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The challenges of globalisation from an environmental accounting perspective

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Abstract. Globalisation influences many economic and social aspects of our society, which in turn influence the pressures that are exerted on environmental systems. This paper will argue that the environmental accounting framework (SEEA, 2003) is particularly useful to assess the influence of globalisation on the environment. The environmental accounts have the advantage that they are consistent with National Accounts. Furthermore, they can be coupled to input-output tables, which make it possible to perform in-depth analyses of the relationship between globalisation and the environment. In this paper we will illustrate the advantages and insights that can be obtained using data for CO_2-emissions for the period 1990-2005 for the Netherlands. Useful indicators, such as the 'environmental balance of trade', are calculated. We will end the paper by raising a number of opportunities for increased coordination as well as methodological and statistical improvements.

1. Introduction

The economy is a complex system of which production, consumption, technology, investment, imports and exports are just a few of the many different interrelated dimensions. All these different aspects of the economy may have detrimental or beneficial effects on environmental pressures. At the same time these economic dimensions are also affected in different ways by globalisation. There is therefore a clear but complex link between globalisation, the economy and the environment. As we show in this paper, this relationship is currently an important question amongst environmental economists.

There are many mechanisms by which globalisation affects environmental pressures. This paper will not able to cover all of them but instead will focus on two important issues. Firstly, enhanced international trade is a driver of economic growth which in turn affects environmental pressures.

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Secondly, globalisation may lead to shifts in production and consumption. International transportation and tourism are clear examples where production and consumption is increasingly taking place abroad. Another common hypothesis is that developed countries will 'export' their pollution by decreasing domestic production of pollution intensive products and increasing imports of these goods.

In this paper we will argue that the environmental accounts, which are satellite accounts of the national accounts, provide an excellent basis to understand and analyse these (and other) mechanisms. We will illustrate the advantages by using data on CO_2-emissions for the period 1990-2005 for the Netherlands. Our discussion will address novel indicators such as the 'environmental balance of trade' as well as opportunities for methodological improvements and further statistical coordination.

This paper is structured as follows. Section 2 discusses the basics of environmental accounting. In section 3 the relationship of globalisation and the environment is illustrated using data for CO_2-emissions for the Netherlands. Finally, in section 4 we make a number of recommendations which should help to further understand the influence of globalisation on the environment.

2. Environmental Accounting

2.1 International Setting

Environmental accounts have been developed to link environmental and economic statistics. An important characteristic of environmental accounting is that the data are consistent with the national accounts. As such they are commonly referred to as 'satellite accounts'. The environmental data from them can be directly compared to macro-economic indicators such as GDP. Specific accounts cover natural resources such oil and gas, material use, air emissions, water, waste, and environmental expenditure. The environmental accounts provide a tool to analyse to what extent our current production and consumption patterns are degrading natural resources or are polluting the environment. In addition the data includes information about policy measures such as environmental related taxes or subsidies.

International coordination of accounting practices culminated in the System of Integrated Environmental and Economic Accounting, commonly referred to as the SEEA2003 (UN, 2003). The SEEA provides an overview of the different environmental accounts. Recently, the UN Committee of Experts on Environmental-Economic Accounting (UNCEEA) was established. Its

main objective is the elevation of the system of environmental accounts to an international statistical standard and the implementation of SEEA in all countries. In Europe, Eurostat has also indicated that the development of the environmental accounts should be given high priority (Eurostat, 2003). On the national level there is also much interest in the environmental accounts, as environmental policy institutes and ministries use this data for environmental-economic analyses and policy development.

2.2 Dutch Environmental Accounts

Statistics Netherlands has a long history in environmental accounting at the national accounts department (de Haan, 2004). In 1991 an illustrative NAMEA (National accounting matrix including environmental accounts) was presented for the first time (De Boo, Bosch, Gorter and Keuning, 1993), based on the conceptual design by Keuning (1993). The original design contained a complete system of national flow accounts, including a full set of income distribution and use accounts, accumulation accounts and changes in balance sheet accounts.

At present, a wide variety of different environmental accounts are produced by Statistics Netherlands. The air emissions accounts cover environmental information on climate change (emission of greenhouse gasses), ozone layer depletion, acidification, and local air pollution. In the energy accounts the supply and use of energy products is shown both in physical and monetary terms. The waste accounts record the production of 70 different kinds of solid waste and how these are treated. The water accounts (NAMWA, national accounting matrix including water accounts) include both the production and consumption of water (tap water, groundwater, surface water), as the emission of hazardous substances to water (heavy metals, nutrients, pesticides etc.). The Dutch environmental accounts also include some monetary accounts related to environmental subjects, namely the environmental expenditure accounts and the environmental tax accounts. Finally, monetary and physical accounts are combined in the NAMEA-matrix (National accounting matrix including environmental accounts).

The range of Dutch environmental accounts will be expanded next few years. New work will be undertaken with regard to material flow accounts (MFA), asset accounts in monetary and physical terms for oil, natural gas, and land. Also the monetary accounts will be extended with respect to environmental subsidies and the environmental goods and services sector. Finally, the data from the environmental accounts will be used to do detailed environmental-economic analyses (structural decomposition analysis, impact analysis etc.).

2.3 Environmental Accounts and Globalisation

The environmental accounts have two primary features which make them very useful to investigate the relationship between globalisation and the environment.

1. Environmental accounts are consistent with the National Accounts. This means that many of the national accounting aggregates which are affected by globalisation (GDP, exports, imports, transportation, tourism) can be linked to environmental indicators.

2. Environmental accounts can be linked to the input-output tables. The input-output tables are part of the national accounts system and can be used for input-output modelling. This type of economic modelling, pioneered by Nobel laureate Wassily Leontief, provides a good basis for in-depth environmental-economic analyses, including investigations of the impact of globalisation and the environment.

These two advantages will be illustrated in the next section where we investigate a number of trends using data from the Dutch environmental accounts.

3. Globalisation and the Environment from a Dutch Perspective

In the introduction we discussed two mechanisms by which globalisation may affect the environment: through economic growth and through shifts in production and consumption. In this section we will illustrate these developments using Dutch data on CO_2-emissions for the period 1990-2005.

3.1 Economic Growth and the Environment

The relationship between economic growth and the resulting environmental pressures has been one of the most important questions in environmental economics for a long time (think for example of Malthus, 1798; Meadows et al. 1972, WCED, 1987). In this 'growth debate' the main question is whether economic growth continues indefinitely given the constraints set by the natural environment. Whereas some argue that this is possible (Beckerman, 1999), others are more pessimistic (Daly, 1999). Growth optimists expect that the positive correlation between economic growth and environmental pressure will, and already is, reversing. Growth pessimists believe that, in the long run, this will turn out to be impossible.

A line of empirical research that has led to significant debate is the Environmental Kuznets Curve (EKC). These studies are based on cross-sectional or time series data, which show an inverted U-shape relationship between economic variables and environmental pressures. The implication is that the environment is a luxury good, which receives more attention beyond a certain threshold of income or wealth. Grossman and Krueger (1995), for example, find that for the pollutants they investigate the turning point is below $8000 per capita. However, the results do not hold for all pollutants and furthermore the EKC is a black-box approach which does not explain the mechanisms that achieve this outcome. Doubts have, therefore, been raised over the robustness and generality of the EKC. Moreover, it has been suggested that relinking occurred in the late 1980s (de Bruijn and Opschoor, 1997; de Bruijn and Heintz, 1999). For an overview see Dinda (2004)

It is therefore very important to capture the relationship between the economy and the environment in statistics, particularly because globalisation, in the shape of increased international trade, can lead to an increase in economic growth. Figure 1 shows the relationships of GDP and CO_2 for the Netherlands for the period 1990-2005. The figures for CO_2-emission and GDP can be compared because the former come from the environmental accounts.

Figure 1 shows that for the period 1990-2005 *relative decoupling* is taking place in the Netherlands i.e. the growth rate of CO_2 is lower than the growth rate of GDP. Note however that relative decoupling still leads to a net *increase* in environmental pressure. Only *absolute decoupling*, whereby environmental emissions decrease can lead to reduced pressure. As the figure shows, in the years 1996-97 and 1998-99 and more recently 2004-05 absolute decoupling occurred for a single year.

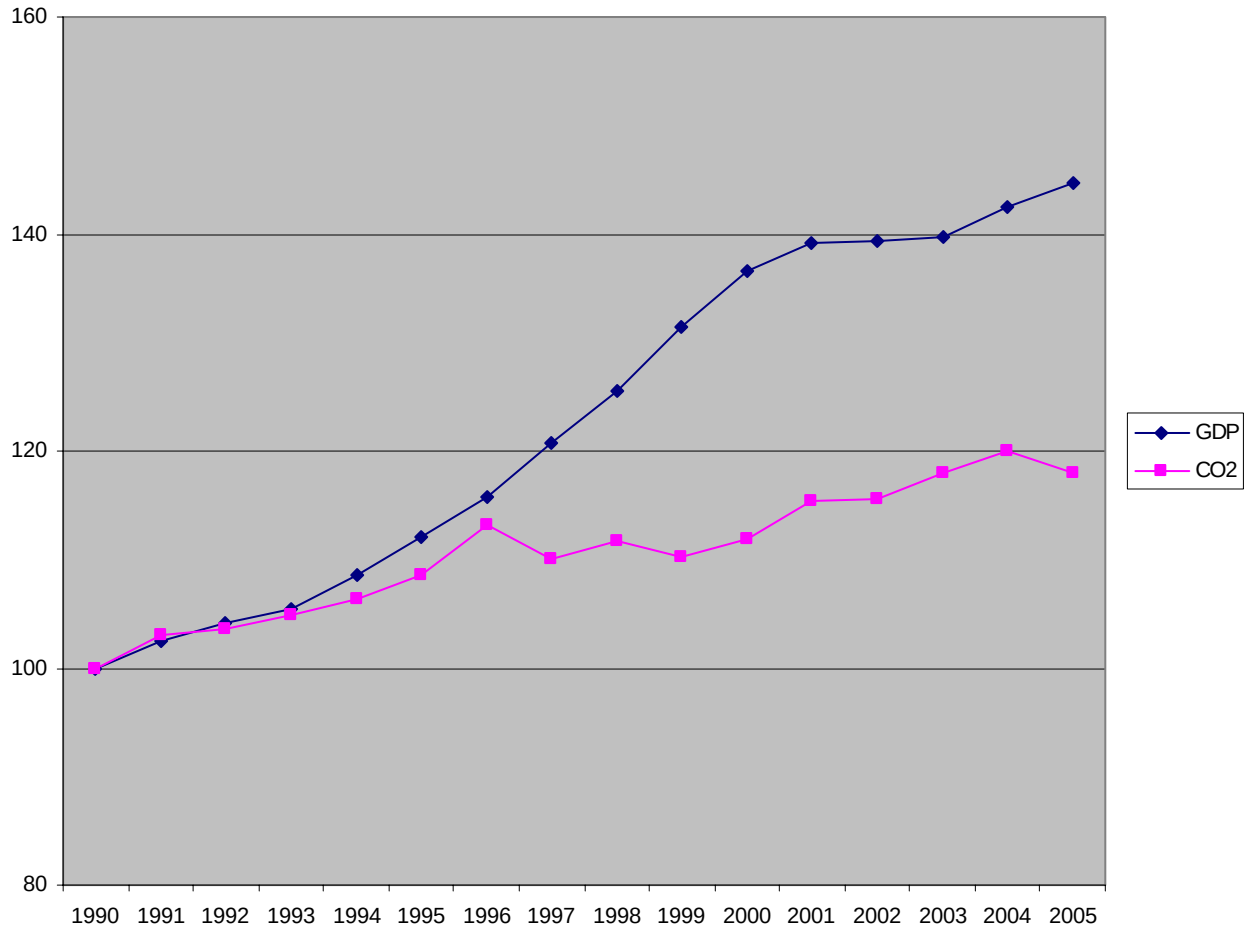

Figure 1. The development of CO_2-emissions and GDP in the Netherlands (1990=100)

3.2 Shifts in Production or Consumption

If the trend towards absolute decoupling is sustained after 2004, is this a good thing? The answer, perhaps surprisingly, is not a straightforward "yes". A lot of the complexity of this question is caused by globalisation, in particular because of the re-distribution of production and consumption patterns.

If figure 1 would represent global GDP and CO_2-emissions, it would be a positive development although we must note for the sake of completeness that even a decrease in emissions could still be too slow to prevent a dramatic climate change and ecosystem collapse in the case of critical limits being exceeded. We will however not dwell on this point.

Figure 1 only represents developments on a national scale, so we need to be careful of its interpretation. From the Dutch perspective figure 1 represents a positive development, but this does not automatically translate into absolute decoupling on a global scale. The contrary could be the

case - absolute decoupling for the Netherlands could actually go hand in hand with global increases in emissions, for example when 'dirty' industries move abroad.

Figures 2 and 3 help to put the trends in figure 1 in perspective. Figure 2 shows the emissions caused by residents (in the Netherlands and abroad) and non-residents (in the Netherlands). It shows that globalisation has caused the emissions of Dutch resident abroad and non-residents in the Netherlands to increase much more rapidly than the domestic emissions of residents. This can easily be explained by the increases in international transportation activities and tourism. Figure 2 shows that a much larger portion of the emissions by residents is taking place abroad. In the case of a global environmental problem, such as CO_2-emissions, the location of the emission is less relevant. However, in the case of acidifying emissions this would obviously constitute the transfer of environmental pressure abroad.

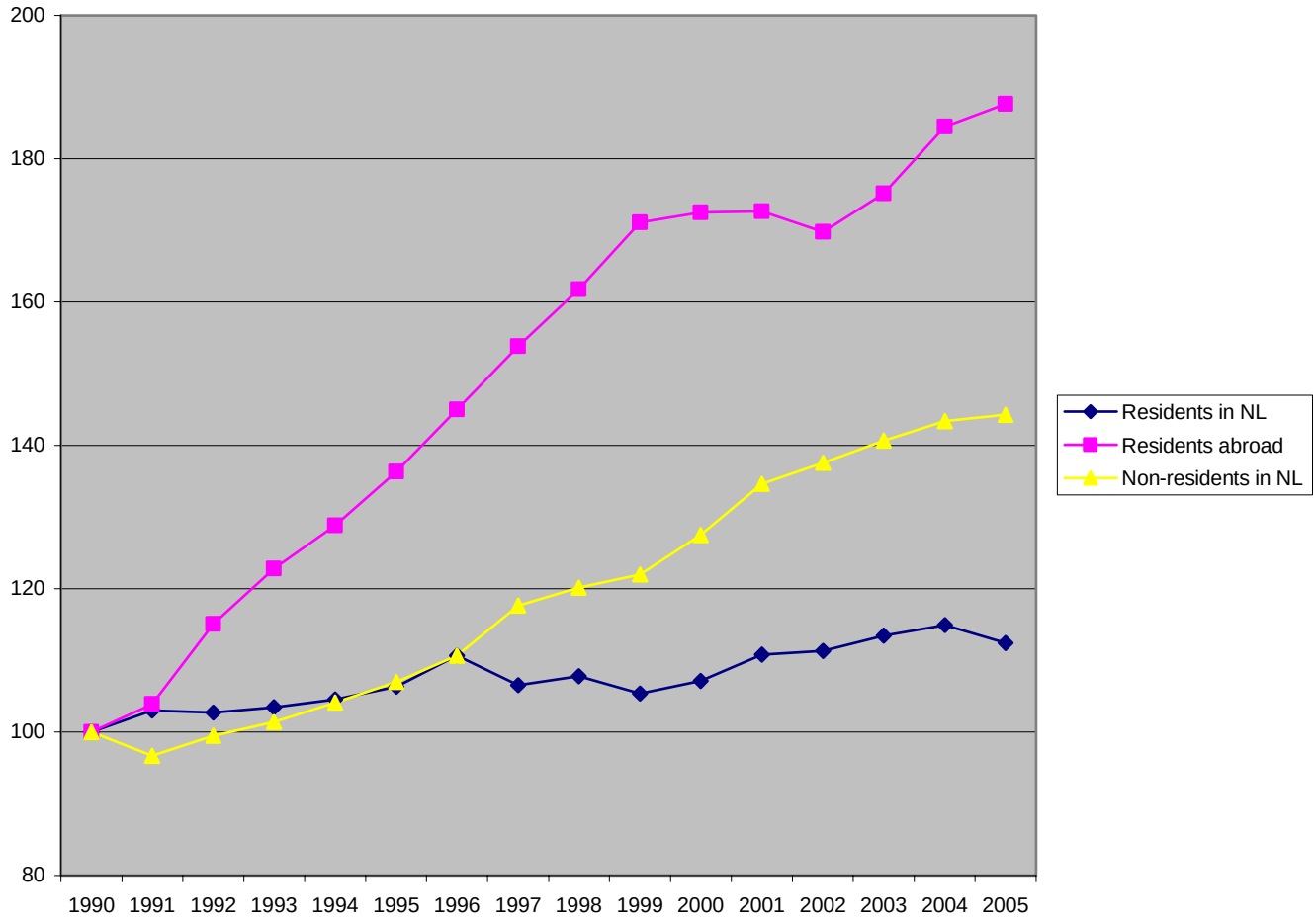

Figure 2. CO_2-emissions by residents and non-residents (1990=100)

Environmental pressures can also be 'exported' in a different way. Industries that produce CO_2 intensive products may go abroad because of environmental regulations or other reasons. These products are then simply imported. This mechanism will lead to decreases in the national CO_2 figures because the CO_2 emitted in production processes abroad to produce our imports are not taken into account. This process is sometimes referred to as "carbon leakage" or the "pollution haven hypothesis" (PHH). Basically the hypothesis is that developed countries specialize in clean production and start to import the 'dirty' products from other (developing) countries.

The environmental accounts provide an excellent opportunity to test the PHH by calculating the 'environmental balance of trade' for a country (see amongst others Wyckoff and Roop, 1994; Antweiler, 1998; de Haan, 2001&2004; Machado et al. 2001; and Suh et al., 2002). In this method the embodied emissions (the direct and indirect emission which were involved in the production process) of imports and exports are calculated using an input-output model. The model attributes emissions to exports and imports irrespective of the location that the emissions take place. The environmental balance of trade is equal to the embodied emissions in exports minus those in imports. If the PHH holds, one would expect the environmental balance to decrease in developed countries and to increase in developing countries.

Figure 3 suggests that the PHH does not hold for this specific emission and period for the Netherlands. The environmental balance of trade is increasing slightly, and we can therefore conclude that, on aggregate, the Netherlands is not shifting its environmental burden abroad in the case of CO_2-emissions. In fact, the opposite is true – our surplus for CO_2-emissions is increasing. Note that we could only conclusively falsify the PHH if the origin and destination of imports and exports were also included in the calculation (see for example de Haan, 2004).

Note that these results for the Netherlands are not atypical. Empirical studies into the PHH show a mixed bag of results. Articles which support the PHH, such as Machado et al. (2001) and Wyckoff and Roop (1994), are contrary to others such as Jacobsen (2000) and Munksgaard and Pedersen (2001) which show results which counter the hypothesis. The results reflect the fact that the mechanisms at work are far more subtle than the simple statement "developed countries become clean at the expense of developing countries". The advantage of the environmental accounts is that, by coupling them to input-output tables, the PHH can be analysed using tools such as structural decomposition analysis (see Rose and Casler, 1996; Rose, 1999; de Haan, 2001; Hoekstra and van den Bergh, 2002; de Haan, 2001; Hoekstra, 2005; and Wilting *et al*, 2006). It is beyond the scope of this paper to discuss these methods any further.

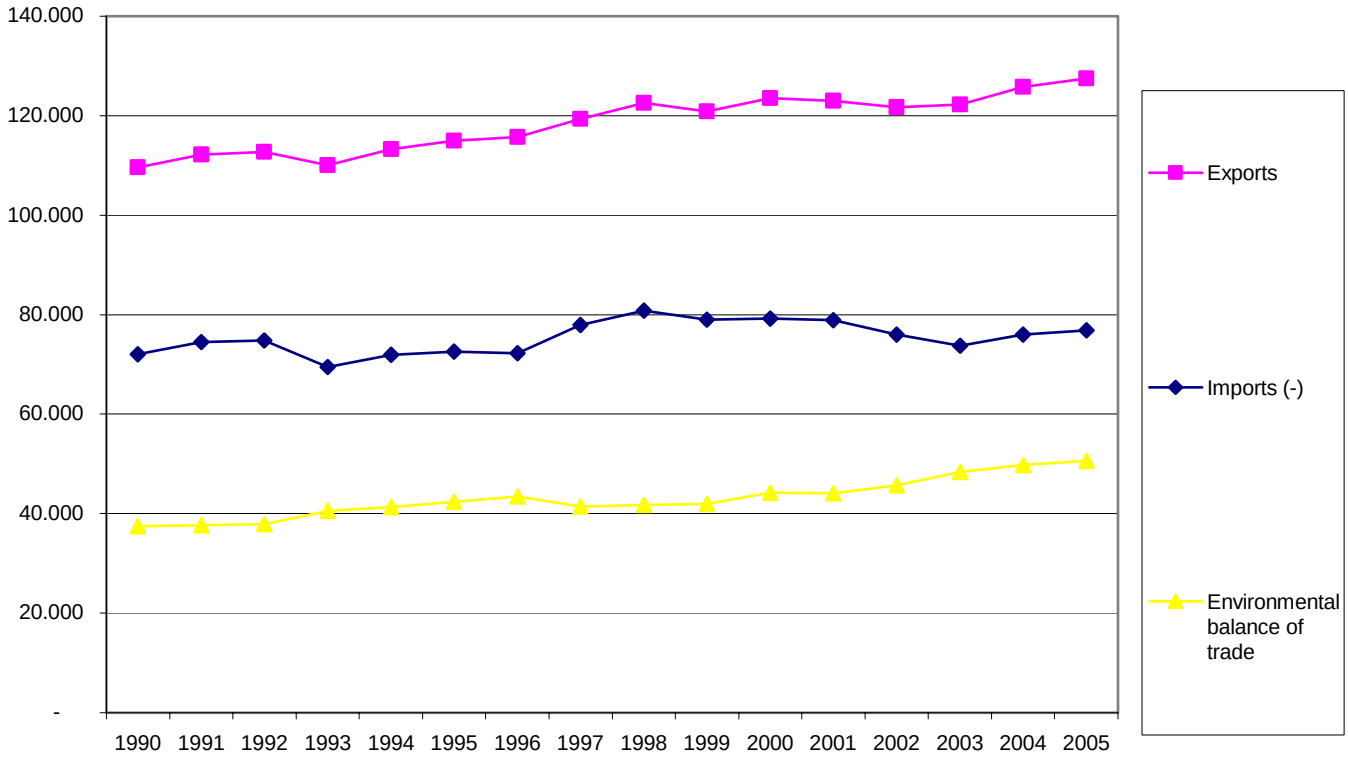

Figure 3. The embodied CO_2-emissions of imports and exports and the environmental balance of trade (million kgs)

In this section we have shown that the environmental balance of trade is an interesting indicator for the effect of globalisation, which could be further enhanced if it were split into the countries of origin and destination. We must point out that the calculation of the environmental balance of trade presented here does include room for improvement. The standard assumptions of the input-output model apply and in addition it is assumed that the imported goods are produced using the same production (and emissions) structure as the Dutch economy. This latter assumption affects the embodied emissions of imports in particular. We will return to this point in the next section.

4. Recommendations

In this paper we have illustrated a number of ways in which the environmental accounts can help to understand the relationship between globalisation and the environment. From our discussion a number of recommendations follow:

- Improve the data sources of the national accounts which are particularly important as measures of globalisation. For example, the emissions of residents abroad are very difficult

to estimate. Statistics Netherlands is presently improving the transport statistics in this field because of its increasing importance. Similarly, the environmental accounts need to be further integrated with other satellite accounts such as the Tourism Satellite Accounts, to further enhance our knowledge of how tourism affects the environment.

- Investigate the use and calculation of indicators such as the environmental balance of trade as measures of the influence of globalisation on the environmental performance.

- This paper was by no means complete in its analysis of globalisation mechanisms which affect the environment. Other issues, such as measures of international technological spillovers (both environmental and regular), also warrant attention.

- Investigate how statistical coordination by Eurostat and other institutes can help us gain more insight into the phenomenon of globalisation and the environment. As an example of this role take the calculation of the embodied emissions of imports. Currently it is assumed that the embodied emissions are based on domestic production technology. This could be improved if the imports were split into the countries of origin. By combining this data to the environmental accounts and input-output tables of the source countries the calculation of embodied emissions of imports could reflect the production technology of the countries themselves. Input-output tables are already transmitted through Eurostat's transmission program as well as the international trade data which specifies individual countries. Eurostat is also discussing the collection of the environmental accouns for air emissions from member states. Clearly, indicators such as the environmental balance of trade, will be benefit from further coordinating activities in this field.

5. Conclusions

This paper shows that environmental accounts are a valuable tool for analysing the influence of globalisation on the environment. Firstly, they provide environmental indicators which are comparable to the national accounts aggregates such as GDP, imports and exports. Secondly, they can be linked to the input-output tables which can be used to analyse the developments that are observed using input-output and other economic models. This paper has illustrated briefly these advantages using Dutch data for the period 1990-2005. This paper argues that improvements in the source statistics, increased research into indicators such as the environmental balance of trade and

increased international coordination will all benefit our understanding of the complex relationship between globalisation and the environment.

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