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S T O C K H O L M

Options for Europe when acting alone on CO₂ emissions from shipping

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Abstract

This paper was prepared as a contribution to the Working Group on Ships of the European Union's *European Climate Change Programme* (ECCP) and presented on 22-23 June 2011 at the second meeting of the group. It discusses various options that may be considered by the EU when contemplating, in the absence of any progress in the International Maritime Organization (IMO), to act unilaterally on market-based measures for curbing CO₂ emissions from international shipping. Focus is, in particular, on the pros and cons of introducing a hybrid scheme where emissions from domestic shipping and other small vessels (below a certain size threshold) are addressed by up-stream allocation of liability, i.e. with the fuel suppliers, while a down-stream allocation of responsibility would apply to large ships and to journeys departing from ports outside of the EU. For the latter, the ship owner would be directly responsible for submission of emission allowances or, alternatively, for paying a CO₂ charge or levy.

Keywords: Shipping emissions, IMO, climate change, ECCP

Introduction

Although preferring a global solution for a market-based measure for curbing CO₂ emissions from international shipping, the European Union has indicated that it will implement its own policies if no global agreement can be reached. EU Directive 2009/29/EC sets a deadline for a global agreement by stating that “In the event that no international agreement ... has been approved ... by 31 December 2011, the Commission should make a proposal to include international maritime emissions ... in the Community reduction commitment, with the aim of the proposed act entering into force by 2013”. To prepare itself for possible action a consortium of researchers was commissioned to produce a comprehensive set of technical support (Faber et al, 2009).

In preparing to act alone Europe faces more than one dilemma. One obvious obstacle with a definitive dead-line is that while the EU is considering what to do, discussions go on at the meetings of IMO’s MEPC, where the European countries will continue to participate, perhaps not even speaking with one voice. This results in Europe aiming at a moving target. Needing at least a minimum of collaboration with nearby non-participating states in order to avoid evasion is a second difficulty. A third problem is the risk of being legally challenged.

Acting unilaterally should be viewed as an interim solution that will only affect a limited part of carbon emissions from international shipping. It may nevertheless be an important step as a means for gaining experience from which the world can learn.

As discussed in the first meeting of the *European Climate Change Programme* (ECCP) Working Group on Ships, for a regional scheme it would be difficult to introduce mandatory operational or technical measures. The focus of this paper is thus on market-based measures. Member States of the EU have during the discussions of MEPC been divided. While Germany, France and the United Kingdom have proposed emissions trading, others have come out in favour of a cap and levy model, originally proposed by Denmark. In an intra-European context, additional options may need to be considered such as a charge on CO₂. Various hybrid solutions may also be contemplated. In all of these alternatives, ships could be required to give a 24h (12h) notice before entering a port and confirm that they are in compliance. Non-complying ships would not be allowed to make voluntary calls.

Range of participation

Acting “alone” should not exclude the participation of non-EU Parties. Norway, Iceland and Switzerland, and the candidate countries should, of course, be invited to become partners. The risk of evasion would diminish if all of Europe joined. The participation of Russia and Ukraine is crucial for avoiding evasion in the Baltic Sea and the Black Sea. The amount of emissions covered in a scheme based on arriving ships would increase from 208 Mt to 277 Mt with pan-European coverage (+33%).

Table 1. Emissions from ships calling at European ports.

Region of origin	Ships arriving in Europe from different regions		Ships arriving in EU27 from different regions	
	Mt CO ₂	Percentage	Mt CO ₂	Percentage
North America	15.9	6	12.0	6
Central America	5.7	2	4.3	2
South America	10.5	4	7.9	4
Africa	21.2	8	16.0	8
Middle Eastern Gulf	5.5	2	4.1	2
Indian subcontinent	2.6	1	2.0	1
Far East Asia	11.6	4	8.7	4
North East Asia	4	1	3.0	1
Oceania	1.9	1	1.4	1
Europe	197.7	71	-	-
EU27	-	-	112.1	54
Rest of Europe	-	-	36.8	18
Total	276.6	100	208.4	100

Source: Faber et al (2009)

Extension to non-European Annex I Parties would further strengthen the scheme as emissions from ships on journey to their ports would also be covered.

Risk of legal challenge

UNCLOS opens the possibility for a State to make voluntary port calls conditional on meeting unilaterally enforced standards if deemed necessary for the protection of its environment. Europe could, thus, base its scheme on Port State rights. No foreign country has bothered to question any of half a dozen earlier cases when a Party to IMO has restricted the right of ships to call at its ports to those fulfilling certain requirements. Examples of this are the United States Oil Pollution Act, the European Union's early ban on single-hull tankers, the 1996 Stockholm agreement on stability requirements for Roll-on-Roll-off ferries, the US ballast water requirements, the European Union's regulation on the highest permissible sulphur content in fuels used by ferries, the Community's requirement on ships not to use fuel containing more than 0.1 per cent sulphur while at berth, and the requirement by the Swedish city of Helsingborg that ferries must have installed SCR as a condition for entry into port.

However, regulating CO₂ emissions may be seen as more far-going and potentially more harmful.¹ The fact that earlier cases of unilateral Port State requirements have not been legally tested makes it difficult to predict with certainty the outcome of a dispute settlement at the International Tribunal for the Law of the Sea that has the power to give binding judgments to the Parties concerned.

¹ In this context, it is worth noting that a number of American Airlines are legally challenging the EU decision to include them in the EU ETS.

Maybe Europe should not worry too much about the outcome of a possible dispute settlement. The EU may refer to UNFCCC's Article 2 on the necessity of stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system, and to Article 2.2 of the Kyoto Protocol that requests Annex I countries to lead on greenhouse gases from international shipping. The fact that many attempts have been made, particularly from EU Member States, during 14 years to bring about a decision in IMO is also relevant for the assessment of any unilateral decision by the EU.

In exercising extra-territorial jurisdiction in the interests of the protection and preservation of the marine environment, the EU would have to ensure that it applies its rules and regulations equally to all ships calling at EU ports in order to avoid contravening its obligation under Article 227 UNCLOS which states that "in exercising their rights and performing their duties under this Part, States shall not discriminate in form or in fact against vessels of any other State." Making sure that the scheme meets all the requirements set out by MEPC 57 in its nine assessment criteria may also improve its chances of being accepted by third Parties. The EU will also have to pay attention to Articles 2.3 and 3.14 of the Kyoto Protocol which say that Annex I Parties must strive to minimize adverse effects on, inter alia, international trade and the economy of the developing countries.

What may count in favor of unilateral action by the European Union is the value to the rest of the world of being able to learn from its experiences. Without the EU ETS, the knowledge of emissions trading would be very limited. Expanding emissions trading to aviation, and potentially to shipping, will add to this knowledge bank.

Expertise from the WTO Secretariat concluded at IMO's GHG-WG 3 that it has been clearly demonstrated that no incompatibility exists between a potential market-based measure for international shipping and WTO rules. WTO clarified that it could not challenge an agreement by another international organization. However, at the meeting the delegation of India raised detailed concerns on the relation with IMO rules, and was requested by the meeting to submit such possible inconsistencies to MEPC 62 (IMO, 2011).

A scheme limited to intra-EU voyages would, needless to say, meet little or no opposition in the surrounding world. Restricting coverage to all journeys ending in participating ports means non-EU countries will be affected economically but to a small extent. Most of them may not bother to protest, and the Annex I countries among them would have little reason to do so. The largest risk of legal challenge comes from export countries in the developing world.

Geographical coverage

Regardless of whether EU27 act alone or in partnership with additional countries, a decision will have to be taken on the geographical coverage of the MBM. Table 1 features emissions from arriving ships in 2006 (100 GT and larger), including those arriving from other parts of the world. If, in a pan-European case, the scheme is limited to ships arriving from participat-

ing ports, the amount covered shrinks to 198 Mt (-28%). In a scheme restricted to EU27 and limited to arrivals from other EU ports, the emissions covered in 2006 would be only 112 Mt.

If, on the other hand, the MBM would cover emissions from both arriving and departing ships regardless of origin or destination, the amount would be much larger. Ships to and from the ports of EU27 were estimated to have emitted 311 Mt in 2006, while ships arriving and departing from all European ports emitted 363 Mt.

Table 2 shows the share of global emissions from international shipping that would be covered in the various alternatives outlined above. A scheme limited to intra-EU traffic would cover 11 per cent, while a model covering all journeys to and from European ports would extend coverage to 36 per cent.

Table 2. The share of global emissions from international shipping covered by different schemes (based on 2006 data when global emissions amounted to 1009 Mt).

Geographical coverage	Mt CO₂	Share of global emissions
Intra-EU journeys	112	11%
Ships arriving in EU27	208	21%
Ships arriving and departing from EU27	311	31%
Intra-European journeys	198	20%
Ships arriving in Europe	277	27%
Ships arriving and departing from Europe	363	36%

Yet another case would be to target all ships arriving in Europe from ports in Annex I countries. This alternative is not included in Table 2 for lack of precise data but would probably cover approximately 23 per cent of the emissions caused by international shipping.

Gradual expansion to other parts of the world

The European Union can, by acting alone, at best target slightly more than a quarter of the emissions caused by international shipping. It should thus be in the interest of the EU to design its scheme in a way that facilitates expansion to other countries and regions. A potential problem in this context is that other countries may favor schemes that differ with regard to size thresholds, geographical coverage and choice of measure.

In the case of international aviation, the EU decided to include emissions from all journeys to and from airports on its territory and to allow exemption of incoming aircraft based on equivalent measures by non-EU States. To monitor international ship movements is more complicated and the inclusion of journeys from EU27 to non-participating ports would either have to rely on port state control in non-participating countries or making ships that call at the ports of EU27 liable for a period of time that is sufficiently long to cover emissions from journeys to and from Europe. The former alternative is not realistic and the latter is problematic as it puts a heavy burden on infrequent visitors. Thus in the case of shipping it may be better to restrict the coverage of the EU scheme to journeys ending in the ports of the partici-

pating countries. This makes expansion relatively uncomplicated so long as new entrants (or parallel schemes) also limit their coverage to incoming ships.

With emissions trading, extending an EU scheme, whether being a part of the EU ETS or a separate cap and trade scheme for shipping, would require cap adjustment. In the case when a non-EU State decides to make emissions from international shipping part of a national cap and trade system, the EU and the other Party would have to decide on whether or not to link the two schemes to each other. The way that emission allowances are allocated could in this case differ between the schemes. For a levy or tax, differing rates in different parts of the world are feasible and may be the result of multiple decisions on voluntary schemes. However, a potential problem with both emissions trading and charges are intermediate stops at non-participating ports made by ships en route to a participating port.

Emissions from small ships and domestic navigation

Another aspect of the choice of market-based measure is that Europe will need to consider how it should handle emissions from smaller vessels and emissions caused by domestic shipping and navigation on inland waterways. The latter two are parts of the emissions inventories of the individual Member State and thus included in the EU's internal agreement on how to split the burden of reducing emissions from sectors that are not subject to the EU ETS. Based on national data reported to UNFCCC, domestic navigation in the EU27 emitted 22 Mt CO₂ in 2008, while marine bunkers sold in Europe for use in international shipping accounted for 170 Mt. The latter figure, of course, is not exactly identical to the emissions (mentioned above) that are caused by ships en route to Europe. It should in this context be observed that the same ship is sometimes used both intra EU and for international voyages.

In the case of aviation the EU decided to include emissions from both domestic and international flights in the EU ETS.

All ships of 100 GT and larger must have an identification number conforming to the IMO's ship identification system. However, only ships of 400 GT and above have to comply with MARPOL. The latter has been a reason to suggest that an IMO instrument should be applied to ships of 400 GT and larger. All types of ship below 400 GT represent approximately 2.7 per cent of overall international shipping emissions in Europe (8 Mt). This threshold would for instance leave most tugs and fishing vessels unaffected.

However, the EU might need to consider how to treat smaller vessels and ships used in domestic trade. The Commission's recent White Paper on transport underlines the importance of internalizing all remaining transport externalities, and an effective climate change policy would enforce the same price on carbon irrespectively of where emissions occur.

A threshold higher than 400 GT may also be considered but for the reason of making the scheme simple and keeping transaction costs at a minimum. If limited to ships of 5,000 GT and more, the scheme would take account for 79 per cent of the emissions caused by ships on journeys to ports in all of Europe.

Choice of market-based measure

For a market-based instrument, the EU may choose between emissions trading and cap and levy. However, a levy on fuel purchased for trips to Europe appears less promising than in a global regime as there would be no way for the EU, when acting alone, to legally enforce this fee on fuel sold in other parts of the world. Neither Flag State obligations nor Port State rights would apply. A third possibility would therefore be to introduce a tax or charge on CO₂ emissions caused by ships on journeys to European ports. This charge could potentially, in line with the Danish proposal for a Fund, be used for buying out of sector emission credits to offset any emissions above a cap. Another advantage with a charge on CO₂ is that the risk of fraud is smaller than for a levy on fuel. Ships can be given the opportunity to choose between a rather high default value and investing in fault-free equipment for measuring real emissions. Ships that regularly call at participating ports might choose to invest in reliable monitoring equipment. Infrequent visitors may prefer standard rates (that also take account of emissions in port).

Emissions trading

The EU ETS now operates in 30 countries (EU27 plus Iceland, Liechtenstein and Norway). The installations currently in the scheme account for about half of the EU's CO₂ emissions and 40 per cent of its total greenhouse gas emissions. Airlines will join the scheme in 2012. The EU ETS will be further expanded to the petrochemicals, ammonia and aluminum industries and to additional gases in 2013, when the third trading period starts. At the same time a series of important changes to the way the EU ETS works will take effect.

During the second phase (2008-2012) 1,859 Mt per year were allocated through national allocation plans (NAPs). For the third trading period there will no longer be any national allocation plans. Instead, the allocation will be determined by benchmarks calculated at EU level. The cap for the year 2013 has been determined at just under 2.04 billion allowances. The cap will decrease each year by 1.74 per cent of the average annual total quantity of allowances issued by the Member States in 2008-2012 (1,859 Mt). In absolute terms this means the number of allowances will be reduced annually by a little more than 37 Mt. In 2020 emissions will be 21 per cent lower than in 2005.

Based on the annual average aviation emissions in 2004-2006, the number of aviation allowances to be created in 2012 amounts to approximately 213 Mt of CO₂, and the number of aviation allowances to be created each year from 2013 onwards amounts to 208.5 Mt. The Directive 2008/101/EC provides that 82 per cent of the allowances will be given for free to aircraft operators, while 15 per cent of the CO₂ allowances will be allocated by auctioning. The remaining 3 per cent will be allocated to a special reserve for later distribution to fast growing airlines and new entrants into the market.

EU legislation provides for participants to use most categories of JI/CDM credits from mechanisms established under the Kyoto Protocol towards fulfilling their obligations under the EU ETS. Credits from afforestation, reforestation and nuclear projects, and from 2013 credits

from HFC23 and N₂O from adipic acid production, cannot be used. Between 2008 and 2020, the EU ETS legislation provides for use of credits up to 50 per cent of the overall reductions below 2005 levels made under the EU ETS. The exact amount per operator is to be determined in line with methodology outlined in Directive 2009/29/EC - Article 11a(8).

The design elements and potential problems with a geographically limited scheme for emissions trading have been discussed in detail in Kågeson (2007), Faber et al (2009), Bäuerle et al (2010) and to some extent in Davidson et al (2010). Provided that such a scheme is not successfully legally challenged there appear to be no insurmountable difficulties in implementing it, although some degree of evasion may occur as a result of ships calling at nearby non-participating ports. This risk can be minimized by ruling that incoming ships are liable for emissions caused on journey from the port where most of the cargo intended for Europe was laden. However, this solution would be conditional on bills of lading being sufficient instruments for clarifying the origin of all cargo entering a participating port. This needs to be investigated more closely.

CO₂ tax or charge

Unlike the emissions trading option for a unilateral regime, a European tax on CO₂ emissions from shipping has been less thoroughly investigated, although being one of five instruments assessed in Faber et al (2009) and also touched upon by Davidson et al (2010). It may therefore require additional attention.

Making ship owners liable for the emissions caused by vessels on route to EU ports by collecting a charge per ton emitted could potentially be implemented by fuel taxation for ships that never leave European waters, and for other visitors by an emission fee based on default values that take into account distance and type and size of machinery. As observed by Faber et al (2009), most other design elements are identical or similar to those that need to be in place for emissions trading.

A tax or charge may offer some advantages in comparison with emissions trading. The most obvious benefit is that the industry will know what cost to expect and be able to include it in its business and investment calculations. Another advantage is that the absence of any cap makes expansion of the geographical coverage of the scheme somewhat easier than would be the case with emissions trading or cap and levy. A tax regime could even cope with differing rates in other parts of the world, if this were deemed necessary for attracting the participation of additional countries.

The negative aspect of a traditional charge is, of course, that no absolute cap is enforced on emissions from maritime transport. A sufficiently high charge would, however, provide a marginal abatement incentive equal to that provided by the cap. It should be possible to remodel a scheme based on charges to cap and trade once consensus is achieved for a decision on a global market-based instrument (in case IMO prefers emissions trading to a levy).

In a proposal for a new directive restructuring the Community framework for the taxation of energy products and electricity (Directive 2003/96/EC), the European Commission proposes the introduction of a uniform CO₂ tax of 20 euro per ton on fuels used in road transport, to

come in addition to the current minimum rate for the taxation of petrol, which would in future be based on energy content and apply equally to all road fuels. The rate of the CO₂ tax corresponds relatively well to the expected EU ETS short-term price of carbon when the cap is gradually lowered in years to come.

Even though competition between aviation and maritime transport is very limited, it may be wise to level the playing field by choosing a tax rate for ships that comes close to the expected price of allowances used for compliance with the EU ETS. Relevant in this context is also that electrified rail transport, which competes with short sea shipping, pays electricity bills that are affected by the price of carbon in the EU ETS.

If the EU contemplates choosing taxation rather than emissions trading in the maritime sector, the energy tax directive (2003/96/EC) must be changed as Article 14 as it currently stands prevents taxation of fuels used for the purpose of navigation. The proposal for the revision of the energy tax directive, mentioned above, does not include the removal of this barrier.

A problem with European taxation is that any decision on a common rate will have to be unanimous. However, if the European Commission believes that it has a chance of getting the Council to agree on a common CO₂ tax on road fuels, it may just as well try to expand its scope to include emissions from shipping. In this context one may observe that a decision by IMO on a global levy or tax would also need ratification by the individual Member States.

Need for a hybrid?

To be able to include domestic emissions and emissions from ships below a certain size threshold in a cap and trade system one would need to use an up-stream approach for small vessels and a down-stream allocation of responsibility for bigger ships, including most overseas arrivals. In the case of up-stream allocation, the fuel providers would be liable for submitting allowances equal to the emissions that will eventually result from combustion of the fuel sold. The EU could set the limit for a down-stream approach at a certain threshold, say 5,000 GT (possibly with an option for ships above this limit that travel exclusively between participating ports to alternatively make fuel providers buy emission allowances on behalf of them).

Using a tax or charge would similarly make it easy to cover all ships that never fuel outside the participating countries. The charge would in this case be paid by the fuel supplier who will include the expenditure as one of the cost elements on the bill. Any ship, regardless of size, that has not bought fuel from a taxed source would be liable for emissions caused from the last port based on default values or a reliable form of monitoring. Small ships arriving from nearby non-participating ports would be among them. This means in practice that a ship that sails from a non-participating country would on arrival to an EU port have to declare how much it has emitted from the port on its journey where most of the goods intended for Europe were laden.

In both emissions trading and a case of charging/taxing, a hybrid model for the liability would be needed. Most of the emissions would in both cases be covered by an up-stream approach.

It may be observed that in the context of a cap and levy under the auspices of the IMO, the liability would be placed up-stream. It may also be noted that under emissions trading based on a down-stream approach (for all ships), the small ships would probably anyway have to rely on the fuel providers for buying emission allowances equal to the emissions caused by the combustion of the fuel.

An objection to an up-stream allocation of responsibility might be that the reliable entity should be the one having influence over emission reduction measures. However, split incentives are common in the shipping sector as a result of charter arrangements, and a clear indication on the fuel bill of the cost associated to emission allowances or a CO₂ charge would anyway make it possible for any stakeholder to consider whether, for instance, investment in retrofitting of hull, propeller or machinery is worthwhile.

Evidence from existing taxation of fuel in the EU as well as in the United States indicates that fuel suppliers are able to distinguish between deliveries to customers of different kind. Diesel fuel, for instance, is taxed differently depending on where it is used. It appears possible to segregate how much fuel suppliers have delivered for different purposes. Making them liable for emissions trading based on an up-stream approach or making them responsible for an additional form of taxed fuel will increase the existing burden but not by much. Fuel is normally taxed in the upper part of the delivery chain. In Sweden the number of companies that have to report and pay fuel excise duties is only ten (including those that deliver natural gas). The number of firms affected probably is not much higher in more populous Member States.

Interesting in this context would be to understand how Member States distinguish between marine fuel for domestic use and the same type of fuel for use in international voyages when reporting CO₂ emissions to UNFCCC.

A complication in the case of taxation is that the money would be raised by Member States at the point of tax duty. The revenue may then have to be delivered to the EU for redistribution. This means money will have to be transferred from Member States to the EU. The approximate share originating from domestic shipping and inland navigation could be destined back to the national treasuries as lump-sums. One way of avoiding this problem, would, of course, be to allow the Member State where the fuel was sold to keep the revenue. The proceeds from a CO₂ tax on emissions from ships above the size threshold of the hybrid system (or on ships arriving from non-participating countries), could in this case be collected by a European authority and the revenue could be used for any purpose. If allocated to the Member States, the Community would presumably have to take account of trade including that with land-locked countries.

With emissions trading, on the other hand, the allocated allowances could be sold on a common European auction. This would also work for an up-stream approach. Some or all of the proceeds could in this case be distributed among the participating countries according to some agreed key (or used in any other way).

Expansion into global application

When designing a European hybrid system, it is necessary to contemplate how it would work in a global context. With a threshold of, say, 5,000 GT, the EU could continue to use CO₂ fuel taxation or emissions trading (based on an up-stream approach) for ships below this size. If IMO were to choose a threshold that differs from the initial choice made in Europe, the EU would have to change its threshold accordingly.

A gradual phase-in?

The EU may contemplate a gradual phase-in of its market-based scheme based on vessel size. However, this may be more meaningful with emissions trading than with a tax/charge (or for that matter a levy). Addressing larger ships first would make it possible to assess the scheme's monitoring capabilities and difficulties. However, a threshold based system could incentivize shipping companies to order new ships just below the threshold. To avoid this drawback it might be necessary to make known in advance when the scheme will be extended to cover emissions from smaller vessels. In a recent ECJ case (Arcelor case C-127/07) the Court ruled that provided that the regulator extends coverage over time, a portion of sector may be covered at first.

Leveling the European playing field

The recent White Paper on transport highlights the importance of internalizing the marginal social costs of all modes of transport. In order to level the playing field this ought to be done, where possible, in ways that provide equal treatment to all modes. In this context it is worth noting that airlines will be allocated 82 per cent of the emission allowances free of charge, while rail transport has to pay the costs passed on to them by their electricity suppliers, who in the third stage of the EU ETS will have to buy all allowances on auction.

Faber et al (2009) show that one possibility for the shipping sector may be to allocate some of the allowances to individual ships based on the number of allowances surrendered by each ship during the previous year. This "recycling" of allowances could be carried out on a declining scale so that after some years all allowances would be sold on auction. However, a problem in this context is that the system would not work in a case of partial up-stream allocation of responsibility.

As far as known, the shipping industry has not asked for free allowances in the context of a possible global scheme, perhaps understanding that grandfathering is not a natural option in an industry where the liable entities are per definition extremely movable and where the cost of fuel may fall on either the owner or the charterer of a vessel. Instead, the industry has demanded that part or all of the revenues should be recycled to the shipping community and used for investment in less polluting technologies. This has also been the attitude taken to the proceeds of a levy.

In the context of equal treatment of all modes it should also be observed that the EU ETS allows 50 per cent of the overall reductions below 2005 levels to be offset by credits from pro-

jects in developing countries. Such credits are normally somewhat less expensive to purchase compared to emission allowances.

It may also be worth noting that enforcing cap and trade on two European transport modes and an excise duty or tax on the remaining two may cause a difference in cost. However, by tying the rate of the CO₂ charge/tax to the price of EU ETS emission allowances, all modes would face the same marginal compliance cost.

A tax/charge/levy could initially be set below the price of emission allowances as a way of leveling the playing field (compared to aviation but not to rail). However, if shipping emissions keep rising, a growing part of the proceeds would have to be used for offsetting emissions so long as the charge/tax is lower than the carbon price.

Use of revenues

Regardless of whether Europe goes for emissions trading, with allowances being auctioned, or decides on a tax/charge/levy on CO₂, its choice of market-based measure will raise a substantial amount of money. In the first case, the resulting revenues will be determined by the size of the cap and the carbon price of the day, in the latter by the rate of the tax/charge and the amount of emissions caused by ship movements that are subject to it.

As long as the tax rate is identical to the EU ETS price, the net revenue will also be identical. However, in a case where emissions exceed the cap, the gross revenue of the tax will be higher but the difference would in a charge and cap scheme be used for buying allowances and credits that offset the excess emissions. An identical rate would also make the two options provide the same marginal incentive to utilize in sector abatement measures. The two models would thus be equally effective. However, in a case where the tax/charge/levy was set considerably below the price of emission allowances, the marginal incentive would be smaller as would the net proceeds.

If emissions on journey to EU ports amount to 208 Mton, as they did in 2006 according to Faber et al (2009), and the rate is €20 per ton, the proceeds will be €4.2 billion per annum assuming full auctioning. If the non-EU part of Europe also participates, the amount covered will be higher (approx. 277 Mton in 2006), and the revenues grow accordingly.

Out of 4.2 billion approximately one tenth will originate from domestic shipping and navigation on inland waterways. The treasuries of the Member States concerned might see this part of the money as belonging to them regardless of whether they result from the auctioning of emission allowances or from a tax/charge. Not earmarking them for use elsewhere appears to be particularly relevant in the case of Member States that have legal constraints on hypothecation of tax revenues (Davidson et al, 2010).

However, the remaining part of the proceeds has no obvious owner (if designed as an international duty). It could be distributed to the national treasuries based on some agreed key or

alternatively be used for other purposes (and in the case of cap and levy or charge be allocated to a Fund that buys emission credits).

The need for compensating developing countries for the direct effect on their economies of European emissions trading or taxation would be small. It may in this context be worth noting that the importing country bears the entire cost of shipment of crude oil as tankers return empty, and that Europe pays the lion's share of the costs connected to container shipments to and from its ports. However, if emissions on journey from developing countries were to be included, the effect on their economies may require compensation. Making up a small fraction of all emissions subject to a European market-based instrument, presumably, a miniature share of the proceeds will sufficiently cover this requirement. Overcompensating the developing countries at this stage should be avoided as the money may be needed for convincing them in a later phase to allow the scheme to turn global.

Allocating money for the purpose of in-sector emission abatement measures may increase the possibility of additional participation by developed States. The Republic of Korea (GHG-WG 3/3/1) and Japan (GHG-WG 3/3/2) want to use any proceeds from market-based measures on incentivizing the industry to invest in more efficient vessels and improved operation of ships. The United States also gives priority to measures aimed at improving the efficiency of ships, albeit by a different method. In the case of a geographically limited regime, support could be provided to efficient ships regardless of flag, provided that they are used or will (by contract) be used on routes to participating ports. Norway has shown how this can be done by allocating grants from its NO_x Fund (financed by an emissions fee) to measures onboard ships regardless of flag and domicile of the owner. The only requirement is that the ship is used or is intended for use in Norwegian waters.

A useful way of spending a small part of the money may be to reward ships for voluntarily using the Energy Efficiency Operational Index (EEOI), and for investing in equipment for continuous measurement of CO₂ in the exhausts, as these are important means for improving the owner's, the operator's and the crew's understanding of how various measures affect real fuel consumption and emissions. Measuring emissions in a way that is robust against manipulation and fraud is, in addition, important in the context of applying a correct tax or a precise liability for submitting allowances. Such instruments are already in the market.

In the context of the overall costs for greening international shipping it may be worth noting that ships travelling in SECAs will have to take on considerable costs from 2016 to comply with the IMO's sulphur limit of 0.1 per cent. While emissions trading may raise fuel costs by about 10 per cent, the MARPOL effect will probably exceed 40 per cent (based on the current premium for 0.1 per cent sulphur over 1.0 per cent). Black carbon may also have to be addressed in the near future in order to avoid the polar area from heating up. This may result in additional abatement costs for ships in northern Europe. Using some of the proceeds from a tax/charge/levy or emissions trading for facilitating this process may also be worth considering.

Acting while the discussions at MEPC continue

As highlighted in the introductory section of this paper, the discussion on a MBM at the meetings of MEPC will continue. One way for the EU to tackle the difficulty of acting while not knowing if those discussions will result in any action could be to start by inaugurating a scheme covering only intra-EU journeys, and make clear that the scheme will be extended to all arriving ships within a few years if by then no decision has yet been taken by IMO. Extension could, of course, also happen as a result of other Parties joining this scheme voluntarily in the mean-time.

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