A6. *Effects of globalisation: the natural environment*

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6.1 Introduction

There are many mechanisms through which globalisation affect the natural environment (OECD, 2002). For example, globalisation expands production and world economic output, as well as the consumption of polluting goods (scale effects). This can lead to growing pressures on the environment due to increased pollution and natural resource use. In addition, globalisation is characterised by a reallocation of production and consumption across sectors and countries (structural effects), with different consequences for the natural environment in each country. By improving structural efficiencies, globalisation can make new investments in environmental protection possible. At the same time, globalisation is paired with the development and diffusion of new technologies (technology effects), resulting both in new products and services, as well as more efficient production processes (Fortanier and Maher, 2001). Increased environmental regulations provide an incentive for multinational enterprises and other firms to innovate in areas that improve resource efficiency or reduce industrial waste. Once developed, new technologies can be applied on a worldwide basis by the multinational, in order to benefit from economies of scale.

It is not within the scope of this paper to address all these elements related to the consequences of globalisation for the natural environment in the Netherlands. Instead, we concentrate on two key issues. First, we address the globalisation of *inputs* of the production process, in particular the use of (non-renewable) energy sources. Economic growth is generally paired with an increased use of energy carriers, which results in a worldwide depletion of natural resources such as oil, coal and gas. Often, these natural resources are imported, which increases the dependency of the Dutch economy on other countries with respect to those energy sources, and affects energy security. We analyse how the dependency of the Dutch economy on external sources of energy has developed over time, and how it varies across energy sources, sectors, and geographic regions.

Secondly, this paper investigates the international dimensions of one of the *outputs* of economic activity: the Dutch contribution to climate change as a result of CO_2 emissions. We include both the production and consumption points of view.

From a production point of view, globalisation leads to an increase in international transportation and tourism. In addition, developed countries may also 'export' their pollution by decreasing domestic production of pollution intensive products and increasing imports of these goods. In contrast, the consumption approach considers global pollution as a result of Dutch consumption demands. Until now most policies regarding climate change, for example the Kyoto protocol, focus on reducing CO_2 emissions that occur during the production processes. However, recently the Social and Economic Council of the Netherlands advises the government to promote sustainable consumption by taking the (global) production chain into account (cf. SER, 2008).

The remainder of this paper is structured as follows. The first section discusses the data and methodology used to address the consequences of globalization for the natural environment for the two selected issues. Subsequently, section 6.3 shows the results of the analyses of the relationship between The Netherlands and other countries with regard to the supply and use of energy carriers. Section 6.4 then addresses the effect of Dutch production and consumption on global CO_2 emissions. The final section summarises the main findings and suggest several areas of further research.

6.2 *Methodology*

The data that are discussed in this paper are derived from the Dutch environmental accounts (CBS, 2009). Environmental accounts are satellite accounts of the national accounts and have been developed to link environmental and economic statistics. They provide an excellent basis for understanding and analysing the relationship between globalisation, the economy and the natural environment. Environmental accounting has a long history of international coordination culminating in the System of Integrated Environmental and Economic Accounting (SEEA; UN et al., 2003). The SEEA handbook was produced to provide an overview of a variety of environmental accounts.

The 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 and transportation) can be linked to environmental indicators. Also, environmental accounts can be linked to the economic input-output tables, and can hence be used for input-output modelling. This type of economic modelling provides a good basis for in-depth environmental-economic analyses, including investigations of the impact of globalisation and the environment. In the next section the applications of the environmental accounts are illustrated, first with respect to energy dependency, and then for CO_2 emissions.

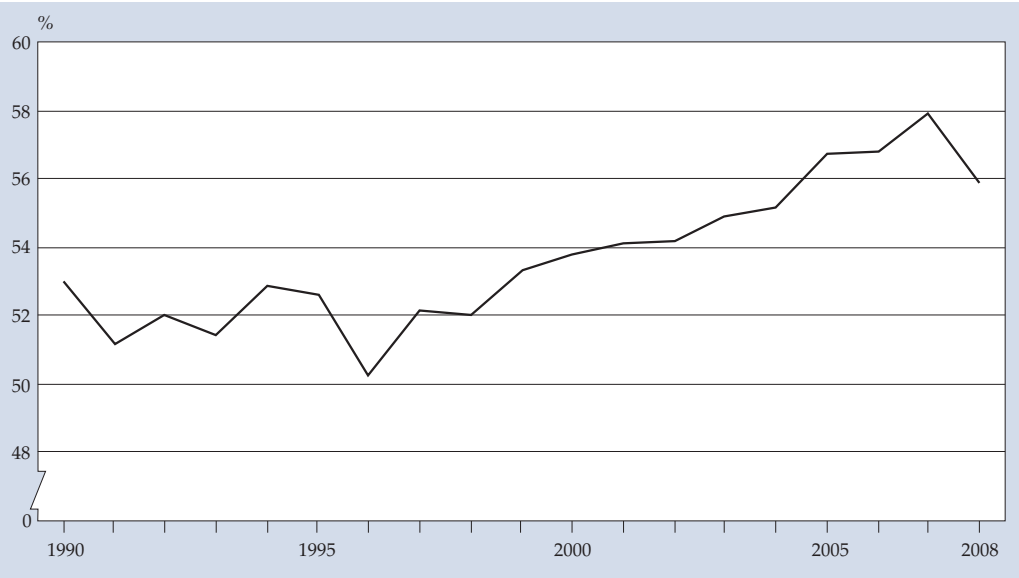
6.3 *Energy dependency*

Energy is essential to all economies, both as input for production and as a consumer good. Energy carriers such as oil, coal, and natural gas, can either be extracted from a country's own territory or imported from other countries. When many energy carriers have to be imported, a national economy will become very dependent on these other countries.

Such so-called energy dependency can be defined in several different ways. What makes a univocal definition problematic is that part of the imported and extracted energy carriers are not for domestic use, but destined for export. For example, in the Netherlands a large part of the imported crude oil is exported again after conversion by refineries into oil products like diesel and petrol. Therefore, energy imports cannot be directly related to energy use in order to calculate the energy dependence. In this study energy dependency is calculated as the share of net domestic energy consumption that originates from imported energy products [1)]. Defining the energy dependency in this way has the advantage that energy dependence can be related to domestic energy consumption as well as to different industries.

The net domestic energy consumption of the Dutch economy has increased by 23 percent since 1990. Particularly the energy use of the aviation sector, the chemical sector, the refineries and the electricity producers has increased. As graph A6.1 shows, in 2008 the energy dependency of the total Dutch economy amounted to

A6.1 Energy dependency Dutch economy on foreign countries

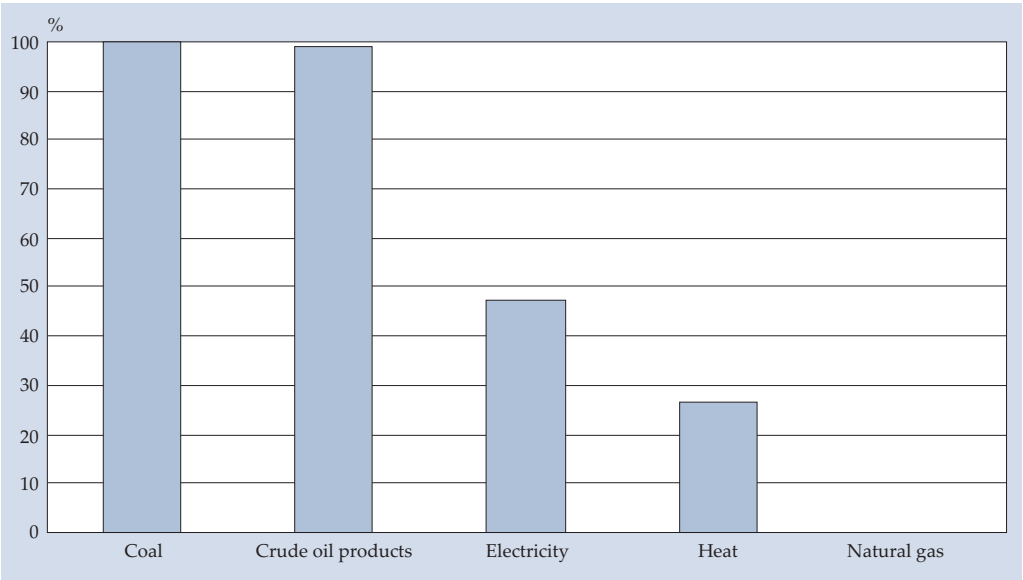


56 percent. This means that 56 percent of the net domestic energy consumption originates from foreign countries, whereas the remainder was extracted within the own country. The Netherlands has substantial stocks of recoverable natural gas beneath the surface. Since its discovery in the fifties and sixties of the previous century, natural gas has been extracted for the benefit of the Dutch economy. So, the Netherlands is self supporting with respect to natural gas. For oil and coal, however, the situation is completely different. The few oilfields on Dutch territory do not supply nearly enough crude oil to meet the large demand for oil products. Since the closure of the coal mines in the province of Limburg all coal is imported.

Over the last ten years the Dutch economy has become increasingly dependent on energy carriers from other countries. Imported energy rose from 51 percent in 1997 to 58 percent in 2007. The increase in import dependency is mainly due to the increased demand for crude oil products. In the nineties the growing demand for crude oil products was compensated by the increasing use of natural gas by power plants for the production of electricity. From 2000 onwards the domestic demand for natural gas has remained stable. Between 2007 and 2008 the energy dependency decreased because of an increase in the domestic demand for gas and a decrease in the domestic demand for oil products. The lower demand for oil products, particularly in manufacturing, is a direct result of the financial crisis.

The import dependency is different for each energy carrier (see graph A6.2). With regard to natural gas, the Netherlands are self supporting due to large subsoil

A6.2 Dependency on the import of energy carriers, 2007

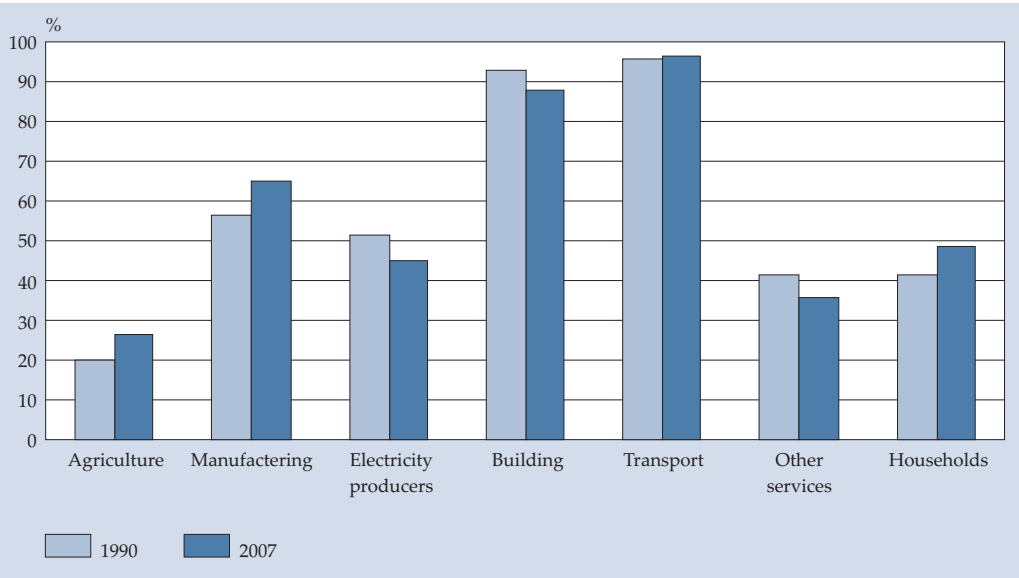


reserves. Coal, and almost all crude oil and related products, however, have to be imported. The import dependency of electricity amounts to around 50 percent. Most of the electricity is generated by burning imported coal or domestic natural gas. Around 15 percent of the electricity is directly imported.

By analysing the energy use of different industries it is possible to estimate their energy dependency. As graph A6.3 indicates, agriculture is least dependent on energy imports. This is because horticulture, which consumes by far most energy in the agricultural sector, primarily uses gas to heat greenhouses. In contrast, the transport and building sector are highly dependent on imported energy. These industries mainly use oil products, such as diesel, fuel oil, petrol, and asphalt. Manufacturing is dependent on energy imports for 60 percent. This percentage has increased over the last eighteen years, mainly because of the growing turnover in the refineries and chemical sector. Electricity companies have become less dependent on other countries for their energy supply. This is because in the nineties the electricity companies have been using more gas than coal for the production of electricity. Households are dependent on energy imports for approximately 50 percent, as they are using a mix of gas for heating and petrol for their cars. This percentage has also increased for households in the 1990–2007 period, as motor fuels became more important in their total energy consumption.

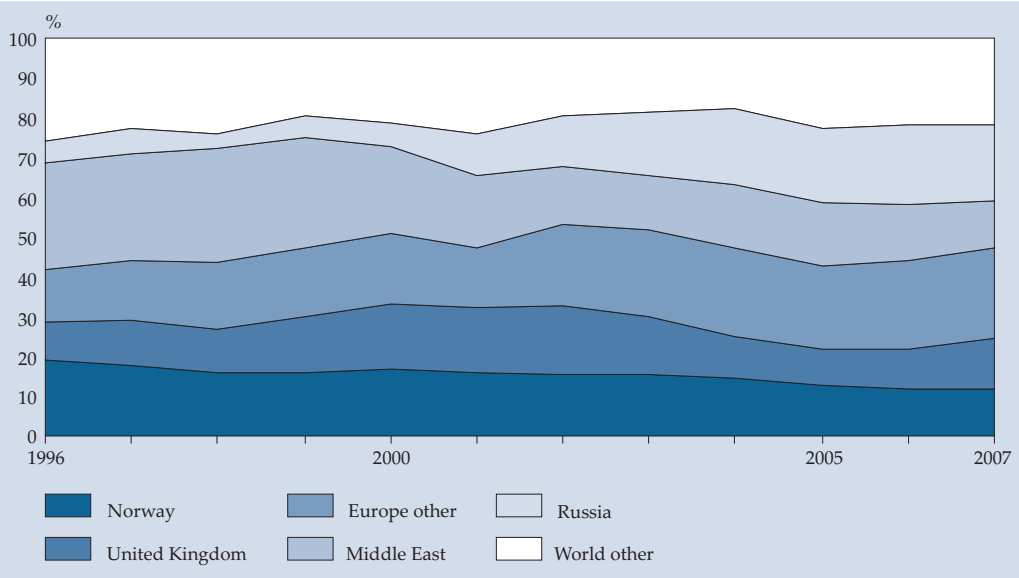
The Netherlands depends on a number of countries for its energy supply, see graph A6.4. Nearly 50 percent of energy is imported from other European countries.

A6.3 Dependency on the import of energy carriers by industry



Coal is mainly supplied by the United States and South Africa. Crude oil is imported from Russia, the Middle East and Africa (Algeria). The last decade saw a shift in the import of crude oil from the Middle East to Russia. The import of oil and gas from Norway decreased, whereas the import of these products from Belgium and Germany increased. The oil and gas from Belgium and Germany were probably not extracted within these countries, but imported from elsewhere. So, the energy dependency is spread over a large number of countries.

A6.4 Imported energy by geographic region



6.4 CO_2 emissions

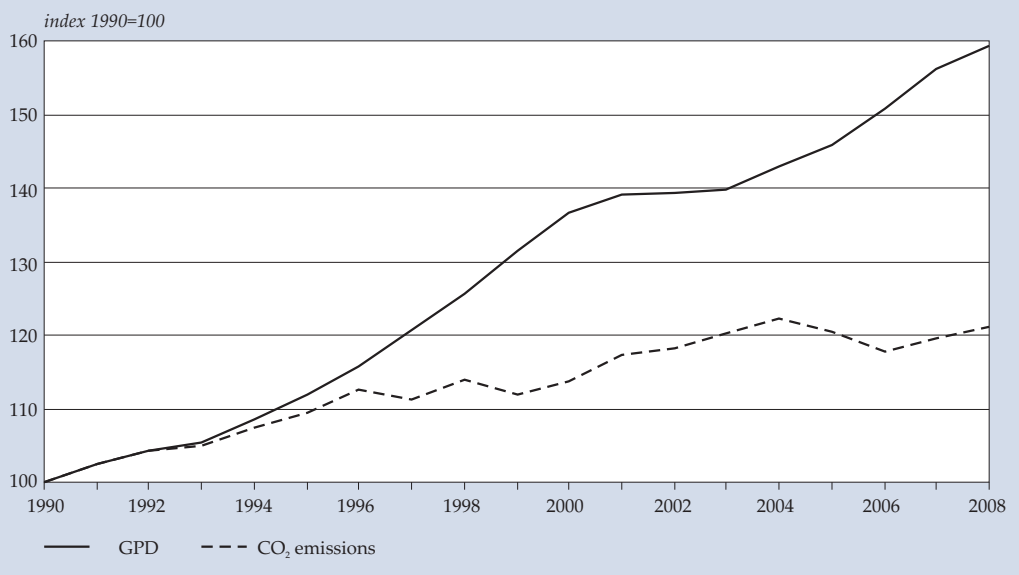
6.4.1 CO_2 emissions related to Dutch production

The relationship between economic growth and environmental pressures has been a major issue in environmental economics. Some academics expect that the positive correlation between economic growth and environmental pressure will reverse, as higher incomes would result in higher demands for environmentally friendly products. Others expect that such decoupling between economic growth and environmental pollution will be impossible in the long run.

In graph A6.5 we show the relationship between economic growth and CO_2 emissions for the Netherlands. The graph indicates that, *relative decoupling* took place in the Netherlands in the 1990–2008 period: i.e., the growth rate of CO_2 from production processes was lower than the GDP growth rate. However that relative

decoupling has still lead to a net *increase* in total emissions. Only *absolute decoupling*, whereby environmental emissions actually decrease, can lead to reduced environmental pressures.

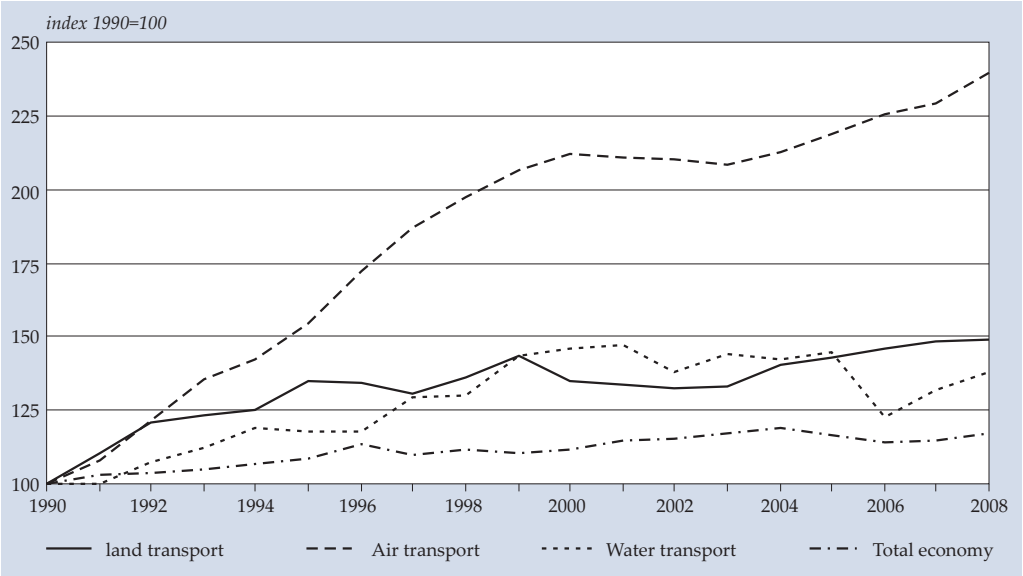
A6.5 Development of CO_2 emissions and GPD in the Netherlands



However, decoupling for a single country does not inevitably lead to reduced global environmental pressure. From the Dutch perspective decoupling represents a positive development, but this does not automatically translate into absolute decoupling on a global scale. The contrary could be the case – decoupling in the Netherlands could actually go hand in hand with global increases in emissions, if for example CO_2 intensive products are increasing imported from the rest of the world. To make a balanced assessment of the relationship between economic growth of the Dutch economy and CO_2 emissions, the international re-distribution of production and consumption patterns should be considered (see section 6.4.2).

Transport activities, and their related CO_2 emissions, often take place beyond the Dutch border. Graph A6.6 shows the emissions caused by different means of transport (in the Netherlands and abroad). It shows that globalisation has caused the emissions of the Dutch transport industry to increase much more rapidly than the domestic emissions of residents. Emissions from air transport have more than doubled in this period. This can be explained by the increases in international transportation activities in the last eighteen years.

A6.6 Development of CO_2 emissions for different means of transport



6.4.2 *CO_2 emissions related to Dutch consumption*

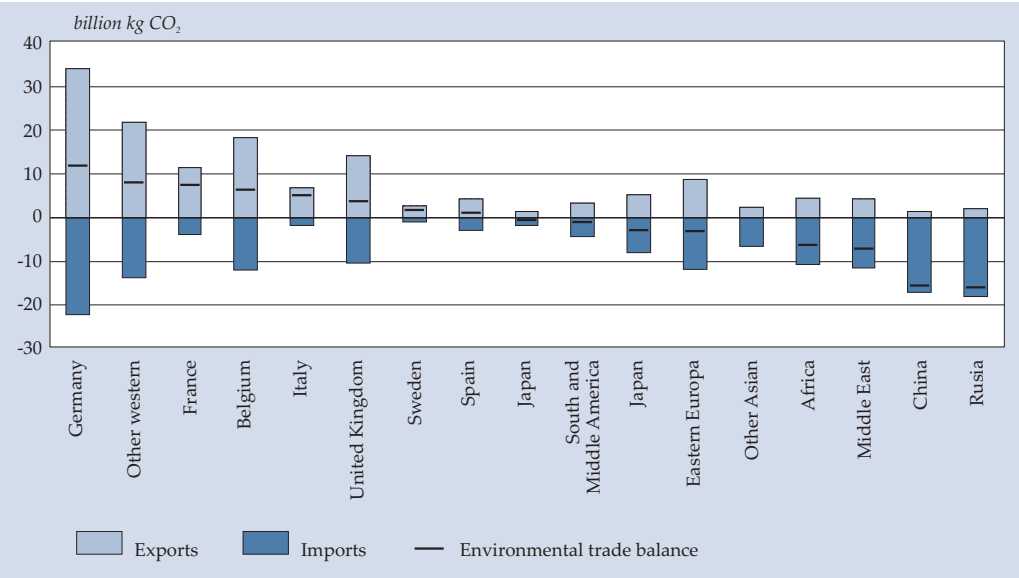
Environmental pressures are not only 'exported' by international transport but also by reallocating CO_2 intensive industries abroad. Industries that produce CO_2 intensive products may go abroad because of more lenient environmental regulations, for example. These products are then simply imported. 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). The hypothesis is basically that developed countries specialize in clean production and start to import the 'dirty' products from developing countries. In order to investigate this issue, a shift from a production approach to a consumption approach should take place. What global environmental pressures occur as a result of our final consumption requirements?

The environmental accounts provide an excellent opportunity to investigate the consumption approach by estimating the 'environmental balance of trade' for the Netherlands in an input-output model (de Haan, 2004). The environmental balance of trade is equal to the embodied emissions in exports minus those in imports. Embodied emissions are the emissions that have occurred during the whole chain of production processes involved in making a particularly commodity. The model attributes emissions to exports and imports irrespective of the location (domestic or abroad) where the emissions take place. Worldwide emissions as a result of Dutch consumption needs can be estimated by subtracting the environmental trade balance from the emissions produced by Dutch residents.

Graph A6.7 shows the CO_2 emitted in each region to produce imports to the Netherlands and the CO_2 emitted in the Netherlands to produce exports to each region. The difference is presented as the environmental balance of trade. The CO_2 emissions per unit output of an industry are based on the production technologies applied in different regions of the world. The overall CO_2 balance of trade is negative. A negative balance indicates that global CO_2 emissions as a result of Dutch consumption needs are higher than the emissions produced by Dutch residents. Especially non-western countries show a negative trade balance. Their level of emissions associated with the manufacturing of the goods consumed in the Netherlands is higher than visa versa. The use of less 'clean' production technologies in developing countries is one reason for the negative balance. Furthermore, energy-intensive raw materials are imported while, at the same time, exports to developing countries are low. The negative balance for China is a result of the latter: import volumes from China are more than 7 times the export volumes to China. For Russia and Africa the negative balance can be attributed to the large imports of emission-intensive resources like crude oil. The import of oil from Russia amounts to 6 billion euro. This is more than half of the total import value from Russia and about equal to the total export value to Russia. The positive CO_2 balance with western countries is mainly due to the export of emission-intensive products like products made from crude oil, chemicals and horticulture products.

The development of the environmental balance of trade indicates the displacement of polluting industry between the Netherlands and foreign countries. Because no

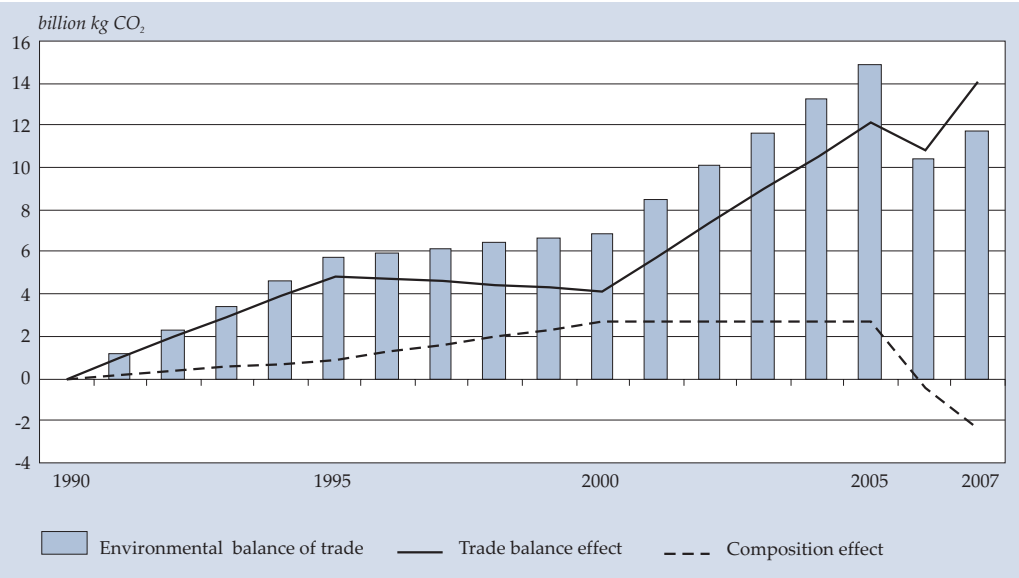
A6.7 Bilateral environmental trade balance for CO_2 by geographic region, 2007



time series of foreign emission coefficients is available, Dutch emission coefficients are also used for foreign countries. Thus, it is assumed that the imported goods are produced with the same emission intensities (CO_2 emissions per unit output) as the Dutch economy. Graph A6.8 shows an environmental balance of trade that is increasing slightly in time. On aggregate, it appears that the Netherlands is not shifting its environmental burden abroad in the case of CO_2 emissions. In fact, the opposite is true – our deficit for CO_2 emissions is decreasing.

The environmental balance of trade can be decomposed into a product composition and trade balance effect. The balance of trade effect indicates that part of the environmental trade balance can be attributed to volume differences between import and export. The Dutch economy has a substantial trade surplus that increases over time. The trade balance effect results in a decrease of the net environmental burden abroad that becomes stronger over time. The composition effect quantifies that part of the environmental trade balance resulting in differences in product composition between import and export. From 1990 to 2005 the composition effect increased over time. Dutch export products became relatively more environmentally intensive. The negative composition effect in 2006 is partly due to the increased import of electricity, resulting in a higher share of emission intensive products in the imports.

A6.8 Breakdown of the environment balance of trade



6.5 Conclusions and future research

Two important mechanisms by which globalisation affect environmental pressures are discussed in this chapter. The first section is about the relationship between the Netherlands and other countries with regard to the supply and use of energy carriers. In the last ten years the Dutch economy has become more and more dependent on energy carriers from other countries. The increase in import dependency is mainly due to an increased demand for crude oil products. The transport and building sector mainly use oil products and therefore they are very dependent on imports. The energy dependency is spread over a large number of countries. Almost 50 percent is imported from European countries. In the last decade there has been a shift in the import of crude oil from the Middle East to Russia.

The second section is about the effect of Dutch production and consumption on global CO_2 emissions. Relative decoupling is taking place in the Netherlands i.e. CO_2 increases less than GDP. This positive development does not go hand in hand with global increases in emissions. A negative environmental balance of trade indicates that global emissions as a result of Dutch consumption needs are higher than the emissions produced by Dutch residents. From the increase of the environmental balance in time, it appears that the Netherlands is not shifting its environmental burden abroad any further in the case of CO_2 emissions. In fact, the opposite is true – our deficit for CO_2 emissions is decreasing. Looking at bilateral balances of trade for the Netherlands with other countries or regions we find a negative balance for non-western countries and a positive balance for western countries.

In the future, our understanding of the complex relationship between globalisation and the environment could benefit from improvements in the source statistics, increased research into indicators such as the environmental balance of trade and increased international coordination. Data on the CO_2 (and other greenhouse gasses) emission coefficients of individual countries, especially those outside Europe, could be improved. There is already statistical coordination by Eurostat and other institutes in collecting data and a single widely accepted method to estimate the balance of trade is already being developed. International consensus would enhance the use of indicators, such as the environmental balance of trade, as a tool for policymakers to develop policies that take the influence of globalisation on environmental performance into account.

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Note in the text

1) The net domestic energy consumption equals the final energy use for energetic and non energetic purposes plus the transformation losses by residents.