd. Obviously, this exercise demonstrates the importance of knowing exactly which question one wants to ask.

4. TRADED NATURAL RESOURCES

We will now turn to the issue of traded natural resources, for instance oil, fish and timber. In the case of these resources, market values do exist, and the valuation problem, although still present in some cases, becomes less urgent. We will not argue against corrections to account for changes in the stock of traded natural resources in general. Our concern is *the aim and the application of such corrections.* At a first glance, the aim is straightforward: The corrected figures should give a better reflection of value added in the economy. But at a closer examination, the question arises as to whether the proposed corrections enable policy makers to make better decisions regarding the management of natural resources.

It is well known that the net national product is exaggerated as a measure of value added if a large part of current income is based on extraction of natural resources. In addition, national account figures in such economies are biased in the sense that degradation of the value of some

categories of wealth, man made capital, is accounted for, while for others, like natural resources, it is not (see for instance Ahmad et al. (1989)).

Most of those who have dealt with this topic seem to agree that although difficult, attempts should be made to correct the measures of domestic product for the extraction of natural resources. In the revised system of national accounts (SNA), (United Nations (1990b)) an expansion of the balance sheets are proposed, including balance sheets for natural resources.

4.1 The depreciation approach

El Serafy and Lutz (1989) refer to two different approaches of measuring degradation of natural resources, the "depreciation approach" and the "user cost approach". Both methods satisfy an important and necessary condition for any information to the National Accounts; that input to the computations must be easily obtainable from observable data. There are, however, problems with both approaches related to how the corrected measures should be interpreted and applied in policy decisions.

"The depreciation approach", proposed by Harrison (1989) among others, implies deductions for the change in the stock of natural resources. To be compatible with the balance sheets in the national accounts, the wealth of the stock must be estimated, and the depreciation of stock is measured as the change in wealth[6]. It seems to be generally acknowledged among those who have dealt with corrections of the SNA that calculations of wealth must be based upon expected income.

Expected income, however, is highly uncertain. This is closely related to uncertain future price of the resource. The corrected NDP measure does not incorporate the aspect of uncertainty, which is essential to every policy decision concerning the management of such resources.

An example may be clarifying: In Norway, the wealth of petroleum has been calculated as expected net present value of the rent from oil and gas (see Aslaksen et al. (1990)). The estimates are based on expectations of prices and future production profiles, prevailing in the year for which the estimate is made. The expectations are taken from different official documents (see figure 2). Figure 1 shows the changes in the wealth of petroleum from 1973 to 1990. The first bar in each year shows the total change in the wealth from the preceding year. The second bar shows the pure effect of changes in the expectations of the future price of oil.

The figure illustrates the problem of using wealth figures, at least for petroleum. For some years the changes in wealth exceed the GDP for Norway, and the main reason for the fluctuations in the wealth is changes in the expectation of the price of oil. The effect of changing expectations in prices actually predominates the change in total wealth for some years. This is due to the fact that the expected return from the wealth exeeds the rent. Thus, the deterministic factors that contribute to changes in the wealth of petroleum (the value of extraction and expected return) are "negligible" compared to the effect of the uncertain factors (such as prices and resource estimates). To correct national account figures for deterministic factors thus seems to be like concentrating on the strength of the wind when explaining the speed of a car.

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[6] The rent from a natural resource might be estimated independently of wealth figures, as the income from the production of natural resources in exess of a normal renumeration on labour and capital (see e.g. Aaheim (1986)). However, such figures are not sufficient to reflect degradation of the stock.

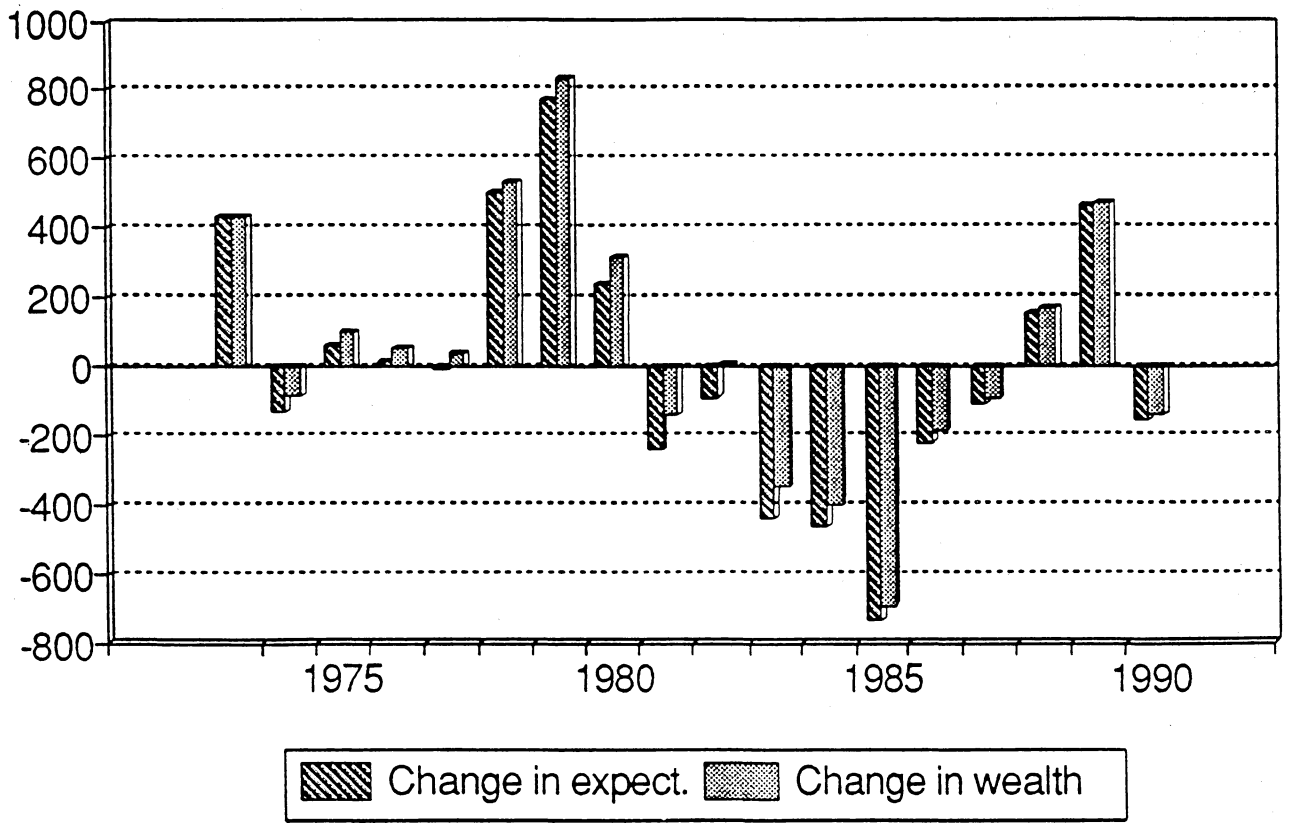

Figure 1. Changes in the Wealth of Petroleum. 1973 - 1990. Bill. NOK.

4.2 The user cost approach

El Serafy (1989) tries to avoid this problem by calculating the "user cost" of extraction as the basis for deductions of NDP. This enables him to estimate the "true" income which is ultimately free to dispose in the rest of the economy. Income in excess of "true" income should be invested in order to upheld the level of national wealth. The user cost is defined simply as the discount factor of the income from extraction in the terminal period. With strictly simplifying assumptions, he calculates the ratio between "true" income from the resource and actual income as 1 minus the user cost[7]. This method does not require predictions of future prices. His corrections are based on current prices, and therefore independent of changes in the expectation of prices.

However, there is normally a strong relation between expectations of future prices and the current price, which is crucial in El Serafy's calculations. Figure 2 shows the current oil price and expectations on future oil prices that was used for the assessments in figure 1. The rule of thumb for the predictions is evident: The price of crude oil starts at current level and follow some sort

[7]Some of these assumptions are indeed incompatible, such as constant prices, constant extraction level, and behaviour according to the Hotelling rule.

of "Hotelling rule" in the future. There is no particular reason to suspect Norwegian authorities to be worse predictors than others. Predictions in other countries probably exhibit the same pattern. Our point is that basing deductions from NDP on the current price of oil may be just as problematic as basing them on price expectations. Although one might reduce the fluctuations somewhat by El Serafy's method, it is not easier to interpret his results. The core of the problem is unfortunately how to cope with uncertainty within resource management, and not how to be good predictors.

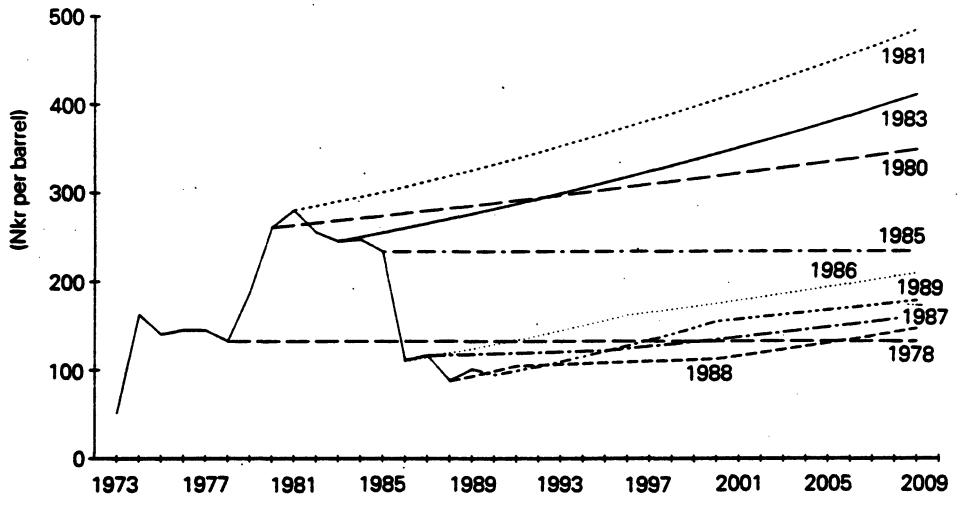

Figure 2 Actual and expected oil price, deflated by the GDP index of Norway, 1986=100. Predictions of the price of crude oil. US $ per barrel.
Source: Governmental White Papers (national budgets, long-term programmes and others).

This illustrates a main problem with the proposals, namely that theoretic and empiric work are not integrated. The theory lacks important properties to be realistic, while the empiric proposals lacks a theoretic basis necessary for an interpretation of the results. There may be a good case for adjusting the income measures in the national accounts for changes in the wealth of natural resources. However, before doing so, one must clarify what kind of information one needs in order to follow a desired management policy. Without such a clarification, complex management decisions are easily turned into a subject of simple technical procedures. Mis-management of the resources may be the result. The examples from the calculations of the wealth of Norwegian oil and gas reserves show that information on annual changes in the wealth does not help authorities in making crucial management decisions such as dividing resources revenues into investments and consumption. Our fear is that simple calculations might make decision makers *believe* that sufficient information for making such decisions is available.

Finally, bear in mind that the evolution of the National Accounts was a response to the pre-war macroeconomic theories of Keynes and others. These theories gave guidelines to data that was needed to design macroeconomic policy. The proposed corrections of the National Accounts seem to turn this proceedure upside down: To develop data in advance of theories.

5. AN ALTERNATIVE: THE MODELLING APPROACH

We have discussed two problems of correcting the national product so far; the valuation problem and the problem of interpreting a corrected NDP as "sustainable income" if no account has been made of uncertainty. There is, however, a third aspect which we would like to address as well. It regards the question of whether or not national accounting is a suitable tool for answering those questions the corrections aim at. In the following, we will assume that the question we want to answer by estimating an environmentally corrected national product, is the following: What would the national product be if no degradation of the environment were allowed?

If the economy was really changed in such a manner, a vast reallocation of resources would probably have to take place. A society with no environmental degradation would differ from the ones we know in many respects. Polluting activities would cease to be profitable, and labour and capital would move to new expanding sectors, such as production of cleaning equipment. This would have consequences for the distribution of income and allocation of resources. A subtraction of hypothetical cleaning activities from SNA figures would say nothing about these changes. If the changes were small, this would not matter much, but unfortunately, most nations are currently in a situation very different from the one described here. Consequently, such procedures cannot be expected to provide reliable answers to hypothetical questions like the one posed above.

To illustrate the limited and sometimes misleading information provided by correction procedures, we will compare the effects of an increased effort in environmental protection policy, calculated by a macroeconomic model, with the result of a correction procedure similar to that proposed in UN (1990a).

In the model, the economy is described by two sectors. A "multiple" good, which may either be consumed or invested, is produced in sector 1. This good is termed x_1. Sector 2 covers activities that can be connected to external diseconomies, which again lead to losses of environmental functions, (Hueting (1980)). An example of such an activity is medical care of people suffering from respiratory diseases caused by air pollution. To increase environmental quality or to decrease the damage from a bad environment, production in sector 2 will have to be increased. Thus, sector 2 corresponds to some extent to the defensive activities described in the satelite account proposed in UN (1990a) and UN (1992).

The production level in sector 2, x_2, will partly depend on laws and regulations, which reflects the public opinion on the requirements of environmental standards or the limits of environmental damage. In the example below, we assume that the level of production in sector 2 is exogenously determined. In a more sophisticated model, the interrelations between environmental quality and economic activity within certain sectors could be modelled explicitly. The model allocates available resources in the economy, here described as given amounts of labour and capital to sector 1 and sector 2, given that both sectors minimize costs.

NDP[8] is calculated as the value of x_1 measured at market prices, plus the value of x_2. However, for x_2, market prices do not exist. We therefore adopt the practice of valuation of public services in the SNA, by defining the value added of x_2 as the sum of labour and capital costs. The first two rows in the table 1 displays our "base case" in this economy, yielding a NDP on 2 121. (The exogenous numbers are arbitrarily chosen.)

[8]Depreciation of man-made capital is neglected, thus NDP equals GDP.

Assume that in order to obey "strong sustainability", x_2 would have to increase from 150 to 200 in volume terms. That is, if x_2 were increased by 50 to 200, the change in environmental quality from the previous year would be zero. The abatement cost of this change corresponding to the guidelines for the calculation of EDP given by UNSO, would be 50 times the unit cost of x_2, and amounts to 79. Accordingly, whereas NDP in our example amounts to 2 121, EDP would be 2 042.

To a policy maker, a reasonable interpretation of this deduction might be that it indicated the social cost of imposing stronger environmental goals. But it is only the nominal value of NDP that is affected by the correction procedure. All the volume figures in the accounts are left unaffected. Thus, the exercise does not give any impression of the macroeconomic consequences of the hypothetically changed policy, nor the social costs. For instance, the procedure gives no information about the necessary change in consumption, or production levels in different sectors of the economy. Hence, we find it hard to give a good interpretation of the result.

Table 1 Correction versus macroeconomic figures at equal increase in environmental efforts

	Corretion of NDP		Model approach		
	Volume index	Value	Volume index	Values	
				Nominal prices	Constant prices
Production of x_1	1555	1944	1494	1927	1868
Private consumption	1307	1634	1267	1634	1584
Investments	248	310	227	293	284
Production of x_2	150	177	200	236	236
Gross domestic product		2121		2163	2104
- Corrections for sustainability		79			
Eco-domestic product (EDP)		2042			

With a macroeconomic model, some of these problems could be handeled more appropriately. In the simple model described above, the reallocation of resources necessary to meet strong sustainability is a result of cost minimizing behaviour. To be able to compare the results with the correction procedure, x_2 is increased exogenously from 150 to 200. The reallocation of labour and capital implies changes in the relative shortage of resources in the economy, thus bringing about a change in all prices in the economy. In other words, a first order approximation of costs is insufficient. In the third through fifth column of the table, the effects of an increase of the production of x_2 to 200 within our simple macroeconomic model is shown.

The reduction in x_1 resulting from the increase in x_2 implies that the volume index of both consumption and investments are reduced. Investments are reduced a little less than consumption. Measured in nominal prices, however, NDP is increased. This is mainly explained by an increase in the price of x_1, which results in "inflation", which is due to a higher shortage of investment- and consumption goods. (Of course, this effect is exaggerated in a model of a closed economy.) The reduction in NDP, measured in constant prices is lower than shown by the correction procedure, since the the model reallocates resources instead of withdrawing them.

EDP as measured above can be interpreted as a first-order-approximation-answer to the following question: What would NDP be if no environmental deterioration was allowed? However, as the exercise above shows, EDP gives a very limited amount of information about the costs of a stricter environmental policy.

EDP does not give *any* information of the severity of the actual environmental damages during the accounting period, since the hypothetical costs of avoiding those damages need not tell us anything about what happens if we *do not* avoid them (see the discussion in 3.2). Accordingly, we cannot see how EDP can be used as an indicator of the necessity of imposing a stricter environmental policy. Further, since neither change in consumption levels, nor any consideration of the effects of *not* avoiding the damages are discussed, it is difficult to see how EDP could be said to measure changes in welfare.

The above conclusion may seem to run counter to the conclusions of Hartwick (1990) and Mäler (1991) (see chapter 2). However, their results presume that the allocation of resources is already optimal (efficient), and that only small changes are considered. This is crucial for their assumption of linear, or first order, approximation of shadow prices. In our example, this assumption is violated. One may interprete our point of view as sceptisism to this assumption, and also sceptisism to the national product used as a welfare measure in a sub-optimal economy.

6. CONCLUSIONS

Intuitively, the idea of an environmentally adjusted national product is appealing. However, the interpretation of such a measure is crucially dependent of the method of measurement. In this paper, we have argued that

-the information provided by corrected NDP figures are very easily misinterpreted,
-the figures will not necessarily give any indications of the need of imposing stronger environmental policy actions,
-as a method of estimating the consequences of imposing a policy of stronger environmental efforts, correction of NDP is a very crude (and inconsistent) technique, which does not capture main aspects of such changes.

In the ongoing debate on this issue, little weight has so far been put on defining *which question a corrected national product is really meant to answer.* It is therefore not surprising that the various discussants seem to disagree strongly with each other, regarding which method of measurement is the correct one. The correct measurement method will of course vary with the question asked. The first step to reach a generally accepted method of integrating environmental and economic analysis, should therefore be to clarify what it really is one wants to know. When this is clear, we can proceed to discuss what is the best tool for analyzing this topic.

We have argued that when it comes to estimating the effects of *hypothetical* changes, macroeconomic models are better suited than the national accounts. We are aware that macroeconomic models have quite a few drawbacks as well. Building such a model requires both a lot of data and a lot of work. Numerous assumptions, of which the results will rely heavily, have to be made. These objections are nevertheless also true if the national accounts are to be used for such purposes. Moreover, a model can be run several times with varying assumptions or input to analyse different questions. Accounting procedures are not flexible in this manner.

When it comes to measuring *observed* environmental changes, this is clearly an accounting task. Valuing such changes in *monetary terms* on a macro level might, however, be rather confusing. These resources are frequently managed in a sub-optimal manner, and hence the assumption of one common marginal value for all applications of the good can be very misleading indeed.

We would, however, like to emphasize that we find the task of integrating environmental and economic policy and analysis a very important one. Nevertheless, focusing on an environmentally adjusted national product could, in fact, give the impression that environmental problems are less urgent than they actually are.

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