Transport, Trade and Climate Change:
Carbon Footprints, Fuel Subsidies and Market-based Measures

Working Paper

ICTSD
International Centre for Trade and Sustainable Development

BMZ
Federal Ministry for Economic Cooperation and Development

German NGO Forum on Environment and Development

November 2011







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International Centre for Trade and Sustainable Development

Working Paper

Published by

International Centre for Trade and Sustainable Development (ICTSD)
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Publisher and Director : Ricardo Meléndez-Ortiz
Programmes Director: Christophe Bellmann
Programme Manager: Ingrid Jegou
Programme Officer: Joachim Monkelbaan

Acknowledgments

This working paper stems from and has been informed by extensive multistakeholder Dialogues, networking and research undertaken under the Global Platform on Climate Change, Trade and Sustainable Energy of ICTSD. In this regard, the most relevant recent events are a side event at UNCSD-18 in New York, USA on 10 May 2010, ICTSD's trade and climate change symposium in Cancun, Mexico on 8 and 9 December 2010, and a parallel event at the UNFCCC intersessional meeting in Bonn, Germany on 8 June 2011. Lead author is Joachim Monkelbaan from ICTSD.

The author is grateful to Daniel Schmoll for his crucial support and to Samantha Derksen, Christophe Bellmann and Ingrid Jegou of ICTSD for their review and guidance. He also wishes to acknowledge various experts for their valuable comments and inputs, notably Jasper Faber, Alexander Kasterine, Ronald Steenblik, and Andre Stochniol.

This paper was produced under the ICTSD Programme on Trade and Environment for the German NGO-Forum. ICTSD is grateful for the support of ICTSD's core and thematic donors including the UK Department for International Development (DFID), the Swedish International Development Cooperation Agency (SIDA); the Netherlands Directorate-General of Development Cooperation (DGIS); the Ministry of Foreign Affairs of Denmark, Danida; the Ministry for Foreign Affairs of Finland; the Ministry of Foreign Affairs of Norway; Australia's AusAID; the Inter American Development Bank (IADB); and Oxfam Novib.

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Citation: Monkelbaan, J. (2011); *Transport, Trade and Climate Change: Carbon Footprints, Fuel Subsidies and Market-based Measures*; ICTSD Global Platform on Climate Change, Trade and Sustainable Energy; International Centre for Trade and Sustainable Development, Geneva, Switzerland; www.ictsd.org

ISSN 1992-1675

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LIST OF ABBREVIATIONS AND ACRONYMS

BAU	Business as Usual
CBDR	Common but Differentiated Responsibilities
CDM	Clean Development Mechanism
CO_2	Carbon Dioxide
EEDI	Energy Efficiency Design Index
ETS	Emissions Trading Scheme
EU	European Union
EUA	European Union Allowance
GHG	Greenhouse Gas
g/tkm of CO_2	Grams of CO_2 emitted per kilometer travelled per ton of freight transported
IATA	International Air Transport Association
ICAO	International Civil Aviation Organization
IMO	International Maritime Organization
JI	Joint Implementation
MBM	Market-based Measure
METS	Maritime Emissions Trading Scheme
Mton	Megaton
RTK	Revenue Tonne Kilometre
SEEMP	Ship Energy Efficiency Management Plan
UNFCCC	United Nations Framework Convention on Climate Change
WTO	World Trade Organization

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INTRODUCTION

International transport, be it by ship, airplane, train or truck, is essential for international trade and to global economic development. However, transport is at the same time the fastest growing source of greenhouse gas (GHG) emissions.[1]

The objective of this paper is to examine the viability and potential effects of different actions that Germany and the European Union (EU) can take to curb the growth of GHG emissions from the international transport sector. It analyzes different options that policy makers have available to reduce transport induced emissions. In doing so, this paper takes the impacts on trade, especially for developing countries, into account. The overarching question that is reverberates throughout this paper is: what are the advantages and disadvantages of different measures that Germany and the EU can take to limit emissions from trade-related transport?

This paper starts off by showing the historic and projected growth of trade-related GHG emissions from transport and the various measures that have been proposed or implemented to curb this growth. A global response to climate change will inevitably include methods to mitigate GHG emissions from the transport sector.

Three important ways to limit GHG emissions in the transport sector are discussed in this paper in more detail:

1. Carbon footprinting and labelling

2. Ending fossil fuel subsidies and tax breaks for transport fuels

3. Installing market-based measures, such as emissions trading and fuel taxes

Through the study of these climate change mitigation measures and their projected effects on emissions, it is determined which solution is most likely to be successful in controlling worldwide emissions from international transport. Throughout this paper three criteria will be critically taken into account for the design of climate change policies: effectiveness (i.e. resulting in emission reductions), efficiency (i.e. policies that cost little to implement) and equity (i.e. policies that are not regressive, and do not unnecessarily distort trade or have an undue impact on competitiveness). At first hand, localising or regionalizing trade for example may sound as an interesting option for limiting transport emissions but when taking a closer look at the facts, such measures may not reach the desired cuts in total emissions.

In any case, regulation of emissions is set to lead to higher costs of international transport and this could directly affect vulnerable developing countries, particularly those who rely on export oriented development strategies. However, many of these measures generate revenues that could potentially be used to counteract these financial burdens on developing countries as well as stimulate investment in other measures or technologies to curtail greenhouse gas emissions.

Thus there are political and developmental considerations to address when analyzing potential climate change mitigation measures in the international transport sector. On one hand the IMO and ICAO propagate the principle of 'equal treatment' between developed and developing countries. But measures against climate change may impose an unequal burden on developing countries. The UNFCCC's 'Common But Differentiated Responsibilities' (CBDR) principle attempts to tackle these discrepancies and various methods of implementing CBDR in the transport sector are also addressed in this paper.

In making recommendations to the German government, this paper engages a powerful player on the international scene and uses the European Union as a model for the creation of global regulation of GHG emissions in the transport sector. The EU, for example, is determined to include international aviation in its emissions trading scheme from 2012 and considers including maritime transport in the longer run. This paper notes how Germany's position within the EU can allow it to be a leader in the global arena when it comes to a global, multilateral emissions mitigation agreement.

Structure of the paper

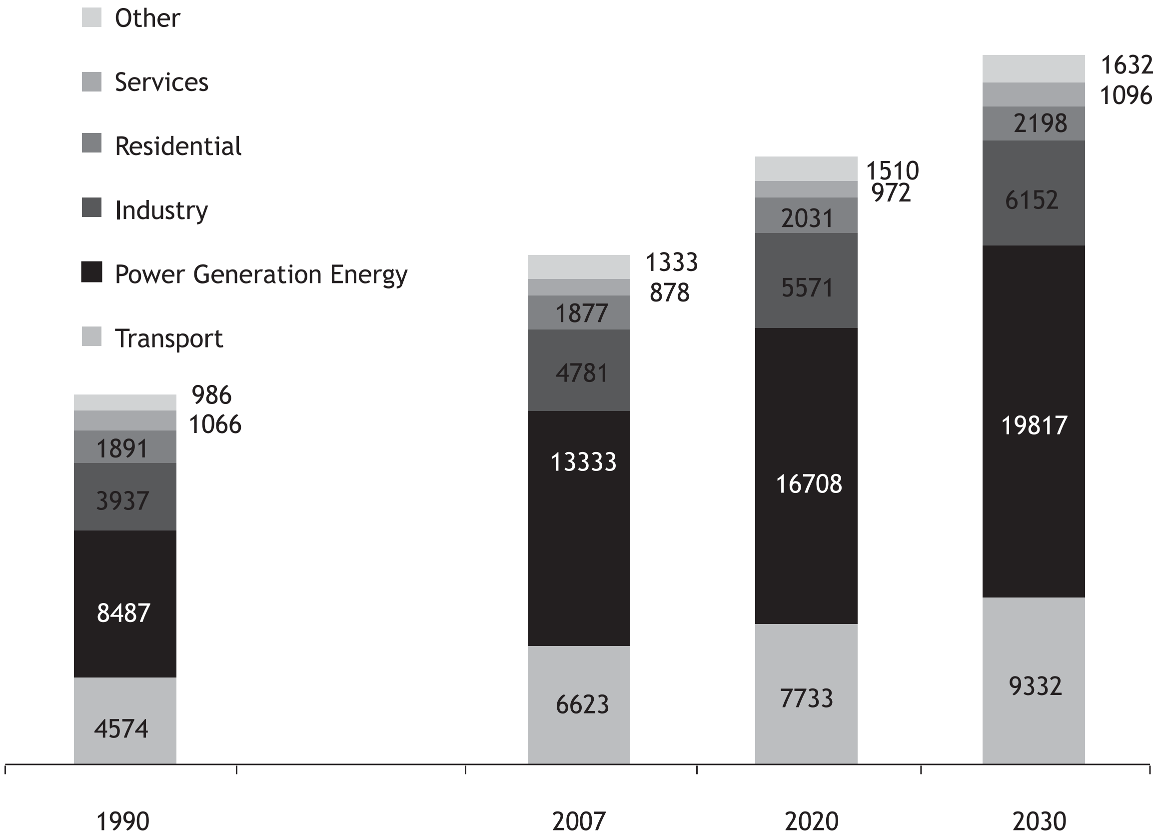
This paper starts off by examining the current state of transport emissions and their future projections. In the second chapter, the carbon footprint approach and its effectiveness in reducing global emissions is analyzed. The third chapter assesses the impact of fossil fuel subsidies on trade volumes and emissions and examines the impact of eliminating these subsidies. Chapter four studies market based measures ('MBMs', for example emission trading schemes) and their projected impact on trade and on emissions from transport. The fifth chapter discusses ways to integrate CBDR in MBMs. The sixth and final chapter concludes and offers recommendations as to which transport-related policies would be most effective in the fight against climate change.

1. EMPIRICAL ANALYSIS OF TRANSPORT RELATED EMISSIONS AND THEIR FUTURE PROJECTIONS

1.1 Total Transport Related Emissions

In 2005, the transport sector accounted for 27% of world energy related greenhouse gas (GHG) emissions[2] amounting to around 6300-6400 $MtCO_2$-eq.[3+4] Of all energy using sectors, transport showed one of the highest levels of growth in overall energy use: global CO_2 emissions from transport grew by 45% from 1990 to 2007 and are expected to continue to grow approximately 41% by 2030.[5]

Figure 1: Chart showing the growth of total CO_2 emissions as well as that of each major industry ($MtCO_2$)

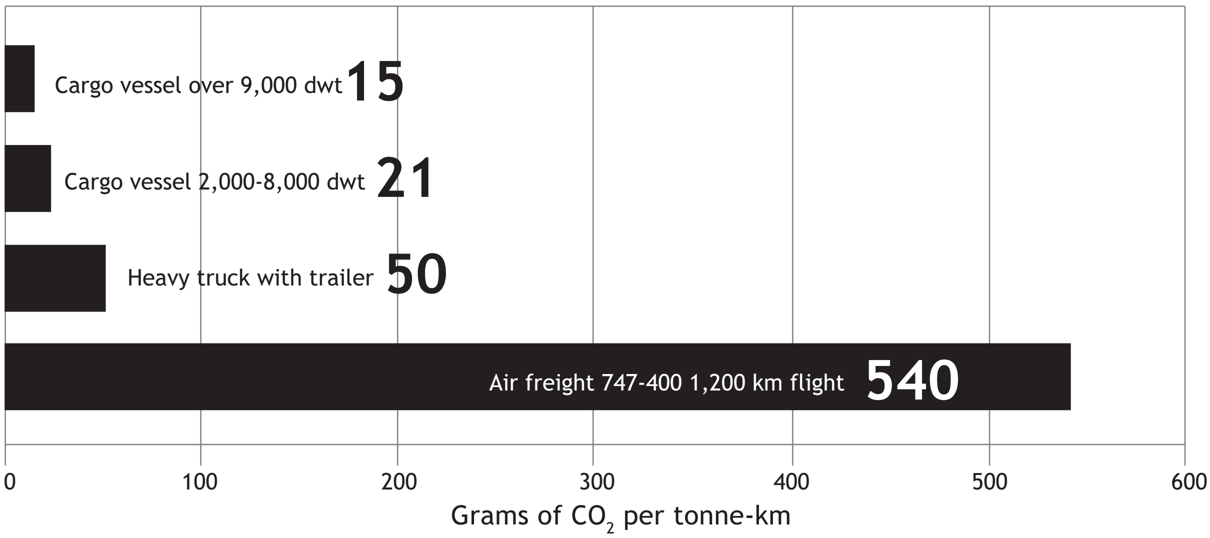


Source: International Transport Forum (2010)

Global estimates of GHG emissions from within the transport sector are based on the typical fuel use and efficiency of each form of transport. This growth is shown in figure 1[6]. As can be seen, total emissions will increase as will transport emissions.

Industrialization and globalization have stimulated the demand for freight transport so that it now constitutes approximately 35% of all energy consumed by the transport sector. Freight transport is considerably more energy conscious than passenger transport because of the market pressure on transporters to cut costs. Therefore, energy efficiency has been increasing rapidly in the freight transport sector. However, recently, there has been a growing demand for quicker, and therefore more energy intensive, forms of freight transport, as speed has increasingly become paramount in many sectors of trade (such as perishables, where shelf life is limited). This has led to the rapid growth of the highway (with large/heavy trucks) and air transport categories coupled with the decline of the rail and domestic waterway categories.[7]

Figure 2: Chart demonstrating the relative rate of emission for different modes of transport



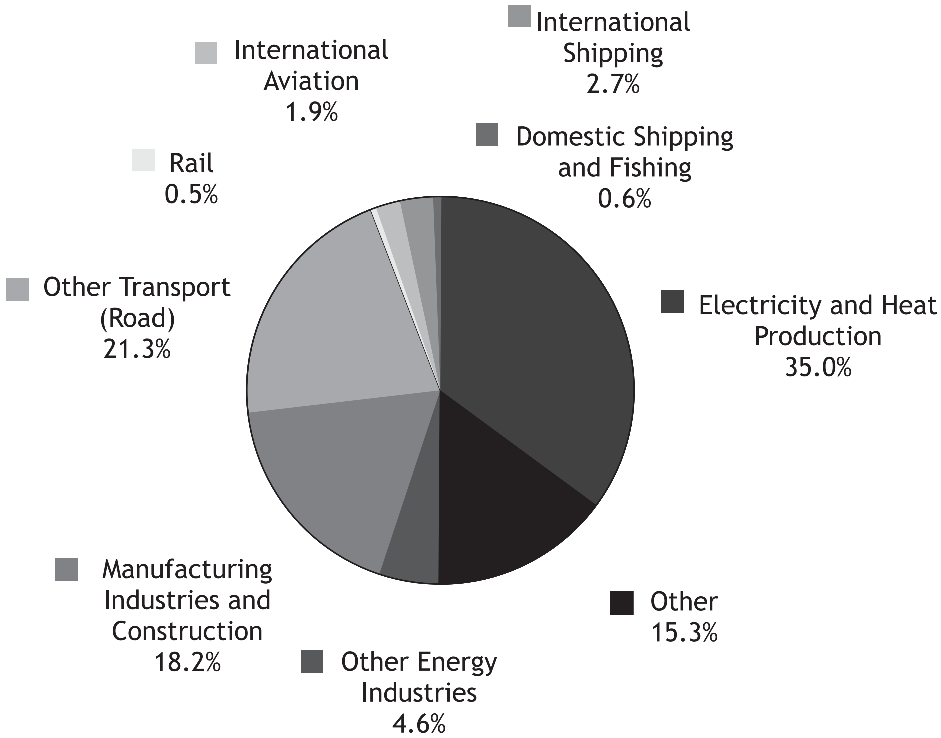
Source: NTM

1.2 Trade Related Emissions from Different Modes of Transport

CO_2 emissions per ton kilometer (g/tkm, grams of CO_2 emitted per kilometer travelled per ton of freight transported) vary greatly between the different modes of transport. When compared, as in figure 2[8], air freight is by far the most carbon intensive with 540g/tkm. This is followed by truck transport which varies (depending on the size of truck, between 12 and 36 tons in this study) from 50 – 110g/tkm of CO_2 emitted. Rail follows with 23g/tkm and the most efficient is maritime shipping which produces 15-21g/tkm.[9+10] Therefore, the increasing demand for quicker transport has negative effects on emissions as the quicker forms of transport are much more emission intensive. However, while maritime shipping may be the most emission efficient form of trade transport, it represents a large share of global emissions, due to the sheer volume of goods transported by sea.

Shipping is responsible for transporting 90 per cent of world trade and has doubled its volume in the past 25 years. Maritime transport currently contributes to between 600 and 800 million tons of CO_2 per year or about 3 per cent of the global total. This is equal to the total emissions of Germany and approximately 50 per cent more than that of air travel. Therefore, the climate impact of trade transport is not only a question of efficiency but also of scale.[11] However, in a worst-case scenario shipping emissions are expected to triple by 2050 while aviation emissions are expected to quintuple over that span.[12] Also it needs to be taken into account that while air transport accounts for around 2 per cent of global emissions, it is responsible for 4 to 9 per cent of the climate change impact of human activities. The range reflects uncertainty surrounding the effect of cirrus clouds and contrails. Figure 3[13] shows how the transport emissions are currently distributed between the different types of transport relative to total global emissions.

Figure 3: Chart showing the share of total emissions attributed to each type of transport and industry relative to overall emissions



Source: IPCC, 2010

The road transport sector can be divided into four separate classes: passenger, light commercial vehicles, medium trucks and heavy trucks. The latter three categories are what is considered road freight and can therefore be applied to international trade estimates. According to the IEA, emissions from freight transport account for 30% to 40% of all road sector emissions with the rest coming from passenger vehicles.

1.3 Emissions from Trade Related Transport by Region.

Examining countries within the International Transport Forum (ITF) and the major absentees from this organization gives a good indication of the discrepancies between different geographical regions.

Table 1[14] shows the distribution of emissions by region and by ITF membership.

Table 1: Total global emissions and global transport emissions in 2007 by region

Region		Total Emissions ($MtCO_2$)	% of Global Total	Transport Emissions ($MtCO_2$)	% of Global Transport Total
EU	All	3926	**13.5**	963	**14.5**
	EU 15	3199.8	**11.5**	842.9	**12.7**
	New EU	726.2	**2**	120.1	**1.8**
North America		6780 (USA 5769.3)	**23.4 (USA 20)**	2120 (USA 1807.5)	**32 (USA 27.3)**
N. Asia + Pacific[15]		2157	**7.4**	421	**6.3**
Latin America (excluding Mexico)		625	**2.1**	224.4	**3.4**
Other ITF Members		3782 (Russia + India 2911.5)	**13.1 (Russia + India 10)**	870 (Russia + India 347.5)	**13.1 (Russia + India 5.2)**
Top 10 non ITF		8835 (China 6071.2)	**30.5 (China 20.8)**	632 (China 411.6)	**9.5 (China 6.2)**
Rest of World		1835	**6.3**	380.6	**5.7**
Totals		28962		6633	

Source: ITF, 2010

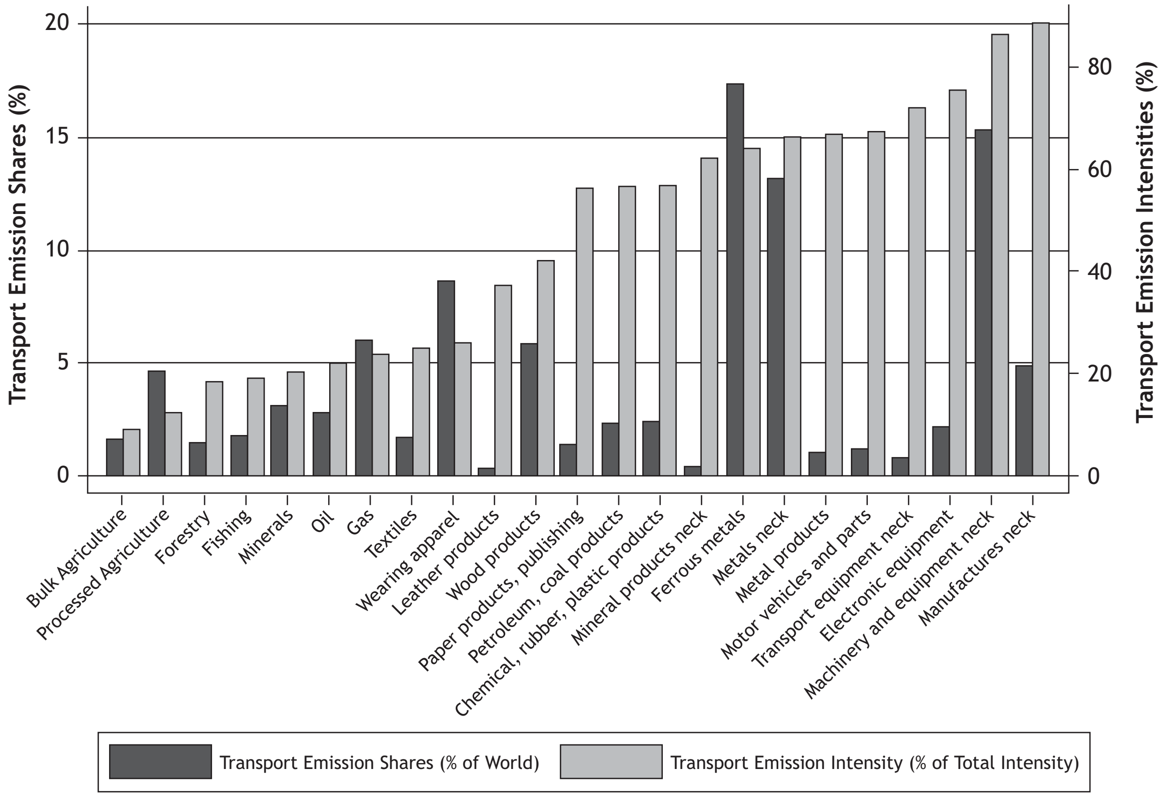
Please note that Brazil is counted in both the Latin America and in the Top 10 non ITF countries category.

The emission values are attributed to sales of fuel within each country or region. Table 1 shows that emissions are dominated by the USA, the original 15 members of the EU, China, Russia and India. Together these countries produce 62.3% of all global CO_2 emissions and 51.4% of global transport related emissions. Transport appears to constitute a relatively constant share of emissions within each country. This is shown by the fact that (with the exception of China and India) the percentages tend to be roughly proportional between % of global emissions and % of global transport emissions. This shows that most major emitters distribute their emissions in roughly the same way. However, China and India are exceptions as their transport emissions make up a much smaller percentage of their total carbon emissions. This could be because of their massive recent increases in energy generation from fossil fuels that have come with their burgeoning economic development. Indeed, China's energy related CO_2 emissions have risen by 10% every year since 2000 and in 2006, China surpassed the United States as the biggest greenhouse gas emitter. This has been due to 'rapid growth in industrial demand and a heavy reliance on coal'.[16] Therefore, it appears that their transport emissions have not yet caught up with the rapid increase in emissions from energy generation.

1.4 Emissions from Trade Related Transport by Industrial Sector

The major sectors of trade also show differences in their transport-related emissions. Figure 4[17] shows transport-related emissions divided by industry as well as the overall intensity of trade-related emissions relative to the trade value of the good.

Figure 4: Transport emissions intensity by sector



Source: ITF, 2010

As can be seen in figure 4, the heaviest transport related emitting industries relative to their total emission intensity (% transport emission intensity) are lighter products such as machinery and electronics. This is because these are often transported by emissions intensive air travel, while the heavier raw materials are usually transported by ship. This means that the transport of raw materials is less emission intensive than lighter, more expensive materials. Raw materials are not particularly emission intensive, but account for a large proportion of emissions because they have a low weight to value ratio and are therefore transported in large quantities and this leads to higher total freight costs and emissions (see ferrous metals). The blue graphs show the share of transport emissions for each material. This is more useful for showing the total amount of the good that is transported and traded worldwide. Wearing apparel and ferrous metals have a large share of the emissions relative to their intensity because they are traded in such high volumes while leather and mineral products are the opposite because they are traded in such low volumes.[18]

1.5 Potential for GHG Reductions in Shipping and Aviation

1.5.1 Shipping

The overall potential CO_2 emission reductions from current ship design strategies for newbuilds can be estimated to be in the range of 5-30%. Technical retrofit and maintenance strategies on existing vessels can potentially reduce CO_2 emissions from the existing fleet by 4-20% while operational strategies might potentially reduce fuel use and CO_2 emissions by as much as 40%. Combined technical and operational measures have been estimated to potentially reduce CO_2 emissions by up to 43% per tonne-kilometre by 2020 and by up to 63% per tonne-kilometre by 2050.[19]

Speed reduction, especially for fast vessels, represents an important operational measure that can save fuel and limit CO_2 emissions at relatively low cost and little effort. While not free, speed reduction, especially for high powered and high speed container vessels can lead to significantly reduced fuel consumption and CO_2 emissions especially as there is evidence that a real gap exists between optimum travel speeds and actual speeds. Optimum vessel speeds from the perspective of fuel consumption are not necessarily the slowest speeds when all factors are considered.

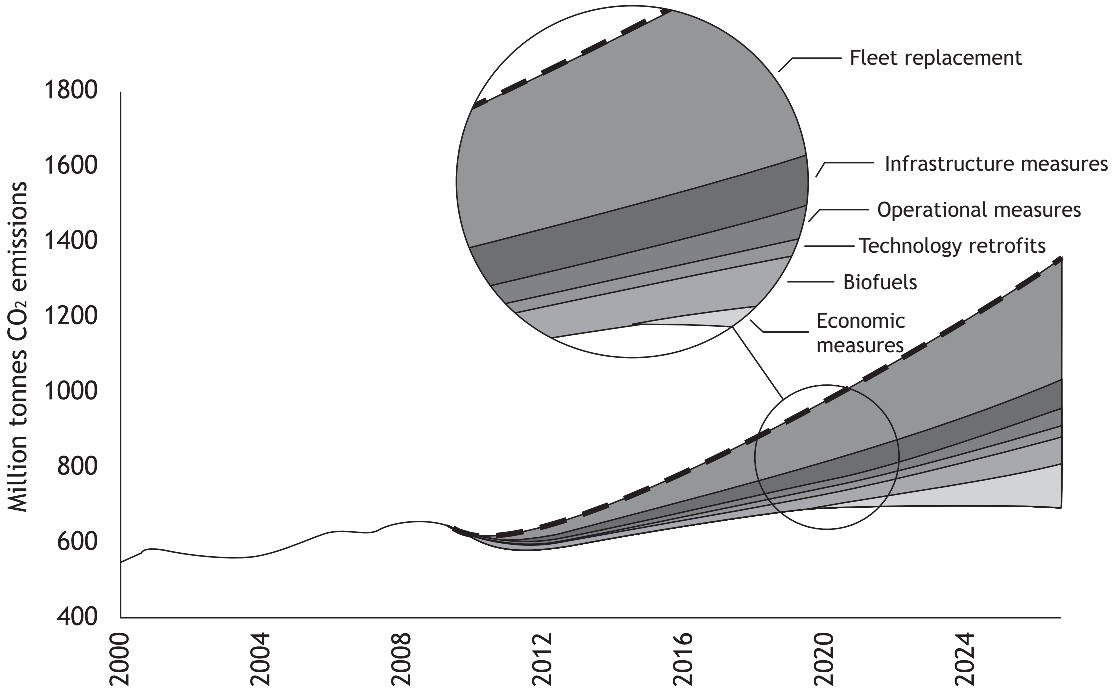
Exploiting the potential for efficiency gains does not only lie in technological improvements. Many maritime trades are characterized by a principal agent problem where the parties responsible for designing (and, to a lesser extent, operating) a vessel and those responsible for paying for fuel are not the same. Depending on the particular charter party contract, fuel costs may be borne by the owner, the vessel operator or the cargo owner and responsibility for fuel costs may even change whilst the vessel is underway.

Even though the IMO has recently adopted a mandatory energy efficiency design index (EEDI) for new ships, slow fleet turnover means that operational and maintenance-related efficiency gains will likely dominate over the short- to medium-term. The EEDI will lead to less carbon emissions - approximately 25-30 percent reductions by 2030 compared to the Business as Usual (BAU) scenario. Accordingly, operational measures such as the IMO's also recently the adopted Ship Energy Efficiency Management Plan (SEEMP) and, ultimately, economic instruments such as a global fuel levy or emission trading need to be implemented if significant emission reductions from current fleet activity are to be achieved over the next decades.

1.5.2 Aviation

The 'carbon-neutral growth' scenario from IATA (International Air Transport Association) is displayed below in Figure 5. In this scenario aviation's net CO_2 emissions will remain flat after 2020 even as demand grows. The top (dashed) line shows where emissions would be if there was no new technology or fleet replacement, based on forecast passenger growth. Each segment adds to emissions reduction potential. Economic measures kick-in 2020 to make up any shortfall in emissions reductions and provide for a cap in net emissions from 2020 – this scenario is referred to as 'carbon neutral growth' by the airline industry. IATA's scenario is generally criticized by environmental groups as being overly optimistic and not mandatory. Please note that although aviation will be included in the EU ETS from 2012, the airline industry expects these economic measures to have an influence on cutting emissions at the earliest from 2020. Until then, the EU ETS will only reach relative emission cuts (i.e. as compared to a business-as-usual scenario).

Figure 5: The 'carbon-neutral growth' scenario from IATA



Source: IATA

2. ANALYSIS OF THE PRODUCT–BASED CARBON FOOTPRINT AND LABELLING APPROACH

2.1 The Carbon Footprint Approach, Food Miles and Carbon Labelling

2.1.1 Background

A carbon footprint is the total set of GHG emissions caused by an organization, event, product or person.[20] Carbon footprint analysis can be both an instrument for producers of goods and services to identify potential carbon efficiencies in their value chains, and it can be a measure against climate change as it can inform consumers on the impact of their behavior. The carbon footprint is a subset of the ecological footprint and of the more comprehensive Life Cycle Assessment (LCA). An LCA is a technique to assess environmental impacts associated with all the stages of a product's life from-cradle-to-grave (i.e., from raw material extraction through materials processing, manufacture, distribution, use, repair and maintenance, and disposal or recycling).[21]

Firms have the option, and the incentive, to engage in carbon footprint analyses which allow them to determine the true cost of their products to the environment and to increase savings through lower emissions and energy usage. A carbon footprint analysis mostly examines the entire value chain of a certain product to determine the total amount of CO_2 emitted throughout its production as well as how those emissions are shared over the various sectors involved. This analysis examines the product from its very beginning as raw materials through the transport to its retail locations. Increasingly, it also includes emissions produced from the use of the product by consumers and from its disposal or recycling.

2.1.2 Advantages of the carbon footprint approach

For a product or product range within a firm, the carbon footprint approach is an attractive proposition as it has many advantages because there are many issues (cost cutting, image of the company) that pressure companies into taking action on climate change within their value chains.

Increases in energy costs have direct and indirect effects on costs for firms. They cause costs to increase within the firm (direct) as heating and electricity costs increase. They also increase indirect costs as other companies supplying the firm with goods and services, such as raw materials or transport, are increasing their prices to cover the rising cost of energy within their own cost structures. As a result, rising energy prices create a multiplying effect of cost increases since almost every part of the value chain is affected by them. For many firms these cost increases serve as a major financial incentive to decrease energy consumption (and therefore emissions).

Reducing emissions could potentially have further positive effects because of consumer attitudes towards climate change. This could present companies with the opportunity to develop and market low carbon products. A supply chain emissions analysis will aid a firm in determining where it can cut emissions and potentially publicize these policies, hence taking advantage of these changing consumer attitudes.[22] A carbon label describes the carbon dioxide emissions created as a by-product of manufacturing, transporting, or disposing of a consumer product. Such labelling is already in place in many countries such as the UK, Australia and Switzerland.

In a study published in the Journal of Consumer Policy by Jerome Vanclay *et al.*, it was concluded that labelling of products as having below average, average or above average embodied carbon emissions (emissions throughout the supply chain) caused a significant change in sales patterns with products in the below average category recording an increase of 4% and those in the above average category showing a 6% decrease in overall sales.[23]

2.1.3 The carbon footprint approach as an answer to food miles

A narrow focus on the transport aspect of a value chain over other areas can discriminate against export oriented developing economies. By focusing too much on the transport portion over the other emitting sectors in the value chain, countries that are located far from the major OECD markets and have less access to the more efficient high volume shipping systems are unfairly targeted by such measurements. These factors must be taken into account when applying labels to products as this can be detrimental to fragile economies.[24] For instance, the use of 'food miles' labelling (labelling products with the total distance it has travelled before it is purchased by the consumer) focuses on transport emissions only and neglects other areas.

'Food miles' is the primary form of carbon labelling currently used by supermarkets. Food mile labels rely strictly on the distance travelled by a product and neglects other areas of the production process. The further the item travels, the more it contributes to greenhouse gas emissions. Today, food travels an average of 2,400 to 3,200 km before reaching the consumer - a 25-percent increase from 1980.[25]

Many people purchase locally produced food in the belief that this action is reducing emissions while it could, in fact, be causing greater levels of emissions.[26] The first reason is that the form of transport is much more important to the overall emissions than the total distance that the food traveled and it is in this area that discrepancies arise. Maritime shipping is used for most of the long distance transport needs of the agricultural industry and many of the products with a large number of 'food miles' have been transported by sea. However, maritime transport is the most efficient form of transport and therefore products that a transported by truck or air over shorter distances (thereby fewer 'food miles') can actually contribute to higher emissions.[27]

Several organizations involved in organic certification and standard setting are developing standards that incorporate carbon accounting. For example, the Swiss organic labelling organization, Bio Suisse, does not give certification to air-freighted products (see box 1).

Box 1: Swiss organic markets and import restrictions: the case of Bio Suisse

The Swiss organic labelling organization, Bio Suisse, has incorporated food miles measures into its standards. Some of the criteria for awarding its label include:

- Products imported into Switzerland by land or sea (but not by air transport);
- Priority to organic imports from nearby countries; and
- Products for which all the processing is carried out abroad.

Fresh products (fresh fruit, vegetables, herbs), fruit juices and frozen products from overseas (except the Mediterranean) cannot be labeled with the Bio Suisse organic label. Products which are "detrimental" to the image of the Bio Suisse label may be refused a license contract. The following criteria may apply: "Ecology, transport distances, packaging, and consumer expectations". Examples of products which have been refused contracts in recent years due to this restriction are: wine and tinned tomatoes from overseas, caviar and instant ice tea.

The preference for Swiss products appears to be based on meeting the wishes of consumers. Jacqueline Forster-Zigerly of Bio Suisse said in 2008: "In a time of globalization, it becomes clearer how important it to have a strong national or regional profile. We notice that the consumers are becoming more interested in locally-produced products, sometimes even more interested than in the organic products"

Source: (The Organic Standard, 87: 3)

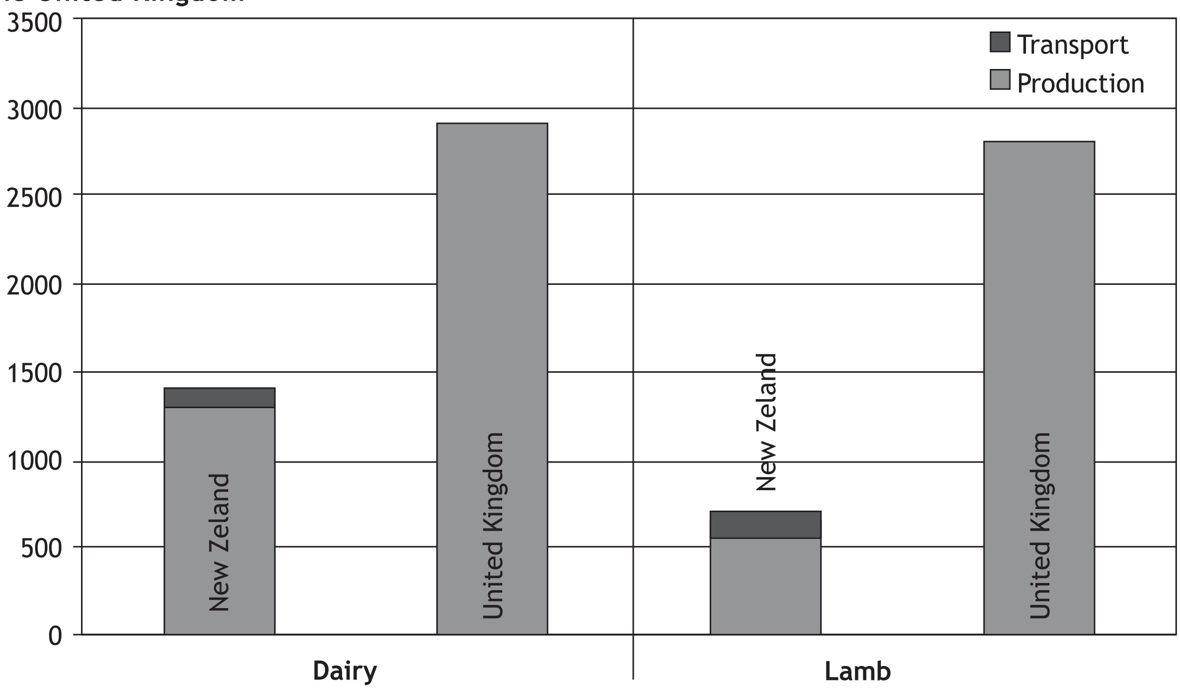
The second argument that challenges the assumption that locally produced produce is more environmentally friendly than that shipped from abroad is that this assumption is oversimplified and places too much emphasis on transport emissions compared to emissions from other aspects of the value chain.

A narrow focus on emissions resulting from transport overlooks that certain production systems and locations are more energy-intensive than others. Tomatoes grown in greenhouses in Sweden and the Netherlands, for example, were found to be 10 times more energy-intensive than those grown in open fields (Carlsson-Kanyama, Ekstrom and Shanahan, 2002). Saunders, Barber and Taylor (2006) compared energy use and emission levels in the production and transport (from a New Zealand to a United Kingdom port) of several commodities (see figure 6 for dairy products and lamb, and Figure 7 for apples and onions, which include storage). They concluded that with 3 of the 4 products, emissions were lower when produced in New Zealand and transported by sea to the United Kingdom than when produced in the United Kingdom. The length of time that food is stored prior to retail can add substantially to GHG emissions. The cold storage used to allow consumption of out-of-season apples can account for over 40 per cent of a product's energy inputs. The impact on global warming of locally grown United Kingdom produce placed in storage for 10 months is twice as high as that of South American apples sea-freighted to the United Kingdom.[28]

In conclusion, it can be argued that in many cases food produced abroad and transported to the country of consumption (especially if that country is in a northern region) generates lower emissions than food produced locally.[29] This argument is based on the high levels of emissions that are associated with production of tropical or warm climate crops in temperate or colder regions and the increasing efficiency levels of international bulk transport.

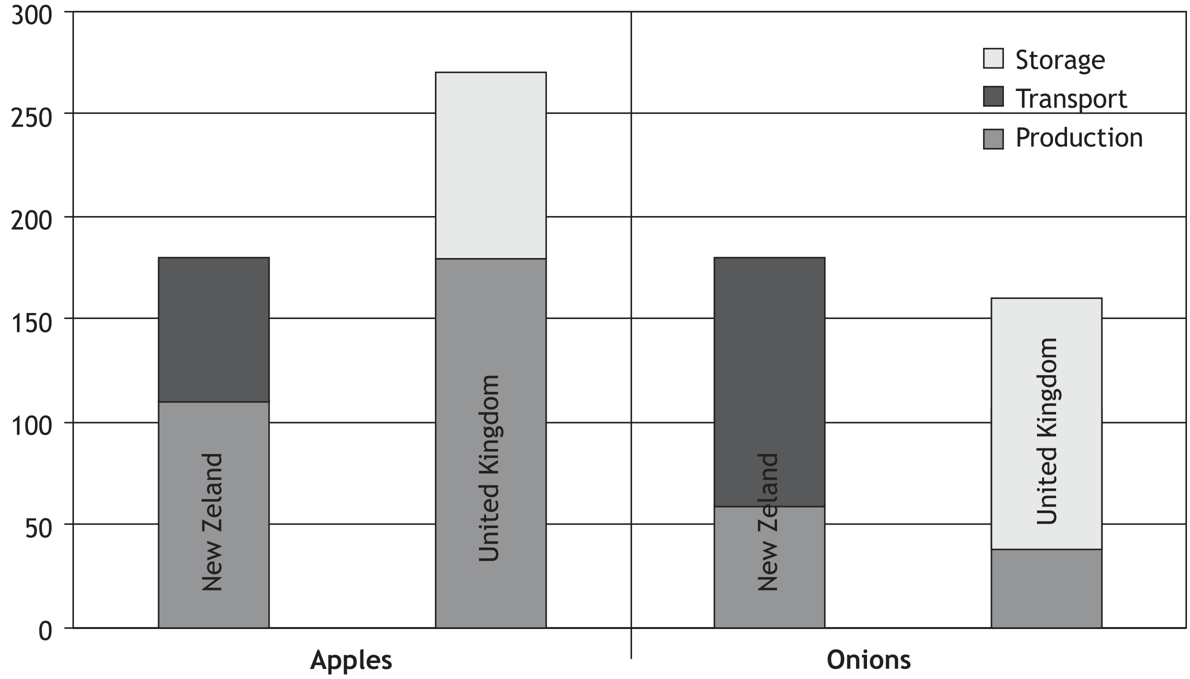
The focus of food miles on distance, then, is a crude indicator of environmental damage as it ignores the difference in GHG emissions between different forms of transport and energy costs in other stages of the supply chain. It also ignores non-carbon GHGs. The use of energy in production systems and cold storage is also significant. Efficiencies in these areas can offset emissions from transport over great distances (as illustrated in figures 6 and 7).

Figure 6: Comparative CO_2 emissions per ton of dairy and lamb produced in New Zealand and the United Kingdom



Source: ITC

Figure 7: Comparative CO_2 emissions per ton of apples and onions produced in New Zealand and the United Kingdom



Source: ITC

Figures 6 and 7 are based on sea-freighted transport. Air freight is very energy-intensive and normally does not compensate for lower energy costs associated with production in warmer climates like Kenya. Fruit and vegetables grown in Kenya and air freighted to Europe involve substantially higher GHG emissions – around 10 times greater. The carbon footprint of flowers grown in open fields with geothermal power in Kenya and air freighted to Europe was lower though than that of flowers grown in greenhouses (and heated by fossil fuels) in the Netherlands.[30] Thus a narrow focus on food miles and the transport component of the value chain could have a negative impact on vulnerable exporting countries, like high-value fruit and vegetable exporters in sub-Saharan Africa.

It is mostly in response to the challenges of food miles that carbon footprints are based on life cycle analyses (LCAs) which illustrate where energy costs fall in each stage of the supply chain from "farm to fork". As this section has shown, areas other than transport can be an important contributor to the carbon footprint of especially food products.

2.1.4 Challenges of the carbon footprint approach

Probably the biggest challenge of the carbon footprint approach is that there is no commonly adopted LCA methodology[31], which makes it difficult for consumers to compare and comprehend the different labelling schemes. The effectiveness of carbon labels in curbing emissions is further undermined by their voluntary nature, which allows free-riding by less "conscientious" consumers.

Secondly, the the cost of compliance and time requirements for analysis of embodied emissions can be prohibitive, especially for small producers in developing countries.[32] Thus there remain concerns about the potentially inequitable impact on developing-country exporters. Compliance costs and lack of sound methodologies for measuring carbon emissions embodied in every single product results in food miles being the carbon label of choice, as the calculation of distance travelled by a product is by far the simplest measure available to many retailers.

Environmentally, the biggest challenge of the carbon footprint approach is that it can, in the best case, only contribute to reduced emission intensity. That is, the label gives the impression that there are less emissions per unit or per product. If that leads to raised consumption of that same product because consumers get the impression that the product has less of a climate impact, then that could in fact lead to increased total emissions (the rebound effect[33]).

And finally, the results of carbon footprint analyses are specific (usually centered around one product) and therefore are not necessarily applicable industry-wide. Therefore, industry-wide recommendations are not usually possible and this means that only a small proportion of the value chain or industry is aware of its capabilities or incentives to reduce their carbon footprint.

2.2 Examples of Emissions Resulting from Transport in Different Sectors Compared with Total Production Emissions

Examining some approximate numbers from a variety of different products in different industries, we can see how important transport is to the overall emissions. While these figures only speak for certain products, they show how the emissions from transport, in terms of percentage of total emissions for a product, can vary between industrial sectors. Examining a variety of products can allow for the formation of hypotheses about the relative importance of transport to the overall emissions of a sector. However, concrete conclusions cannot be fashioned but patterns may be identified. Products from the newspaper, electronics, pharmaceutical and mining industries are examined[34] below as they give a wide range of different transport needs.

Trinity Mirror, the producer of the Daily Mirror UK newspaper, was examined. Its value chain emissions from its Daily Mirror distribution were approximated to give a general idea of how much transport played into the overall emission figures. Each Daily Mirror, through production, distribution and disposal, produced 174gCO_2 in 2006 and with a readership of 1,727,672 in January of that year, leads to overall emissions of approx. 0.094 MtCO_2. Of that, approx. 0.01MtCO_2 are caused by the transport sector (either through transport of raw materials or through distribution). This amounts to 11% of the total emissions related to the Daily Mirror.[35]

The emissions of electronics company Apple are also regularly examined. Apple produced 9.6 MtCO_2 in 2009. However, 4.5 Mt came from consumer use of its products and will not be counted in this assessment of its supply chain. Therefore, Apple produced 5.1 Mt through the production and sale of its products in 2009. Of this, 0.51 MtCO_2 came from transport. This is 10% of its total.[36]

Bayer, the German pharmaceutical company, was also examined. From its voluntary response to the Carbon Disclosure project in 2009, its scope 1, 2 and 3 emissions can be determined. Bayer produced 8.07 MtCO_2 in 2008, of which 0.5 MtCO_2 came from transport within its supply chain. This constitutes 6.2% of its total CO_2 emissions.[37]

Within the mining sector, two companies were analyzed; Rio Tinto and Anglo American. Rio Tinto produced 34.9 MtCO_2 in 2006 of which 19%, that is to say 6.6MtCO_2, came from transport (both upstream and downstream).[38] Results for Anglo American were similar, producing 22.9 MtCO_2 in 2009. Of that, 2.9 MtCO_2 came from transport, which comes to an overall percentage of 14.5% of all emissions.[39] The results of this comparison are shown in Table 2 below.

Table 2: Transport emissions for different firms.

Company or sector	Industry	Total Scope 1 + Scope 2 Emissions ($MtCO_2$)	Emissions from Transport ($MtCO_2$)	Percentage of Total Emissions that are related to Transport
Trinity Mirror	Newspapers	0.094	0.01	11%
Apple	Electronics	5.1	0.51	10%
Bayer	Pharmaceuticals	7.57	0.5	6.2%
Anglo American	Mining	20	2.9	14.5%
Rio Tinto	Mining	28.3	6.6	19%

Source: ICTSD

For an overview of the amount of emissions resulting from domestic and international transport as compared to the emissions resulting from food production in Chile, please consult Annex I.

2.3 Trade and Development Aspects of the Value Chain and Carbon Footprint Approach

It can be inferred from these case studies, that transport plays a vital role in the overall emissions of a company's supply chain. The industry with the largest need to transport raw materials (mining industry) has the highest levels of transport emissions relative to total emissions. This is especially important for developing countries because they are usually the exporters of raw materials and are often towards the beginning of the supply chain.

Examining the results in Table 2, it appears that raw material transport is a large factor in supply chain emissions (transport for mining companies emits substantially more CO_2 than the transport of Apple's electronic products). Therefore, developing countries who are major suppliers of raw materials deal with much higher rates of emissions from transport due to the emission intensity of raw material transport (see section 1). A reduction in emissions from raw material transport will reduce global emissions substantially as well as save the firm money in the long term through fuel savings. There is also a developmental alternative however, as, in the long run, it may be possible for some developing nations who rely economically on the exportation of raw materials to move up the value chain and begin to export manufactured goods. This would eliminate some of the heavy emissions associated with raw material trade as only domestic transport of such commodities is necessary. Therefore, encouraging investment in domestic secondary and tertiary industries in developing countries could also alleviate the climate change burden of raw material exportation.

Another issue resulting from a carbon footprint based approach is the fact that it can facilitate the introduction of unilateral measures against imports of carbon intensive products by individual countries. Some countries are considering unilateral measures such as an ETS and accompanying border tax adjustments or BTAs[40]. While in theory BTAs are about treating imports and domestic products equally, there are concerns that they would amount to grees protectionism.[41, 42] The most notorious example of a unilateral measure in the transport sector is the inclusion, in January 2012, of aviation in the EU ETS.[43]

Both the USA[44] and China[45] have expressed strong negative sentiments towards inclusion of aviation in the EU ETS. The USA and China are adamant that such a policy is unfair and that the EU has no right to subject foreign airlines to its policies. This dispute shows the difficulties surrounding the implementation of MBMs in a non-global fashion. A 'patchwork' solution, where countries or regions implement their own rules, could lead to clashes such as the one described above and reinforce the need for a global scheme.

As said, carbon labelling and carbon footprint requirements can pose substantial compliance costs on producers in developing countries. A strong argument can be made that trade policy makers should not only focus on discouraging or prohibiting such measures as non-tariff barriers to trade, but instead make an effort to harmonize the differing standards. Trade is often a driver of standard harmonization in general (e.g. in the EU). Developing countries that are poorly involved in current harmonisation efforts should be encouraged to participate more fully, especially in the context of a global climate change approach. This involvement will also be important in the case of any technology transfer commitments that come out of the UNFCCC process. OECD countries and international organisations could try to get developing countries more involved through:

- assistance on policy development in climate change and energy efficiency;
- technical assistance in all aspects of the standards development and implementation process;
- financial assistance to help in standards development and implementation; and
- exchange of best practices.[46]

In terms of realizing the potential for efficiency gains in their value chains, firms have their own challenges. If a firm wants to cut costs in its transport operations throughout the value chain it must coordinate with other firms associated with its product. While financial incentives are present throughout the value chain (a decrease in costs for a firm towards the beginning of the value chain will have a ripple effect and decrease costs for all the subsequent firms), costs such as transport involve many other firms that are not necessarily associated with the company undertaking the value chain cost analysis. A raw material exporter, for instance, will have many different clients and an auto company will mostly not be the only client of a steel manufacturer. Therefore, the ability to coordinate with many firms in varying sectors is indispensable if one wishes to cut emissions from transport specifically.

2.4 WTO Law and Product Labelling

In the context of carbon labelling, the term 'non-product-related processes and production methods' (NPR-PPMs) refers to carbon emissions associated with a product's production or transport that are indiscernible in the final product, including how much carbon was emitted to generate the electricity used to manufacture the product, or to transport it by ship or plane to the country of sale. The applicability of the WTO Agreement on Technical Barriers to Trade (TBT) to non-product-related PPMs is one of the principal uncertainties regarding the application of the TBT Agreement to carbon standards and labelling schemes.

Issues related to global trade rules begin to arise with the question of whether such labels can be applied to imported goods. Efficiency standards and labels are reported to be the single largest cause of national notifications to the WTO under the TBT Agreement. Given their importance in stimulating highly cost-effective energy and emissions savings, this is likely to continue as governments worldwide continue to step up their environmental efforts. Whatever costs these regulations imply for industry and trade, it can be argued that they are generally less than the value of the energy savings they foster.

The key principle of WTO law with regard to carbon labelling is non-discrimination: goods imported from foreign producers must get no worse treatment than like goods from domestic producers. This raises the question of whether or not the application of carbon labels to products provides them with any commercial advantage or disadvantage. With respect to discrimination on the basis of embodied carbon, the million-dollar question is how to define 'like' goods. Is a pound of bananas grown using environmentally friendly farming methods 'like' a pound of bananas produced using more polluting means? If so, tariffs based on embodied carbon may violate the principle of non-discrimination as set forth by the WTO. This interpretation of similar products depends on the meaning that one ascribes to the word ‘related’. Does ‘related’ mean product-related (detectable in the final product)? Or does ‘related’ have a broader meaning, such as being associated with a product, process or production method? The scope of the TBT Agreement will ultimately depend on the WTO’s interpretation of the term ‘related’.

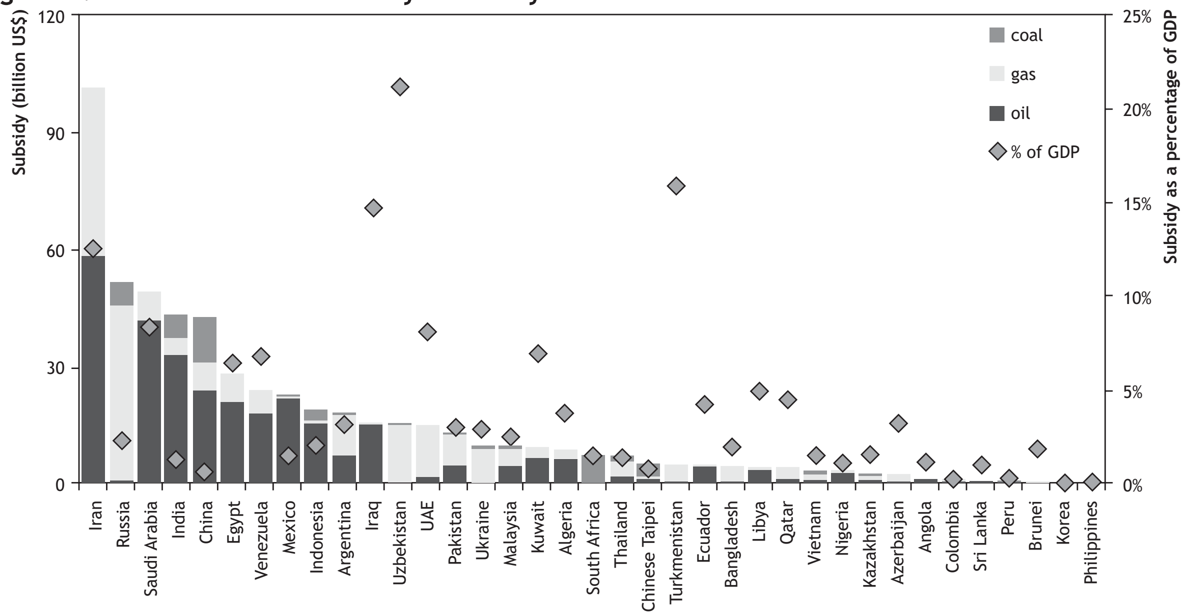
Finally, do carbon labels have any effect on imported versus domestic sales within the current market? The examples given in this chapter suggest so. A WTO panel faced with a technical regulation or standard applicable to carbon emissions is likely to turn first to the TBT Agreement. The agreement differentiates between technical regulations (mandatory measures) and standards (voluntary measures) and sets forth rules applicable to both, which would apply to the subject of carbon labelling. Mandatory application of carbon labelling would therefore have to be applied equally to imports and domestic goods, and should satisfy non-discrimination provisions by proving that the labelling of imports does not put them at an unfair disadvantage vis-à-vis domestic products.[47]

3. REMOVAL OF FOSSIL FUEL SUBSIDIES: IMPACT ON TRADE AND LEVEL OF EMISSIONS

3.1 Size, Nature and Impact of Fossil Fuel Subsidies

It is estimated that global fossil fuel subsidies totaled somewhere between $312 billion to $558 billion in 2009[48]. There is a strong linkage between fossil fuel subsidies and demand for transport fuels; more than 60 percent of daily oil consumption is used for transport.[49]

Figure 8: Fossil fuel subsidies - by economy and as a share of GDP



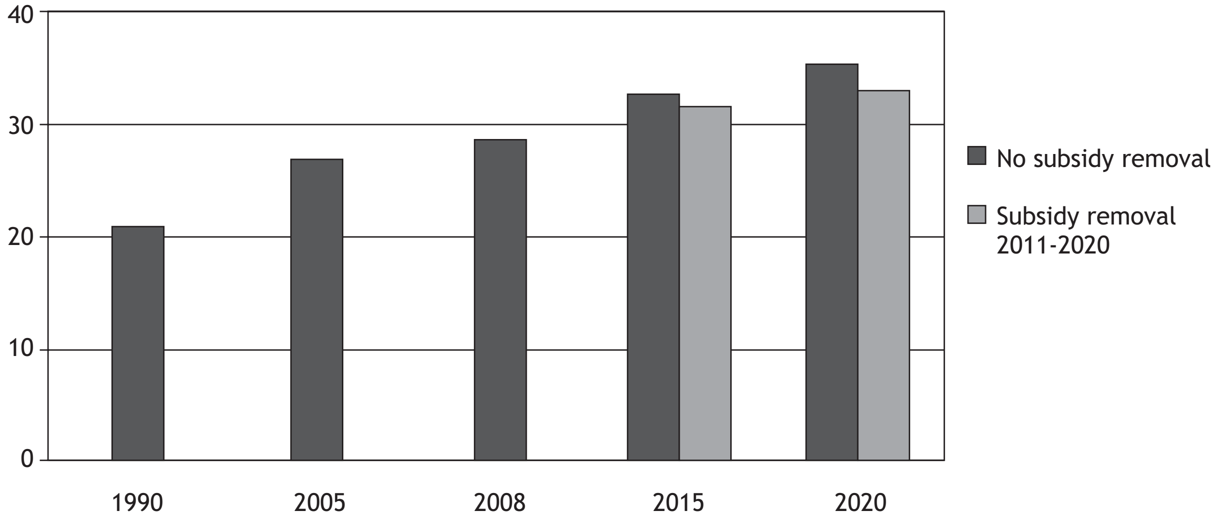
Source: IEA

Fossil fuel subsidies propagate themselves in various ways: government intervention in markets to affect costs and prices, transfers of funds directly to recipients, partial assumption of risk, selective reductions in taxes, and undercharging for the use of government goods or assets. Often, multiple functions are used. The effect of these subsidies depends on how and what the government subsidizes (i.e. consumer or producer prices/costs, consumption or production levels, enterprise revenues, intermediate outputs, or production factors).[50] Up to some extent the fact that airplane kerosene and shipping fuel are not taxed can be seen as a subsidy as it gives these modes of transport an unfair competitive advantage over modes that pay taxes on their fuel (such as road transport).

The reason why jet kerosene for example is not taxed is because of the threat of "tankering": carriers filling their aircraft as full as possible whenever they land outside of a country that taxes fuel to avoid paying tax, increasing the level of aviation emissions. Although there have been some moves to reach an international agreement on taxing transport fuel, progress has been very slow.

According to a study by Burniaux and Chateau[51], if all 37 countries in the IEA fossil fuel subsidies database[52] eliminate their subsidies between 2013 and 2020, world GHG emissions could potentially be reduced by 8% in 2050 relative to the baseline projections.[53] The model used incorporates approximately 95% of global fossil fuel subsidies and is, therefore, a very effective simulation of the potential emissions reductions that can be achieved in this area. The vast majority of fossil fuel subsidies are implemented by non-OECD countries (only two countries covered by the study, South Korea and Mexico are members of the OECD).

Figure 9: Impact of subsidy phase-out on energy-related CO_2 emissions



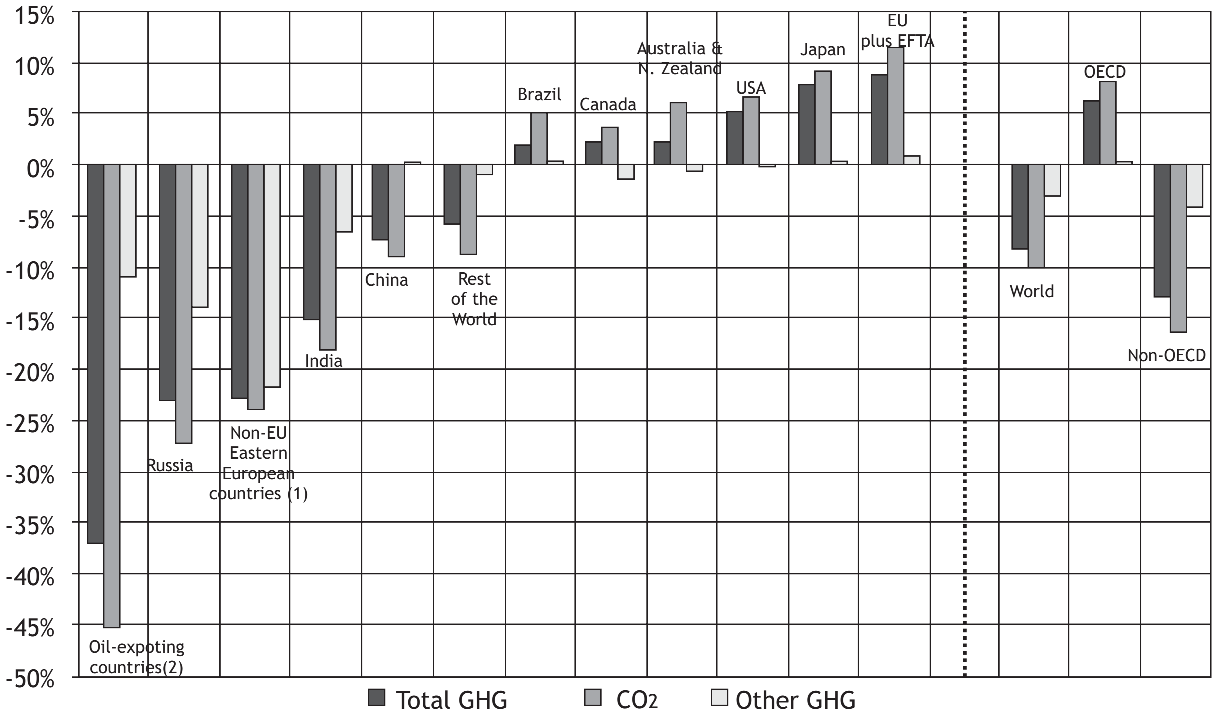
Source: IEA

While the global emissions reduction would be 8%, some individual countries and regions show much more substantial emissions reduction potential. Russia, for instance, could reduce CO_2 emissions by some 25% while oil exporting nations would see a drop in emissions of 45% relative to the predicted baseline. However, as outlined above, the total global figure is 8%, substantially less than that seen in heavily fossil fuel subsidizing countries. This is shown in figure 10[54], and is due to the lack of emission caps on OECD countries.

If subsidies would be eliminated, fossil fuel consumption would fall in non-OECD countries. In the hypothetical situation that fossil fuel production remains constant (i.e. producers such as OPEC do not restrict supply), the model shows that international fossil fuel prices would fall as well. This would cause an *increase* in fossil fuel consumption in countries that do not subsidize their demand or do not eliminate their subsidy programmes. This phenomenon is known as 'carbon leakage' and would be particularly pronounced in the EU and European Free Trade Association (EFTA)[55] where emissions would *increase* by 12% relative to the projected baseline. Around 17% of the 6.1 $GtCO_2$ emissions cut in non-OECD countries due to subsidy elimination would be offset by increases in emissions in OECD countries due to the subsequent price drops. It is estimated in the study by Burniaux and Chateau that the removal of subsidies would cause a decrease in international crude oil and natural gas prices of 8% and 13% respectively by 2050. Coal prices would fall by 1%.[56]

Transport demand is projected to continue to increase globally, with particularly strong growth in developing countries like China. This demand growth (past and future) is a major reason for the increase of oil prices but these price increases have done little to curb consumption because they are more than offset by population and income increases. Therefore, the elasticity of demand for oil will continue to decline. This means that substituting away from oil to other forms of fuel will become increasingly difficult due to increases in the demand for fuel consuming industries such as transport. Therefore, price increases will have smaller and smaller effects on consumption and measures that attempt to decrease consumption through the increase in prices will have to raise prices high enough to have noticeable effects on oil consumption.[57]

Figure 10: the predicted effects on emissions from removing fossil fuel subsidies. The figure illustrates the phenomenon of carbon leakage and the inherent inequality of the emission reductions associated with the elimination of fossil fuel subsidies.



Source: OECD, 2011

This accounts for the increase in emissions in some countries. Burniaux and Chateau recommend, therefore, that 'binding emission caps' be placed on OECD countries to compliment the subsidy reforms in order to ensure the restraint of carbon leakage and the consequent increase in global emissions reductions.[58]

Trade will also be affected by the elimination of fossil fuel subsidies. However, the extent to which it impacts international trade and the regions it affects the most will depend on whether the subsidies are removed unilaterally or multilaterally. This will be further discussed below.

3.2 Unilateral Removal of Fossil Fuel Subsidies

In the case of a unilateral elimination of subsidies for fossil fuels, if a country is an energy importer (e.g. India), the removal of subsidies will lead to a drastic reduction in imports of fossil fuels. In a fossil fuel exporting country (e.g. Saudi Arabia), the decline in domestic consumption resulting from the increase in the domestic fuel price causes domestic production to become more export oriented. In both cases, a 'transitory account surplus is created' as imports shrink and, in the case of oil/energy exporting countries, exports rise. This change is absorbed in the real exchange rates of the country's terms of trade. Furthermore, this causes an increase in non-energy related imports and a decline in exports (especially products of energy-intensive industries) as the fossil fuel related costs rise and exchange rate appreciation threatens their competitiveness internationally.[59] Therefore, the removal of fossil fuel subsidies would mean that the companies within the country would see increases in the fixed costs as fuel prices increase. Obviously, this will affect the energy intensive industries the most as they rely on larger quantities of fuel for their production. This removal will mean that any advantage these domestic firms had over international competition due to the lower cost of fuel will evaporate. However, the exact trade-related effects of a unilateral removal of subsidies will vary between countries as each has its unique trade structure.

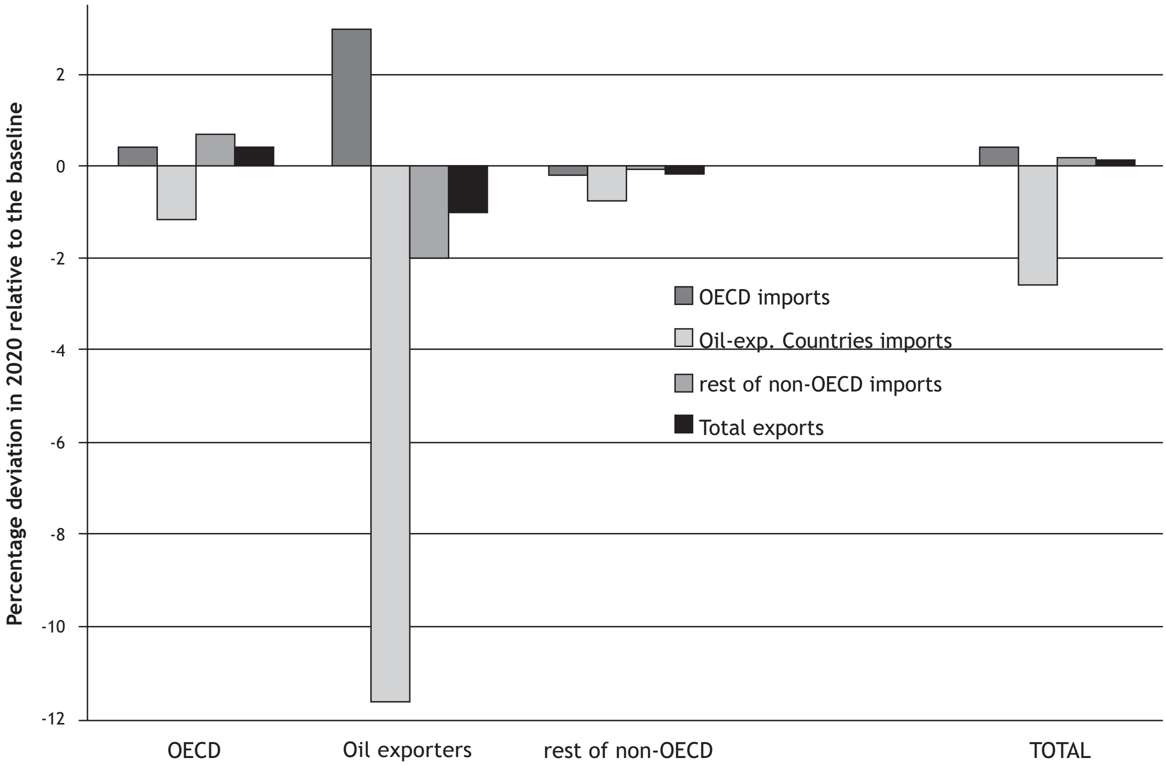
With respect to transport, the elimination of fossil fuel subsidies in one country or region will mean that transport cost within that country will rise. Also, the cost of its trading could increase depending on the amount of energy it supplied its trade. A rise in a country's fossil fuel prices could affect the cost, and therefore the levels, of international trade depending on how much of the global fuel total the country supplied (this is particularly prevalent for oil exporting nations). Therefore, the unilateral removal of subsidies will have varying effects on international trade and emissions depending on a variety of factors including: the number of countries removing their subsidies, the extent to which their subsidies are removed, the nature of the country in the international market (energy importer or energy exporter) and how the country appropriates the money gained from no longer having to pay the subsidies. Due to the large differences between countries and the large number of factors that can influence the effects of subsidy removal, it is impossible to determine concrete values for these effects on the global level. However, were one to examine individual countries, welfare gains and emissions reductions could be calculated.

3.3 Multilateral Removal of Fossil Fuel Subsidies

In the case of a multilateral subsidy removal, it is much easier to quantify and examine the global economic and environmental effects because many of the factors influencing these effects of the removal of subsidies are eliminated. It no longer depends on which countries are removing their subsidies and the removal is standardized amongst all participants. In the case where all countries simultaneously remove their fossil fuel subsidies, real income at the global level will rise, albeit unevenly. Under this scenario, many non-OECD countries that remove their subsidies (including Russia and oil-exporting countries), would not enjoy the welfare gains they were set to receive were they acting alone. This is due to the fact that their fossil fuel products are no longer produced in the same volumes due to the increase in their domestic prices. Therefore, the economic gains resulting from the export of these products are reduced. These losses are much greater than the efficiency gains from improved resource allocation (the transfer of funding from subsidies of fossil fuels to other areas). Therefore, the overall welfare of these nations would not increase as much, and could even decrease, compared with unilateral action.

Importing (fossil fuel importers, that is) OECD countries, on the other hand, would enjoy larger income gains due to the improvement in their terms of trade (the price of exports/ the price of imports in a country; the higher the terms of trade, the more imports a country can purchase for a given quantity of exports) because of the fall in world energy prices. Under this scenario, world trade volumes increase marginally (approx. 0.1%) due to the increases in volumes of energy intensive industries trade being offset by decreases in natural gas (-6%) and coal (-1%). The following chart (Figure 11[60]) summarizes the redistribution of global imports and exports after the removal of the subsidies and a hypothetical emissions cap on OECD countries. Therefore the removal of fossil fuels will allow for the marginal growth in world trade by 2020.

Figure 11: Predicted effects of the removal of fossil fuel subsides on world trade



Source: OECD, 2011

It appears that, through the global elimination of fossil fuel subsidies combined with an emissions cap on OECD countries, GHG emissions could be cut by 10% and world trade would also increase due to the elimination of carbon leakage. If the multilateral removal of subsidies occurred without a simultaneous cap on OECD emissions, and production would remain constant, then in the model of Chateau and Burniaux fossil fuel consumption would increase in the OECD because of the decrease in world prices associated with the lowered demand in countries which remove their subsidies. Capping emissions in the OECD would eliminate this as there would be no room for growth of the market in this region. That is why, with a cap on emissions in the OECD, global GHG emissions would be cut by an additional 2% (from 8% to 10%).

In the used model, the vast majority of the export surplus recorded by OECD countries in 2020 results from increases in their exports of products from EIIs (Energy Intensive Industries, such as the steel industry) and this results in further increases in their imports of crude and refined oil products. Therefore, oil exporters either restrict production and drive up prices, or further trigger their domestic production towards exportation. In the latter case, EIIs will tend to relocate towards OECD countries as they no longer benefit from cheaper fossil fuels in oil-producing countries due to the elimination of subsidies and the relative competitiveness gains in OECD countries despite the cap on their emissions. This causes the increase in imports of EIIs in oil producing countries as some of the industries have relocated away from them, forcing them to import.[61] In any case, removing fossil fuel subsidies would incentivize EIIs in non-OECD countries to adjust faster to energy prices that will inevitably increase, and would force them to realize the productivity and competitiveness gains from energy efficiency sooner.

The income gain recorded in oil exporting nations is gradually offset by the adverse effect on economic growth they encounter with the rise of domestic prices which lead to increased costs of investment, loss of competitive advantage for their products and relocation of EIIs. Therefore, their contributions to world trade would continue to shrink in this model after 2020 to a level 6% below the baseline in 2050. Their exports to OECD countries fall 4% by 2050 which is due to the loss of competitive advantages for the EIIs of oil exporting countries. Total import volumes of oil exporters fall approximately 4% by 2050.[62] These projections indicate that wasting cheap energy and neglecting energy efficiency now may have consequences for trade and competitiveness in the future.

Artificially low fuel prices in countries which subsidize their fossil fuels create an artificially low global carbon price which jeopardizes international attempts to regulate emissions through Market Based Measures (MBMs, see next chapter) such as emissions trading and fuel levies. These measures will bring about global economic and environmental benefits though they may not be equally distributed. However, the countries that face real income reductions (mostly the oil-exporting states) can mostly offset these losses through the welfare gains of using the funds previously used to subsidize fossil fuel to invest in other areas. As outlined above, useful investment of the funds made available from the elimination of subsidies can be very beneficial to a country's long-term economic growth and stability. In the long term, emissions fall 10% by 2050 with the removal of subsidies and a cap on OECD emissions.

3.4 Political Economy and Feasibility of Fossil Subsidy Removal

As the economic analysis above has shown, reforming—ideally eliminating—fossil fuel subsidies is a rational "no-lose" (or "win-win") policy that could improve energy security, protect the environment and also promote economic growth. So why do fossil fuel subsidies still exist and why is it so difficult to remove them?

The answer to this question seems to lie mostly in the failure to appreciate the political economy of subsidy policies. While win-win policies are ideal in theory, in practice well-organized groups usually benefit from existing policies, such as subsidies, and thus are poised to block reform. Moreover, policy reforms that generate positive net benefits may not be viable politically unless they also reflect a wide array of social goals about the allocation of benefits and costs. Thus the actual experience with subsidy reform is mixed at best. Some governments have reduced subsidies, while in many other countries the cost of subsidies has actually risen sharply in recent years as many governments have struggled to insulate consumers from the full rise in the cost of fossil fuels.[63]

First of all it would be good to look for the reasons why fossil fuel subsidies exist at all. In most cases these subsidies exist because they are rooted in a political logic that is often difficult to alter. The interest groups that demand subsidies are usually well organized, and the provision of a subsidy usually makes those groups even more aware of their interest in sustaining the subsidy policy. Further, the entities that supply subsidies often find political advantage in providing this costly service. These political facts make it particularly difficult for policy-makers to separate the purely interest-based political purposes of subsidy and the many "legitimate" purposes of this form of government policy. Some governments use a subsidy to help provide energy services to low-income communities as part of a worthy effort to redistribute income or help alleviate poverty.[64]

Political economy analysis often begins with the standard assumption that government leaders act with the goal of staying in power. Policies that provide subsidies often help leaders achieve that goal by channelling resources to interest groups that could affect government survival, such as by voting or by donating to their political campaigns.

Once a subsidy is created, regardless of its original purpose, interest groups and investments solidify around the existence of the policy and make change difficult. It is important to examine both the demand for and supply of subsidies. Relatively straightforward mobilization of interest groups can explain much of the demand for subsidy. But that perspective is unable to explain why the supply of subsidy takes such different forms. The central problems actually lie with supply—a subsidy is a readily available mechanism for governments (or their agents, such as state oil companies) and requires very little administrative capability. Subsidies are pervasive not so much because demand for them is so large but because the subsidy supply mechanisms exist and it is politically difficult for many governments to resist using them. For many governments, there are no other readily available mechanisms for satisfying important interest groups.[65]

The "populist paradox" means that the cheapest fuels are often provided by governments that do not face popular referenda. One reason for this paradox is that while these governments do not face elections they do confront other existential tests. In particular, they fear instability. And they believe that one way to reduce those dangers is to provide highly visible services at low cost. Once they begin this process it is difficult to stop. And since many of these governments are oil-rich petrostates, subsidy is a readily available means of supplying visible goods and services to unrest-prone populations.[66] In general, fossil fuel subsidies seem to concentrate on consumers rather than producers.[67]

3.5 How to Remove Fossil Fuel Subsidies?

Victor (2009) suggests four lessons for reformers—both those inside countries and external parties, such as multilateral lending institutions that want to help countries adopt durable subsidy reforms. First, any reform strategy must begin with the political logic that led governments to create the subsidy. Fixing the subsidy problem requires a political strategy that compensates powerful interests that consent to a change in policy.

Second, an effective political strategy usually benefits from transparency in the cost and purpose of the subsidy. Many subsidies survive because the parties that carry the burden are unaware of the cost they are paying and because opacity makes it difficult to pursue an informed debate over the legitimate purposes of the subsidy.

Third, where subsidies are unavoidable—either because they are rooted in an unwavering political calculus or because they serve legitimate public purposes—then better subsidy design can usually help reduce any pernicious effects of the subsidies and also ease the task of reforming them in the future.

Fourth, and finally, subsidy reformers can have more success when governments have better administrative tools in their arsenal. Broad-spectrum subsidies are blunt instruments that are nonetheless popular because governments often have few choices. And the path dependence that is evident in their use makes it additionally difficult for a government to find an incentive to build alternative administrative tools.[68]

While many of these actions will be at the national level, international collaboration and agreement can support national efforts regarding research and technical assistance, sharing of information and best practice, establishment of rules, financial support, and through increased accountability.

But where should this international collaboration and agreement be housed?

The World Trade Organization's (WTO) Agreement on Subsidies and Countervailing Measures seems the obvious first choice; however, the WTO's established subsidy disciplines, reporting mechanism and Dispute Settlement Body have not comprehensively addressed fossil fuel subsidies to date — due, in part, to its trade-focused mandate and the lack of political will on the part of its members to address energy trade issues. As the membership expands to include more energy producing countries and as energy security and climate change become higher national priorities, the calls for addressing fossil fuel subsidies more comprehensively within the WTO may increase. This will necessitate negotiating new subsidy disciplines that address the economically distorting and environmentally harmful nature of fossil fuel subsidies. It is not politically feasible to progress this during and beyond the Doha Round of negotiations, but increased efforts to advance research, technical analysis and awareness raising will pave the way for incorporating fossil fuel subsidies into the agendas of future rounds of multilateral trade negotiations.

The UNFCCC (United Nations Framework Convention on Climate Change) is another obvious choice. It has comprehensive membership and a well-established secretariat and schedule of meetings; climate change is one of the key rationales for fossil fuel subsidy reform. Although subsidy reform is mentioned within the text of the UNFCCC and its Kyoto Protocol, no serious initiatives or discussions to reform subsidies have as yet been held. Further, the UNFCCC has always strongly upheld the principle of national sovereignty and has made little attempt to agree on lists of policies and measures that countries should undertake. Legally binding commitments to fossil fuel subsidy reform thus seem highly unlikely in at least the medium term, particularly given the fundamental discussions on the future direction of the UNFCCC, which are currently (2010) underway.

The UNFCCC could, however, support voluntary and nationally focused efforts. The UNFCCC could advise developed countries that fossil fuel subsidy reform, or supporting it, is a recommended course of action. For developing countries, nationally appropriate mitigation actions (NAMAs) are likely to be part of their commitments to a post-2012 climate change deal. Fossil fuel subsidy reform would fit well into such policy commitments, which could be supported by developed countries technically or financially. Both options would be dependent on progress on the post-2012 international architecture in general. The interest in and efforts of a set of countries to champion the issue of fossil fuel subsidy reform is a prerequisite: such reform is only a theoretical option at present, and enshrining mechanisms within the UNFCCC will require a concerted effort of potentially long duration.

Subsidy removal has already gained some attention though as an initial strategy for developing countries that are under pressure to help address climate change, but are reluctant to spend their own resources on policies that do not align with their own national goals.[69]

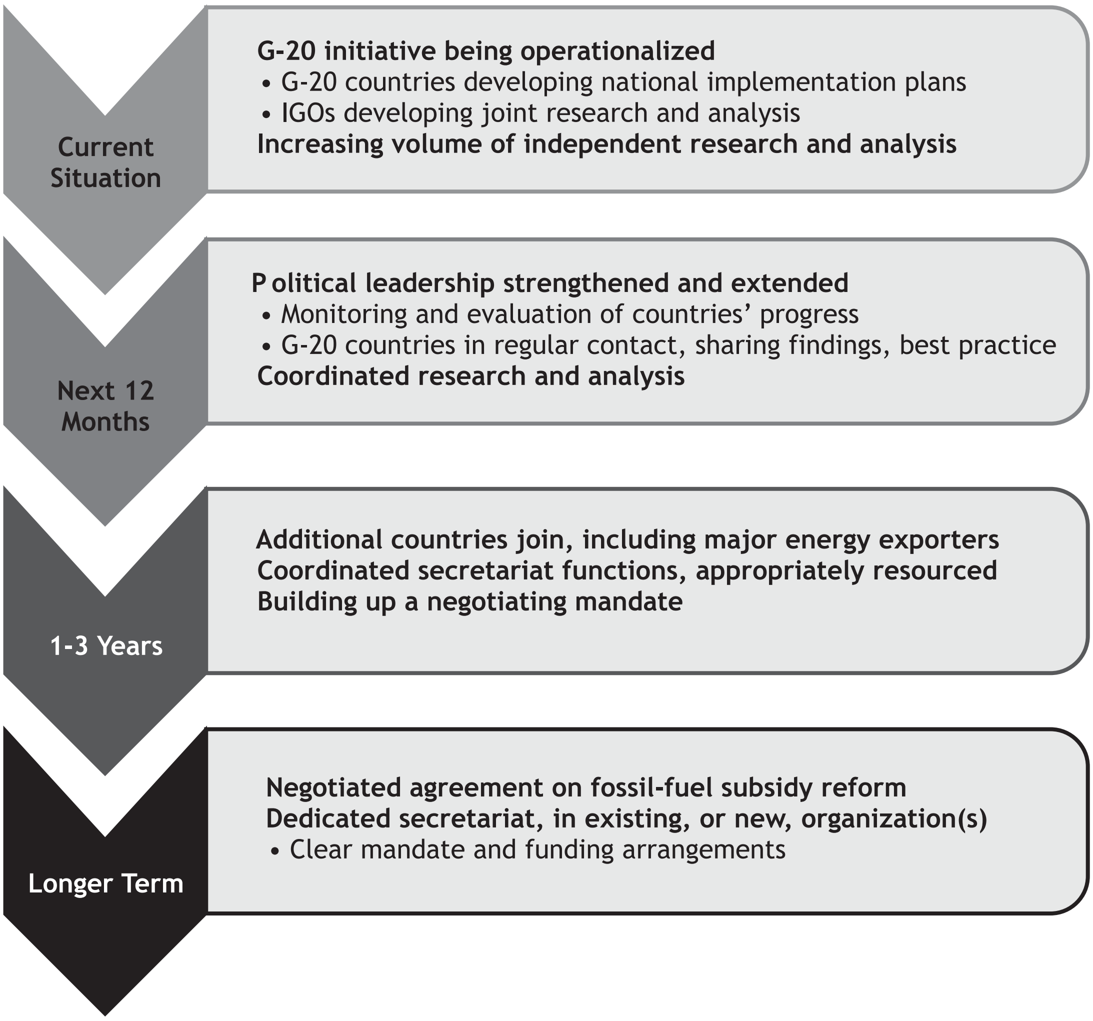
Many other international organizations are active in the field of energy subsidies. The International Energy Agency (IEA) and the Organization for Economic Co-operation and Development (OECD) have strong research capacities to identify, measure and analyze the impacts of fossil fuel subsidies. The World Bank and International Monetary Fund (IMF), in addition to their research capacities, have experience providing financial and technical support to assist developing countries in reforming harmful subsidies and introducing more effective poverty alleviation measures. The United Nations Environment Programme (UNEP) has established a body of policy research on the key issues, benefits and challenges of fossil fuel subsidy reform. In addition, non-governmental organizations (NGOs) such as the Global Subsidies Initiative and Earth Track have substantive research and analysis capacity and play an important role in monitoring and raising awareness about new issues and the progress of national reform efforts.

The roles of these organizations will continue to be essential for supporting any initiatives to reform fossil fuel subsidies, whether within the WTO, UNFCCC or otherwise. Not one of these organizations alone, however, can currently provide all the secretariat functions necessary to support an international movement to reform fossil fuel subsidies.

The potential gains from fossil fuel subsidy reform are high, and an increasing number of actors is now working towards the achievement those gains. International cooperation has an important role to play. This report concludes that the efforts of a range of diverse institutions will be required in the short and medium term.

A formally negotiated agreement is the long term goal, but it would be too much to attain in a single step. The political leadership recently shown by the G-20 and subsequent collaboration of international organizations provide a good starting point, especially now that the UNFCCC and Doha Round negotiations seem to be in paralysis. Taking the G-20 initiative to phase out inefficient fossil fuel subsidies as its starting point, Figure 12) shows a roadmap that plots the route toward a negotiated agreement, detailing the steps required during the short term (next 12 months), the medium term (1-3 years) and the longer term.[70]

Figure 12: Roadmap for international cooperation on removing fossil fuel subsidies



Source: IISD

4. MARKET-BASED EMISSION REDUCTION MEASURES IN THE TRANSPORT SECTOR

The most common measures in the international transport sector to reduce GHG emissions are energy efficiency measures[71] and Market Based Measures (MBMs) such as emissions trading and fuel levies. This chapter will discuss these MBMs in more detail.

4.1 Emissions Trading

In a cap-and-trade scheme, total emissions are limited by a cap and emission allowances are traded to the most cost effective sector, therefore making a cap-and-trade scheme probably the most cost effective policy instrument towards reducing emissions.

Allowances are either given out for free, auctioned or a combination of both. When allocated for free, a set number of credits are released throughout the industry and polluters are then free to sell unneeded credits to other industries. In the case of an auction, the government(s) or oversight organization (e.g. in the case of the shipping sector possibly the International Maritime Organization) would hold an auction for the credits and firms would bid for however many credits they need. This has a few advantages over the free allocation alternative. Firstly, it would generate revenue that could be invested in other areas (such as clean energy or fuel efficiency research) and secondly, an auction would ensure that the transport firms determine the price through market demand, eliminating the need for costly research by governments or other organizations to determine the necessary carbon price. It would also reduce the risks of windfall profits (because the credits must be purchased) and over-compensation (because firms would hold no more emission allowances than they would need).[72]

An emissions trading scheme (ETS) can either be ‘open’ or ‘closed’. If an ETS is open, then polluters are able to trade their credits to other emitters outside of their industry if they so choose. The advantage here is that it becomes a much more efficient scheme as the market is as large as possible and the areas with the greatest need (those purchasing the most credits) are not restrained. An issue with an open system arises, however, when the difficulty to implement such a scheme is considered. The need to coordinate between many different industries with different needs and different markets is very difficult and can become incredibly complicated when trying to craft an overarching market for emissions.

A closed system is much easier to put into practice as only one industry has to be dealt with. However, the advantage of the much larger market is lost when using a closed system. The ideal form would be a global, open ETS as this would completely eliminate carbon leakage and ensure no unfair advantages are gained by those economies that are not partial to the policy. However, as demonstrated by the relative failure of the international community to design and implement such a scheme unilateral measures are being employed in many regions, most notably in the EU with the EU ETS.

An advantage of an ETS or a cap and trade scheme is that there is no rebound effect. That is, fuel efficiency regulation has the same effect as lower fuel prices. While the emissions per kilometer will decrease, the number of kilometers travelled could increase. This is because a more fuel efficient mode of transport will, by definition, use less fuel and therefore, the transporter can travel further on the same amount of fuel. This could lead to increases in travel distances and no meaningful reduction in emissions. However, when incorporating an ETS, this has the same effect as increasing fuel prices as transporters must hold allowances for their emissions and these are tied to their fuel use. Therefore, the long run cost savings from efficiency increases (potentially leading to more transport) are offset by the cost increases associated with emissions trading.

There are also some drawbacks associated with an ETS or a cap-and-trade system (whether open or closed). Firstly, it is difficult to determine the price of carbon and therefore difficult to establish a cost for the emissions credits at the outset of the program. This will eventually be resolved as the market (through the trading of credits between polluters) settles on a price, but, at the beginning, the scheme will likely be inefficient as the probability of determining the correct price without the credits being subject to market conditions is quite low. This can be avoided by issuing the credit for free or through an open auction. Secondly, such a policy would have to be wide enough in scope so as to eliminate, or make very difficult, circumvention by transport polluters. This circumvention can occur, for example, by shipping companies changing the country of origin of the ship so as to avoid the ETS in one country, or by airlines outside of the ETS gaining a large competitive advantage over airlines subject to the regulations.

4.2 Fuel Levies

A fuel levy will establish a tax on transport fuel. It would be established at a given price per ton of fuel depending on the emission levels associated with the fuel. Therefore, a more polluting fuel would be subject to a high per ton tax. This would increase transport costs in an attempt to reduce emissions either through reductions in transport or through investment in more fuel efficient strategies and technology.

In theory, both emissions trade and carbon taxes achieve a similar level of efficiency by reaching the abatement level target at a minimum cost.[73] However, the two instruments differ in design. A cap-and trade-scheme sets a limit (cap) on emission levels and allows the price of the emissions (in this case CO_2) to vary. A carbon tax, on the other hand, puts a price on emissions, but allows the emission levels to change. A carbon tax can be increased if the emission levels are still too high, whereas permits are allocated for the duration of a cap-and-trade scheme.

The IMF (2008) cites three main advantages that carbon taxes have over cap-and-trade schemes: greater price stability, greater flexibility as economic conditions change, and a larger stream of revenue that can be used to enhance efficiency and equity (see also WTO/UNEP, 2009; and Blandford and Josling, 2009 for further discussion). However, as said, emissions trading is considered a more cost-effective policy instrument towards reducing emissions.

4.3 Environmental Impact of Emissions Trading in the Maritime Sector

A Maritime Emissions Trading Scheme (METS) would constitute a cap and trade system placed upon the international shipping community in an attempt to limit emissions coming from this sector. Many factors can influence the impact of an ETS on emissions.

Firstly, the scope of the scheme; the larger the scope, the more emission producers are included and the more emissions can be controlled. The fewer exceptions or exclusions to the scheme, the fewer possibilities exist to circumvent the regulations and cause reductions in the overall effectiveness of the scheme.[74] An important aspect to avoid is the exceptions awarded to certain countries. That is, certain countries would not be included in the METS. If this were the case, ships would simply change flag to fly under the flag of a country not subject to the emissions cap, thereby skirting the cap and threatening the reductions in emissions targeted by the scheme.

Another area of scope that must be addressed is the geographical scope, i.e. limiting the scope to certain routes. This factor would be less easy to circumvent than the flags, however, there is still potential for avoidance. One way to avoid the cap is to offload cargo at a port outside of the scheme and transport the cargo to the final destination through other means. Another way is to add a port call to a voyage that would normally be non-stop in order to reduce emissions counted under the scheme. Both these methods would result in higher total emissions and undermine the overall goal of the ETS. Therefore, the wider the scope of the ETS, in terms of number of countries involved and routes covered, the more effective the scheme in reducing emissions through MBMs such as an ETS.

4.4 Economic Impact of Emissions Trading in the Maritime Sector

It is important to examine the effects of the various regulatory measures designed to reduce GHG emissions from transport on export-oriented development strategies so as to see what economic effects such policies will have. Table 3[75] shows that MBMs are the most effective form of emissions mitigation policy, but it has been shown that they have their shortcomings.

Table 3: Relative cost effectiveness of different types of carbon reduction strategy in the maritime sector

Type / Base	Market based Instruments	Standards	Voluntary measures
Maritime GHG emissions	Most effective Most cost-effective		Not so effective Very cost-effective
Operational efficiency			
Design efficiency		Less effective Less cost-effective	

In the maritime sector, when examining major commodities (agricultural products, raw materials, crude oil and manufactures), and the different types of ships that usually transport them, we can see what effects an ETS or a fuel tax will have on the prices of different goods. Different types of ships used in international maritime trade produce different amounts of emissions, their transport costs vary relative to the value of the good. Therefore, a good or industry where transport has a greater effect on the overall international price will be more affected by an ETS or a fuel tax. This is shown in table 4.[76]

Table 4: Potential effects of an ETS on different types of ships

Type of commodity	Ship type*	Average transport costs ad valorem (%)	Average value of goods (US$/ tonne)	Percentage increase in value of goods for a CO_2 price of (in euros/tone), price		
				7	25	45
Agriculture	HB	10.89	740.50	0.33%	1.09%	1.85%
Raw materials	CB	24.16	134.89	0.72%	2.90%	5.32%
Crude oil	VLCC	4.03	448.88	0.12%	0.44%	0.81%
Manufactures	C	5.11	3403.91	0.26%	0.87%	1.58%

*CB - Capesize bulker.
*HB - Handy Size Bulker.
*VLCC - Very Large Crude Carrier.
*C - Container Vessel.

Table 4 shows that raw materials, already established to be very emissions heavy when transported, are greatly affected by policies to reduce carbon emissions in trade as transport is a large aspect of their emissions as well as their prices on the international market. This is due to the fact that they have a low weight to value ratio and are therefore transported in larger quantities, meaning that transport cost are a bigger percentage of their total cost. As can be seen above, an ETS or a fuel tax will cause, proportionally, a much greater effect on raw material prices than on other commodities.

An important area of limitation within the scheme is the size of ships to include. Having a very wide scope in this area would cause a very large administrative, and therefore costly, burden. For example, research, patrol and rescue vessels account for less than 1% of maritime emissions; therefore, their elimination from the scheme would have marginal adverse environmental effects. It could, therefore, be cost effective to eliminate certain ships from the scheme. However, one must be careful when eliminating smaller ships to be sure that they are not in the same market as larger ships as this could cause the relocation of trade from larger to smaller vessels, something that would only increase emissions outside of the regulated cap.[77]

4.5 The Way Forward: Shipping in the EU ETS?

The EU has announced that if no international agreement to implement reduction targets for emissions from seaborne transport has been approved by the UNFCCC by December 31st 2011, the European Council is assigned with submitting a proposal for inclusion of marine transport into European emissions reduction policies, most likely the EU ETS. This should result in a 43% emissions reduction compared to projected "business as usual" emissions in 2020.[78] The EU has also shown, through its upcoming inclusion of aviation into the EU ETS, that it is possible to design policy for international transport into such a scheme. Therefore, the inclusion of maritime transport is a logical step forward.

It remains to be seen whether the EU considers the recent adoption of efficient measures (Energy Efficiency Design Index (EEDI) for new ships, and the Ship Energy Efficiency Management Plan (SEEMP) for all ships) by the IMO to be sufficient measures to prevent it from including shipping in the EU ETS unilaterally.[79]

4.6 Aviation in the EU ETS

As said, aviation will be included in the EU ETS from January 2012. The EU resorted to including aviation in the EU ETS after the failure of decade-long talks held in the International Civil Aviation Organization (ICAO). The EU, in order to assure the continued competitiveness of its domestic airlines and to avoid carbon leakage[80], feels obliged to include foreign airlines within the policy. However, this is being met with stiff opposition from foreign companies and countries[81] and exposes a major issue with unilateral transport emission reduction policy: in order to maintain competitiveness of domestic transport industries, foreign companies must also be subject to the policy.

This brings to case issues of national sovereignty. It is unclear if the EU has the legal right to subject foreign airlines to its policies as the extent of sovereignty is uncertain. Does the USA have sovereignty over its airlines, no matter where they are (in which case the EU would have no right to impose the ETS) or can the EU regulate airplanes beyond its own airspace (in the EU ETS an airplane that flies from, say, Sydney, to London pays for emission allowances for the full flight and not only for the part of the flight that is over Europe)?

In a recent report, the European Commission outlines a proposal for an allowance based scheme to cap emissions from the aviation sector within (including flights to and from) the EU. The total number of allowances, i.e. the cap, will be set based on the average emissions from this sector between 2004 and 2006. The report shows that the most effective way to reduce emissions is to auction off all the allowances at a higher price (€45) as this will cause a 17.7 $MtCO_2$ reduction within the airline sector. However, the growth through substitution of emissions in other sectors, as people substitute away from airline transport to other forms, is not clear, as there are different factors to consider. The report goes on to argue that the emissions reductions also depend on how much of the costs the airlines are allowed to 'pass through' to their consumers. In two other models the report shows that emissions decrease less if the airlines have to bear 50-75% of the expenditures associated with the allowances. However, the report also shows that allowing airlines to pass through all expenditures gives them windfall profits at the expense of the consumer (3.1 to 5.4% by 2020). These windfall profits will occur when some, or all, credits are allocated free of charge to the industry. Offering only a minimum amount of free credits can limit or avoid this and ensure that the funds gained by the airlines are given to the government/ overseeing organization and therefore can be invested in other areas.[82]

Research by ICTSD[83] (forthcoming) shows that the regulation on the inclusion of aviation in the EU ETS is non-discriminatory and treats all airlines (EU and non-EU) the same, which contrasts with the 'Common but Differentiated Responsibilities' principle of the UNFCCC. There are however, exemptions for airlines with few flights (including several airlines from small developing countries).

On the basis of existing literature, it can be concluded that the ETS will have a small impact on ticket prices and demand. Therefore, the impact on aviation emissions will be small. On the other hand the impact on net emissions could be large, because aviation will have to offset an increasing share of its emissions through buying allowances from other sectors in the ETS or Kyoto project credits.

The same research by ICTSD shows that while the inclusion of aviation in the EU ETS is implemented in a way that limits distortion of competition, some changes in competitiveness may nevertheless occur. The competitiveness of hub airports just outside the EU and the non-EU airlines that serve these airports (including airlines from developing countries) may increase slightly on some routes. Therefore, some carbon leakage will take place, meaning that the reduction in aviation emissions in the EU will be partly compensated by an increase of emissions elsewhere in the world.

The impact on trade between Europe and developing countries is likely to be small because of the low increase in aviation costs, but impacts may vary between products and regions. For the same reason, the impact on tourism is likely to be small on average because transport costs are a small share of total tourism expenditures, but for some destinations high cross-price elasticities of demand may cause a larger impact.

Alongside these small negative impacts, there may be some small positive impacts on developing countries. The impact of the use of revenues from auctioning allowances depends on the decisions of Member States on their use, but there is a large chance that at least part of the revenues will benefit developing countries, e.g. when it is spent on adaptation to climate change in developing countries.[84]

4.7 Emissions Trading in the Road Transport Sector

According to research[85] by the Swedish Environmental Protection Agency, fuel efficiency regulation in the road transport sector should be combined with emissions trading to reach the maximum emissions reductions in the most efficient manner. Because fuel efficiency regulation can be introduced much faster than emissions trading, it can negate the negative effects of the usual long term waiting period for emissions trading benefits to kick in. It also leads towards long term innovation as manufacturers are constantly developing and refining their vehicles towards fuel efficiency. However, the introduction of emissions trading can alleviate many of the shortcomings and disadvantages of regulation such as negative public sentiment towards increased government oversight and regulation as well as offering an open market based complement to legislative management. It also provides a concrete empirical value of the levels of emission reduction within a certain time period, unlike fuel efficiency regulation. Another advantage it has is that emissions trading has no rebound effect (see above). Therefore, combining these two policies is a much more attractive way to reduce emissions in the road transport sector as each one will cancel out the negatives of the other.

Furthermore, because the road transport sector is much more adaptable (in terms of ability to adapt to efficiency minimums) than maritime or aviation sectors due to the relatively low cost of their vehicles, the implementation of efficiency minimums in road transport does not face the same challenges as the maritime or aviation sectors. The cost for replacing an inefficient truck is not nearly the same as the cost to replace an inefficient airplane and this allows for the realistic ability of the road transport sector to put in place efficiency minimums. Therefore, their impact on overall road transport emissions appears to be quite substantial as the two policies complement each other to iron out negative aspects and streamline the effectiveness of a comprehensive emissions reduction policy. To implement a global ETS for shipping or aviation, various calculations must be made in order to attribute the responsibility for emissions as well as rebate measures for developing countries to ensure their economies are not burdened too heavily by the policy.

5. STRATEGIES TO REDUCE THE IMPACT OF MARKET-BASED MEASURES IN THE TRANSPORT SECTOR ON DEVELOPING COUNTRIES

In some cases, the burden of more costly transport that results from MBMs against climate change upon developing nations could be detrimental to their development. A solution to the issue of the Common But Differentiated Responsibilities (CBDR) principle is discussed in this section and involves rebates to developing nations for their costs incurred in their participation in an MBM, with the funds for these rebates coming from the revenues generated through the sale of emissions credits or fuel levies.

5.1 Unequal Economic Effects of Climate Change Mitigation Policies in the Transport Sector on Developing Economies

Examining the effects of various regulatory measures on export oriented development strategies is particularly important as it will help determine and calculate the developmental effects of such policies. Raw material exports are particularly important for developing countries and these exports are very transport emission intensive. Despite the fact that raw material prices are expected to increase in the longer term and it may be difficult to find substitutes with lower transport costs, policies to limit emissions from trade related transport could heavily affect these economies. Therefore, examining the effects of these policies is essential to the seamless integration of policies that aim to tackle emissions in the transport sector. MBMs and fuel efficiency minimums can have adverse effects on the development of an economy that relies on exports, and hence on transport, for its economic growth.

Table 5[86] demonstrates the unequal proportions of costs due to a global maritime ETS. As can be seen, the most affected regions (relative to their respective GDPs) are Africa and South East Asia, where many of the world's developing nations are located. As shown in Table 5, these regions are only responsible for 184 $MtCO_2$ or 18% of the global total of 1006 $MtCO_2$ but, relative to their GDP, they would bear a much higher cost under a global maritime ETS than the developed countries that are responsible for a much larger portion of emissions.

Table 5: Table demonstrating the unequal burden thrust upon developing nations by carbon reduction policies

Region of destination	CO_2 emissions Mt CO_2	Cost increase of maritime transport USD bln. USD 15-30/tone CO_2 (USD 10-50)	Cost increase of maritime transport % of GDP USD 15-30/tone CO_2 (USD 10-50)
North America	120	1.8-3.6 (1.2-6.0)	0.01-0.02% (0.01-0.04%)
Central America and Caribbean	53	0.8-1.6 (0.5-2.7)	0.01-0.01% (0-0.02%)
South America	59	0.9-1.8 (0.6-2.9)	0.05-0.09% (0.03-0.15%)
Europe	277	4.2-8.3 (2.8-13.8)	0.02-0.05% (0.02-0.08%)
Africa	68	1.0-2.0 (0.7-3.4)	0.1-0.2% (0.07-0.33%)
Middle Eastern Gulf, Res Sea	62	0.9-1.9 (0.6-3.1)	0.08-0.15% (0.05-0.25%)
Indian Subcontinent	24	0.4-0.7 (0.2-1.2)	0.03-0.06% (0.02-0.1%)
North East Asia	194	2.9-5.8 (1.9-9.7)	0.03-0.06% (0.02-0.1%)
South East Asia	116	1.7-3.5 (1.2-5.8)	0.17-0.35% (0.12-0.58%)
Australasia	35	0.5-1.0 (0.3-1.7)	0.06-0.13% (0.04-0.21%)
World	1006	15.1-30.2 (10.1-50.3)	0.03-0.06% (0.02-0.1%)

Source: ICTSD, 2010

Transport cost increases for raw materials could potentially lead, in the long run, to a reconsideration of industrial strategy whereby the production aspect of business could be relocated closer to the site of the raw material extraction so as to save on transport costs and reverse the trend of fragmentation of production and elongation of value chains.[87] This could be beneficial to developing countries with export oriented economies as it could ensure that the gains associated with the secondary production of a product remain (for the most part) within the developing economy. Therefore, aid that enables developing economies to move up the value chain could be beneficial to the environment as emissions from international raw material transport could be reduced. It is hypothesized that the majority of cost of such measures will be passed onto developed countries because freight rates are such that developed countries pay for both legs of the voyage. Also, in a two way trade system (i.e. raw materials from developing to developed countries and more refined products back the other way) the countries with the greater demand (usually the developed countries) will be willing to pay for the cost increases because their demand is much less elastic for goods such a crude oil and other raw materials. This is because raw materials are indispensable for their production and sale oriented economies, while imported manufactured goods are much less vital to the economies of many developing nations.

Within other transport sectors, much of the same phenomenon is seen. Developed countries, in need of the raw materials produced and exported by developing countries, are more willing to pay the cost increase in transport from an MBM such as an ETS. Furthermore, the introduction of a rebate mechanism into such a scheme will compensate developing nations for the costs of participation in an MBM.

5.2 Implementation of CBDR: Rebate Mechanisms

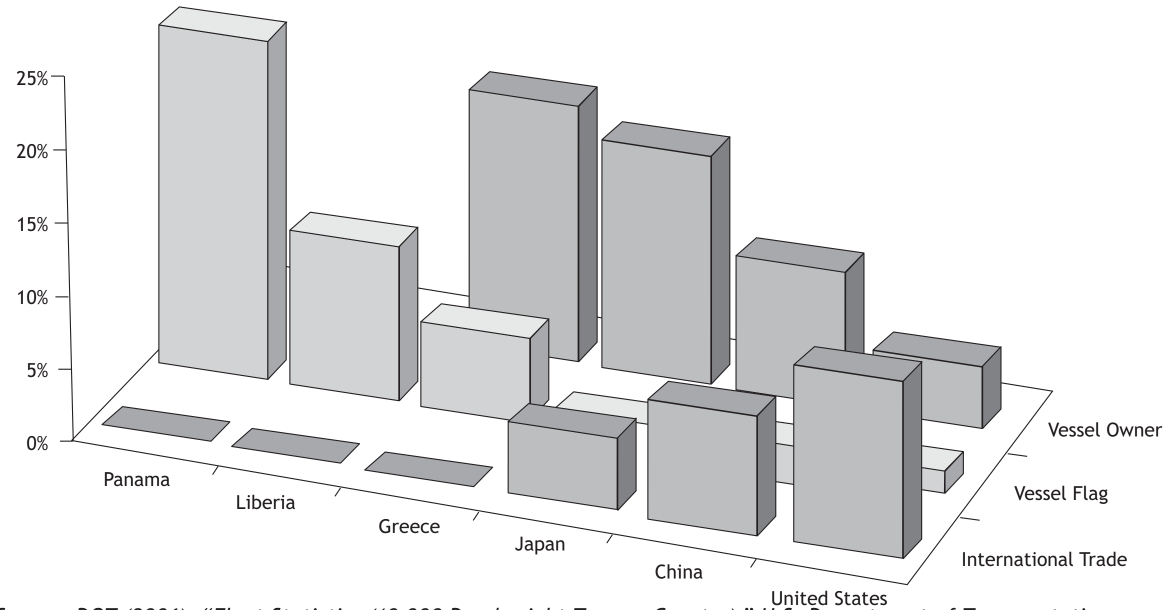
5.2.1 Common but differentiated responsibilities (CBDR)

Much of the deadlock over tackling transport emissions on a global scale has revolved around how to apply to aviation and shipping the differing guiding principles of the institutions that govern bunkers emissions. A key issue is reconciling the IMO's specific precept of No Favorable Treatment (i.e., all ships are regulated equally regardless of where the ship is owned or registered) and the fundamental ICAO principle of non-discrimination with the UNFCCC's principle of Common But Differentiated Responsibilities (CBDR) which is valid for the wider climate change negotiations. This attempt at reconciliation has been challenging and has hampered discussions.

The CBDR principle was established under the UNFCCC. The practical consequences of CBDR are that different obligations are imposed on the Parties to the UNFCCC, depending on their level of development. The prime example of this is the Kyoto Protocol, where only countries listed in its Annex I (developed countries and countries with economy in transition) have quantified emissions reduction obligations under the agreement. In practice this means that the developed countries, who have the biggest capability to reduce GHG emissions, should take the lead in the fight against climate change.

The principle of CBDR was at the heart of the negotiations on transport at the Copenhagen and Cancun Climate Conferences as developed countries claimed that any of their actions against climate change would remain futile if the bigger developing countries did not do enough to mitigate their emissions. The developed countries argue that developing countries account for more than 70 percent of current maritime emissions and that more than 80 percent of shipping capacity is registered in non-Annex I countries (UNCTAD, 2007, also see figure 13 below). And of course ship owners can take the pragmatic decision to shift their flags from Annex I to non-Annex I countries if they feel the developed country's regulation harms their interests. Developing countries respond that historical emissions, which originate primarily from developed countries, should be taken into account, and that it is the responsibility of developed countries to take the lead in addressing maritime emissions.

Figure 13: Comparison of International Trade (Percent of Global Value of Merchandise Trade), Vessel Flag (Percent of Global Deadweight Tons, DWTs), and Vessel Owner (Percent of Global DWTs) by Country



Source: DOT (2006). "Fleet Statistics (10,000 Deadweight Tons or Greater)." U.S. Department of Transportation.

Therefore, some developing country Parties have resisted the notion of a global approach, claiming that this approach is a way for developed countries to neglect their responsibility for historic emissions and, instead, impose emissions reduction obligations on non-Annex II Parties (developing countries). They argue that the largest share of emissions from international shipping has originated from the cumulative emissions in historical development of developed countries; therefore, it is the responsibility of developed countries to take the lead in addressing maritime emissions.

In the climate change negotiations many developing countries have insisted that any CO_2 emissions reduction required measures or standards do not apply to them at all because of CBDR. This illustrates that the debate is not only about the principle of CBDR itself but also about the way it is applied. Some countries interpret CBDR as a principle that obliges developing countries to take on mitigation efforts within their capacity; others interpret the principle to mean that developing countries do not have to take any climate change mitigation action.

This debate is generic for the climate change negotiations. In the international transport debate specifically, developed countries point to the global nature of the aviation and maritime sectors, and the fact that IMO and ICAO have historically developed policies that treat operators of all nationalities equally.

The Sub-Division for Legal Affairs in IMO identified no potential conflicts between the CBDR principle in the Kyoto Protocol and the Equal Treatment principle under IMO. Therefore, the IMO Legal Affairs Division points out that the Equal Treatment principle should guide future ship emission reduction negotiations; however, this is certainly not the end of the discussion.[88]

It should be also noted that for many developing countries CBDR is not as much an economic as it is a political issue. The reason is that many developing countries are not as much concerned about higher transport prices as they are about taking on commitments on climate change at the same level as developed countries and in that thus setting a precedent for taking up equal responsibility for taking action on climate change.

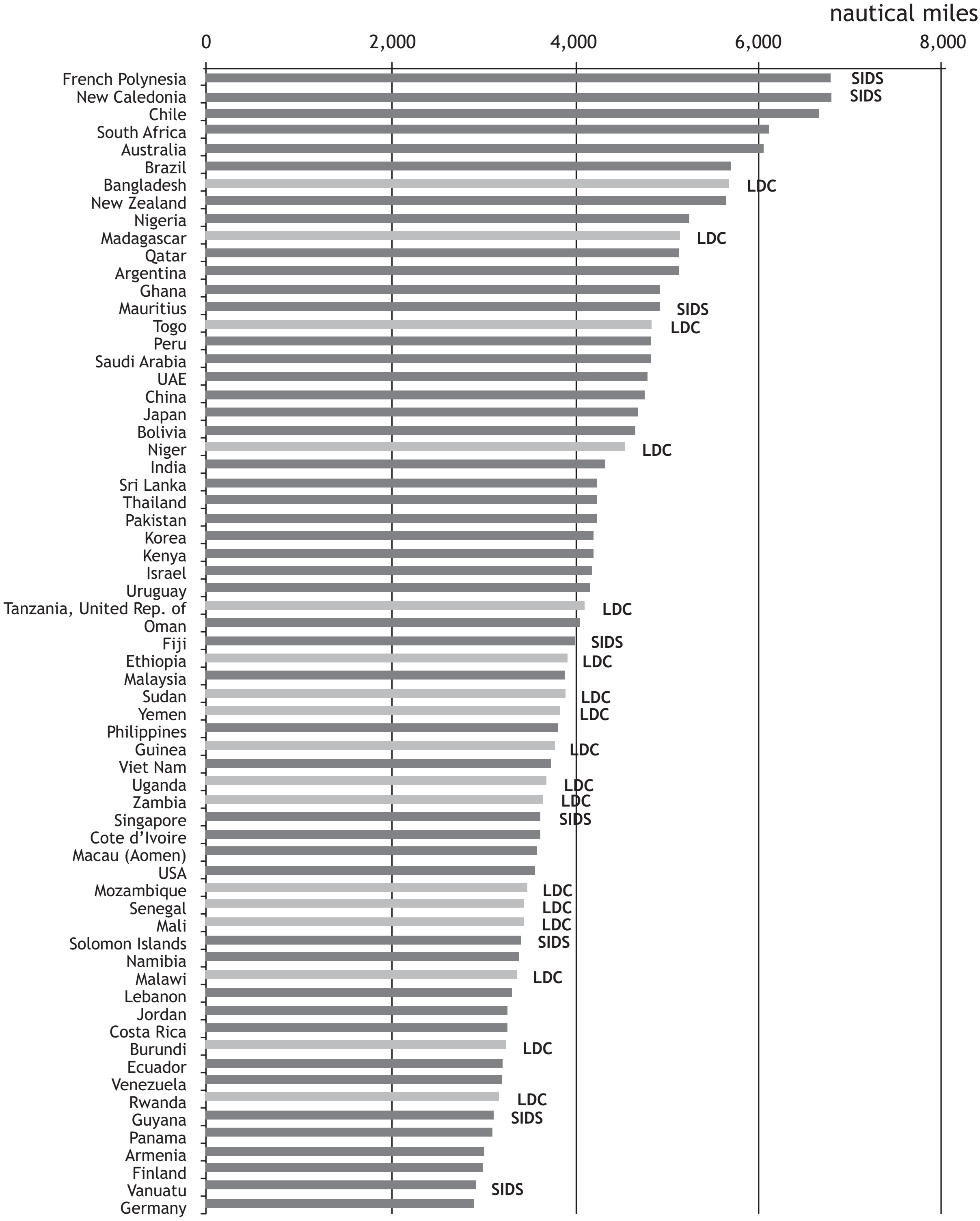
5.2.2 Rebate mechanisms

One way to offset the costs of MBMs for developing countries and to implement the CBDR principle is by installing a rebate mechanism (RM). In fact, the UN High-Level Advisory Group on Climate Financing (AGF) has calculated that up to 24 billion USD per year can be raised from the aviation and maritime sector through MBMs. That would go a long way towards the 100 billion USD per year that the developed countries have pledged to assign to climate financing for developing countries by 2020. These funds could also be used to offset the increased costs of *freight* transport for developing countries.[89] The details towards these plans need to be worked out further though, and their baselines established. Which countries should be offset for which amounts?

At first, it seems like the calculation of trade weighted distances (TWD) should play an important role in establishing an equitable MBM for transport. TWDs are measurements of the distance of a country from it various trading partners weighted by their bilateral trade. A TWD is calculated to see if some countries should take greater responsibility for emissions from transport because of their relatively large distance from their trading partners. However, when analyzing such calculations, Dr. Andre Stochniol, founder of the International Maritime Emission Reduction Scheme (IMERS) which includes a rebate mechanism found that the variability of TWD ranged from 2,000 to 6,000 nautical miles with most countries around the global average of under 4,000 miles.

This shows that, on the whole, distance is not a large factor in differences in emissions between countries. This is because, while a longer voyage will produce more total emissions, shorter voyages tend to use small, less efficient ships or airplanes (due to small transport volume, smaller ports or airports or remoteness from major trade routes) which have a higher emissions per ton transported per kilometer. As the ratio of the larger TWD to the smaller is about 3 (6,000 nm to 2,000 nm) and the emission rate of smaller ships is about 3 times that of larger ones, these two factors essentially cancel each other out, meaning that distance can be eliminated from these calculations.[90] It is also shown that many of the nations with low TWD are small countries (such as Small Island Developing States or SIDS) that usually trade with close neighbors while the countries with high TWD tend to be the larger nations. Because of this, distance can be eliminated from calculations regarding attribution of emission responsibilities and offsets that should be awarded. These similarities are shown in figure 14[91] below.

Figure 14: Chart showing trade weighted distances for different countries



Source: Dr. Andre Stochniol, Optimal Rebate Key for an Equitable Maritime Emission Reduction Scheme (2011)

Table 6: Potential relative rebate attributed to different countries

Developing Country/region	R Key, %
China	8.35
Korea, Republic of	3.68
Singapore	2.36
Taiwan Province of China	2.27
Hong Kong SAR, China	2.06
India	1.98
Mexico	1.46
Next 27	13.55
Bangladesh	0.16
Next 25	2.41
Ethiopia	0.06
Next 25	0.93
Papua New Guinea	0.03
Next 25	0.45
Guyana	0.01
Remaining 40+counries	0.44
TOTAL non-Annex I	40.19

Source: Dr. Andre Stochniol, Optimal Rebate Key for an Equitable Maritime Emission Reduction Scheme (2011)

It is argued, therefore, that in order to establish the cost burden of an MBM such as an ETS to a given country, the country's share of imports from non-adjacent partners (NAPs) is a much better measurement. It calculates the country's share of global imports by sea and air, the higher the share, the greater the cost of the policy to that country. Therefore, a rebate mechanism, in which each developing country is entitled to a rebate equal to their calculated burden from their participation in the MBM ensures that developing countries do not bear an unfair portion of the costs. Such a rebate comes under the umbrella of the CBDR principle where it is noted that, while it is the responsibility of all nations to deal with climate change, the burden should not be equally spread, just as emissions are not equally arranged. To ensure that developing economies are not unduly laden, the funds from an MBM that generates revenue (such as an ETS or a fuel levy) are used to give rebates to developing nations who are subject to the scheme. A country which emits high levels of GHGs will be subject to higher costs from the scheme and should, therefore, be granted high rebates from the RM to help cover these costs. As shown in table 6[92], there are vast differences in the relative shares of trade and emissions that result from trade between developing countries. This is why there is a need for a RM based on each country's individual costs stemming from the policy. A RM would ensure that the cost of such a policy does not adversely affect the economies of developing nations whilst simultaneously ensuring a global cap on GHG emissions.

Therefore, an MBM appears to be a very effective policy to introduce in an effort to curb global GHG emissions. Furthermore, when coupled with an RM (and an emissions cap on OECD countries) which ensures that revenue from such a scheme will be returned to developing countries to ensure their continued economic development, this type of scheme only increases in potential viability.

6. CONCLUSION: DO WE NEED REGULATORY MEASURES AND POLICIES TO ADDRESS TRADE RELATED EMISSIONS FROM TRANSPORT? RECOMMENDATIONS FOR THE GERMAN GOVERNMENT

Transport contributes significantly to global GHG emissions and measures to mitigate these emissions are essential. This paper has discussed several measures that can contribute to mitigating emissions related to trade and transport: carbon footprinting, elimination of fossil fuel subsidies and market-based measures.

First of all, carbon footprinting makes sense as long as it is based on a sound methodology, does not have inhibiting compliance costs and targets lower total emissions instead of just lowering relative carbon intensity. Carbon labels should go beyond a narrow focus on emissions resulting from transport as this is often an inaccurate indication of total emissions resulting from the production and delivery of a good. As this paper has shown, food miles initiatives for example are a blunt and ineffective tool for measuring the environmental impact of food production and trade, and they may have perverse impacts, for example where imported produce is more energy efficient than local products despite the distance travelled. Germany should not only focus on discouraging or prohibiting carbon standards as non-tariff barriers to trade, but also make an effort to assist developing countries in satisfying and harmonizing the differing standards.

Secondly, the practice of subsidizing fossil fuels can be seen as being incompatible with efforts needed to address climate change and develop sustainably. Removing subsidies for fossil fuels has further benefits at the national level; notably, reduced government spending on fossil fuels can help relieve fiscal burdens during times of economic crisis and free up resources for spending on other priorities.

In theory, coupling fuel subsidies elimination with an emissions cap in OECD countries could reduce global emissions by 10% by 2050. It was also shown in this paper that this would come at a cost to the economies of fuel producing countries. However, this economic slow-down is inevitable as the world gradually moves away from fossil fuel use as clean energy technologies grow and develop within the near future. As the modeling in this paper has shown, for oil exporters there is no real alternative than to adjust to higher fossil fuel prices if they want to avoid losing exports and competitiveness in the long term. While fossil fuel subsidy removal seems like a matter of sound environmental and economic logic, there are many political barriers that stand in the way.

Thirdly, it appears from this research that market-based measures are the most effective method through which emissions reductions can be achieved. MBMs provide economic incentives to polluters to cut emissions there where it is most cost-efficient. Furthermore, it has been shown that MBMs such as an ETS would cause significant reductions in emissions from transport, while also, in the long run, encouraging more economical transport practices to cut emissions.

The German government, in order to address the issue of transport emissions in trade, could look to implement an MBM in order to curtail the growth of such emissions. It could also focus on removing distortions in the markets to ensure the effectiveness of MBMs.

In the absence of a global MBM in the transport sector, Germany could work with the EU ETS in order to incorporate more transport related areas into it. Global aviation is already set to become a part of the scheme in January 2012 (see section 4). The EU ETS is a pioneering international agreement that currently has no equal in terms of scope. Therefore, it would be beneficial for the German government, as a leader within the EU and in the global arena, to continue to support the EU ETS and demonstrate its effectiveness to the rest of the world.

While the EU ETS is a step in the right direction and is an example of regional cooperation, it has its own set of challenges. For example, it is not yet large enough to control all aspects of climate change. Therefore, Germany, relying on the framework of the EU ETS, could keep on pushing for a global ETS for the shipping and aviation sectors.

Due to the current lack of a global consensus on the need for an ETS in international transport, Germany could share the lessons and successes of the EU ETS, especially once aviation is included, to lobby for a global scheme that would have a much larger effect than one that only includes Europe. An ETS, especially in its open form, where credits can be traded with firms outside of the transport sector, will reduce emissions and proceeds from purchased credits can be funneled into other areas where emissions clean up is needed (such as electricity production). Therefore, such measures will pass the payments on to polluting firms and reward those who limit their emissions and those who invest or are developing climate-friendly technology.

A multilateral approach to the mitigation of GHG emissions is essential to its success. If countries proceed independently with their own policies to reduce emissions, the overall effectiveness may be reduced as carbon leakage (where emissions that are cut in one country or region are increased in another through the substitution effect) could undermine well intentioned unilateral policies. Carbon leakage is especially present in the transport sector due to the relative ease of relocation for the industry. It is much easier to circumvent an ETS within the transport sector by changing shipping routes, for example, than by relocating a factory to a country outside the ETS. Because of this, a large scope ETS for transport is essential to avoid the concern of carbon leakage.

Regulating the transport sector poses many challenges, not least that of appeasing developing, export oriented economies that could potentially be detrimentally affected. This is a major issue that requires a global solution but can be resolved through implementing the CBDR principle, for example by including rebate mechanisms in an ETS. Through these policies, it is assured that vulnerable economies are compensated for their participation in a world-wide emissions mitigation scheme and that they do not lose competitiveness or risk problems with food security due to higher costs of transport.

When transport costs for raw materials increase, countries would have to reconsider their industrial strategies. This could lead to production being relocated closer to the place where the raw material extraction takes place in order to save on transport costs. Also, this could reverse the trend of fragmentation of production and expansion of value chains.[93] Developing countries with export oriented economies could benefit from this as it could ensure that the gains associated with production higher up the value chain remain within the developing economy. Aid that enables developing economies to move up the value chain could therefore be beneficial to the environment as emissions from international raw material transport could be reduced, also because products higher up the value chain tend to be less voluminous than raw materials.

Overall, hiding the true costs of transport by subsidizing it or by exempting transport fuels (such as kerosene) from taxes makes little sense in the long run. If higher fossil fuel prices lead to improved energy efficiency, then that might make an economy as a whole more efficient and competitive.[94] So in the long run, the costs of the transport-related proposals discussed in this paper should actually be viewed not so much as costs but as investments.

SUMMARY TABLE

This paper has taken three criteria into account for the design of climate change policies: effectiveness (i.e. resulting in emission reductions), efficiency (i.e. policies that cost little to implement) and equity (i.e. policies that are not regressive, and do not distort trade or have an undue impact on competitiveness). These instruments include carbon taxes, emissions trading schemes, food miles and carbon labelling and these are summarized below in Table 8.

Table 8: Summary evaluation of market-based instruments and voluntary measures aimed at mitigating GHG emissions in the transport sector

Instrument	Effectiveness	Efficiency	Equity (distributional)	Equity (export impact)
Carbon tax	High, if applied globally	High, if applied globally	Potentially regressive, although can be made revenue neutral	Insignificant
Cap-and-trade scheme	High, if globally, upstream and with auction of permits[96]	High, if globally applied.	Potentially regressive, but depends on capacity to compensate losers	Insignificant
Border tax adjustment	Low[97]	Low[98]	Ambiguous, depends on sector	May disadvantage some developing countries but favour others
Carbon labelling	Low	Low	Favours larger exporters	Negative impact on countries using air freight or shipping over long distances[99]
Food miles initiatives	Low, perverse effects possible	Low Marketing costs	Favours local producers	Negative impact on countries using air freight or shipping over long distances

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2. World fossil-fuel subsidies and global carbon emissions (Larsen and Shah, 1992);
3. World Energy Outlook 1999: Looking at Energy Subsidies – Getting the Prices Right (IEA, 1999);
4. Environmental Effects of Liberalizing Fossil-Fuels Trade: Results from the OECD GREEN Model (OECD, 2000);
5. Removing energy subsidies in developing and transition economies (Saunders and Schneider, 2000);
6. The economics of climate change mitigation: How to build the necessary global action in a cost-effective manner (Burniaux et al., 2009); and
7. Mitigation Potential and Trade Effects of Removing Fossil Fuel Subsidies, (Burniaux and Chateau, 2011).

This chapter will draw mostly from the latter study as it is the most comprehensive, most recent and most trade-related of all studies undertaken on this topic until now.

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ANNEX I CARBON FOOTPRINT OF SOME CHILEAN EXPORTS

Chile is one of the most far-off countries in terms of nautical distance weighted by bilateral trade (also see Figure 14 on p. 60). A recent study on carbon footprint in Chile suggests that the production of processed food is the most carbon intensive part of the life cycle and not its international transport.[100]

This study used the theory known as "cradle to the next niche business", which states that the end of a product life cycle is the delivery of the product in a foreign port. This means that in quantifying the carbon footprint the following steps in the life cycle were used:

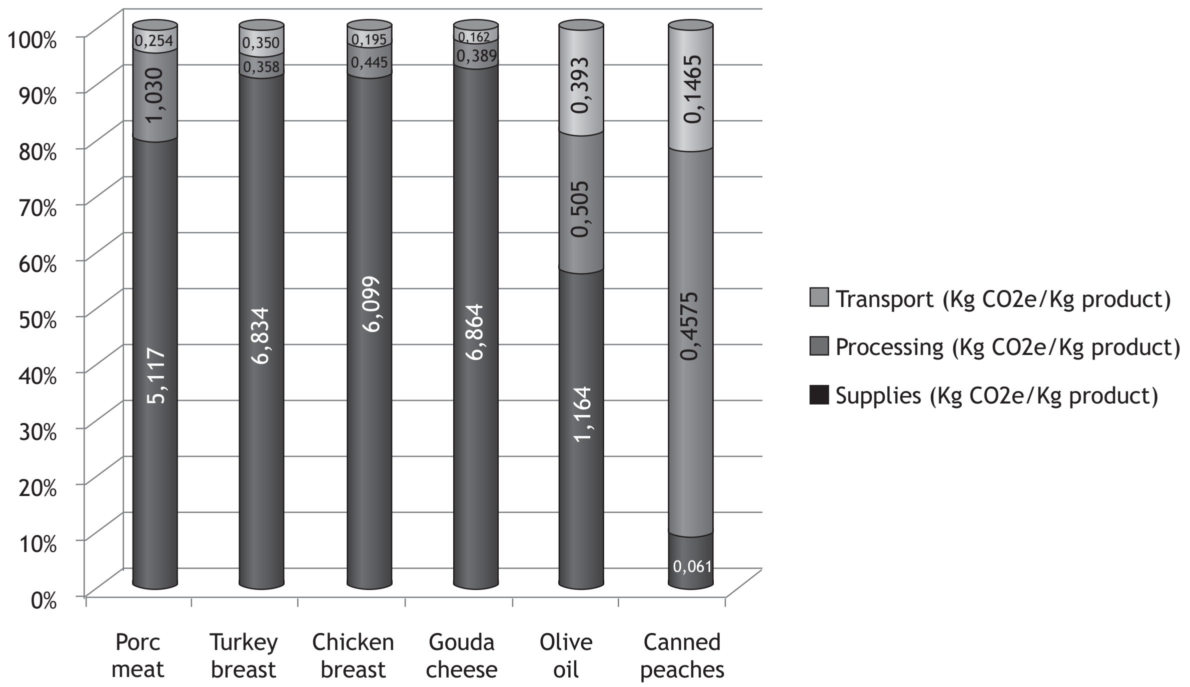
- Change of soil use to agricultural soil
- Production of raw materials (animal production and / or plant), processing or manufacturing, including packaging
- Transportation of the product from manufacturing or processing unit to port of embarkation
- Transportation from port of embarkation to the foreign port.

The phases taken into account for the presentation of the results are: Raw Materials, Production, and Transportation of the product

The table shows the final values of the carbon footprint for each product tested expressed in kg of CO_2e per 1 kg of product. These results show that the carbon footprint calculated from animal products was significantly greater than that of plant products, reflecting the fact that the study is based on emerging products with two adjacent links in the food chain whereby the elements of the superior link require more energy than those of the lower link.

The table shows the final values of the carbon footprint for each product tested expressed in kg of CO_2e per 1 kg of product. These results show that the carbon footprint calculated from animal products was significantly greater than that of plant products, reflecting the fact that the study is based on emerging products with two adjacent links in the food chain whereby the elements of the superior link require more energy than those of the lower link.

Figure 15: Carbon footprint of different food products from Chile, divided by emissions from transport, processing and supplies



ANNEX II REGIONALIZATION OF TRADE AND IMPACTS ON EMISSIONS AND DEVELOPMENT

The impact that many hope regional trade blocs have is to reduce long distance international transport associated with trade as neighboring countries partnering together into trade groups will cut transport distances and therefore cut emissions. Discussions and analysis of carbon motivated regional trade agreements are only going to intensify as more potential policies for the reduction of carbon emissions are examined. Carbon motivated border control measures could take the form of either tariffs against high carbon emitting imports, subsidies of low carbon emitting exports, or both. These measures would effectively increase the competitive advantage of low carbon emitting industry within the country or trade block vis-a-vis heavier emitting sectors and will lead to further investment in lower carbon emitting industry, hopefully lowering overall emissions within the region.

The National Bureau of Economic Research released a report that models a hypothetical situation in which there are two goods (energy intensive and non energy intensive), two factors (energy inputs and other inputs) and four regions (China, USA, EU and the Rest Of the World (ROW)) over a 30 year period in order to see the effects of regional trade blocs for climate friendly technologies (i.e. low carbon intensive goods and technologies). The trade blocs would lower or eliminate trade tariffs on low carbon intensity goods to increase their competitiveness relative to high carbon intensity goods, therefore causing a substitution effect away from the high towards the low, leading to an overall reduction in carbon emissions. Specifically, the report targets potential regional trade blocs of EU-USA, EU-China, USA-China and EU-USA-China and there are two sub forms, one which eliminates tariffs on low intensity goods between the partners while keeping the tariffs on high intensity goods unchanged (known as a carbon free trade agreement) and another which demands a 5% external tariff on low carbon goods, known as a Carbon Motivated Customs Union. Both sub forms effectively increase the competitiveness of the regions' low carbon intensity goods and industries vis-a-vis more carbon intense industries or external regions. While most of these agreements would yield potential global emissions reductions, the effect would be small. As shown in table 7[101], 7 out of the 8 scenarios show a decrease in emissions, with the sole exception being the USA-China Customs Union.

Table 7: Impacts of carbon motivated trade agreements on emissions

Carbon FTA/CU		% Change in Emissions				
		China	EU	US	Row	Total
1	EU US FTA	0.0029%	0.0102%	-0.0266%	0.0013%	-0.0008%
	EU US CU (5% CET)	-0.0123%	0.1761%	-0.0019%	-0.0711%	-0.0162%
2	EU China FTA	-0.0227%	0.1342%	0.0437%	-0.0715%	-0.0186%
	EU China CU (5% CET)	0.0174%	0.1576%	-0.0975%	-0.0509%	-0.0090%
3	US China FTA	-0.0002%	0.0063%	-0.0069%	-0.0067%	-0.0027
	US China CU (5% CET)	0.0311%	-0.0695%	-0.0627%	0.0268%	0.0103%
4	EU-US China FTA	-0.0202%	0.1509%	0.0114%	-0.0771%	-0.0221%
	EU-US China CU (5% CET)	0.0108%	0.1591%	-0.0569%	-0.0695%	-0.0130%

Source: Dong and Whalley (2009)

Therefore, trade policy, according to Dong and Whalley, seems to have only minimal impact on the overall levels of global GHG emissions. While these effects may be positive in that they lead to an overall reduction, this reduction is marginal compared to the increases in emissions that appear to coincide with economic development in least developed countries (LDCs).[102] This can be done by discouraging foreign competition or by encouraging domestic consumption of goods from nearby. However, this is a largely voluntary measure to deal with the growth of emissions and voluntary measures are known to be much less effective than MBMs or efficiency minimums. Furthermore, regional trade agreements are only somewhat practical in reducing emissions as many neighboring countries produce and export similar items. Therefore, many countries must look further afield for products that they cannot produce, be that due to climate, lack of infrastructure or other factors. While this may reduce transport distances to trade with neighbors, many products may still have to be imported (or exported depending on demand) to countries that are not necessarily close by so the positive climate effects of such a policy will be limited. Another challenge is trade diversion, as an RTA may lead to increased trade with a less (carbon) efficient exporter than would have been the case without the RTA.

ABOUT THE GLOBAL PLATFORM ON CLIMATE CHANGE

ICTSD's Global Platform on Climate Change, Trade and Sustainable Energy (Global Platform) focuses on the linkages between climate change, sustainable energy, and trade policy.

The Global Platform mobilizes the technical and political expertise to address these interlocking issues to foster strong multilateral regimes on trade and climate change that effectively promote a transition to a low-carbon economy and a sustainable energy future.