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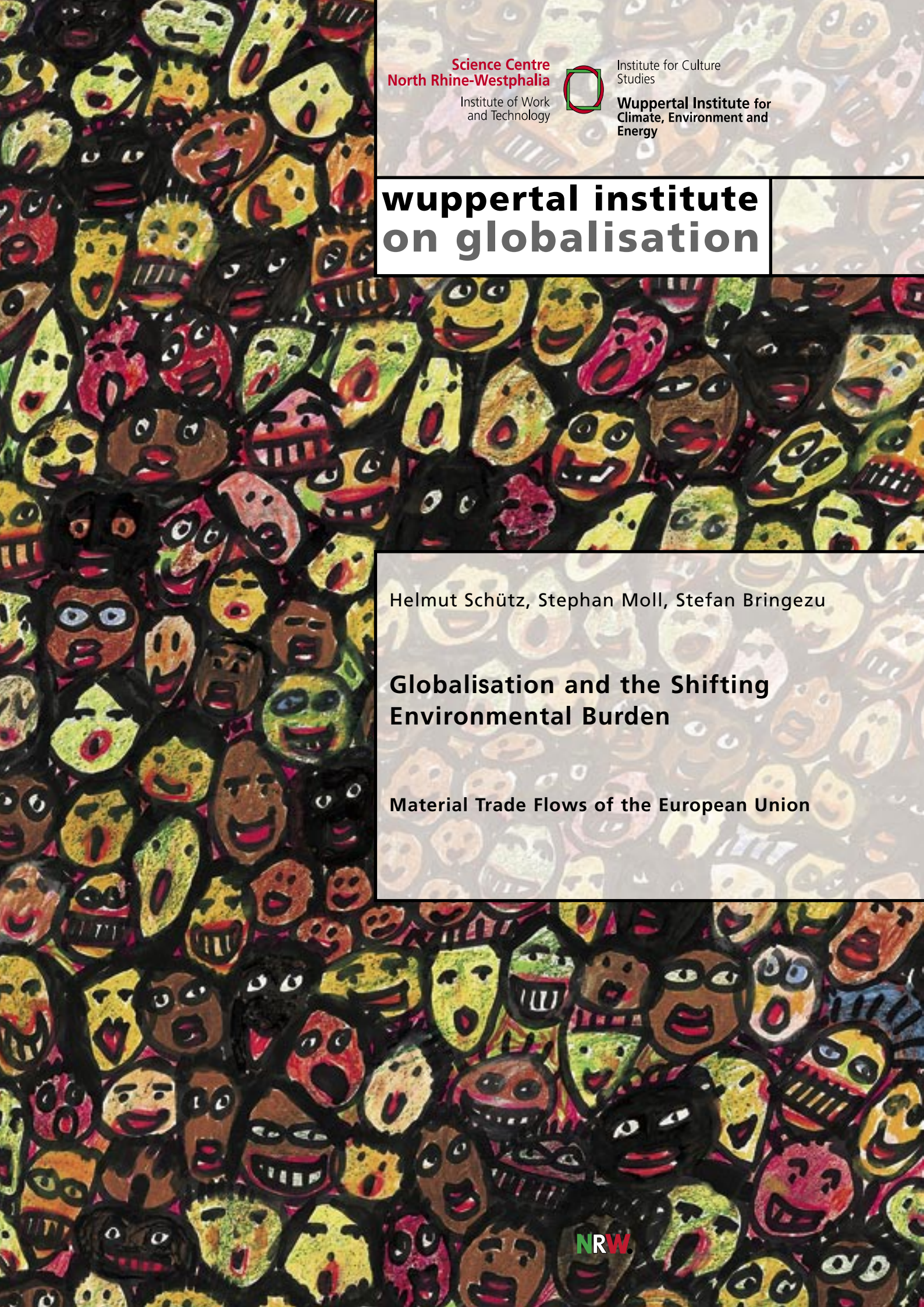

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Globalisation and the Shifting Environmental Burden

Material Trade Flows of the European Union

NRW.

Publisher:

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The picture used for the cover design was painted by the late Peter Kowald, Wuppertalian bass player and artist. Its printing appears by courtesy of Johanna Lenz, Wuppertal.

Contents

Summary

This paper examines the connection between globalisation, with its growth in world trade links, and certain ecological effects especially concerning "North-South" relations. Although world trade in the mid-nineties was significantly uncoupled from growth trends in the world economy, so that since then it has increased nearly three times faster than the global GDP, certain indicators of energy use and CO_2 emissions have not developed proportionately to world trade; globalisation evidently does not lead to a situation where pressures on the environment are increasing to the same extent worldwide. This de-linking may, however, result in the kind of shifts that we examine here with reference to the material trade flows of the European Union. It will be shown that, in the course of globalisation, the countries of the EU have increasingly shifted environmental burdens on to the countries of the South, especially in the form of ecological rucksacks of imported raw materials, while at the same time reducing the pressure on their own domestic environment by extracting fewer material resources. Furthermore, goods whose production places intensive pressure on the environment (industrial emissions into the atmosphere and water, heavy metal emissions, etc.) have been increasingly imported from newly industrializing or developing countries. The greater covering of material requirements from foreign resources has served not so much the EU's internal consumption as its own production of export goods; this shows that the EU has an increasing share in the resource requirement of other economies. The paper concludes that it is absolutely necessary to consider the international dimension in any strategy for more productive use of resources in industrial countries. In the long term, the EU's resource use should also be reduced in absolute terms. This will also be necessary in order to reduce the pressure on the environment due to imports and exports.

The authors are grateful to Raimund Bleischwitz for helpful comments on this paper. We also thank Angelika Zahrnt, Margareta Kulessa, Jill Jäger, Reinhard Loske and Peter Hennicke for helpful comments on an earlier draft, as well as Wolfgang Sachs for helpful suggestions and comments during the development of this paper. We thank Sabine Schneider for her valuable help in the acquisition and preparation of the data, as well as for technical assistance in preparing the paper for publication for which we are further grateful to Bing Fu.

1 Introduction

This Wuppertal paper, which is part of the "What Kind of Globalisation Is Sustainable?" project, presents the results of the "Global Material Flows" working group. The analysis centres on the connection between globalisation, with its growth in world trade and exchange relations, and certain ecological effects especially concerning "North-South" relations. Through this example, the study is meant to provide empirical verification of the hypothesis that globalisation has not only economic but also ecological dimensions. Theoretically, this may involve both uncoupling on the basis of modernization effects and a shifting of burdens on to weaker economies.

Chapter Two begins by asking whether a link can be demonstrated at world level between globalisation and any environmental effects.

Chapter Three examines the extent to which environmental burdens have actually been shifted in the course of globalisation, and especially how this appears within a North-South perspective. Further studies will have to look in greater detail at causal links between globalisation and the shifting of environmental burdens.

Finally, Chapter Four will summarize and discuss the main conclusions to be drawn from the empirical findings.

2 Globalisation Aspects of World Trade and the Evolution of Selected Pressures on the Environment

First of all, we shall focus on the globalisation of world trade in monetary terms, drawing out and elucidating certain characteristic patterns. The availability of the international data means that for now the investigation will have to be largely restricted to monetary figures. But, as far as possible, it would be desirable for further work to include comparative physical data, which would allow the associated environmental effects to be more extensively analysed.

Monetary world trade (imports as well as exports) increased considerably in the last twenty years of the twentieth century, almost tripling between 1990 and 1998. Sharp rises in relation to GDP (see Fig. 1) clearly marked the 1990s, in particular, as a decade of accelerated globalisation (see Enquete Kommission 2002; Le Monde diplomatique 2003). Measured by the rate of growth of imports and exports, globalisation took place mainly in the 1990s, and it affected the traditional industrial countries of the OECD less strongly than the newly industrializing countries (NICs), especially those located in Asia.

The main share of world trade, however, takes place in the wealthy industrial countries, especially the United States and the European Union (Fig. 2). This has to do not with growth-rates but with the established level of foreign trade relations. In the 1990s fast-developing Asian countries (especially China and Hong Kong) pushed their way into the main group of trading partners.

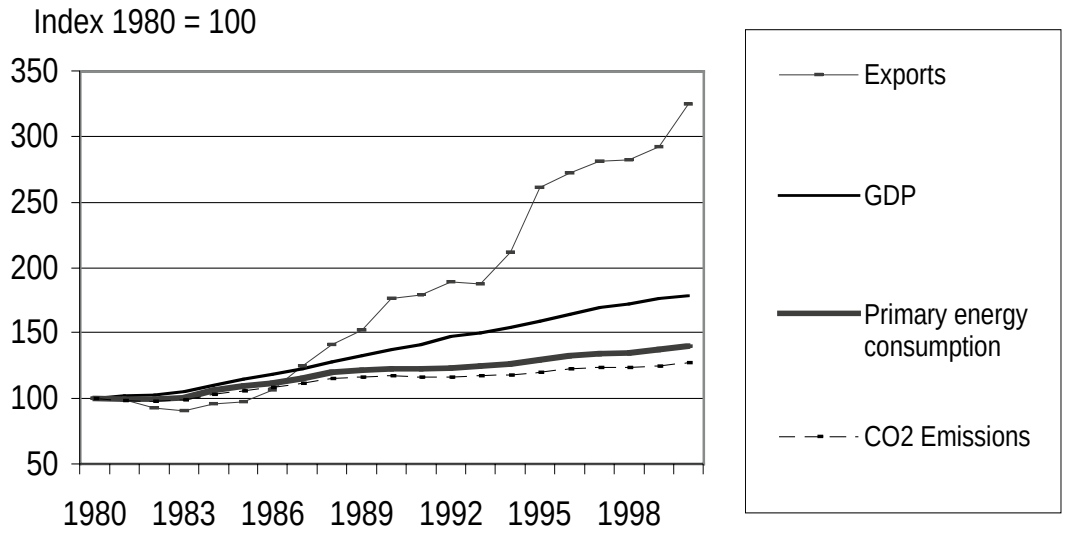
Table: Global Export Values and Export Prices since 1990.

World Export	Value		Change in export prices of primary products	
	Bn. Dollors 2001	average annual % change 1990-01	% 1990-02	spec. Products
All products (a)	5984	5	-9	Primary products
Agricultural products	547	3	-6	
Food	437	3	-14	
Raw materials	110	1	-2	
Mining products	790	4	-23	
Ores and other minerals	63	2	-8	Ferrous ores
Fuels	616	5	6	Oil
Non-ferrous ores	111	4	from -42 to -12	Zinc resp. Aluminium
Processed products	4477	6		
Iron and steel	130	2		
Chemicals	595	7		
Other semi-manufactured products	432	5		
Machinery and transport equipment	2453	7		
Motor vehicles	565	5		
Office and communication equipment	828	10		
Other machinery and transport equipment	1061	5		
Textiles	147	3		
Clothing	195	6		
Other consumption goods	525	5		

(a) incl. Unspecified products, which accounted for 3% of world exports in 2001.

Source: WTO

Figure 1: Global trends 1980-2000: Exports, GDP, Primary energy consumption, CO_2 emissions.



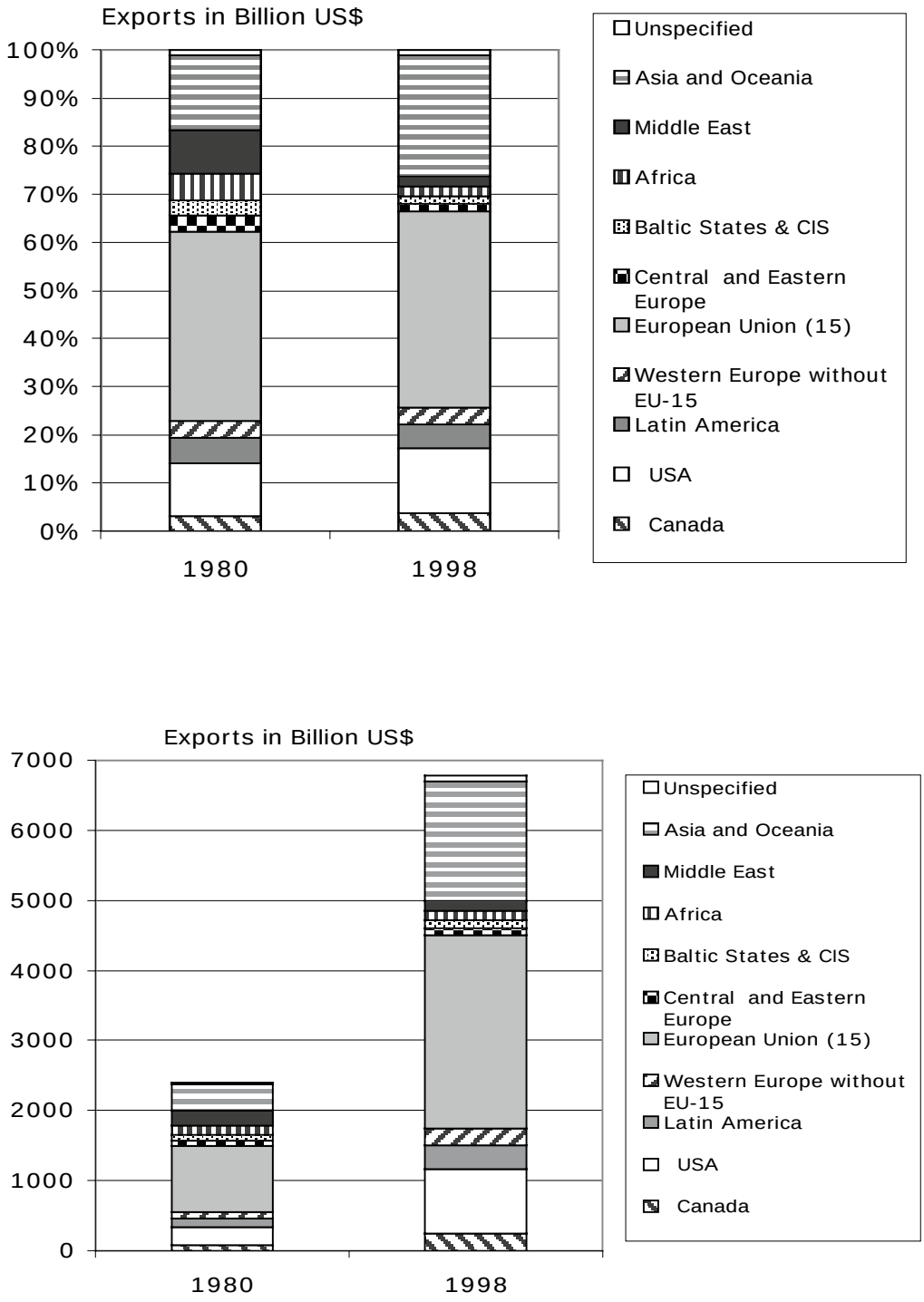
Source: WTO and US-DOE: Energy Information Administration

If globalisation is measured in terms of a foreign trade surplus (exports minus imports), then we see that, in contrast to the early 1980s (when the oil-exporting countries still had the largest surpluses), in the late 1990s it was the industrial countries plus certain NICs (again mainly in Asia) which notched up the largest surpluses. World trade takes place chiefly between these countries or regions. Africa – especially sub-Saharan Africa, with the exceptions of Nigeria and South Africa – has been largely excluded from this surge in world trade. Consequently, it is not really a matter of "globalisation", but rather of more intensive inter-regional trade involving the participation of certain new trade partners.

Measured in terms of the "openness of economies" (imports and exports as percentages of GDP), the increase in foreign trade occurred principally in the NICs of East Asia, Latin America and Eastern Europe. Their formerly low level also needs to be taken into account, of course.

As to the ecological implications, it is particularly important to consider the share of raw materials in world trade during this period, as well as the shares of various countries and regions. Bernd Meyer, from the University of Osnabrück, has shown that in monetary terms world trade has increased since 1980 in processed goods but actually declined in raw materials (especially from mining) and semi-manufactured goods (e.g. iron and steel) (Meyer 2001).

Figure 2: Global exports 1980 and 1988 by region and country — absolute and relative composition.



Source: WTO

The following table shows that between 1990 and 2001 agricultural and mining produce, as well as iron and steel, experienced below-average annual growth in terms of total export values, whereas office and communications equipment, for example, roughly doubled its share of export values. It is striking that export prices for all primary products except oil (whose price is subject to large fluctuations) declined between 1990 and 2002. Thus, despite relatively low growth in monetary terms, world trade in primary products may have expanded quite considerably in physical terms, and this physical growth should be attributed inter alia to the falling prices for primary products.

At a global level no clear links appear between rising volume of world trade and parameters of pressure on the environment. What is evident is a relative de-coupling of monetary and physical quantities (primary energy use and CO_2 emissions) – see Fig. 1. By way of comparison, trends in the global extraction of raw materials would also need to be examined, as well as associated environmental effects. At present this cannot be done because of the lack of statistical data, especially for bulk raw materials such as sand and gravel or natural stone in developing and newly industrializing countries, but future research will seek to quantify total extraction levels by materials and by countries/regions.

In the next chapter, it will be shown on the basis of physical (material flow) data that globalisation has involved a shift in “pressure on the environment” from the industrial countries to the newly industrializing and developing countries.

3 Globalisation Aspects (Monetary and Physical) of EC/EU Foreign Trade, Together with Selected Environmental Implications

Although, at an aggregated global level, no clear link can be seen between growing world trade and a rise in worldwide pressure on the environment, the following chapter will analyse within a North-South perspective whether there have been regional shifts in environmental burdens. Theoretically, a generally beneficial trend may perfectly well go together with major shifts of this kind. We shall mainly focus here, as representative of the North, on the globalisation aspects of the European Union's foreign trade.

First, we shall consider the changing relationship between the EC/EU's physical trade flows and their monetary values. A look at physical trade flows will provisionally indicate whether environmental burdens have been shifted in the context of increasing (monetary) trade. The assumption that pressure on the environment potentially increases with a rise in physical trade flows will then need to be checked through more extensive analyses – for example, of the ecological rucksacks of foreign trade.

EC/EU foreign trade links were first studied by Giljum and Hubacek (2001), for the period from 1989 to 1999. However, they evaluated ecological rucksacks only with reference to EU-15 in the year 1990, with the help of a physical input-output model. The present study goes further by consistently comparing imports and exports between 1976 and 2000 in both monetary and physical terms, as well as their (physical) ecological rucksacks, and by examining the (physical) Total Material Requirement (TMR) and Total Material Consumption (TMC). This makes it possible to draw solid conclusions concerning trends in the physical basis of the EC/EU economy and the importance of its foreign trade links in a context of globalisation of the world economy.

Trends in EC/EU Foreign Trade

In the following account of the changing relationship between the EC/EU's physical trade flows and their monetary values, it will be shown how the global material flow links of the EC/EU changed over the quarter-century from 1976 to 2000.

General Trends

Figures 3 and 4 depict EC/EU-15 imports and exports between 1976 and 2000 in physical and monetary quantities. In the period from 1993 to 2000, both the EU's (monetary) imports of goods and its own exports showed a significant upward trend – a clear indication, first of all, of increasing globalisation. Since these increases in monetary imports and exports,

The main conclusions are as follows:

- In the period from 1976 to 2000, both the imports and exports of the EC/EU displayed a significant and at times striking upward trend – a clear indication of increasing globalisation.
- For the most part, the EC/EU buys cheap goods in the form of raw materials or little-processed goods, and sells expensive goods from sectors that mainly involve higher degrees of processing. It is true, however, that imports of high-value goods did rise markedly from the mid-1990s on, to a relatively greater extent than exports of high-value goods.
- Monetarily speaking, the developed economies conduct brisk business with one another. Physically, a kind of "feeder" flow occurs in this trade, in the shape of raw materials from developing and newly industrializing countries.
- Little (and indeed less and less) EC/EU foreign trade is conducted with poor and highly indebted countries. The only exceptions are physical imports from high-debt countries, which, like developing countries in general, are a major and constant supplier of resources for the EC/EU

and less strongly in physical exports, are greater than the corresponding trends in GDP or Direct Material Input (DMI = imports plus domestic extraction of raw materials), we may speak of an unambiguous globalisation effect (Fig. 4).

Extra-EC/EU versus intra-EC/EU (internal) trade

This study describes and analyses the external trade of the EC/EU with non-member-states. First, we should briefly explain the position of external trade within the EU's total (i.e., inclusive of internal) trade.

The EC/EU's monetary external trade has risen significantly since the mid-1990s. The increase in import and export values (ECUs) roughly doubled between 1993 and 2000, as the index values in Fig. 4 show. If account is also taken of trade within the EU, it becomes clear that (intra-EU) trade between EU member-states constitutes the greater part (two-thirds) of total trade – but that the trend is actually downward. This means that from the mid-1990s extra-EU trade increased by a greater amount than intra-EU trade. The EU's total physical external trade (intra plus extra) also shows increases, but these are less marked than the rises in the monetary values of external trade. In contrast to the monetary picture, the dominant element here is physical imports, approximately 60 per cent of which originate from countries outside the EU. In recent years, however, these physical imports have increased less sharply than physical imports in EU internal trade. Trade links within the EU account for approximately 70 per cent of its physical exports.

Monetary and physical (extra-EC/EU) trade balance and "specific prices"

In monetary terms the EC/EU displays a roughly levelled trade balance, whereas in physical terms there is a clear import surplus. Physically, then, the EC/EU requires appreciably more goods than it returns to the rest of the world. Imports exceed exports by 500 to 1,000 million tonnes – that is, threefold to fivefold – with a fluctuation tendency between 3 and 4 in the 1980s and 1990s. On the other hand, monetary import and export values remained at a similar level throughout the period in question, with a maximum import surplus of 22 per cent in 1980 and a maximum export surplus of 8 per cent in 1996 but without any unambiguous trend. The specific prices (euros per kg.) of imports to the EC/EU were at 0.2 to 0.7 euros per kg always, and roughly to the same relation, below those of exports which ranged between 0.7 and 2.2 euros/kg. EC/EU final exports were on average three times more expensive per kg. than imported goods, though with a declining tendency between 1995 and 2000. This indicates that the EU exports goods with considerably higher value than it imports.

Whereas the average specific prices of imports were roughly constant from 1982 to 1995, they increased by approx. 70 per cent between 1995 and 2000. This indicates that EU imports of high-value goods increased (import quantities rose over the same period by only 13 per cent). The specific prices of exports behaved in a similar fashion, rising by some 40 per cent between 1995 and 2000 after a previous period of stagnation. The clear rise in the value of exports, at a time when there was only a moderate quantitative rise (19 per cent), also points to a more "refined" structure of export goods.

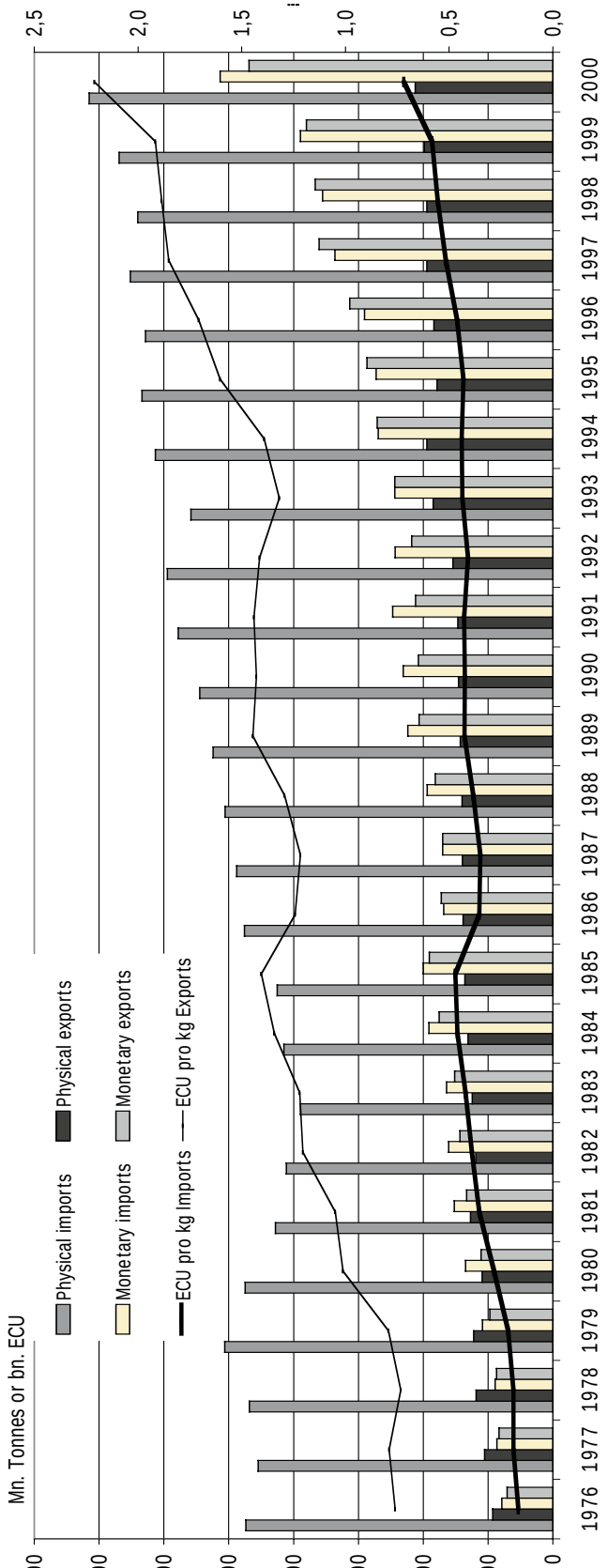
In the next section we shall look more closely at physical imports and exports by category and region.

Physical Imports by Country/Region and Category of Goods

In the period from 1982 to 2000, the largest share of EC/EU physical imports originated in the rest of Europe (Fig. 5), followed by America, Africa and Asia. In 1976 the largest share (42%) still came from Asia, but by 1982 this had fallen to 25% and in the years up to 2000 it stabilized around 15 to 20%. This was due mainly to sharply falling imports of oil from the Middle East. The percentage of imports from OECD countries, mostly in Europe, rose between 1976 and 1994 from 24% to 38%, but then fell continually to reach 31% by the year 2000. Physical imports to the EC/EU from developing countries showed an especially sharp and almost continual decline, from 63% in 1976 to 41% in 1996 – a level that remained constant until 2000 and was still higher than the share of OECD countries. "Least developed countries" (LDCs) always accounted for a bare (and shrinking) minimum of the total, never higher than 4%.

This indicates that, with the rising absolute quantities of imports in the 1990s, increasing environmental burdens were also shifted mainly to other European countries.

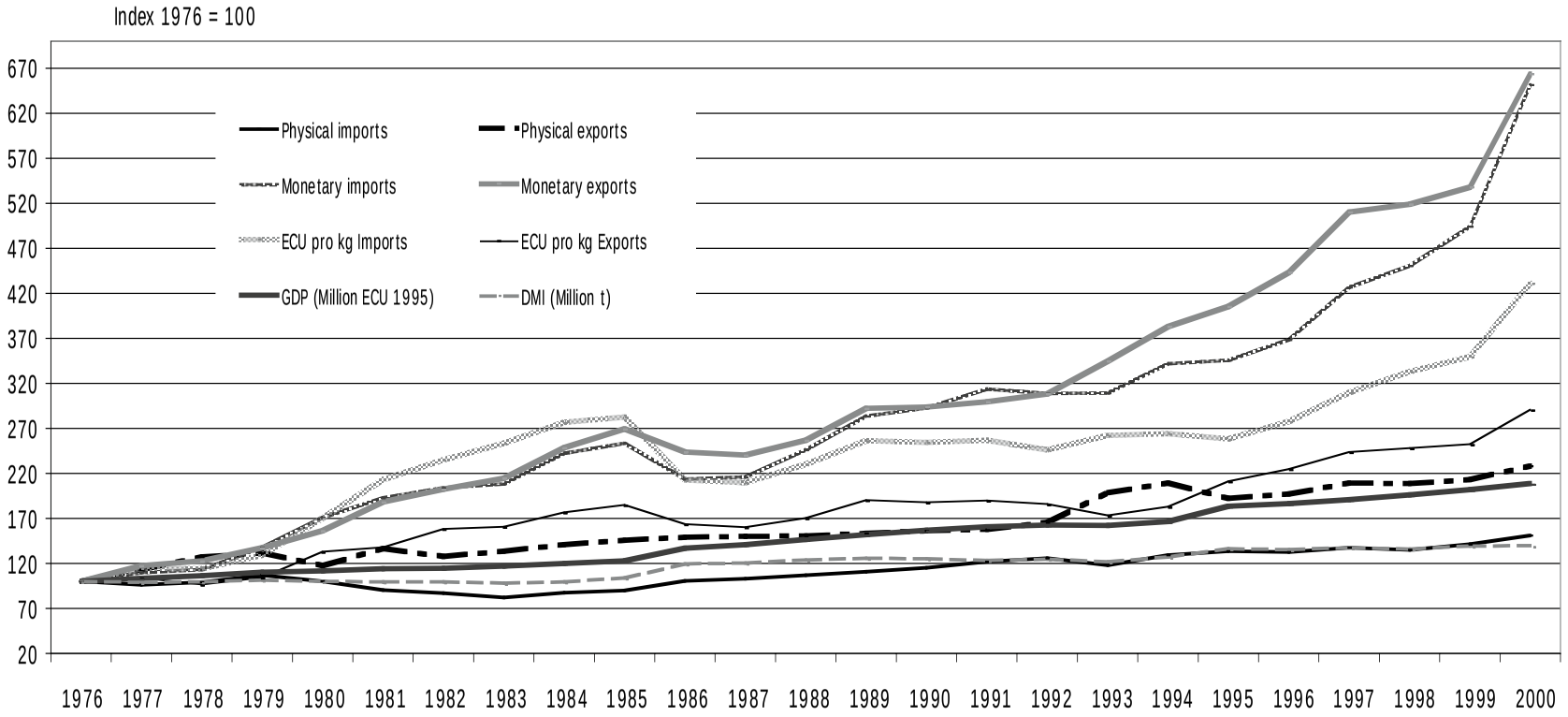
Figure 3: EC/EU imports and exports 1976-2000 — absolute.



Note: 1976-80: EC-9 (B, West Germany, F, I, L, NL, DK, IRL, UK); 1981-85: EC-10 plus GR; 1986-1990: EC-12 plus E, P; 1991-94: EC-12 plus former GDR; 1995-2000: EU-15.

Source: Eurostat Comext 2001.

Figure 4: EC/EU imports and exports 1976-2000 and GDP and DMI – Index.



Note: 1976-80: EC-9 (B, West Germany, F, I, L, NL, DK, IRL, UK); 1981-85: EC-10 plus GR; 1986-1990: EC-12 plus E, P; 1991-94: EC-12 plus former GDR; 1995-2000: EU-15.

Source: Eurostat Comext 2001 (imports and exports); Eurostat New Cronos (GDP); Bringezu and Schütz 2001b and Eurostat 2002 (DMI).

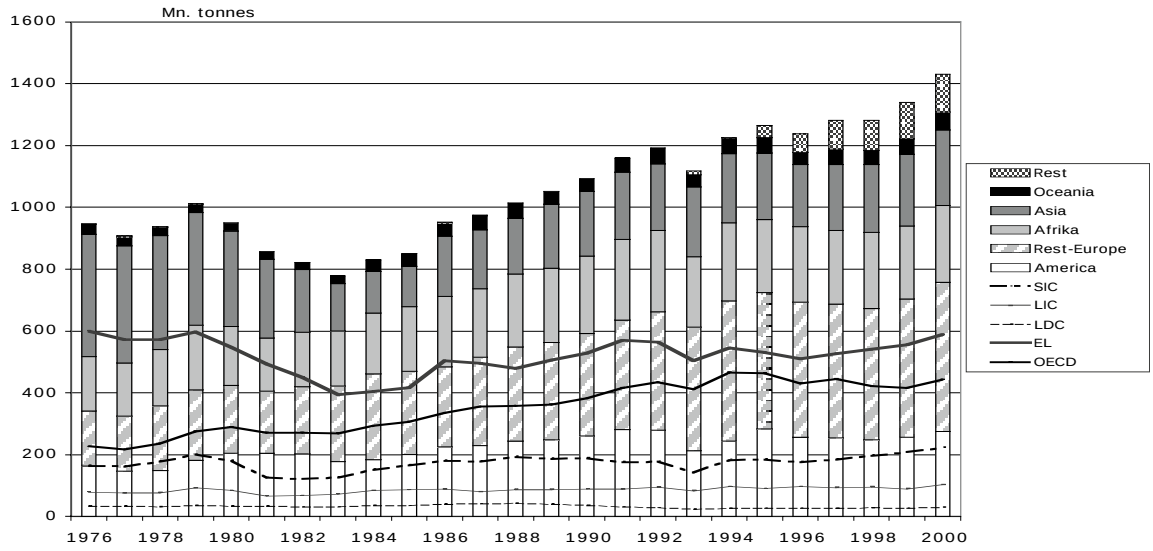
In terms of income differentials, the EC/EU's physical imports came mainly from countries with a high to medium income (GDP per capita); only 7-10% of imports originated in "low income countries" (LICs). On the other hand, the EC/EU imported more from severely indebted countries (SICs: approx. 13-20%, with a tendency to fluctuate).

If individual partner countries of the EU are considered in terms of physical quantity of imports, then Norway, Russia, the United States, Brazil and Saudi Arabia accounted for 35% to 43% of all imports in the period from 1995 to 2000.

The structure of the EC/EU's physical imports remained amazingly constant over the 25-year period in question. Roughly three-quarters of physical imports from outside the EC/EU were raw materials. Fuels were the dominant category of goods, with a constant share of 54% to 63% (Fig. 6). Then came crude ores (and concentrates), with 10% to 16%. Salts and minerals (3-4%) and timber (4-6%) were further raw materials or commodities with a low level of processing. These four groups of materials alone accounted for more than three-quarters of EC and EU imports expressed in tonnes.

Between 1995 and 2000 the physical imports of EU-15 rose by 13 %. A large part (48%) of this increase was due to stronger imports of mineral fuels, and another part (12%) to imports of timber, while salt and minerals contributed only slightly (2%) to the increase in

Figure 5: EC/EU physical imports and exports 1976–2000 by country and region.



Note: Other = unspecified, e.g. data kept secret; SICs = severely indebted countries; LICs = low income countries; LDCs = least developed countries; DCs = developing countries outside Europe.

Source: Eurostat Comext 2001.

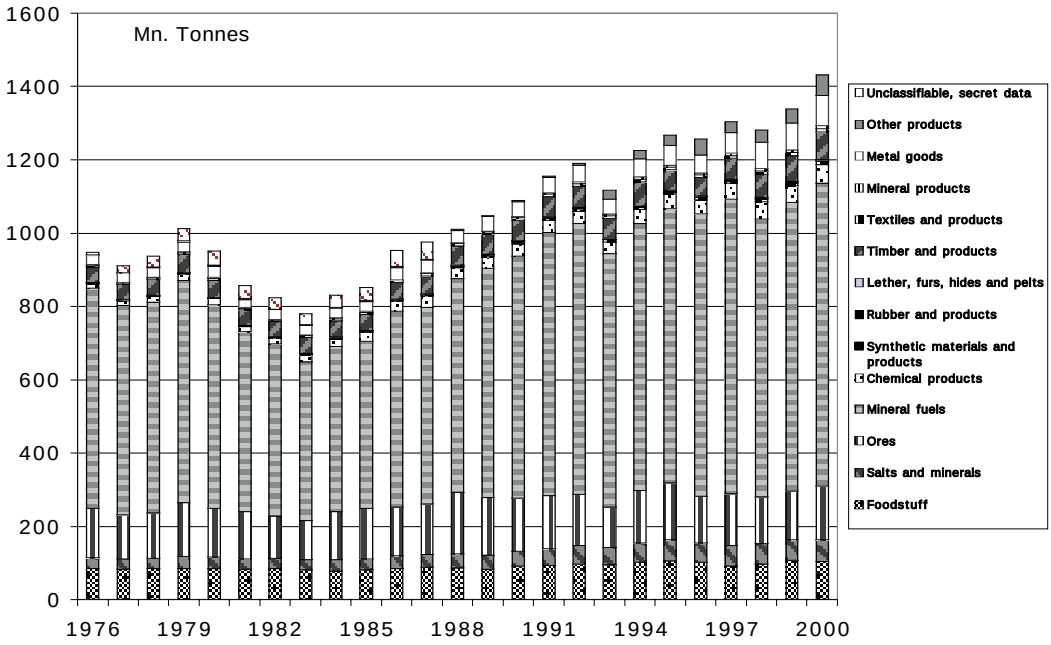
physical imports, and ores in the 1995–2000 period were actually imported in absolutely smaller quantities. Interestingly, however, the import of semi-manufactured iron and steel products increased by approx. 11 million tonnes during the same period and accounted for approx. 7% of the total increase in physical imports (17% for all metals). In the case of metals, there was evidently a shift towards imports with higher levels of processing.

It is interesting that exports also increased in both categories of goods, and that exports were in more or less the same order of magnitude. One is struck that the euro values of exports were markedly higher than those of imports. Thus, trade was conducted in goods with different qualities but belonging to the same category: that is, lower-value iron and steel was imported into the EU (e.g. for buildings), while high-value iron and steel was produced in the EU and then exported. The same was probably true of mineral fuels, and perhaps for chemicals more generally.

Physical Exports by Country/Region and Category of Goods

Geographically speaking, export goods went first of all to America and the rest of Europe (Fig. 7) – 14% to 20% to the United States alone, in the period after 1982. Roughly a half of physical EC/EU exports were destined for OECD countries (44-59%, with a tendency to fluctuate), and, as far as EU-15 trade is concerned, exports to European OECD-countries accounted for roughly half of the OECD share. High export percentages also went

Figure 6: EC/EU physical imports 1976–2000 by product group.



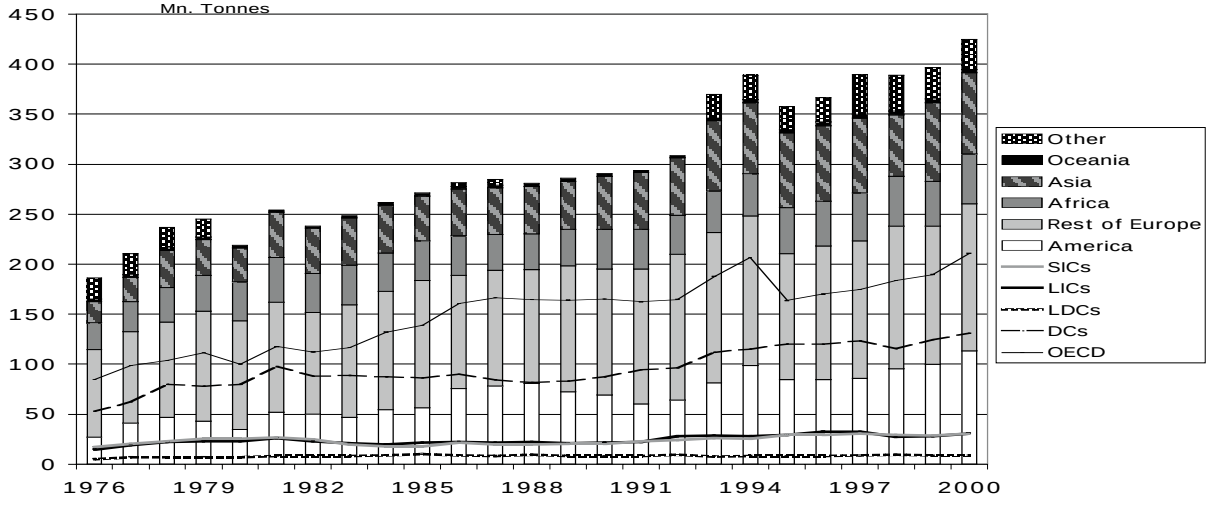
Source: Eurostat Comext 2001.

to developing countries (28-38%, with a tendency to fluctuate), but the share of "least developed countries" (LDCs) approached vanishing point at 2-4%.

In the period from 1976 to 2000, the EC/EU mostly exported to high-income OECD countries, but to an increased extent also to countries with upper medium income levels (10% in 1976 to 23% in 2000). Low-income countries (LICs), on the other hand, received few goods from the EC/EU (7-10%). In physical terms, the EC/EU exported less to severely indebted countries (SICs: 7-12%) than it imported from them (13-20%).

Around a third of the EC/EU's physical exports since 1981 have consisted of raw materials. (The physical trade balance in raw materials, however, displays a clear import surplus; the evolution of the physical trade balance by product groups will be described later – see also Table 2.) With exports as with imports, mineral fuels accounted for the largest individual share – between 23% and 34% (Fig. 8). Then came metals (16% to 26%), food products (10% to 22%), salts and minerals (7% to 13%) and chemicals (8% to 11%). Next, timber products accounted for 2% to 8%, and mineral products for 2% to 4%. The physical structure of exports thus appears to be more complex than that of imports, and product groups with an individual share below 2% of total exports in tonnes are bracketed together to make up 15% to 16% of all exports. Nevertheless, raw materials and semi-manufactured goods made the main contribution to the total in tonnes, although this was less striking than in the case of imports.

Figure 7: EC/EU physical exports 1976–2000 by country and region.



Note: Other = unspecified, e.g. data kept secret; SICs = severely indebted countries; LICs = low income countries; LDCs = least developed countries; DCs = developing countries outside Europe.

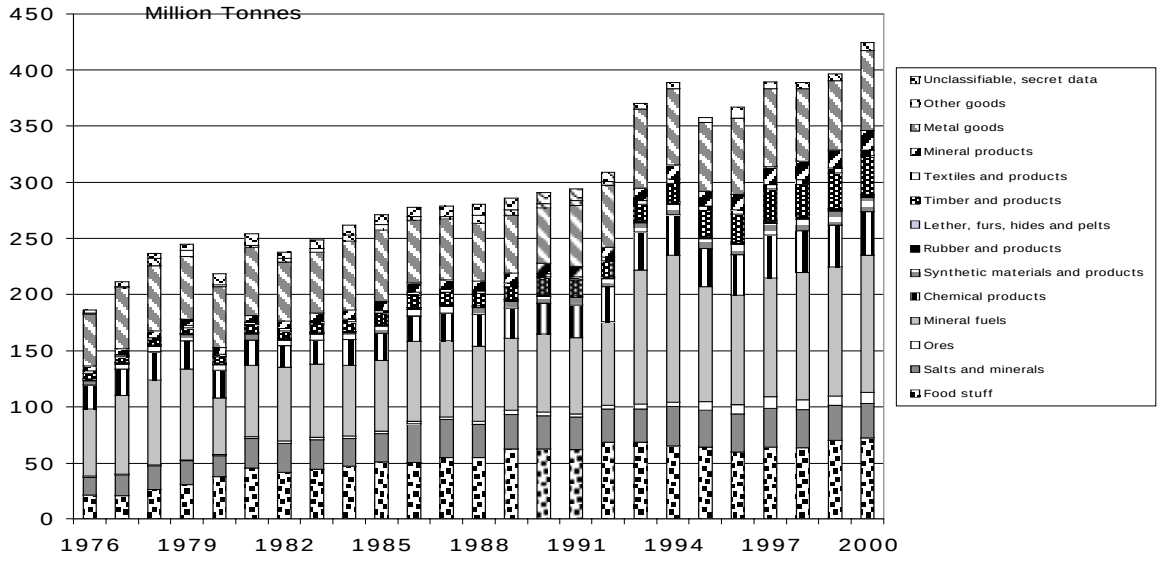
Source: Eurostat Comext 2001.

The forces driving the greater demand of the EU and other industrial countries for resources from abroad (as measured by monetary and physical external trade) are obviously:

- Energy needs: lower domestic extraction has gone together with increased imports (with the exception of the United Kingdom, whose large domestic energy sources are also reflected in high export totals).
- Rising material requirements in processing industries, most evident in increased imports of timber and metals (as raw materials and semi-manufactured goods).
- All in all, the growing economic importance of export-oriented branches may have increasingly affected material-intensive precursors, as data on the commodity structure of exports would tend to suggest. Further studies are needed on this.
- Further studies should also focus on the development of commodity prices

From 1976 to 2000 physical exports increased by approximately 128%, including a 7% leap between 1999 and 2000. This exceeded the increase in imports (51%) during the same period. As in the case of imports, mineral fuels were the largest category (26%) accounting for the rise in physical exports. The next-largest contribution came from food products (22%), followed by timber products (12%) and metals (11%). It should be investigated how far there is a link with world market prices for oil.

Figure 8: EC/EU physical exports 1976–2000 by product group.



Source: Eurostat Comext 2001.

Relocation of Physical Resource Extraction from the EC/EU to Other Regions

The above analysis of the EU's monetary and physical external trade points to increasing globalisation, especially in the 1990s. A study of other economies – incl. USA, Japan, UK and Germany – showed broadly similar globalisation aspects as for the EU, and confirmed that also in a longer time-frame (stretching back to the early 1960s) globalisation was mainly a feature of the 1990s. Surprisingly, however, for reasons that are not yet known, globalisation was marked only in monetary and not physical data for non-EU countries that were the object of study (USA, Japan, China and Poland). It needs to be investigated how far the increased foreign trade of the EU during the 1990s was due to the single internal market, as it is possible that advantages from the single market had an effect on growth. The more intensive trade with Eastern Europe also points to European specificities.

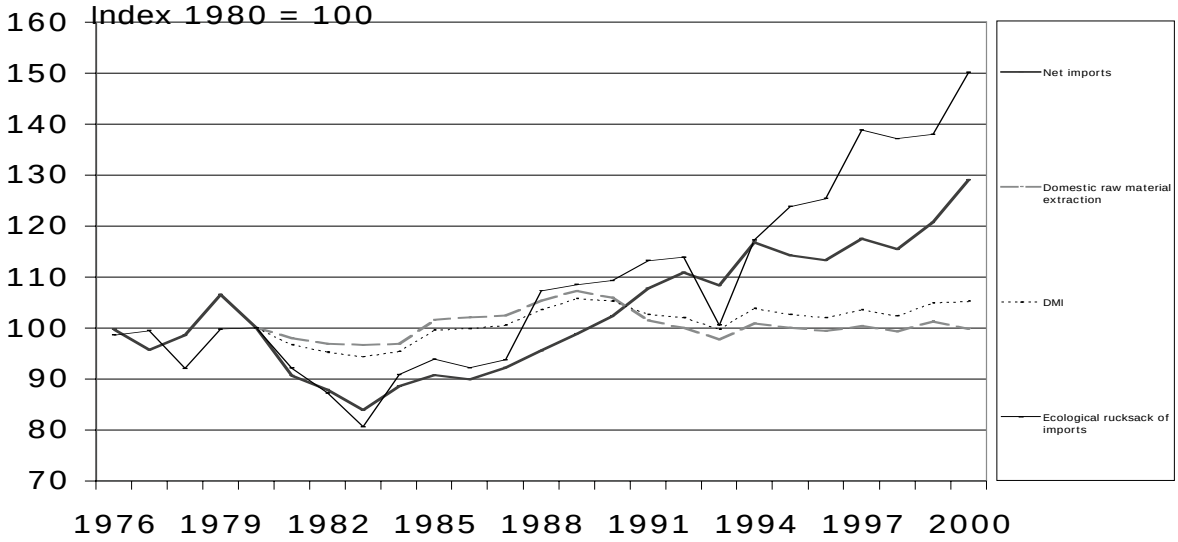
With regard to the EC/EU's rising physical imports from the rest of the world, this section will examine whether it was associated with a shift in resource extraction and also consider the ecological rucksacks in this connection. We also need to investigate from which countries or regions a greater quantity of goods was obtained, and pay special attention to developing and newly industrializing countries. Apart from the aspect of ecological rucksacks, the environmental implications will also be built into the picture through quantitative analysis of pollution intensive goods (based on a World Bank study [Mani/Wheeler 1997], although here the focus is mainly on atmospheric and water pollution and heavy metal emissions.

Shifts in Resource Extraction with Ecological Rucksacks Included

The direct material input (DMI) of the European Union (EU-15) remained more or less constant during the last two decades of the twentieth century (Fig. 9), which indicates a relative de-coupling from monetary economic growth. Yet no absolute reduction of direct material input, or of its non-renewable portion, can be identified in the EU. Such a reduction, however (at least in the view of such experts as Daly 1990, 1992, or Costanza et al. 1997), is the prerequisite for sustainable development in the sense of a fairer distribution of resource consumption, since natural restrictions mean that the per capita consumption of industrial countries (which is far higher then in developing countries) cannot be extended throughout the world.

DMI comprises domestic extraction of raw materials and (physical) imports expressed as absolute quantities. Whereas both the EU's internal resource extraction and its DMI developed in similar ways and at least in the 1990s did not grow, absolute physical imports considerably increased from the mid-1980s on, after a decline in the period from 1979 to 1983, and clearly pointed to a shift in resource extraction to other countries/regions. The same result was found in all other economies under study that displayed clear (physical) globalisation tendencies.

Figure 9: Development of various material input indicators: EU-15 1976–2000.



Note: DMI = Direct Material Input (Domestic raw material extraction plus absolute imports); TMR = Total Material Requirement (absolute imports plus ecological rucksacks).

Source: Bringezu und Schütz 2001a,b; Eurostat 2002.

The inclusion of ecological rucksacks supports this finding and, to some extent, indicates an even greater shift of the EU's resource requirement to other countries/regions. This was also observable in individual member-states such as Germany, United Kingdom, Finland and the Netherlands. In most cases the ecological rucksacks increased even more than absolute imports, especially for the EU since the mid-1990s. This suggests that globalisation enlarges the total foreign resource input and clearly favours the access of industrial countries (and newly industrializing countries) to resources in other regions. It should be investigated how far this is an unintended side-effect or a matter of economic calculation. As a rule, ecological rucksacks are not valued in economic terms and therefore have no price. It therefore seems likely that, where mining processes are strictly regulated, firms incur high transaction costs in complying with regulations. And it is possible that these costs may be reduced through relocation to less regulated economies.

Relocation of Resource Extraction by Region

As we have seen, as much as 41-63% of physical imports to the EC/EU came from developing countries. This indicates that, with the absolute rises in imports, the relocation of environmental burdens to developing countries continued at least as intensely as before. On this assumption, however, pressure on the environment will have appreciably increased in other European countries.

The EC-EU's physical imports mainly consist of raw materials: between 1980 and 2000 their share of total physical absolute imports remained more or less constant at around three-fourths (85% in 1976, falling to 78% by 1980), and in absolute quantities (tonnes) raw materials increased by 31% between 1976 and 2000. Imports of raw materials mainly rest upon a non-renewable foundation, which accounted rather constantly for 90% of the total during this period.

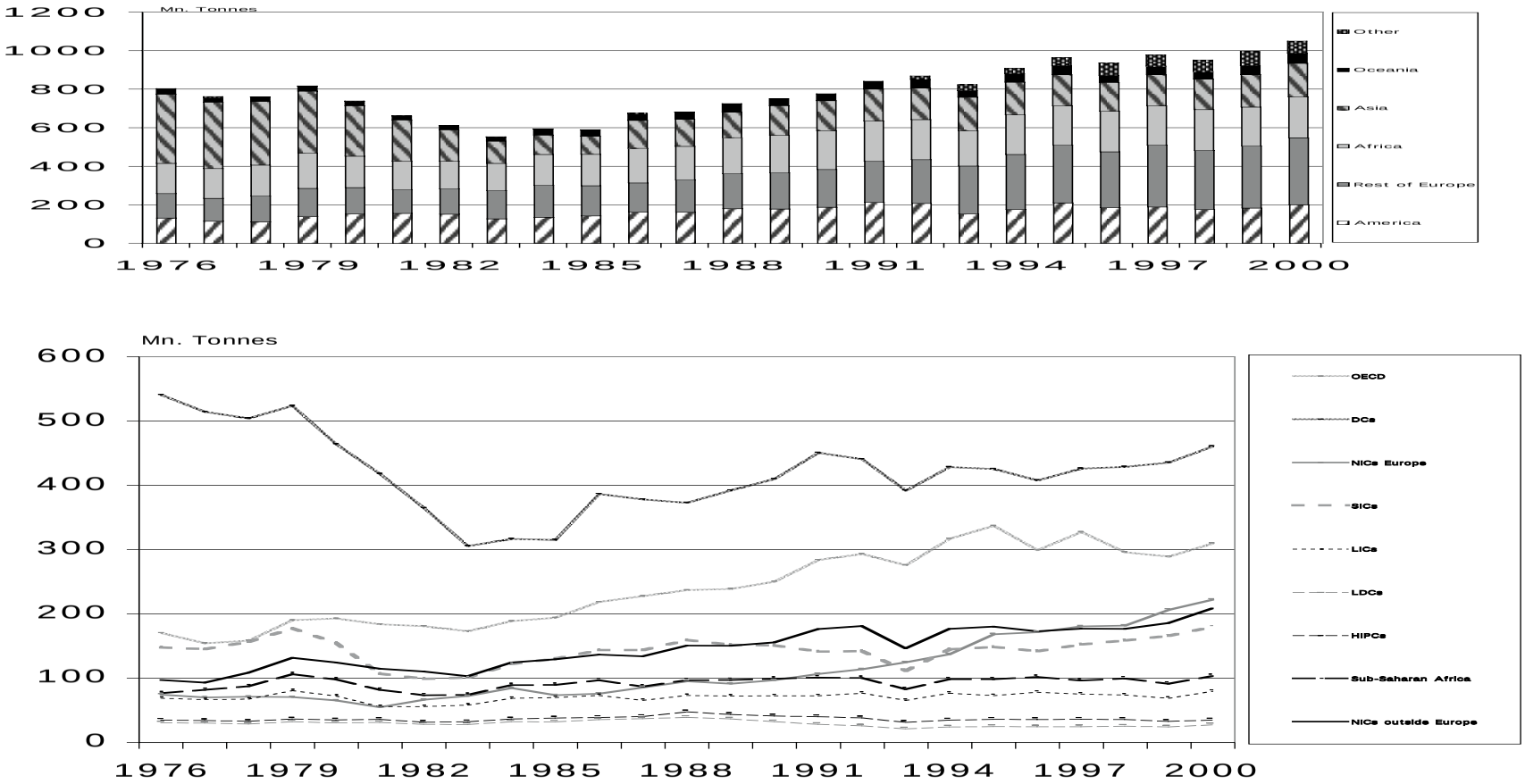
Between 1976 and 2000, a rising proportion (16% to a third) of the EC/EU's absolute imports of raw materials came from other European countries (Fig.10), while a declining proportion (two-thirds to 43%) came from developing countries outside Europe. Throughout the period in question, however, this latter group still made the largest contribution to the EC/EU's raw material requirement, and after the mid-1990s there was again a slight tendency for its share to increase. Newly industrializing countries in Europe played a special role in this, contributing a (clearly rising) share of 8-21% to the EC/EU's imports of raw materials. Towards the end of the period under study, approximately half as many (absolute) raw materials were coming from that source as from all developing countries outside Europe. Poor countries, however, supplied only 7-12% of the EC/EU's raw material imports, and that figure showed a tendency to decrease. High-debt countries supplied 14-22% (again with a tendency to decrease), and highly indebted poor countries (HIPCs) no more than 3-7% (also decreasing). Sub-Saharan Africa's (declining) share of 9-15% was tending to become ever smaller than North Africa's relatively constant 9-13%. In the 1990s poor and indebted countries outside Europe, especially in Africa, were increasingly driven from the market to supply Europe with exports, whereas the "emerging markets" of Eastern Europe clearly improved their position.

When we look at imports of semi-manufactured and finished goods, this de-coupling of countries of the South is even more apparent (Fig. 11). Although we can assume that a large part of the raw materials for the production of semi-manufactured and finished goods still came from developing countries outside Europe, those goods themselves are mainly imported to Europe directly from rich industrial countries of the North – the share of rich OECD countries being 47% to 35%, though with a tendency to decline since the mid-1990s. Developing countries outside Europe together contributed 33-42%, also with a falling tendency between 1976 and 2000. Here too the newly industrializing countries of Europe had an increasing share (14-32%), though it reached its peak in 1995 and then fell to a constant 25%.

Environmental Implications of Resource Relocation

A some what different picture from that of absolute quantities (cf. Fig. 10) emerges when we consider EC/EU imports of raw materials (Fig. 12 and Table 1) in relation to ecological rucksacks (erosion quantities associated with imports of agricultural products and unused resource extraction – e.g. mining waste – in connection with imports of non-renewable materials such as energy carriers, metals and minerals). These also applied mostly to developing countries, but unlike in the case of absolute imports of raw materials

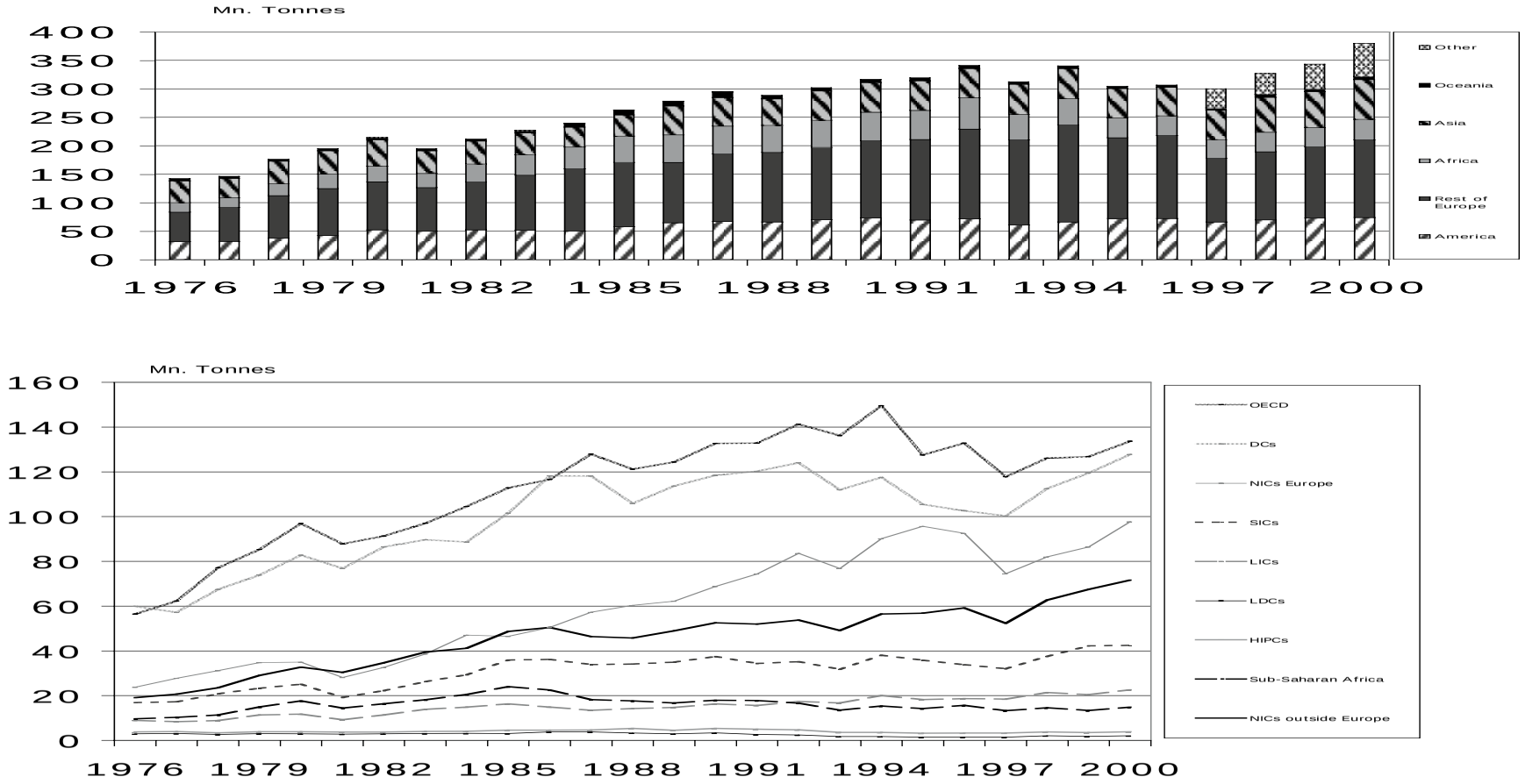
Figure 10: Raw material imports into EC/EU 1976–2000; absolute physical quantities.



ote: Other = unspecified, e.g. data kept secret; HIPCs = highly indebted poor countries; LDCs = least developed countries; LICs = low income countries; SICs = severely indebted countries; NICs = newly industrializing countries; DCs = developing countries.

Source: Eurostat Comext 2001 and own caculations.

Figure 11: Imports of semi manufactured and finished goods into EC/EU 1976–2000: absolute physical quantities



Note: Other = unspecified, e.g. data kept secret; HIPCs = highly indebted poor countries; LDCs = least developed countries; LICs = low income countries; SICs = severely indebted countries; NICs = newly industrializing countries; DCs = developing countries.

Source: Eurostat Comext 2001 and own caculations.

the share of developing countries in the ecological rucksacks (ERs) of EU imports did not decline but remained more or less constant around 56% between 1976 and 2000. Also quite constant, at around a third, was the share in rucksacks from OECD countries. The trends were thus clearly unfavourable to developing countries: the EC/EU received more or less constantly high levels of direct imports from developing countries outside Europe, but this was associated with rising environmental pressure due to ecological rucksacks. This was true only in much weaker form (maximum 10% of total ERs) for newly industrializing counties in Europe, as well as for OECD countries. On the other hand, the trend was even stronger in the case of highly indebted countries and NICs outside Europe: the share of severely indebted countries (SICs) rose from 25% in 1976 to 39% in 2000 of the ecological rucksacks of EC/EU raw material imports, while the share of developing countries outside Europe nearly doubled from 19% to 37%. It would appear that, as a result of the debt crisis, resources were exploited more intensively for exports to countries of the North, or that industrial development in countries of the South did not promote the export of less resource-intensive raw materials. Chile's evolution since 1973 provides impressive conformation of this thesis [Giljum 2002]. As it integrated into the world market between 1973 and 2000, Chile increasingly exported resource-intensive goods, especially copper. In the end a diversification of the Chilean economy, through the expansion of mainly export-oriented fruit-growing, forestry and fishing, served only to expand the resource-intensive sectors. In fact, of the 15 world regions identified by the WTO, Latin America between 1976 and 2000 bore the brunt (one third) of the growing resource extraction and ecological rucksacks involved in imports by the EC/EU (and also contributed to the tune of 22% to the rise in direct absolute quantities of imports). This needs to be investigated further. Most of the ecological rucksacks from developing countries outside Europe fall to non-renewable raw materials (87% in 2000), mainly ores (63%) and energy sources (23%). Erosion made up 13% of the ecological rucksack of the EU's raw material imports in the year 2000.

In 2000, the pressure on the environment due to ecological rucksacks of imports stood at 3.8 to 1: that is, one tonne of imported raw materials resulted in 3.8 tonnes of erosion or unused extraction material in the countries of origin (Table 1). Imports from OECD countries showed a roughly similar picture (4 to 1). Imports from newly industrializing countries in Europe actually showed a lighter burden, with 1.6 tonnes rucksack per tonne of raw materials. By contrast, imported goods from developing countries outside Europe carried a burden of approximately 5 to 1, and those from poor indebted countries (HIPCs) and sub-Saharan Africa as much as 13 to 1 – with a tendency to above-average increases between 1976 and 2000.

It should be investigated further how far resource extraction has actually been relocated from the EC/EU to developing countries. For metals (ores) this has certainly been the case (e.g., Germany since the early 1990s has ceased all production of ores), but for other minerals detailed studies need to be made. It also needs to be investigated how much certain developing countries have engaged in over-exploitation – for example, by switching to marginal locations or by satisfying the new demand for precious metals.

Apart from ecological rucksacks, the quantification of pollution intensive goods has also been used to assess the ecological implications. On the basis of a World Bank study (Mani/ Wheeler 1997), we shall refer to ten product groups from the most polluting branches: iron and steel, non-iron metals, chemicals (industrial and other), mineral fuels, non-metallic mineral products, cellulose and paper, rubber goods, leather goods and metal goods. The data therefore include indistinguishably both raw materials and semi-manufactured and

Geostrategic Resources and Conflicts

Increasing demand for electronic goods such as mobile telephones, computers and video-cameras in the wealthy countries of the North has caused average annual rises of 8% to 12% in the demand for tantalum. Tantalum ores are found mainly in Australia, Canada, Brazil and Central Africa, with smaller quantities in South-East Asia [Tantalum Niobium International Study Center: 2003].

Demand for tantalum has been increasing (2267 tonnes in 2000, the highest ever – Hunziker 2002), as has its value (approx. US$730 per kilogram of Ta2O5 raw ore from Central Africa in the year 2000: prices for tantalum soared 41% between 1995 and 2001, to reach US$1000 in the year 2000 – Hunziker 2002). The bulk of the world tantalum trade, amounting to US$6 billion a year, comes from legal mines in Australia, Canada and Brazil. But a less transparent market has also been developing in the Democratic Republic of Congo.

Belligerent rebel groups, often supported from neighbouring Rwanda and Uganda, have often in recent years used income from tantalum (known as Coltan, a Columbit-Tantalit ore) to finance a bloody civil war involving major human rights violations; the abuse of child-soldiers in a double sense has attracted special attention here (Keitetsi 2002). Congolese rebels and Rwandan soldiers control the illegal extraction of ore under inhuman conditions, often by children, and also steal ore from legal mines (Koetsier 2002).

Having heard of civil wars and the plundering of national parks (e.g., the number of lowland gorillas in the east of the DR of Congo has been whittled down from 8000 to 1000; and the elephant population in Kahuzi-Biega National Park in the Congo has been virtually wiped out in the context of tantalum exports from Central Africa – Hunziker 2002), the Tantalum-Niobium International Study Center in Brussels called on its members (leading corporations in the USA, Canada, Japan, Europe and elsewhere) to obtain their raw materials only from legal sources. All the large global corporations declared that they would have nothing to do with this “bloody” tantalum (Worthington 2000).

One consequence of the world attention was that tantalum ore was taken illegally from Congo to Rwanda, Uganda and Burundi, where it was then exported (often via several intermediaries) by legal trading corporations. This is made easier by the fact that the tantalum market, unlike the nickel or copper market, for example, is

decentralized (Hunziker 2002). Trading firms use international transport companies to ship ore to processing firms in countries of the North, which produce tantalum powder, wire and other semifinished goods from it. In the next stage, condensers and other components are produced from the tantalum powder, and these are then supplied to high-tech corporations such as Ericsson, Intel and Nokia. Effective control over the origin of raw materials must therefore be considered unrealistic. The reserves in Congo are estimated to be the fourth-largest in the world. At current levels of consumption, global tantalum reserves are expected to last another 16 years, and so major efforts are going into exploration for new deposits. Alternatives such as Niobium are also being sought, but tantalum seems to have no competitors for storage capacity and is predicted to have a "glittering future" (Hunziker 2002).

In September 2001 the US House of Representatives passed a resolution prohibiting the purchase of tantalum from Congo. In November 2001 the UN published a second report on the situation in Congo and held the mining companies responsible.

It demanded an embargo on trade in minerals (not only tantalum but also gold and diamonds, as well as tropical wood) from Burundi, Rwanda and Uganda, until it becomes clear who is involved in the incidents in Congo (UN 2001). To date no such embargo has been implemented.

The EU Commission has not yet seen any need to act itself and refers instead to the activities of the UN (EU C161 E/7, 10 July 2003). The International Peace Information Service, a Belgian NGO, published a report in January 2002 ("European Companies and the Coltan Trade: Supporting the War Economy in the DRC") which names certain coltan-importing corporations in Europe (Belgium, Germany and Switzerland) with links to rebel groups in Central Africa. It also demands that the relatively high (and from 1995 to 2000 rising) EU development aid to the relevant countries of Central Africa should be made conditional on democratization and peace-making (Koetsier 2002). The EU's (essentially France's) current commitment, under the terms of Resolution 1484 of the UN Security Council, to stabilize security and to improve the humanitarian situation in the DR Congo at least gives reason to hope that the immediate conflict will be solved.

Between 1989 and 1996, the EC/EU imported niobium and tantalum ores in ever greater quantities – up from approx. 2,000 tonnes to approx. 56,000 tonnes. In 1997 this particular import almost entirely collapsed to a level of 151 tonnes, and by the year 2000 it was down to just 16 tonnes. The origin of the huge imports between 1993 and 1996 is shrouded in almost complete secrecy. The smaller quantities imported between 1989 and 1992 (mainly from Canada) and between 1997 and 2000 (from South Africa, Rwanda, Kenya, Tanzania, Kazakhstan and Lithuania) are comprehensively listed by country. In 1997 just one tonne of ore was imported from Congo, and in 1999 two tonnes. This would suggest that the EU does not currently play a major role in the global tantalum trade (authors' note: data according to Eurostat Comext 2001).

Between 1989 and 1999, the EC/EU imported increasing quantities of semifinished and finished tantalum products (raw metal, powder, wire, condensers, etc.) - up from 515 to 3941 tonnes, but down in 2000 to 2272 tonnes. These came essentially from the United States and the Czech Republic, followed at a considerable distance by South Africa, Thailand, Japan, Israel and Mexico. Evidently, in the 1990s the EU increasingly replaced raw material imports with imports of processed tantalum, so that it is scarcely possible any more to trace the origin of the raw materials (authors' note: data according to Eurostat Comext 2001).

Furthermore, between 1989 and 2000 the EC/EU imported large quantities of tantalum as a secondary material, especially ashes and residue, as well as smaller quantities of waste and scrap. Imports fluctuated enormously between 250 tonnes and 554,000 tonnes (in 1996), with generally higher values in the late 1990s. These came almost entirely from Malaysia, so that it was evidently a question of bye-products of tin production from cassiterite ore concentrates.

Small amounts of secondary material were also sporadically imported from Thailand and Singapore. The highest imports of secondary tantalum in 1996 coincided with the maximum levels for primary ore imports and even matched them in tonnage. It should be investigated how far the relatively high imports of secondary materials between 1997 and 2000 were able to substitute for the almost completely interrupted imports of primary ores, and what were the ecological and socio-economic implications. (Authors' note: data according to Eurostat Comtext 2001.)

Kristi Essik: "A call to arms. How the demand for cell phones and computer chips is helping fuel a bloody civil war in the Democratic Republic of Congo", The Industry Standard Magazine 2001. http://fletcher.tufts.edu/humansecurity/con2/ws2/essik.pdf

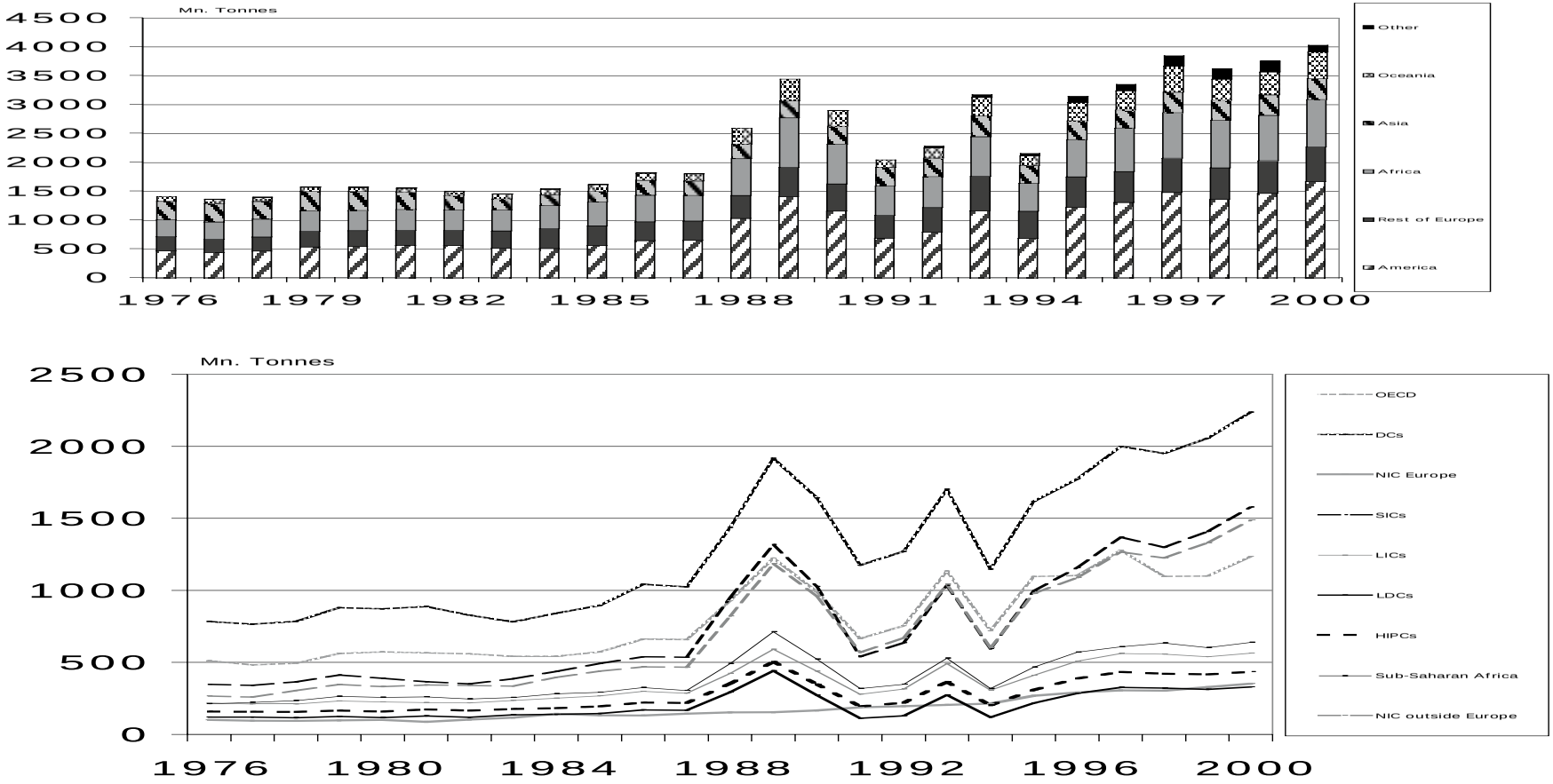
Table 1: Ecological rucksacks of EU raw material imports in 2000 and changes since 1976 (EC).

	Ecological rucksacks (ERs) of imported raw materials			
	Mn. tonnes in 2000	Change compared to 1976	Ers per t. raw material in 2000	Change compared to 1976
Total	4.022	186%	3,8	119%
OECD	1.235	141%	4,0	33%
DCs	2.237	186%	4,9	235%
NICs Europa	352	252%	1,6	18%
SICs	1.579	355%	8,8	274%
LICs	563	158%	7,1	124%
LDCs	330	174%	12,1	207%
HIPCs	435	174%	12,6	173%
Sub-Saharan Africa	638	201%	6,2	123%

Note: HIPCs = highly indebted poor countries; LDCs = least developed countries; LICs = low income countries; SICs = severely indebted countries; NICs Europe = newly industrializing countries in Europe; DCs = developing countries.

Source: Eurostat Comext 2001 and own caculations.

Figure 12: Ecological rucksacks of raw material imports into EC/EU 1976-2000.



Note: Other = unspecified, e.g. data kept secret; HIPCs = highly indebted poor countries; LDCs = least developed countries; LICs = low income countries; SICs = severely indebted countries; NICs = newly industrializing countries; DCs = developing countries.

Source: Eurostat Comext 2001 and own caculations.

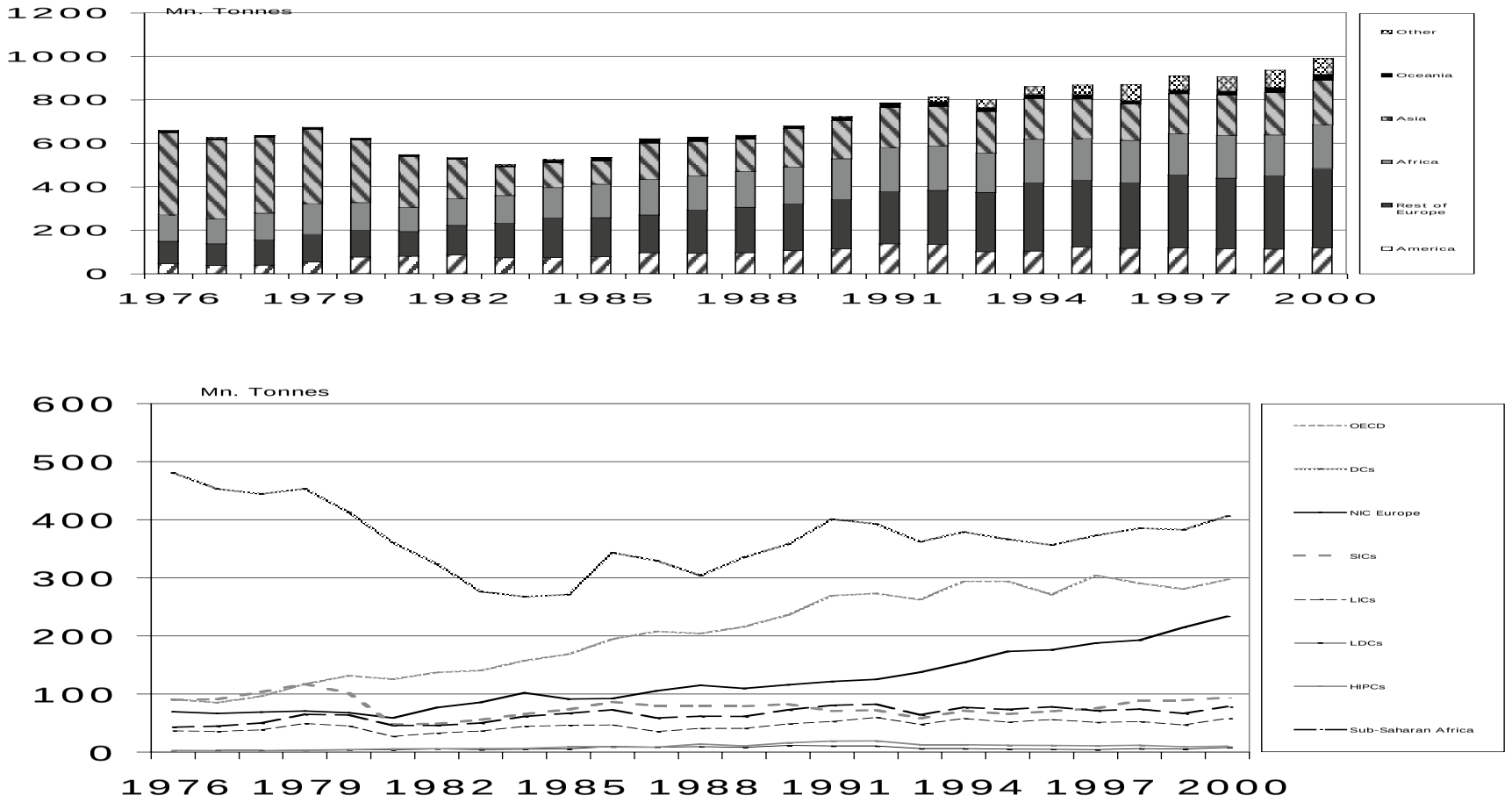
finished goods. The classification is based on polluting factors in the form of atmospheric and water emissions, as well as heavy metal emissions. A further distinction has been made in the category of pollution intensive goods between those with and those without mineral fuels: the latter involve pollution in the producing or exporting economies that mainly puts direct pressure on the environment through emissions or waste; whereas the former mainly put pressure on the global environment through atmospheric emissions due to combustion in the consuming or importing economies.

The years 1976 to 2000 saw increasing imports of pollution intensive goods into the EC/EU (Fig. 13a). In 2000 these were running at 991 million tonnes (164 without fuels – see Fig. 13b) – which was roughly 50% higher than in 1976 (180% higher without fuels). Pollution intensive goods in general accounted for 63-72% of all imports into the EC/EU; those without mineral fuels accounted for 6-11% of all imports, with a clearly rising trend.

In 2000 a large part of these imports came from developing countries (41%), though there had been a sharp fall since 1976 when the figure stood at 73%. OECD countries made up the second-largest share (30% in 2000, with a strong tendency to increase since 1976, when they stood at 14%). The same is true of newly industrializing countries in Europe, which accounted for 24% of all the EC/EU's imports of pollution intensive goods in the year 2000, as against 11% in 1976. With regard to pollution intensive imported goods without mineral fuels, the main purchases were from OECD countries (49%) and newly industrializing countries of Europe (41%), whose share had risen sharply since 1976 (16%), while corresponding imports from OECD countries had shrunk from 70% in 1976 to 49% in 2000. (In absolute terms, these imports from OECD countries amounted to 41 million tonnes in 1976 and 81 million tonnes in 2000.) Imports of "dirty industry" goods from developing countries also showed a striking increase, from 8 million tonnes in 1976 to 45 million tonnes in 2000 (when they accounted for 27% of the corresponding total imports). Pollution associated with the import of pollution intensive goods, especially those without mineral fuels, probably also involves what is actually local output-based pollution. But, because of differences in technology, etc., the specific intensity of pollution may be very different around the world – and hence also the absolute distribution of the actual pressure on the environment.

It is interesting that developing countries outside Europe have a clearly increasing share of "dirty industry" goods without mineral fuels (up from 13% to 27% or, in absolute terms, from approx. 8 to 45 million tonnes). This is similar to the picture we have seen in the case of ecological rucksacks (which refers only to raw materials). Thus, developing countries outside Europe have improved their share of export production for the EC/EU; this is also true, in a weaker form, for newly industrializing countries outside Europe, which increased their share of such exports from 7% in 1976 to 16% in 2000. However, the main rise in import share of such goods was achieved by European NICs (up from 16% in 1976 to 41% in 2000). If it is true that production involving intensive pollution due to emissions is being increasingly relocated in NICs, then this applies especially to the "emerging markets" of Eastern Europe, but also to the NICs of the South. All that can

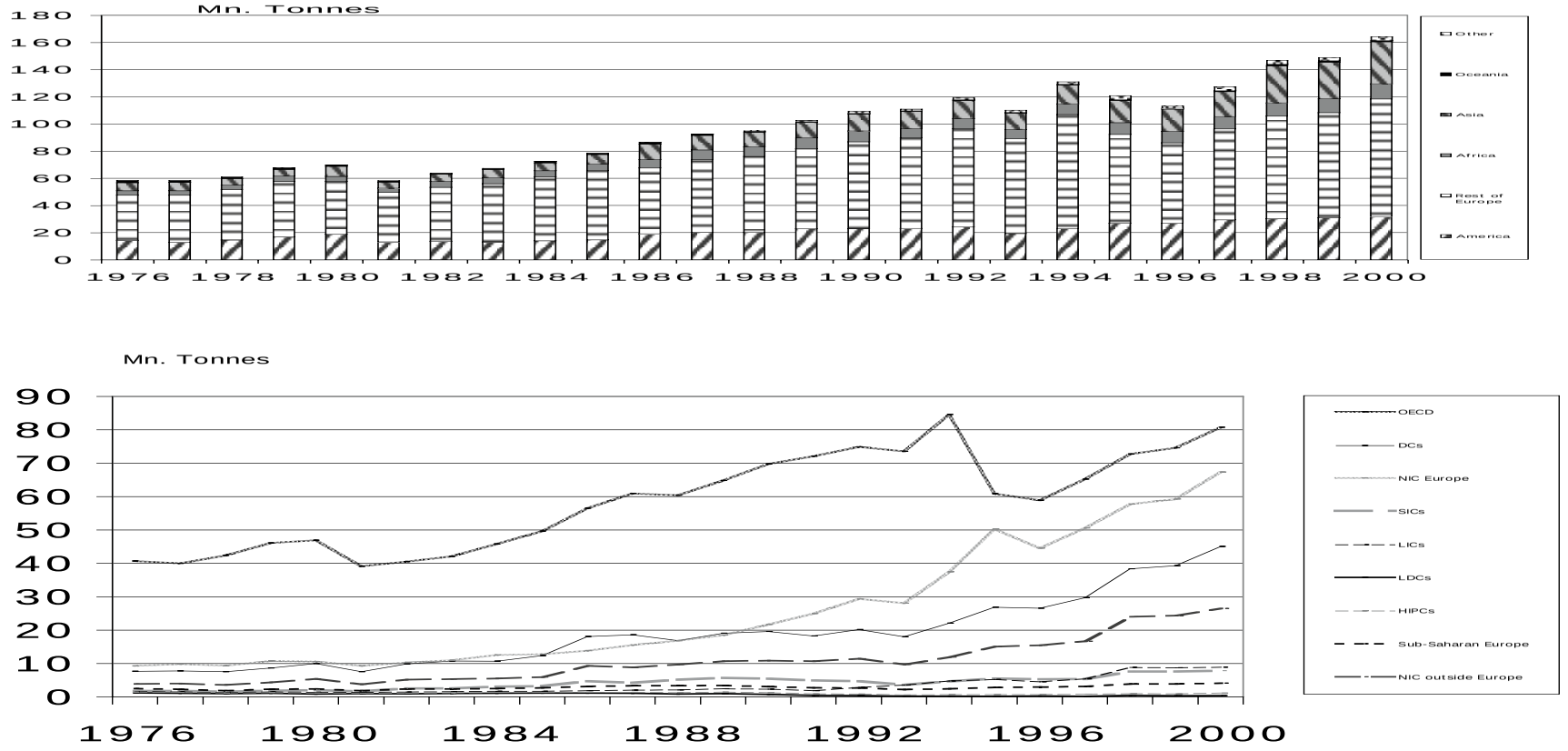
Figure 13a: Total EC/EU imports of pollution intensive goods 1976–2000



Note: Other = unspecified, e.g. data kept secret; HIPCs = highly indebted poor countries; LDCs = least developed countries; LICs = low income countries; SICs = severely indebted countries; NICs = newly industrializing countries; DCs = developing countries.

Source: Eurostat Comext 2001 and own caculations.

gure 13b: EC/EU imports of pollution intensive goods without mineral fuels 1976–2000.



Note: Other = unspecified, e.g. data kept secret; HIPCs = highly indebted poor countries; LDCs = least developed countries;
LICs = low income countries; SICs = severely indebted countries; NICs = newly industrializing countries; DCs = developing countries.

Source: Eurostat Comext 2001 and own caculations.

be initially established here is that there has been an absolute increase in such imports. Further analysis of production data for these sectors would be necessary to clarify the extent to which pollution-intensive production has been relocated abroad through the dismantling of domestic production capacities.

Unequal Ecological Exchange

In this section we shall investigate the EC/EU's exchange relations in world trade. The central question here is whether they lead to unequal ecological exchange. According to Andersson and Lindroth (2001), unequal ecological exchange denotes inequality between imports and exports. The physical trade balances (PTBs) of the ecological rucksacks and of the total resource requirements of an economic area (imports minus exports), may be adduced as indicators of unequal ecological exchange.

Unequal ecological exchange will be investigated here in terms of the balance of imported and exported ecological rucksacks.

PTB inclusive of ecological rucksacks: an import surplus means here that the total strain on resources is greater than the domestic strain associated to exports, i.e., that the environment comes under further pressure in other countries.

The PTB of goods involving pollution intensive production will also be examined here: what is said here refers to production pollution in the form of emissions and waste. For a more differentiated analysis of the features and distribution of such pollution, the PTB of goods involving pollution intensive production might first be reckoned separately for particular product groups and products. This analysis might then be deepened, for example, through special investigation of regional environmental pollution by production technologies, in order to assess any effects of pollution or relief measures in comparison with the status quo ante.

The PTB of absolute imports and exports has also been investigated: an import surplus might mean here that goods are obtained to a greater extent than before from the world market, and that consequently the domestic environment of another state or the regional/global environment has been more heavily polluted by waste and emissions resulting from domestic activities. It may be assumed, however, that the ecological balance may be correlated with the PTB of absolute quantities of goods only if the commodity structure of the imports and exports has not changed. In other words, the ecological balance might, for example, remain absolutely constant despite a changed PTB. It should also be borne in mind that, even with an absolutely even PTB between trading partners, there may be an unequal distribution of environmental burden in the form of ecological rucksacks of the traded goods (as in the example of Chile's PTB with and without ecological rucksacks (Giljum 2002).

A less desirable consequence of the uneven ecological exchange is the "rich country illusion effect" (Andersson/Lindroth 2001). The use of imports to relocate environmental pollution may wrongly lead one to assume that a country's environmental performance has improved, if one simply takes into account its internal levels of pollution.

The main results are as follows:

- The EC/EU's physical trade balance (in tonnes) is increasingly uneven: it imports considerably more goods than it exports. In monetary terms, however, its foreign trade tends to balance out.
- The "ecological rucksacks" of imports exceed those of exports. Since the mid-1990s the PTB incl. ecological rucksacks of the EC/EU has risen considerably more than the PTB in absolute quantities. The total net resource requirement of the EC/EU's foreign trade has therefore increased. Because of the unequal ecological exchange, the EC/EU's total net resource requirement has remained more or less constant, whereas a focus purely in terms of domestic conditions would suggest the opposite.
- As a whole, pollution intensive goods are also clearly and increasingly imported in greater quantity than they are exported. After the mid-1980s, however, the PTB in such goods without mineral fuels tended to balance out, since to date more of these goods had been exported than imported. Furthermore, increasing absolute quantities of imports and exports underlie this even balance, so that in absolute terms foreign production locations have displayed increasing environmental pressure. It should be investigated how far this is due to tougher environmental policies in the EU.
- Uneven ecological exchange has increased in the context of globalisation, whereas the domestic pressure on resources has decreased. On the other hand, the total pressure on resources that can be attributed to consumption within the EC/EU has remained constant.

Examples of the Relocation of Environmental Pollution

The introduction of the autocatalyst some fifteen years ago in Western Europe has helped to reduce motor-car emissions and atmospheric pollution. Nevertheless, this is an example of the (scarcely noticed) relocation of pollution in the form of ecological rucksacks and production processes whose emissions pollute the environment.

The production of a regulated three-way catalyst requires precious metals of the platinum group (PGM), platinum, palladium and rhodium. These have an ecological rucksack of around 300,000 (300 kgs of ore must be processed to obtain 1 gram of PGM). For a single catalyst this means a rucksack up to 6,000 kgs – or 40 grams of resource consumption per kilometre driven, more than the oil consumption for the same distance. The ecological rucksack directly pollutes the countries supplying the PGMs, mainly South Africa and Russia.

In Norilsk, Siberia, the Norilsk Nickel company mostly processes palladium ore with antiquated technology. This generates huge amounts of sulphur dioxide – estimated at 2.8 million tonnes a year, roughly equivalent to Germany's total SO_2 output ten years ago. This has been considerably reduced in recent years (down by three-fourths until 2000), but Norilsk still figures as the most heavily polluted town in Russia, and probably in the world. In addition to the SO_2, there are various heavy metal emissions and an unimaginable pollution of the soil and water. The Norilsk emissions damage the forest over an area of 7,520 square kilometres, and the heavy metals can be detected as far away as Canada and Scandinavia. Some of the ore extracted by Norilsk is further processed on the Kola Peninsula, with the aforementioned ecological consequences. Because of their proximity to Norway and Finland, however, these production processes attract more attention in the West than the distant problems in Norilsk.

Demand for PGMs is growing and is expected to grow further – together with the transfer of severe ecological disadvantages to the producer countries. Minimum standards for PGM production at least are therefore essential to prevent catastrophic consequences for the environment. Cooperation throughout the production chain and between governments is indispensable. The direct impact on Norway has already contributed to financial aid for environmentally cleaner production equipment in neighbouring Russia. Thorough renovation of Norilsk's remote production sites would, however, require considerably greater investment as well as the application of managerial, administrative and environmental expertise. This places a responsibility on the automobile industry – in its own interests. It is to be expected that, with rising demand and stable or rising prices for PGMs, the production of the material will also be more efficient.

Reinier de Man, Umweltzerstörung: Sauberes Auto – schmutziges Siberien,
Munich: Ökon Verlag, 2003

Physical and Monetary Trade Balance of the EC/EU

In the period from 1976 to 2000, the EC/EU constantly showed a clear import surplus in tonnes; the physical trade balance totalled between 531 million and 1 billion tonnes, with a tendency to increase (Table 2). By far the largest contributor to this was mineral fuels (67% to 76%), followed by metals (10% to 20%). The imbalance between imports and exports grew by approximately 32% over the period. Apart from biomasses, for which a declining trend was perceptible, all the other main categories showed a clear increase in the physical trade balance between 1976 and 2000.

The monetary trade balance shows export surpluses between 1993 and 1998 and import surpluses between 1976 and 1992 (except 1986) and in 1999 and 2000 (Table 2). Export surpluses were continually recorded for metals and other products, import surpluses for biomasses and mineral fuels, and a variation of import and export surpluses for minerals. The monetary balances came to a maximum of approximately 22% of the total volume of imports and exports (which roughly equalled each other), and were thus far lower than the physical balances (up to 400% of total export volumes).

In physical terms, therefore, the EU constantly used up more materials than it delivered to the rest of the world (without ecological rucksacks); imports tended to consist of low-value, little-processed goods, and exports of high-value, highly processed goods.

The EC/EU's average import prices rose considerably between 1976 and 2000, by 0.2 to 0.7 ecus per kg (Table 3), mineral fuels being the cheapest (0.08 to 0.18 ecus per kg) and metal goods as well as other products the most expensive.

The EC/EU's average export prices also rose considerably between 1976 and 2000, by 0.8 to 2.2 ecus per kg (Table 3). As for imports, mineral fuels were cheapest export commodities (0.09 to 0.25 ecus per kg) and metal goods the most expensive (1.7 to 6.4 ecus per kg).

In general, the import-export price ratio remained more or less constant, at 0.2 to 0.3 (Table 4). In the metal and mineral groups, as well as mineral fuels, imports were always appreciably cheaper than exports.

Table 2: EC/EU physical and monetary trade balance 1976-2000.

EC/EU	B,West Germany,F,I,L,NL,DK,IRL,UK EC-9					plus GR EC-10					plus E,P EC-12									plus A,FIN,S EU-15						
	Physical trade balance **Million Tonnes**																									
	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
TOTAL	761	698	700	767	731	602	585	531	568	579	674	696	731	763	799	862	881	747	837	910	890	914	892	942	1006
Biomasses	104	99	97	101	88	71	77	73	69	65	74	77	80	69	75	78	76	70	87	79	68	59	67	70	68
Metals	112	90	89	116	108	88	86	75	93	99	107	114	146	140	133	130	128	75	120	140	98	117	125	134	146
Minerals	10	8	5	9	11	0	-1	-0	4	4	-5	-2	4	5	7	11	18	14	13	19	13	13	13	19	23
Mineral fuels	541	500	500	526	504	427	404	369	389	393	463	469	518	560	591	652	664	571	598	646	674	698	647	673	704
Other products	-6	1	9	17	21	16	18	14	13	18	35	38	-17	-11	-7	-9	-4	17	18	25	37	28	40	47	66
	Monetary trade balance **Billion ECUs**																									
	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
TOTAL	16	7	5	24	49	37	35	25	31	19	-8	1	25	34	46	71	51	-0	-3	-28	-45	-49	-23	19	89
Biomasses	28	30	28	32	29	27	29	34	42	44	44	49	38	37	37	36	32	25	34	18	14	14	17	16	16
Metals	-41	-48	-47	-46	-46	-61	-67	-63	-63	-69	-58	-52	-29	-30	-30	-19	-27	-54	-58	-73	-92	-98	-67	-38	-30
Minerals	0	0	-0	0	1	-1	-1	-1	-1	-1	-2	-2	-3	-4	-4	-3	-3	-3	-4	-4	-5	-6	-5	-5	-5
Mineral fuels	43	42	38	50	75	88	89	80	90	89	49	47	39	52	59	61	55	49	49	51	63	68	48	61	117
Other products	-14	-17	-14	-13	-10	-16	-15	-24	-37	-44	-41	-41	-21	-21	-16	-5	-5	-17	-23	-20	-24	-27	-16	-16	-9

Source: Eurostat Comext 2001.

Table 3: EC/EU imports and exports prices 1976–2000.

EC/EU	B,West Germany,F,I,L,NL,DK,IRL,UK EC-9										plus GR EC-10										plus E,P EC-12										plus A,FIN,S EU-15						
	Imports **ECUs per kg**																																					
	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000												
TOTAL	0,17	0,19	0,19	0,22	0,28	0,35	0,39	0,42	0,46	0,47	0,35	0,35	0,38	0,43	0,42	0,43	0,41	0,44	0,44	0,43	0,46	0,52	0,55	0,58	0,72												
Biomasses	0,31	0,36	0,35	0,37	0,40	0,46	0,48	0,52	0,62	0,63	0,55	0,52	0,56	0,61	0,56	0,56	0,53	0,53	0,57	0,53	0,56	0,63	0,60	0,55	0,61												
Metals	0,24	0,29	0,31	0,32	0,41	0,48	0,56	0,65	0,67	0,70	0,66	0,66	0,76	0,91	0,97	1,05	1,05	1,34	1,17	1,13	1,42	1,51	1,72	1,85	2,14												
Minerals	0,10	0,11	0,11	0,12	0,15	0,17	0,17	0,17	0,20	0,19	0,15	0,14	0,20	0,19	0,17	0,16	0,15	0,18	0,17	0,15	0,16	0,17	0,19	0,19	0,22												
Mineral fuels	0,08	0,09	0,08	0,10	0,15	0,21	0,23	0,22	0,24	0,24	0,11	0,11	0,08	0,10	0,11	0,10	0,09	0,09	0,09	0,09	0,10	0,11	0,08	0,10	0,18												
Other products	1,04	0,91	0,76	0,79	0,91	1,09	1,31	1,32	1,39	1,32	1,07	1,05	2,33	2,49	2,38	2,60	2,46	1,78	1,79	1,73	1,54	1,95	1,89	1,92	1,99												
	Exports **ECUs per kg**																																					
	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000												
TOTAL	0,76	0,79	0,73	0,79	1,01	1,05	1,20	1,22	1,34	1,40	1,24	1,22	1,29	1,45	1,43	1,44	1,41	1,32	1,39	1,60	1,71	1,85	1,89	1,92	2,21												
Biomasses	0,52	0,62	0,55	0,53	0,56	0,59	0,65	0,61	0,63	0,56	0,50	0,35	0,67	0,69	0,64	0,68	0,65	0,70	0,79	0,84	0,89	0,91	0,89	0,79	0,88												
Metals	1,70	1,65	1,56	1,77	2,05	2,13	2,61	2,62	2,64	2,79	2,87	2,91	3,34	3,77	4,00	3,78	3,80	3,41	3,93	4,48	4,45	4,95	5,53	5,89	6,38												
Minerals	0,13	0,14	0,14	0,15	0,19	0,18	0,20	0,22	0,25	0,25	0,19	0,19	0,28	0,31	0,29	0,28	0,28	0,31	0,30	0,30	0,31	0,33	0,33	0,35	0,41												
Mineral fuels	0,09	0,10	0,09	0,13	0,20	0,24	0,26	0,26	0,29	0,30	0,15	0,14	0,12	0,15	0,16	0,16	0,14	0,13	0,12	0,13	0,16	0,16	0,13	0,15	0,25												
Other products	1,27	1,40	1,23	1,37	1,58	1,85	2,37	2,31	2,48	2,61	2,67	2,60	2,03	2,35	2,36	2,29	2,37	2,55	2,64	2,74	2,73	3,10	3,25	3,44	3,94												

Source: Eurostat Comext 2001.

Table 4: EC/EU import prices divided by export prices 1976–2000.

EC/EU	B,West Germany,F,I,L,NL,DK,IRL,UK EC-9										plus GR EC-10										plus E,P EC-12										plus A,FIN,S EU-15						
	Import-/Export-Prices																																					
	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000												
TOTAL	0,2	0,2	0,3	0,3	0,3	0,3	0,3	0,3	0,3	0,3	0,3	0,3	0,3	0,3	0,3	0,3	0,3	0,3	0,3	0,3	0,3	0,3	0,3	0,3	0,3												
Biomasses	0,6	0,6	0,6	0,7	0,7	0,8	0,7	0,9	1,0	1,1	1,1	1,5	0,8	0,9	0,9	0,8	0,8	0,8	0,7	0,6	0,6	0,7	0,7	0,7	0,7												
Metals	0,1	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,3	0,3	0,2	0,2	0,2	0,2	0,2	0,3	0,3	0,4	0,3	0,3	0,3	0,3	0,3	0,3	0,3												
Minerals	0,8	0,8	0,8	0,8	0,8	0,9	0,8	0,8	0,8	0,7	0,8	0,8	0,7	0,6	0,6	0,6	0,5	0,6	0,6	0,5	0,5	0,5	0,6	0,5	0,5												
Mineral fuels	0,9	0,9	0,9	0,8	0,8	0,9	0,9	0,9	0,8	0,8	0,8	0,8	0,7	0,7	0,7	0,6	0,6	0,7	0,7	0,7	0,6	0,7	0,6	0,7	0,7												
Other products	0,8	0,6	0,6	0,6	0,6	0,6	0,6	0,6	0,6	0,5	0,4	0,4	1,1	1,1	1,0	1,1	1,0	0,7	0,7	0,6	0,6	0,6	0,6	0,6	0,5												

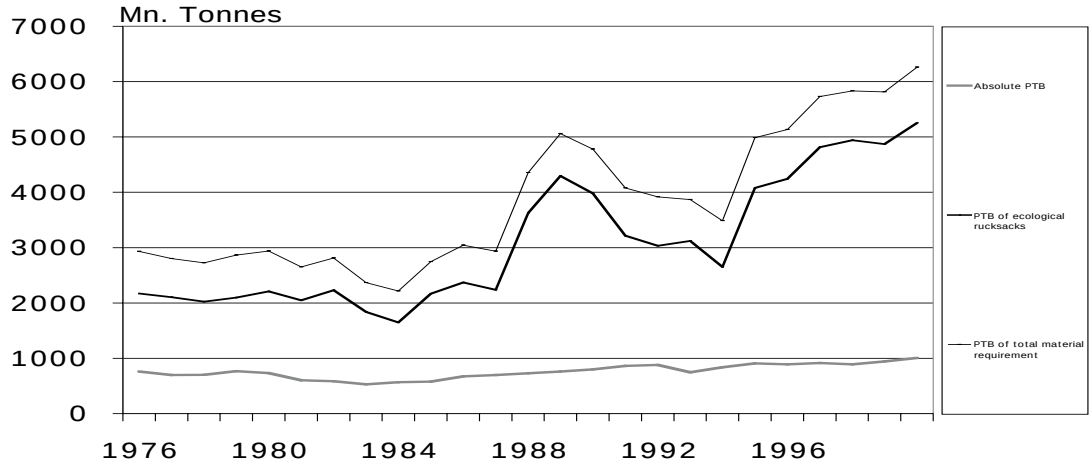
Source: Eurostat Comext 2001.

Trade Balance of Ecological Rucksacks of the EC/EU

The EC/EU's physical trade balance (imports minus exports) has been considered with the inclusion of ecological rucksacks. As we said before, this PTB of ecological rucksacks seems to us most appropriate for the consideration of uneven ecological exchange.

Between 1976 and 2000, the EC/EU showed a clear and rising import surplus without ecological rucksacks, up to as much as 1 billion tonnes (Fig. 14). This uneven picture is considerably sharpened when we include the ecological rucksacks, as that demonstrates a maximum import surplus of 5.3 billion tonnes in the year 2000. The same may be said of the total resource requirement (absolute physical imports minus exports, both inclusive of ecological rucksacks), which rose to a maximum of 6.3 billion tonnes in the year 2000 from around 3 billion tonnes in the 1976-1987 period. The whole increase took place in two periods, 1984-1989 and 1994-2000, with a decrease in between. Altogether, then, the EC/EU constantly and increasingly used more physical resources than it made available to the rest of the world. Inclusion of the ecological rucksacks makes it clear that the statistically unrecorded net resource requirement is three to five times larger than the simple volume of trade.

Figure 14: Physical trade balance (PTB) with and without ecological rucksacks: EC/EU 1976-2000.



Note: Physical trade balance = imports minus exports.

Source: Eurostat Comext 2001 and Wuppertal Institute data base.

Box: Less Pollution Possible Also with Unequal Ecological Exchange

Unequal ecological exchange does not necessarily have to result in greater pressure on the environment. It can also lead to reduced pressure on the environment, when the unequal ecological exchange is maintained and, at the same time, the volume of trade (imports plus exports) actually increases.

The following imaginary example illustrates this with reference to resource extraction including ecological rucksacks*:

	1 domestic resource extraction (incl. ecol. rucksacks)			2 physical imports (incl. ecol. rucksacks)			3 physical exports (incl. ecol. rucksacks)		
	before		after	before		after	before		after
North (developed countries)	100	=>	80	30	=>	40	5	=>	15
South (developing countries)	50	=>	60	5	=>	15	30	=>	40
World (total)	150	=>	140	35	=>	55	35	=>	55

In the first period, the developed countries (North) extract 100 units from their domestic environment. The developing countries (South) extract 50 units from their environment. Together this gives a worldwide resource extraction of 150 units.

The North exports only 5 units to the South but imports 30 units from the South. This gives an unequal ecological exchange of 25 units – that is, the North imports 25 units more from the South than it exports there.

In the second period, the North reduces its internal extraction to 80 units, while the South increases its own to 60 units. This gives a total worldwide reduction in resource extraction from 150 to 140 units, and so the pressure on the environment decreases.

At the same time, both have expanded their trade: the North now imports 40 instead of 30 units from the South, and exports 15 instead of 5 units to the South. In this way, the unequal ecological exchange remains unchanged from the first period, at a total of 25 units. Altogether, however, the pressure on the environment decreases.

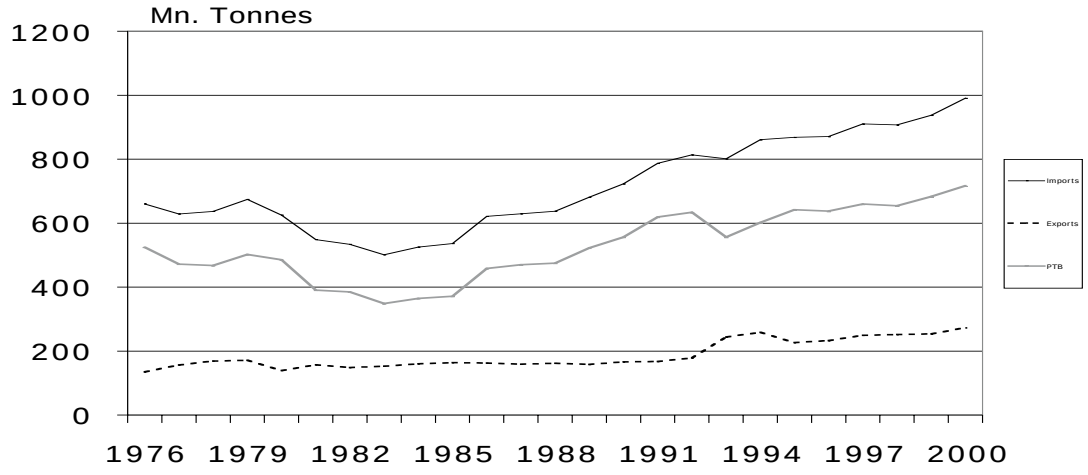
* The example is also comprehensible in terms of other indicators of pollution (e.g., energy consumption, waste, CO_2 emissions, etc.)

Balance of Pollution Intensive Goods

Between 1976 and 1997, the EC/EU always imported a greater amount (3 to 5 times more) of pollution intensive goods as a whole (as previously defined) than it exported (Fig. 15a). After the 1976-1988 period of relative stability (measured by PTB) in the external trade relationship, the import surplus increased considerably and peaked at 700 million tonnes a year in the 1990s. Unequal international exchange of pollution intensive goods apparently continued in the case of the EC/EU. It is quite clear that, especially in the 1990s, pollution intensive products were purchased abroad in greater quantity. This correlates in time with the general tendencies to globalisation, as well as with similar rates of increase (37% from 1990 to 2000) to those in external trade as a whole (31%).

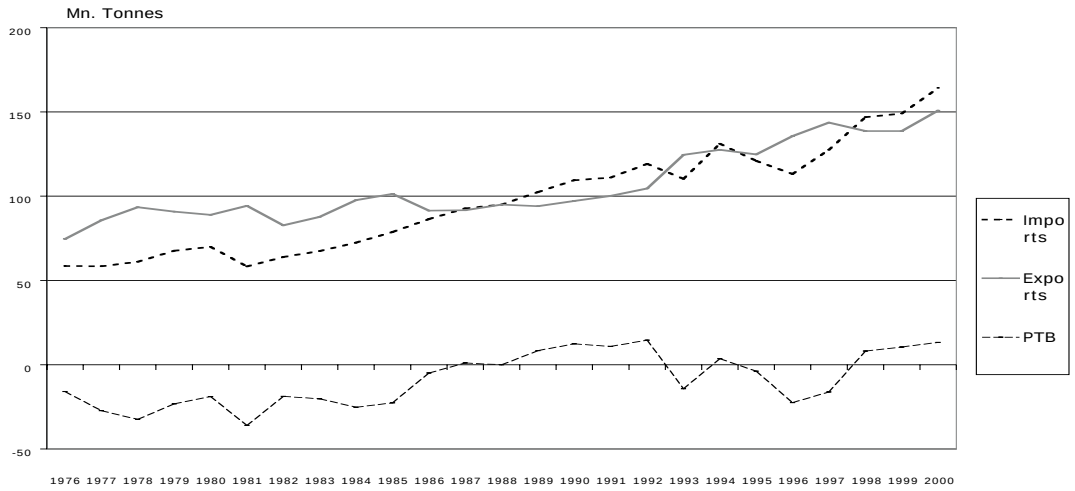
Less marked is the unequal external trade relationship (PTB) for pollution intensive goods without mineral fuels (Fig. 15b). In that case, from the mid-1980s on, there was a fairly even import-export ratio, although considerably more had been exported than imported up to the mid-1980s. Thus, the PTB in pollution intensive goods without mineral fuels has also developed in such a way that foreign production locations display greater pressure on the environment. Moreover, both imports and exports of these goods increased almost constantly in absolute terms between 1976 and 2000, with considerably higher rates of increase than for pollution intensive goods as a whole (cf. Fig. 15a). It should be investigated how far these trends correlate with tougher environmental policies in the EU, and there should also be detailed analysis both of the product structure and of regional specificities in the production of pollution intensive goods.

Figure 15a: Total external trade in pollution intensive goods: EC/EU 1976–1997.



Source: Eurostat Comext 2001 and own calculations.

Figure 15b: Total external trade in pollution intensive goods.



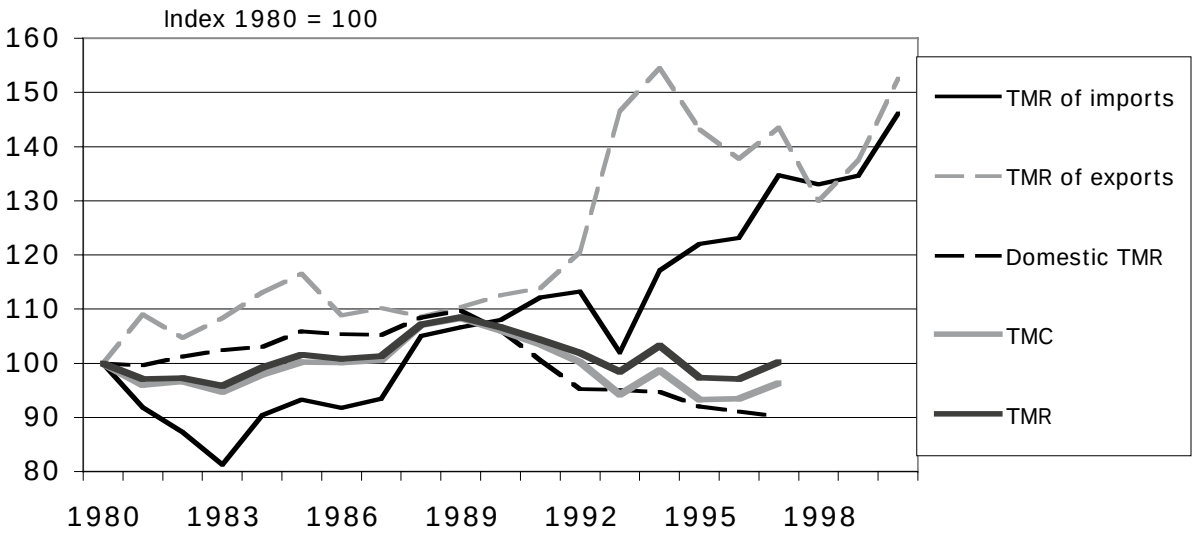
Source: Eurostat Comext 2001 and own calculations.

No Increase in Domestic Consumption of Materials

Although the EU's physical trade balances (in the form of "ecological rucksacks" and pollution-intensive goods) are uneven – which means that unequal ecological exchange is present, as shown especially in the PTB of the ecological rucksacks – the total pressure on resources attributable to domestic consumption within the EU has remained constant. This indicates a relative de-coupling of resource consumption from monetary economic growth. However, it is not possible to establish any significant absolute reduction in the EU's total material requirement (TMR), in the high proportion of non-renewable resources within that requirement, or in total material consumption (analogous to direct material input, or DMI, as previously described). In the view of certain experts, however (e.g. Daly 1990, 1992; Costanza et el. 1997), such a reduction is the prerequisite for sustainable development in the sense of a fairer distribution of resource consumption, since per capita consumption levels in industrial countries – which are far higher than in developing countries – cannot be achieved worldwide because of natural restrictions. Up to now, we know of only exceptional cases where an absolute uncoupling of total material consumption and economic growth has occurred (Bringezu et al, forthcoming). The central issue with regard to "resource justice" appears to be that per capita consumption in the countries of the North has not declined. These per capita considerations should always include the import-export balance, since an exclusive focus on domestic (per capita) consumption may lead to wrong conclusions. Globalisation heightens the danger of "wrong conclusions", as more and more goods are imported and exported.

The greater use of foreign resources to cover the EU's material input does not serve internal consumption alone, but increasingly also the production of goods for export. This demonstrates the EU's growing role in the resource requirement of other economies. On

Figure 16: Development of total material requirement and consumption: EU-15 1980–2000.



Source: Wuppertal Institute data base.

the other hand, the internal final demand for goods has remained quantitatively more or less constant.

If the ecological rucksacks are factored in, their increase in the EU's imports and exports means that in global terms the EU consumed roughly the same resources between 1980 and 2000; its global Total Material Consumption or TMC (domestic extraction plus imports and minus exports, in each case incl. ecological rucksacks) varied between a maximum of 8% higher and 7% lower than in 1980 (Fig. 16). This relatively constant or even declining (in the 1990s) TMC suggests that globalisation has not led to greater EU consumption of resources. But it needs to be further investigated how far various elements have affected this evolution of TMC (e.g., transport, eco-efficient modernization processes, population trends, etc.). These elements probably point in different "directions": for example, transport growth certainly contributes to increased material consumption. But this is obviously offset by other elements.

Goods and Regions with Increasing Importance in the Physical External Trade of the EC/EU and Other Aspects

In this section we shall investigate which goods have an increasing quantitative importance in the foreign trade of the EC/EU. Along with a general consideration of product groups, we shall investigate the role of developing and newly industrializing countries in connection with import growth.

The main results are as follows:

- Non-renewable materials (fossil fuels, metals and metal goods) play a dominant role in both imports and exports. The structure of the EC/EU's imports and exports did not essentially change between 1976 and 2000 in relation either to the specific DMI or the specific TMR; at the same time, the growth in the quantitative turnover of both imports and exports points to increased group-specific pressure on the environment associated with external trade.
- From developing countries outside Europe the EC/EU imported, in particular, environmentally intensive goods with a relatively low degree of processing (ores, mineral fuels). Imports from developing countries as a whole remained constantly high. Large increases were recorded for certain quantitatively still unimportant product groups from branches with a higher manufacturing depth. To some extent, then, a switch to high-value export goods also occurred in developing countries.
- Imports from European NICs have been sharply increasing, with a diverse product structure and higher levels of processing. Above-average increases occurred – as previously described in the case of developing countries – for quantitatively still unimportant product groups from branches with a high manufacturing depth.
- Most raw material imports are of goods that cannot be gained at all within the EU, or only in small quantities (coffee, cocoa beans, cotton, fossil fuels, ores, rare minerals, etc.). These come to a large but declining extent from developing countries, and to an increasing extent from European NICs and highly indebted countries

Imports in General

The present structure of the EC/EU's physical imports is as follows:

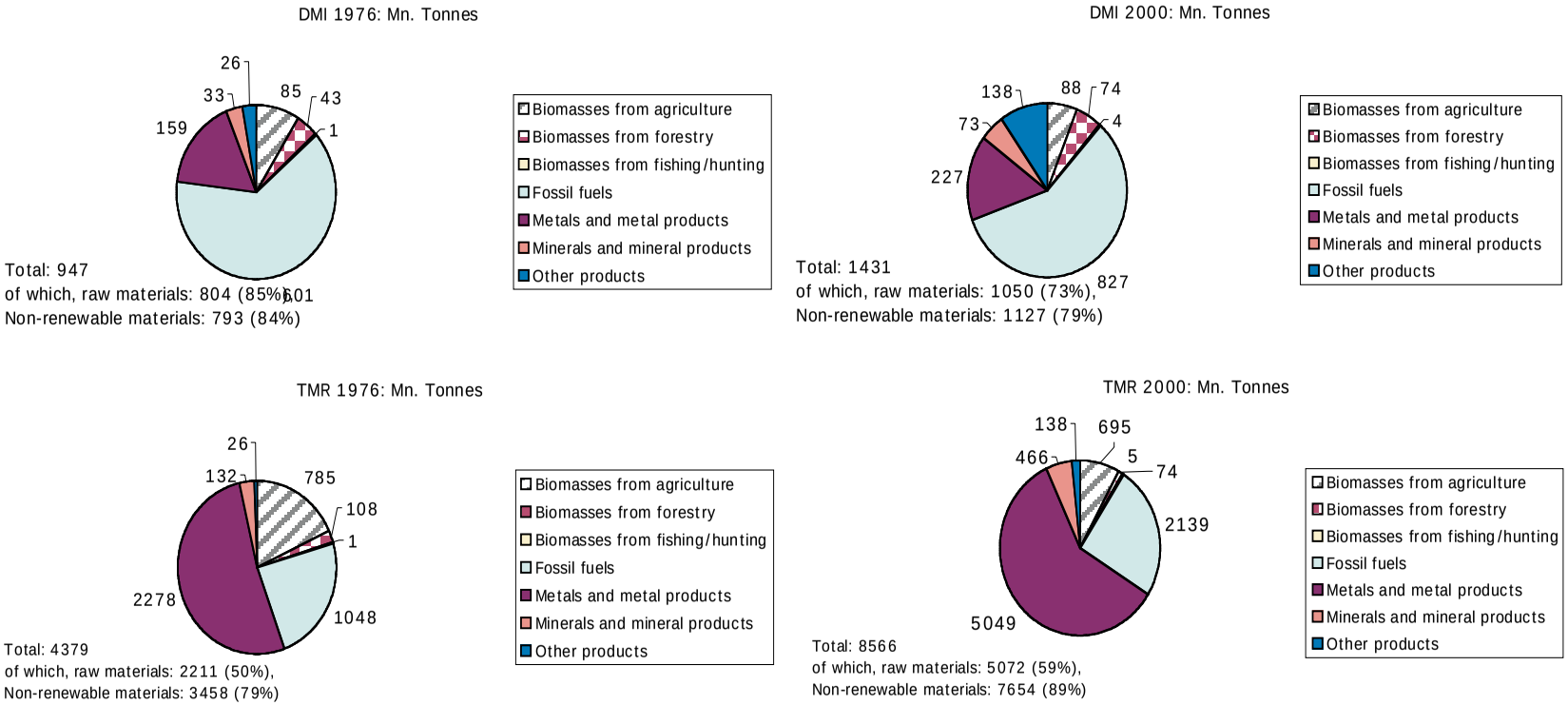
Fossil fuels, metals and metal products clearly dominate the physical range of imports and their ecological rucksacks (Fig. 17).

Then come biomasses from agriculture.

Between 1976 and 2000, the structure of EC/EU imports – as well as exports – did not change essentially in respect of specific DMI or specific TMR; the greater import and export turnover therefore also points to increased group-specific pressure on the environment associated with external trade.

The structure of absolute imports (DMI) between 1976 and 2000 also showed fossil fuels in the dominant position, followed by metals and metal products (Fig. 17). The picture is

Figure 17: Product structure of EC 1976 and EU 2000 imports: DMI and TMR.



Source: Eurostat Comext 2001 and Wuppertal Institute data base.

similar when account is taken of the ecological rucksacks - only then metals and metal products come before fossil fuels. In 2000, the share of non-renewable imports in the EC/EU was 79% of absolute imports. This figure has scarcely fallen since 1976 (84%), and the same is true of renewable imports (12 or 14%). Thus, the EC/EU's physical demand on resources (DMI) abroad has largely continued to rest on a non-renewable and therefore non-sustainable basis. This finding is considerably strengthened if we include the ecological rucksacks: 89% of the EC/EU's total material requirement (TMR) in 2000 rested on a non-sustainable basis, up from 79% in 1976; and the share of renewable imports (TMR) fell from 20% in 1976 to 9% in 2000.

Without exception, absolute imports (DMI) of the main groups of materials increased through the period. The EC/EU's material input from abroad scarcely changed its structure between 1976 and 2000, although absolute imports (up 51%) and the total material requirement (up 96%) considerably increased during this period, the largest proportion in each case being on a non-renewable basis. A trend towards sustainable global pressure on resources is therefore not discernible in the EC/EU. Rather, in absolute terms, the global demand has increasingly been for non-renewable materials.

As far as absolute imports are concerned, some of the highest increases over the period in question were recorded by other than the quantitatively principal groups of materials. Most conspicuous here were imports of fish products and synthetic materials. As to the ecological rucksacks, it was mainly fossil fuels, metals and metal products, together with minerals and mineral-derived products, which contributed to the rise in the total material requirement through imports.

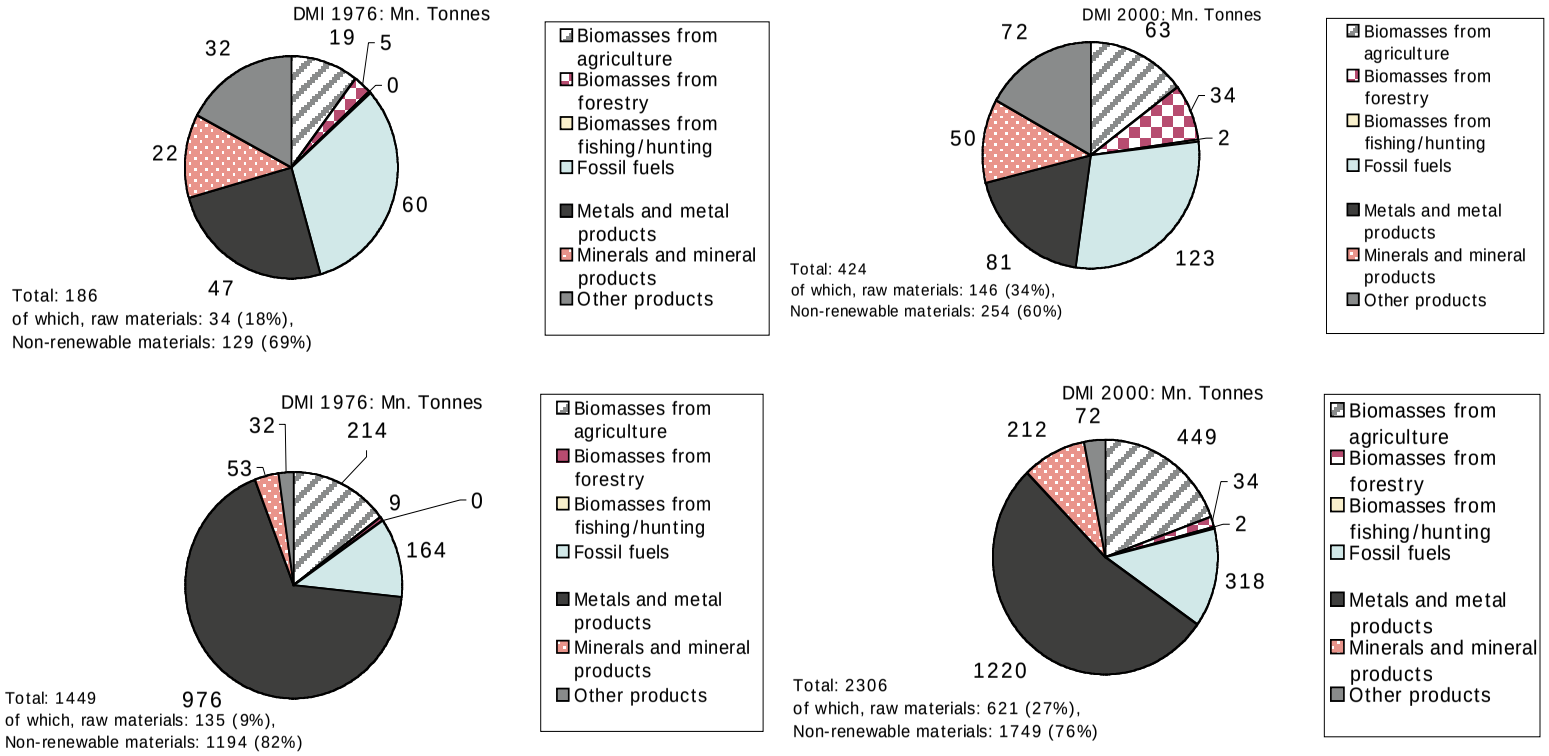
Exports as a whole

As in the case of imports, fossil fuels, metals and metal products contributed most to the EC/EU's absolute exports and their ecological rucksacks (Fig. 18). Most striking in comparison with the import structure are the high export shares of minerals, biomasses from agriculture and other unspecified products.

In 2000, the share of non-renewable goods in the EC/EU's absolute exports (DMI) was 60%, which is considerably lower than for import goods (79%). This was somewhat down on the 1976 figure of 69%. Unlike in the case of imports, then, the EC/EU's physical exports clearly and increasingly corresponded to the requirements of sustainable development (if not yet to a satisfactory degree). This was less true of the total material requirement (TMR) of exports, however, 76% of which was of non-sustainable origin in the year 2000 (slightly down from the 1976 figure of 82%).

The EC/EU's exports and their ecological rucksacks also increased over the period under investigation. Of the main exported materials, high increases were recorded especially for fossil fuels, metals and metal products, as well as biomasses from agriculture. The EC/EU's exports did change significantly between 1976 and 2000, in the sense that the

Figure 18: Product structure of EC 1976 and EU 2000 exports: DMI and TMR.



Source: Eurostat Comext 2001 and Wuppertal Institute data base.

non-renewable share of absolute exports (DMI) fell from 69% to 60% - although this was still associated with an absolute increase in non-renewable exports. The non-renewable TMR for exports fell in essentially the same way, so that we may anyway say that the development of the EC/EU's exports was of weak sustainable kind at best.

The relatively highest increases over the period in question for absolute exports and their ecological rucksacks were recorded by forestry and fishing products (the latter also for imports).

Trade Balance by Product Group

When we look at the trade balance by product group (imports minus exports), it becomes clear that the EC/EU's net balance (DMI) between 1976 and 2000 was due to fossil fuels and to metals and metal products (Table 5). Their increase over this period also crucially contributed to the total increase in net purchases. Both of these product groups also determined the overall net pressure on resources (TMR) and its increase from 1976 to 2000.

Table 5: Physical trade balance of EU 2000.

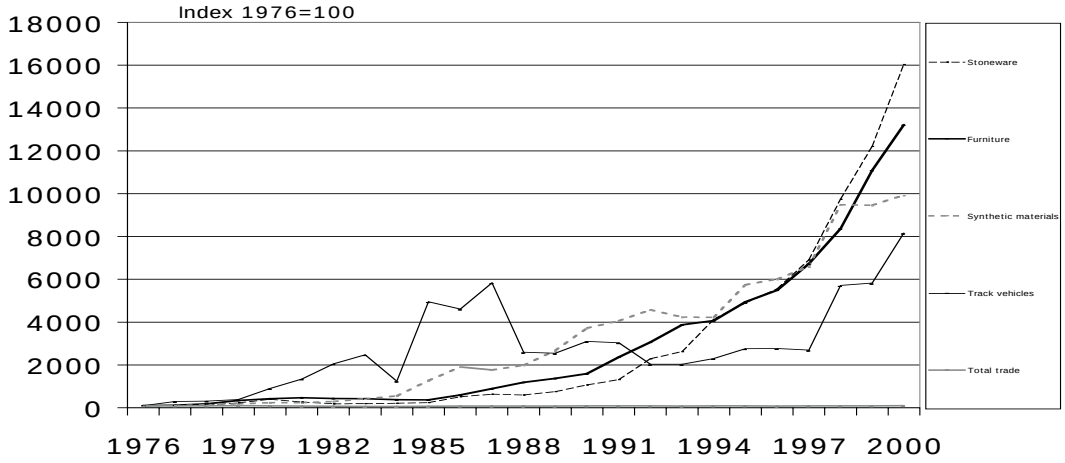
Physical trade balance				
	DMI 2000 (million tonnes)	DMI: change compared to 1976	TMR 2000 (million tonnes)	TMR: change compared to 1976
Biomasses from agriculture	25,4	-61%	245,7	-57%
Biomasses from forestry	40,3	8%	107,7	8%
Biomasses from fishing/hunting	2,0	268%	2,6	270%
Fossil fuels	704,1	30%	1821,5	106%
Metals and metal products	146,1	30%	3829,1	194%
Minerals and mineral products	22,7	121%	254,1	221%
Other products	65,8	-1.141%	65,8	-1.141%
Total	1006,4	32%	6259,2	114%
Renewable materials	67,7	-35%	356,0	-47%
Non-Renewable materials	872,9	32%	5904,8	161%

Source: Eurostat Comext 2001 and Wuppertal Institute data base.

Imports by Region of Origin and Upward Tendency

Complementing the general picture, we shall consider in this section, which EC/EU imports from developing countries outside Europe and from European NICs are especially important because of above-average growth in absolute quantities.

Figure 19: Rising import trends of product groups from developing countries outside Europe to the EC/EU: 1976–2000.

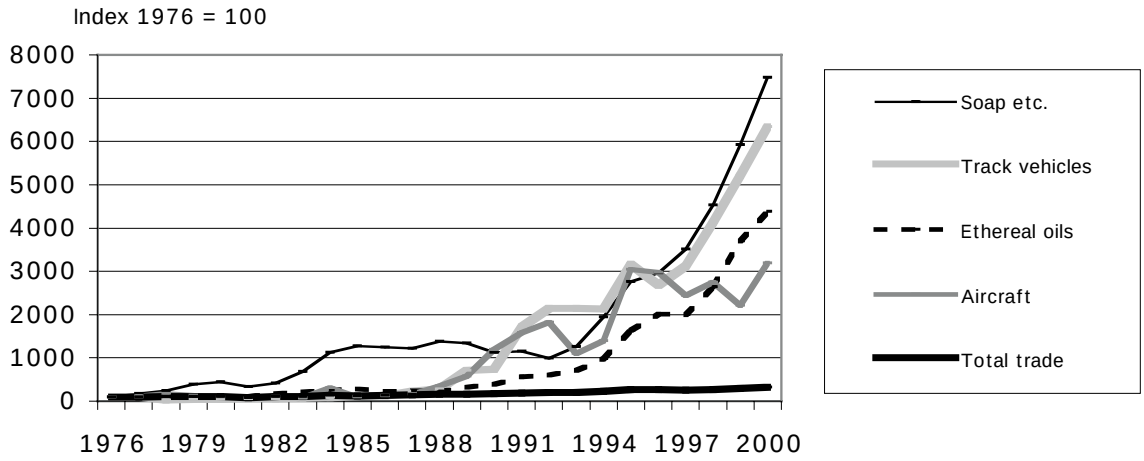


Source: Eurostat Comext 2001.

In general, imports from developing countries outside Europe remained at a high level from 1976 to 2000 (although their share of such imports fell considerably from around 60% in 1976 to around 40% in 2000). The following product groups from developing countries outside Europe did increase their imports into the EC/EU at quite a fast rate: stoneware, furniture, synthetic materials and track vehicles (Fig. 19). Altogether, however, these groups accounted for no more than 1% of the EC/EU's total imports from developing countries in the year 2000, although the trend has been upward (a factor of 100 compared with 1976). The main imports to have declined in significance are: furs, wool, cereal products and vegetable textiles from developing countries outside Europe – that is, mainly products from primary sectors and base material industries. The increase in products such as track vehicles, synthetic materials and furniture, in particular, indicates that in developing countries too there has been a shift towards higher-value export goods. Future studies will have to investigate which particular products and countries are involved, how constant and profound this trend is, and what ecological-social consequences are bound up with it.

All in all, imports from European NICs increased by 226% between 1976 and 2000 (Fig. 20). The extent to which production for internal needs was relocated outside the EU could only be determined from a comparative temporal analysis of internal production and imports, but at present that is not feasible for production. The absolutely increasing quantities of imports already indicate at least some degree of relocation, however, as well as increased pressure on the environment associated with the imports. Fast-growing imports to the EC/EU from European NICs should be noted for: soaps etc., track vehicles, ethereal oils and aircraft. Nevertheless, as with developing countries, these groups together accounted for no more than 0.2% of the EC/EU's total imports from NICs in the

Figure 20: Rising import trends of product groups from European NICs to the EC/EU: 1976–2000.



Source: Eurostat Comext 2001.

year 2000, though with an upward trend (a factor of 20 in comparison with 1976). The main groups to decline in importance were: corkware, silk, natural resins and varnishes, animal and vegetable fats and oils, and ores – basically the same result as in the case of developing countries outside Europe.

Traded Goods That Were Not Produced At All Internally, Or Only on a Small Scale

Here we shall investigate the significance of EC/EU imports that cannot be produced at all internally, or only on a small scale. These products are not present at all, or present only on a small scale, in the natural production area of the EC/EU. For them to be replaced with internal products at given levels of demand, there would have to be major efforts to develop supply, production and consumption technologies. In this connection, we shall consider only materials such as coffee, cocoa beans, cotton, all ores, fossil fuels (where imports account for roughly half) and rare minerals. Because of natural conditions in the EC/EU, these materials are available there only in limited quantities if at all. To a considerable extent, alternative technologies can substitute for them in the medium to long term – including through the use of alternative materials (especially renewable raw materials and energy sources but also more efficient technologies). Dependence on imports of such materials may therefore only be assumed on the basis of existing technologies. For the sake of simplicity, we shall designate such goods here as trade goods.

In the year 2000, the EC/EU imported 892 million tonnes of trade goods, 28% more than in 1976 (Fig. 21). This amounted to 85% of all imports of raw materials – a percent-

age that remained fairly constant between 1976 and 2000. The EC/EU's imports of raw materials therefore mostly served to cover current demand with resources that were not available internally.

The bulk of these trade goods came from developing countries (74-46%, with clearly downward trends in both percentage terms and absolute quantities), and 14-32% from OECD countries (with a tendency to fluctuate). Increasingly significant were imports of trade goods from European NICs, which raised their share from 9% in 1976 to 17% in 2000. Severely indebted countries (SICs) supplied large and fairly constant quantities of trade goods to the EC/EU (around 20%). Thus, European NICs – together with SICs – increasingly serve as suppliers of raw materials to the European economy that are unavailable to it internally, or available only on a small scale. By contrast, low income countries (LICs), highly indebted poor countries (HIPCs) and sub-Saharan Africa accounted for considerably smaller shares in 2000 (3-11%), with a tendency to decline since 1976.

An Overview of the Role of Developing and Newly Industrializing Countries

Some results of this study point to change in the roles of developing and newly industrializing countries as sources of EC/EU material input. Fig. 22 gives an overview of this in relation to the main components: imports of raw materials, semi-manufactured and finished goods (together forming the DMI of imports) and their respective ecological rucksacks.

Whereas DMI imports for developing countries remained fairly constant between 1976 and 2000, they significantly increased for NICs both within and outside Europe, in each case reaching roughly half the level for developing countries in 2000. These increases should be attributed primarily to imports of raw materials. Imports of semi-manufactured and finished goods increased slightly in all three regions, but remained at a considerably lower level than those of raw materials. Developing countries as a whole stagnated as far as their direct material input to the EC/EU was concerned, whereas newly industrializing countries increasingly assumed the role of supplying raw materials. In all three regions no clear general shift was discernible into more highly processed exports (only a partial shift, as previously described).

As we have already explained, in contrast to direct imports of raw materials from developing countries, their ecological rucksack increases disproportionately and leads overall to a considerable rise in the total resource requirement for exports to the EC/EU. This is less clear for the ecological rucksacks of semi-manufactured and finished goods, which are subject to great fluctuation. The same picture holds for newly industrializing countries outside Europe.

Things look different for Europe's newly industrializing countries: here the total resource intensity of raw material exports to the EC/EU increases less sharply. Instead, the ecological rucksacks increase disproportionately for exports of semi-manufactured and finished

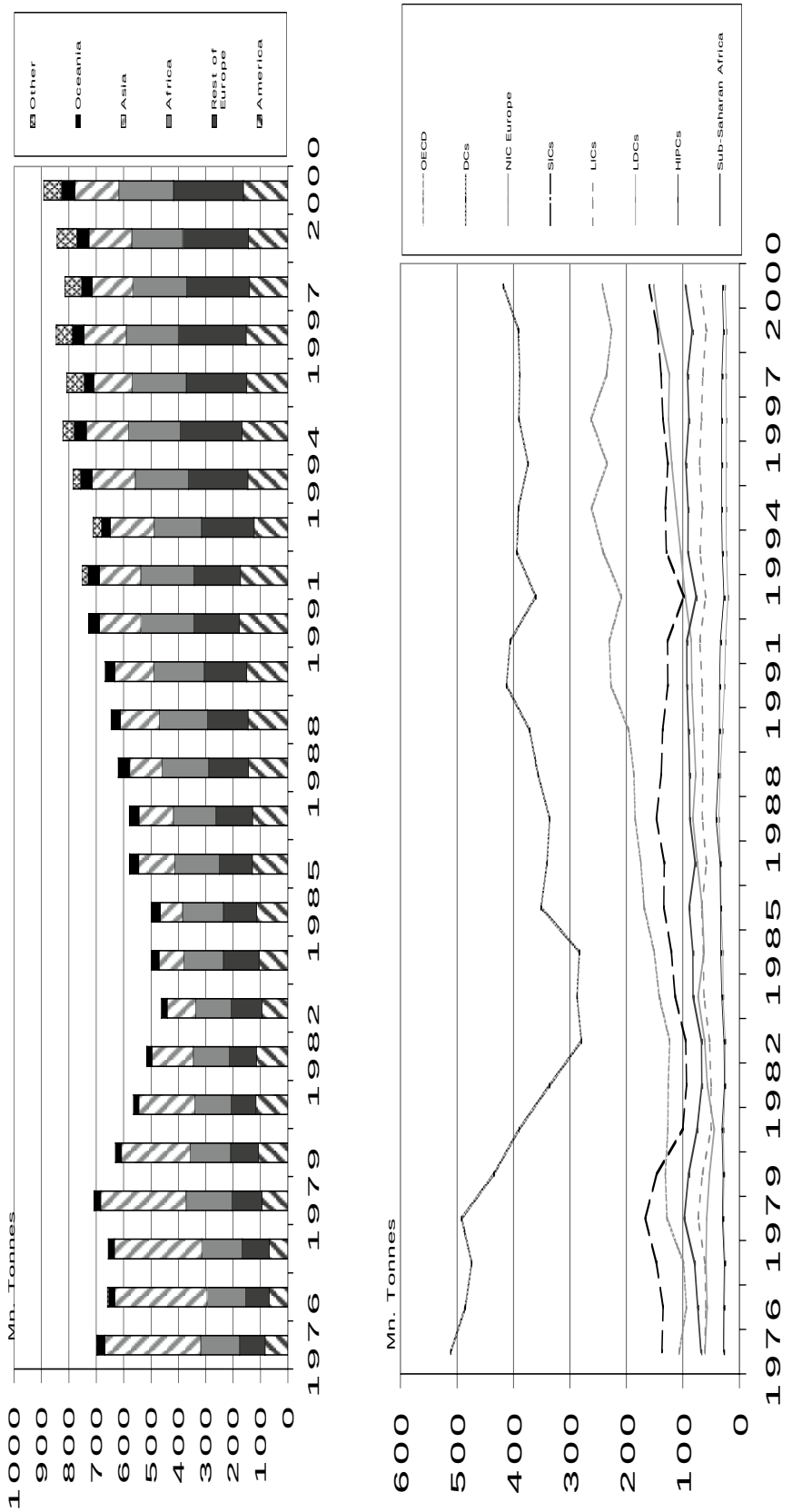
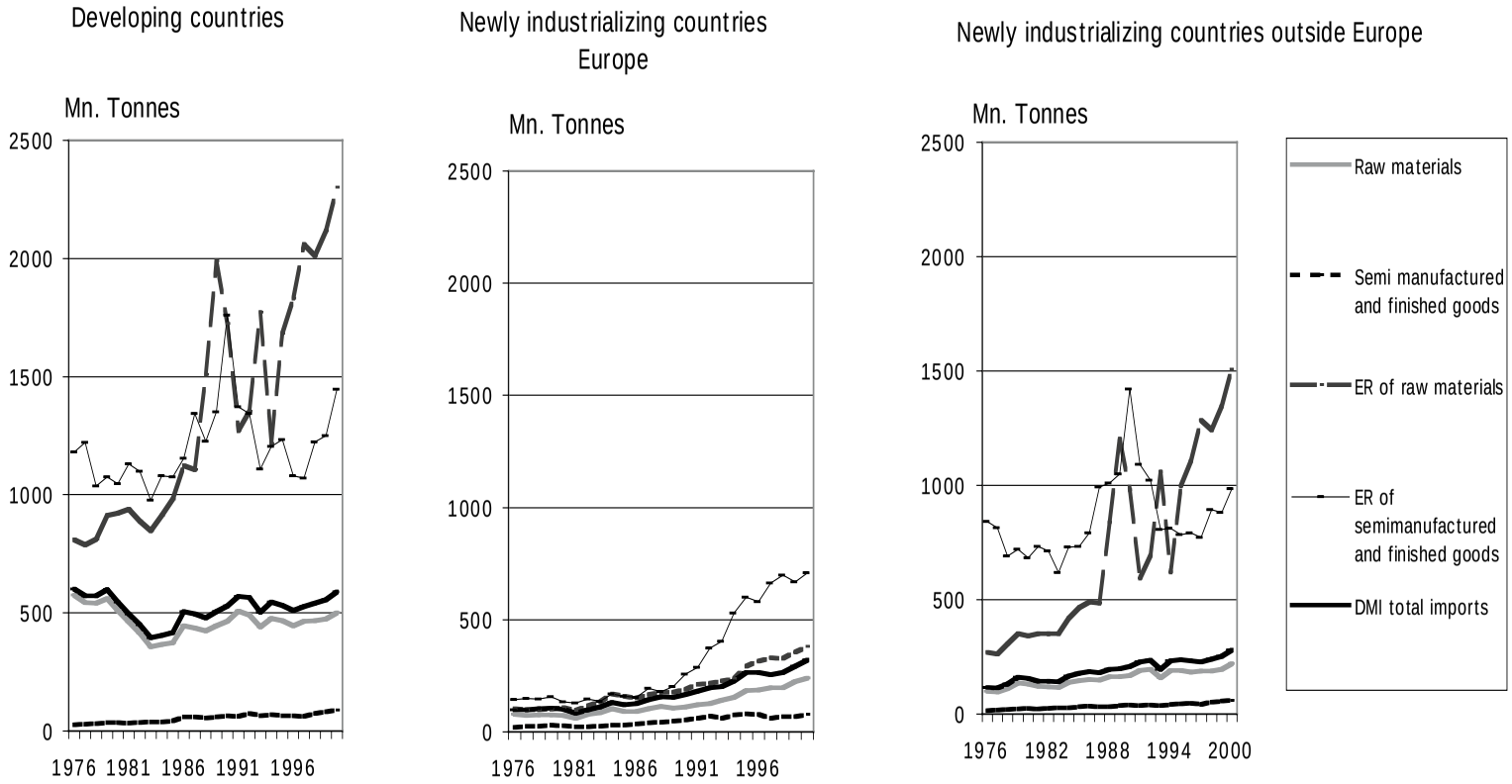


Figure 21: Imports of trade goods to the EC/EU 1976–2000

Note: Other = unspecified, e.g. data kept secret; HIPCs = highly indebted poor countries; LDCs = least developed countries; LICs = low income countries; SICs = severely indebted countries; NICs = newly industrializing countries; DCs = developing countries.

Source: Eurostat Comext 2001 and own caculations.

Figure 22: Development of EC/EU imports from developing countries 1976–2000



Note: ERs = ecological rucksacks; DMI total imports = raw materials + semi manufactured and finished goods.

Source: Eurostat Comext 2001 and own caculations.

goods, and in the 1990s they dominated the total resource requirement for exports to the EC/EU. Exports of this kind were thus increasingly based upon resource-intensive production or semi-processed goods in Europe's newly industrializing countries. This underlines the conclusion with regard to the rise in EC/EU imports of pollution intensive goods from Europe's newly industrializing countries. One suspects that the comparatively "rich" countries of the EU have increasingly relocated pollution intensive and resource-intensive production to the transformation economies of Eastern Europe. As we said before, this point would have to be confirmed through analysis of the relevant production within the EU. But that is not presently feasible because the necessary data are either missing or incomplete.

4 Summary Discussion

Pressure on the Environment: Its Extent and Its Relocation

Growing pressure on the environment in the wake of economic globalisation has been investigated by means of world data and an analysis of material flows in the EC/EU economy as a whole. Global pressures on the environment, in the form of energy consumption and CO_2 emissions, did not increase worldwide during the last two decades of the twentieth century in proportion to the monetary trade volume as a measure of globalisation.

Consumption of primary energy and primary materials in Germany and the EU (and in the UK), seen as representative of industrial countries, has tended to stabilize or actually stabilized. Resource consumption by these economies has been relatively de-coupled from economic growth, and therefore also from monetary trade volume. But an absolute reduction in resource consumption has not yet been achieved in the EU. Moreover, non-renewable resources have remained dominant, so that it is still far from possible to speak of sustainable development.

The absolute quantities of trade flows, and of the associated total material requirement (TMR) including the ecological rucksacks of imports and exports, have risen in the wake of globalisation, as has the quantity of emissions involved in the EU's pollution intensive trade flows. Pressures on the environment associated with internationally traded goods have, thus, also increased. It cannot be concluded, however, that the global sum of pressures on the environment related to resources and emissions has increased.

Pressures on the environment have thus been relocated between regions of the world economy:

- on the production side, the share of imported resources in the total material requirement of EU industrial countries has increased (Figs. 9, 12 and 16);
- developing countries outside Europe serve as constant suppliers of raw materials (Figs. 10, 12 and 22); recent trends point to possible advances towards greater value-creating industries;
- newly industrializing countries within and outside Europe are increasingly assuming the role of suppliers of raw materials and semi-manufactured goods to the rich countries of the EU (Fig. 22).

Development of Unequal Ecological Exchange

Unequal ecological exchange has been defined here as unequal weighting in relation to:

- The PTB including ecological rucksacks: an import surplus here means that the total pressure on resources is greater than the domestic pressure associated to exports, i.e., that there is additional pressure on the environment in other countries.

In principle the same is true for the PTB of pollution intensive products, with regard to production-side pressures in the shape of emissions and waste. Here, however, it is necessary to make a differentiated analysis of the characteristics and distribution of these pressures on the environment. First, we might reckon up the PTB separately for each individual group and product of pollution intensive products, then, for example, deepen this with analysis of particular regional pressures on the environment resulting from production technologies, in order to assess possible effects of additional or reduced pressure in comparison with the status quo ante.

The EU as a whole, as well as Germany and other industrial countries, import physically more goods than they export. Unequal ecological exchange between rich industrial countries and the rest of the world manifests itself primarily in physical trade quantities and their resulting ecological rucksacks. It testifies to greater pressure on resources through domestic activity abroad than through exports to the rest of the world. The United Kingdom occupies a special position in this respect among rich industrial countries. Its physical trade balances are partly even. To some extent, the UK acquires abroad less environment-straining goods than it produces itself for transfers to other economies.

Unequal ecological exchange between industrial countries and newly industrializing or developing countries qualifies the assertion that developed economies have successfully reduced their pressures on the environment.

The EC/EU's foreign trade asymmetry has intensified in the wake of globalisation. Its claim on resources through foreign trade (net imports) has increased. At the same time, internal pressure on the environment through resource extraction has diminished, with the result that total material consumption (TMC) has remained constant. This means that pressures on the environment attributable to the EU have remained at the same level, but have been geographically relocated.

On the Factors Driving the Global Consumption of Resources and Its Spatial Distribution

The consumption of resources in the EU has reached a constant level. Thus, what appears to be decisive for the sharply increasing trade flows is no longer internal demand but demand in other economic areas (USA, developing countries and newly industrializing countries). Exports are not only the motor of the economy but also the drive belt for the input of resources into the EU.

This means that, in the medium to long term, development in newly industrializing and developing countries will determine the dynamic of global resource consumption.

Further de-coupling of global resource consumption from world economic growth can therefore take place only in so far as exports from industrial countries to developing or newly industrializing countries (a) are produced by themselves with a more efficient use of resources, and (b) involve the least possible resource requirement. This means that international environmental and economic policy is increasingly called upon to assist with sustainable cross-sector resource management in these countries. In this context, it needs to be investigated what positive influence may be exercised by internationally active corporations.

If unequal ecological exchange in relation to international pressures on the environment is to be reduced, then it is above all necessary to lessen the resource requirement in production (that is, imports of primary raw materials and associated semi-manufactured goods) in the industrial countries. Thus, greater resource productivity in the industrial countries, together with an absolute reduction in resource consumption, has a multiple strategic significance for the sustainability of an increasingly global world economy. The measurement of resource productivity must take these imported quantities into account. This applies especially to the official reporting instruments (e.g., National Statistical Offices and Environment Agencies, or the EU's Eurostat).

Further Work

The following questions suggest themselves for further work:

- Which geostrategically significant resources contribute especially to the relocation of environmental problems through the economy of the EU (see the examples of tantalum and platinum in the text)? Which regional/global problems of availability or scarcity should be expected to arise? Which technologies are mainly associated with them? What are the possibilities of reducing such elements of dependence?
- Which economic, ecological and social effects arise from the increasing stain on resources in developing and newly industrializing countries (e.g., with regard to the exploitation of precious metals)? Which possibilities exist there on which to build sustainable resource management? How can international organizations and various players in industrial countries help in this process?
- Which instruments and measures should the EU and its member-states develop to boost their resource productivity, thereby reducing the global consumption of non-renewable resources and the international disparities in resource use? What role is played in this by economic and financial policy, and by technological or institutional innovation? Which instruments are also suitable for developing and newly industrializing countries?
- What resource consumption targets and what kind of ecologically equalized trade balance can be deduced for industrial countries such as Germany and the EU? What does this imply for a strategy to increase resource productivity?

In general, more attention should be paid to how an increase in resource productivity, and especially a dematerialization of industrial countries, is likely to affect developing and newly industrializing countries.

5 Methodology and Data

This study is largely based on official trade (imports plus exports) statistics for the EC/EU, which are published annually by the Statistical Office of the European Commission: EUROSTAT (Comext data base on CD-Rom). Their quality may be described as very good. This is also true, of course, of the global (monetary) foreign trade data of the WTO. Data on GDP, energy consumption and CO_2 emissions should in general be considered to be of a similiarly high quality.

The methodology for data generation, as well as for the deduction of total resource requirement and consumption in national economies, has been officially laid down in texts such as EUROSTAT's Methodological Guide for Economy-Wide Material Flow Accounts and Derived Indicators (2001b). Official statistics have adopted TMR, and hence the methodology for the determination of ecological rucksacks and TMC, as an indicator of total resource requirements: in the United Kingdom (www.statistics.gov.uk), Bringezu and Schütz 2001c), Poland (Central Statistical Office Poland 1999), Denmark (Pedersen 2002), Finland (Muukkonen 2000), Italy (Barbiero et al. 2003) and EUROSTAT (Bringezu and Schütz 2001b). TMR has also been adopted in the USA, Japan and a number of other countries (for an overview see Bringezu et al. 2003).

The quantitative presentation of pollution intensive goods is based on a World Bank study (Mani/Wheeler 1997). Ten product groups from the most intensive sectors are singled out: iron and steel, non-ferrous metals, chemicals (industrial and other), mineral fuels, non-metallic mineral products, cellulose and paper, rubber goods, leather goods and metal goods. The data therefore do not distinguish between raw materials and semifinished or finished goods. The classification is based on polluting emissions into the atmosphere and water, as well as heavy metal emissions. In addition, a distinction is made between pollution intensive goods with mineral fuels and without mineral fuels: the latter are in the main those which directly pollute the environment in producing or exporting countries through emissions and waste; whereas the former pollute the global environment mainly through atmospheric emissions resulting from combustion in the consuming or importing economies.

The long time series for imports and exports (1976 to 2000) corresponds to the member-state structure of the EC or EU-15 for the respective periods. This is unavoidable, because EUROSTAT's foreign trade statistics provide no other data. Aggregate import and export trends, both monetary and physical, show that the incorporation of new countries during the 1976-1995 period did not have any noteworthy effect on the scale or course of EC or EU foreign trade. This is confirmed by other assessments of total physical imports and exports that extend the data for the EC to the area of the EU-15 (Bringezu and Schütz 2001b, Eurostat 2002). These are used above in our analysis of the relocation of resource extraction with the inclusion of ecological rucksacks, as well as in our account of trends in total resource requirement and consumption.

The classification of countries by income and level of debt has been taken from the World Bank, as has that of the HIPCs. Developing countries are defined by consideration of lists of the UN (Human Development Report), the World Bank and the OECD. Least developed countries (LDCs) as well as amalgamations of countries such as the OECD are classified in accordance with the systems used by the UN (COMTRADE) and the WTO (Trade Statistics). Newly industrializing countries (Schwellenländer) are identified in accordance with data of the German "Bundeszentrale für politische Bildung" and the Börsenlexikon. The grouping by geographical regions corresponds to WTO Trade Statistics.

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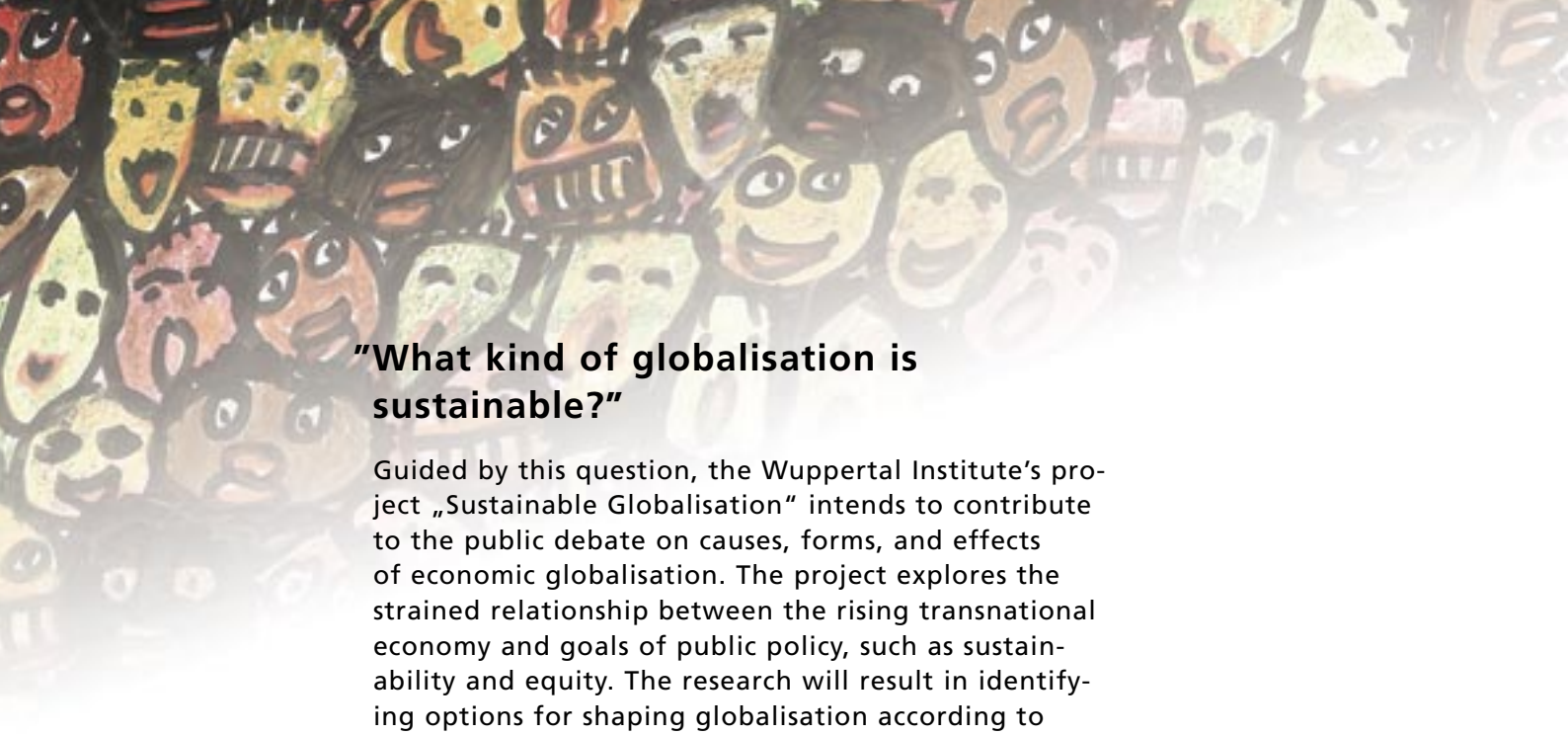

"What kind of globalisation is sustainable?"

Guided by this question, the Wuppertal Institute's project „Sustainable Globalisation" intends to contribute to the public debate on causes, forms, and effects of economic globalisation. The project explores the strained relationship between the rising transnational economy and goals of public policy, such as sustainability and equity. The research will result in identifying options for shaping globalisation according to these goals. As it happens, debates on globalisation often fail to pay sufficient attention to the environmental causes and effects of globalisation. Moreover, they rarely appreciate the nexus between ecology and equity. Our project intends to remedy this deficit. On the project's website, we present our research programme along five thematic threads, offering introductory texts, bibliographies, web links as well as our own publications.

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