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The economics of the CDM levy:
Revenue potential, tax incidence and distortionary effects [*]

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Abstract

A levy on the Clean Development Mechanism and other carbon trading schemes is a potential source of finance for climate change adaptation. An adaptation levy of 2 percent is currently imposed on all CDM transactions which could raise around $500 million between now and 2012. This paper analyses the scope for raising further adaptation finance from the CDM, the economic costs (deadweight loss) of such a measure and the incidence of the levy, that is, the economic burden the levy would impose on the buyers and sellers of credits. We find that a levy of 2 percent could raise up to $2 billion a year in 2020 if there are no restrictions on demand. This could rise to $10 billion for a 10 percent tax.   Restrictions on credit demand (called supplementarity limits, the requirement that most emission abatement should happen domestically) curtail trade volumes and consequently tax revenues. They also alter the economic impact of the CDM levy. Without supplementarity restrictions sellers (developing countries) bear two-thirds of the cost of the tax. If there are supplementarity limits they can pass on the tax burden to buyers (developed countries) more or less in full. Without supplementarity restrictions the distortionary effect of the levy (its deadweight loss) rises sharply with the tax rate. With them the deadweight loss is close to zero.

Keywords: Clean Development Mechanism, adaptation, CDM levy, adaptation finance

1. Introduction

Raising sufficient funding for adaptation measures in developing countries is a key challenge for the post-2012 climate change architecture. How much adaptation in developing countries will cost is still highly uncertain, but available estimates point to financing needs of tens of billions of dollars by 2020: The lowest estimates start at $4 – 9 billion a year, the highest ones are in excess of $100 billion (see Agrawala and Fankhauser 2008, Fankhauser 2009 and Parry et al 2009 for recent surveys).

Currently there are two main sources of international adaptation finance. The first source is bilateral and multilateral initiatives such as the Pilot Programme on Climate Resilience, the Least-Developed Country Fund and the Special Climate Change Fund. They are financed through fiscal transfers from western governments, not dissimilar to the way multilateral development assistance is pledged.

The second source is the Adaptation Fund of the UNFCCC, which is funded through a 2 percent levy on all transactions under the Clean Development Mechanism (CDM). On current trends, the levy can be expected to yield perhaps $500 million by 2012 – substantial but nowhere near enough to meet global adaptation needs.[1]

Other funding mechanisms – such as a tax on international bunker fuels, a global carbon tax or the sale of Assigned Amount Units (AAUs) – have therefore been put forward. They have been surveyed and assessed by Müller (2008) and Harmeling et al (2009).

No consensus on the best sources of adaptation finance emerges from these studies, but an extended levy on carbon credit transactions tends to score fairly highly in assessment exercises. The CDM levy has the advantage over new proposals of being up and running and, unlike government pledges, it creates a revenue stream that is clearly distinct from and additional to official development assistance.

But how much money can realistically be raised through a levy on the CDM or its successor mechanism? The tax base is relatively small, even if trading volumes continue to grow and the levy were broadened to include other carbon transactions, such as Joint Implementation and the trade in AAUs. This means the tax rate would have to be higher than the current 2 percent. But like all taxes, the CDM levy imposes a cost (deadweight loss) on the economy in the form of less abatement or the same abatement at higher costs. The deadweight loss increases disproportionately with tax rate, suggesting there are in-built limits to the amount of money the CDM levy may raise.

Moreover, it seems counterintuitive to raise revenues from an activity – emission reductions – that ought to be encouraged and not stifled through taxation. Complaints about the adaptation levy do not feature much in the extensive literature on CDM shortcomings and transaction costs (see e.g., Hoogzaad et al 2008; IETA 2008; Streck

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[1] The CDM is expected to deliver emission reductions of about 1.3 billion tonnes by 2012 (www.cdmpipeline.org; as of May 2009). At a carbon price of $20 (higher than the current market rate) the 2 percent levy would yield revenues of $20*1,300*2% ~ $500 million.

and Lin 2008; Wara 2007). But how much of a burden does the adaptation levy actually impose on the global carbon market?

One may also question whether the CDM levy indeed raises additional adaptation funding from developed countries, as expected under the post 2012 climate architecture. Developing countries have always seen the CDM levy as a solidarity payment from countries like China and India, which host the majority of CDM projects, to least developed countries. They are at least partially right. As with all taxes, the economic burden of the CDM levy is shared between the buyers and sellers of CDM credits, that is, between developed and developing countries. Who pays how much is an empirical question and depends on the relative price elasticity of supply and demand.

This paper explores these basic insights from tax theory numerically. We start with a description of the analytical approach and the data sources model on which the numerical results are based (section 2). Focusing on the year 2020, we then estimate the revenue raising potential of a tax on international carbon transactions (section 3), assess the distortionary effects of such a tax (section 4) and analyse the tax incidence, that is the split of the tax burden between supply and demand (section 5).

In each case, we ask how the outcome depends on the design of the international climate regime, in particular the presence of import quotas on CDM credits. The Kyoto Protocol implicitly restricts the use of international offsets by requiring that most of the abatement action occurs domestically. These supplementarity restrictions are known to be welfare-reducing because they limit the benefits from trade, although they help to accelerate the long-term decarbonisation of the domestic economy (Fankhauser and Hepburn 2009). As we shall see, supplementarity limits also have strong ramifications for the economic impact of the CDM levy.

2. Method and data

The analysis is based on a straightforward static model of global supply and demand for CDM-style offset credits. Aggregate supply and demand curves were calculated from a series of marginal abatement cost curves (MACs) for different countries and sectors. The levy was then imposed by adjusting the supply schedule for the tax rate, assuming a fully competitive market and no general equilibrium effects.

Chart 1 shows the analysis in stylised fashion. D denotes the global demand for credits. S1 shows the global supply without a levy and S2 with a levy. The total amount of revenue raised is shown by the square ABGF. Of this total, a share of ABDC (lightly shaded) falls on the demand side, and CDGF (heavily shaded) falls on the supply side. The deadweight loss of the levy is the triangle BEG.

The data to calculate global MACs were taken from the Global Carbon Finance (GLOCAF) model and the data sources used to calibrate that model. GLOCAF distinguishes 15 world regions and 17 sectors, using data from several models: POLES for energy emissions (e.g., European Commission 1996), IIASA for forestry emissions (e.g., Benitez-Ponce et al. 2007) and IMAGE for non-CO2 emissions (e.g., Bouwman et al. 2006).

Chart 1: Stylised analysis
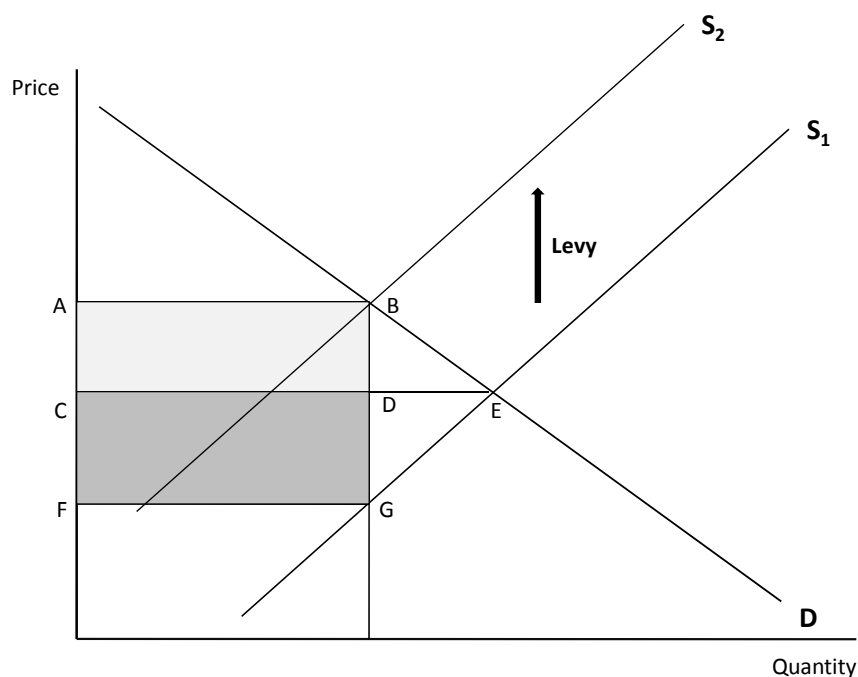
While these are well respected models in their respective fields there is still considerable uncertainty about the costs of abatement in different regions. Indeed, these MAC curves are influenced by policy, so for example heavy investment in renewable technology in Annex 1 regions would reduce the demand for credits from Annex 1 regions. To account for this uncertainty we distinguished between several supply and demand scenarios.

On the supply side the main uncertainty is about the eligibility of different abatement technologies. The MAC curves were recalibrated to take into account the fact that not all of the potential abatement may be accessed through the CDM. The following two scenarios were investigated:

- *Low Supply* – The CDM operates in 2020 in the same way as now, with certain sectors and regions generating very few credits.
- *High Supply* – The CDM is gradually improved and expanded such that more credits are generated from sectors and regions which currently produce little, including emissions reductions from deforestation and forest degradation (REDD).

The two credit supply curves generated from the data are shown in Chart 2. An important assumption in the high supply scenario is the inclusion of the complex and controversial REDD sector (see e.g. Eliasch 2008). To identify and isolate the impact of REDD we also calculated a medium supply scenario, which excludes REDD but maintains the same assumptions as the high scenario in all other respects (see Annex for full results).

Chart 2: Supply scenarios
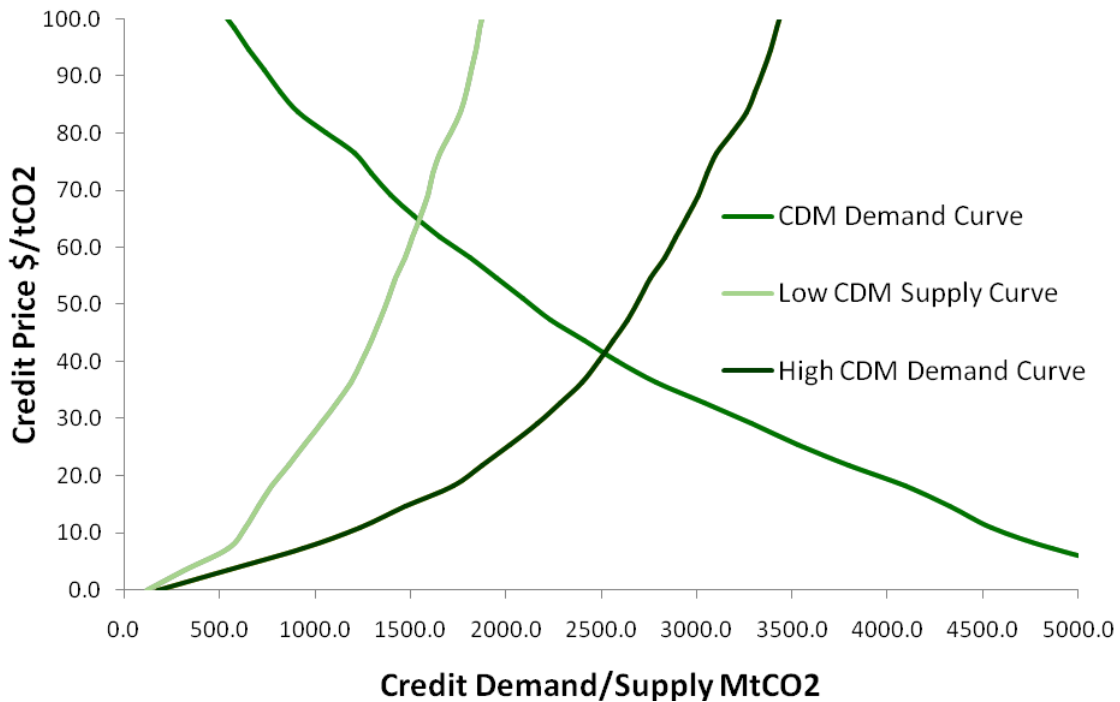
The demand for CDM credits depends on MAC data, business as usual emissions, but also on the global abatement target. We assumed that all Annex 1 regions would cut their emissions by 20 percent, relative to 1990, by 2020. This is at the lower end of the range identified in the IPCC fourth assessment report (Barker et al. 2007) but higher than what many countries are currently committed to. Non-Annex 1 regions do not take on any targets. Both assumptions are of course contingent on the shape of any global deal and different targets would change the results. However, qualitatively the story should not change much.

A far more critical assumption concerns possible restrictions in global credit demand due to supplementarity rules. The Kyoto Protocol (and many countries in their domestic arrangements) emphasises the priority of domestic abatement over trading. Without such supplementarity limits the demand for CDM credits would be relatively elastic. But once they are introduced, demand becomes highly inelastic at the point the constraint starts to bind. This has powerful ramifications for the distortionary effect of the levy and the tax incidence, which both depend heavily on the price elasticity of demand. We therefore distinguish the following demand scenarios:

- *High demand* – No supplementarity restrictions and completely free trading of emissions credits
- *Low demand* – Demand is restricted. Regions may only buy in up to 20 percent of their target through the use of credits

The two demand schedules generated by the data are depicted in Chart 3. Finally, the analysis distinguished two levy rates: The 2 percent tax rate currently in place and a higher 10 percent levy with the potential of raising higher tax revenues.

Chart 3: Demand scenarios
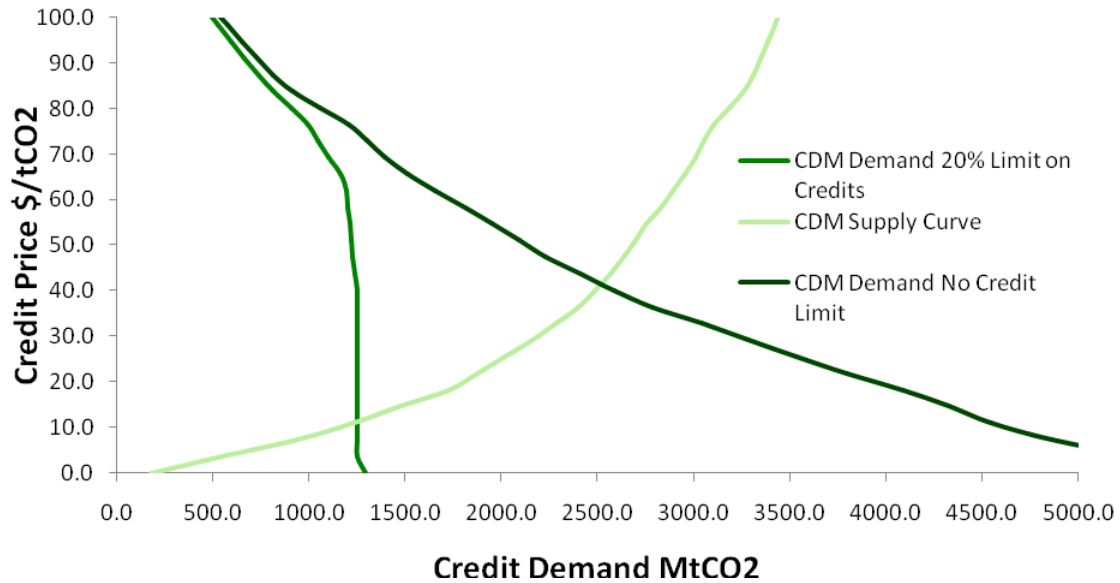
3. Potential revenues from the levy

The first question we turn to is the potential of the CDM levy to raise revenue. The main parameters that determine the revenue potential of the levy, besides the tax rate, are the volume of CDM transactions and the price of credits. Table 1 summarises the pre-tax value of the two parameters for the different scenarios. It also gives the revenues we can expect for the two tax rates considered.

At the current tax rate of 2 percent the CDM levy is unlikely to raise more than $2 billion a year by 2020, or as little as $250 million if a low demand is combined with a glut in supply. Raising $10 billion a year would require a tax rate of at least 10 percent and the absence of any constraints on demand.

Table 1: Revenue potential of a CDM levy (by 2020)

Demand Supply	High	Low
High	Pre-tax price ($/t) 41.5 Pre-tax volume (Gt) 2.5 Tax revenue, 2% ($bn) 2.0 Tax revenue, 10% ($bn) 10.1	Pre-tax price ($/t): 11.2 Pre-tax volume (Gt): 1.3 Tax revenue, 2% ($bn) 0.25 Tax revenue, 10% ($bn) 1.4
Low	Pre-tax price ($/t): 64.8 Pre-tax volume (Gt): 1.6 Tax revenue, 2% ($bn) 2.0 Tax revenue, 10% ($bn) 9.7	Pre-tax price ($/t): 40.3 Pre-tax volume (Gt): 1.2 Tax revenue, 2% ($bn) 1.0 Tax revenue, 10% ($bn) 4.9

Revenues are fairly insensitive to the assumed credit supply, particularly in the high demand scenario. The higher transaction volumes that a stronger supply pipeline would bring are offset by the fall in carbon prices. For the same reason, the inclusion or exclusion of REDD has little impact in the high demand case. Excluding REDD from an extended CDM reduces transaction volumes by about 20 percent. However,

the carbon price would rise by a similar percentage and tax revenues would remain steady at around $10 billion a year (see Annex).

Revenue expectations are much more sensitive to changes on the demand side. Constraining demand through supplementarity limits has an immediate and strong impact on both transaction volumes and the carbon price, which drop by 20–50 percent and 25 – 40 percent, respectively. As a consequence tax revenues fall by about half in the low supply case and by over 80 per cent in the high supply case. Restricting demand is bad news for the revenue prospects of the CDM levy.

4. The distortionary effects of the levy

Practically all taxes impose a cost on the economy, the deadweight loss that arises from moving the economy away from its equilibrium (see Chart 1 above). The ideal tax from an efficiency point of view raises whatever amount of revenue is required with minimal distortions to the economy. In the words of Colbert, the 17th century French finance minister, the goose has to be plucked in a way that yields the largest amount of feathers with the least amount of hissing.

To reduce their distortionary effect, economists prefer taxes that are broad-based (for example a tax on consumption) or target activities that are inelastic to changes in price (such as the consumption of alcohol and tobacco). A broad-based tax is preferred because it reduces arbitrage and substitution opportunities and because it requires a lower tax rate to raise a given amount of revenue. The deadweight loss of a tax rises at the square of the tax rate,[2] so there is a premium to keeping the tax rate low. Activities with inelastic demand are attractive because the tax will cause only a small deviation in the quantities consumed.

The deadweight loss from a tax may be turned into a gain if taxation leads to a socially desirable deviation from the market equilibrium. This is the case for Pigouvian taxes, such as pollution levies or a carbon tax, which correct for market externalities. The motive for taxation is then not just revenue generation but the correction of market failures.

Clearly, a levy on greenhouse gas emission reductions does not fall into this category. It discourages an activity that should, if anything, be promoted. The tax base – the volume of CDM transactions – is also still fairly narrow. So how damaging is the adaptation levy to the development of the global carbon market?

The answer depends on the tax rate and on the shape of the demand function (see Table 2). In the absence of supplementarity limits (high demand case), the demand for international carbon credits is relatively elastic, a reflection of the flat MAC curve in the Annex 1 buyer countries. This suggests that the distortionary effect of the CDM levy might be substantial, and indeed in the 10 percent-tax case the deadweight loss is equivalent to about 1-2 percent of the revenue raised. However, in absolute terms the amount is small and it is a tiny fraction of the overall gains from trade. In the case of a 2 percent levy the deadweight loss is less than one percent of total tax revenues.

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[2] Assuming supply and demand are roughly linear at the market equilibrium. See Stern (1987) for an introduction to optimal taxation.

Table 2: Deadweight loss from the CDM levy (in percent of tax revenues)

Supply \ Demand	High		Low	
High	2% levy	0.35	2% levy	0.00
	10% levy	1.25	10% levy	0.00
Low	2% levy	0.60	2% levy	0.10
	10% levy	2.19	10% levy	0.40

In the presence of supplementarity limits (low demand case), the demand curve is close to vertical and the levy causes no additional distortions even in the 10 percent tax case. The deadweight loss is essentially zero. However, we need to remember that the supplementarity limit itself is a highly distortionary constraint on trade with huge welfare implications. The effect of the CDM levy is of second order in comparison.

The inelastic demand schedule also results in a larger price effect. In the low demand case the levy leads to an increase in the carbon price of up to 10 percent. The tax is fully passed on. In the high demand case, where the demand response curtails the price effect, prices rise by only 3 percent.

5. Tax incidence

A key tenet of tax theory is that, whether a tax is raised on supply or demand, the tax burden is shared between buyers and sellers. Who pays how much depends on the relative price elasticity of supply and demand. The more price-inelastic party will bear a higher share of the cost.

The difference between the high demand case (where the price response is relatively elastic) and the low demand case (where the price response is highly inelastic because of supplementarity limits) is therefore crucial in determining the tax incidence of the CDM levy. Table 3 shows the results.

Table 3: Tax incidence (cost borne by buyer / seller in percent of total)

Supply \ Demand	High		Low	
High	2% tax, buyer	37.5	2% tax, buyer	100.0
	2% tax, seller	62.5	2% tax, seller	0.0
	10% tax, buyer	31.7	10% tax, buyer	100.0
	10% tax, seller	68.3	10% tax, seller	0.0
Low	2% tax, buyer	30.7	2% tax, buyer	75.0
	2% tax, seller	69.3	2% tax, seller	25.0
	10% tax, buyer	26.2	10% tax, buyer	82.5
	10% tax, seller	73.8	10% tax, seller	17.5

In the high demand case, when there are no supplementarity constraints, the cost of the levy is predominantly borne by the sellers of credits, that is, by developing countries. In pretty much all cases they will foot over two-thirds of the total tax bill. The CDM levy becomes a South-South transfer, as southern negotiators have long claimed, rather than a transfer from developed countries to developing countries.

This changes completely in the low demand case. The restrictions on credit demand allow sellers to pass on the full extent of the tax to buyers without encountering an adverse demand response. The tax burden is borne practically fully by the developed country buyers of CDM credits. But developing countries also lose out because the demand limits prevent them from selling more credits at a higher price.

6. Conclusion

Besides fiscal transfer from governments, the 2 percent adaptation levy on CDM transactions is the main source of international adaptation funding at the moment. The amounts currently raised are clearly insufficient, but an extended levy on a broader set of carbon market transactions remains an attractive option to raise adaptation revenues going forward – or indeed to finance other climate change needs, such as technology support.

In this paper we have explored three basic economic features of an extended CDM levy:

- *Revenue potential*: how much revenue can realistically be raised through a levy on carbon transactions?
- *Distortionary effects*: what is the deadweight loss of such a levy and what is its effect on the development of the international carbon market?
- *Tax incidence*: how is the tax burden shared between the buyers and sellers of credit, that is, between developed and developing countries?

We concluded that a levy on CDM transactions (or its successor mechanism) alone is unlikely to raise the amount of finance needed for adaptation over the medium term. By 2020, the levy could raise around $2 billion a year with a 2 percent tax rate and up to $10 billion a year with a 10 percent tax rate. These are substantial sums, but to meet global adaptation needs they would have to be complemented with revenues from other sources (e.g., government pledges, a tax on bunker fuels or the auctioning of AAUs).

Moreover, revenues of this order are only realistic if there are no restrictions on the demand for credit. This is unlikely. The principle of supplementarity – the view that domestic abatement should have precedence over international trade – is strongly held both in the international arena and in the domestic policy approach of most Annex 1 countries. Although such limits to "where" flexibility are known to increase compliance costs, it is fairly certain that most of the cap-and-trade schemes currently contemplated in Annex 1 countries will have limits on the use of international offsets, as the EU Emissions Trading Scheme already has.

This will have a detrimental effect on the revenue raising potential of a CDM levy. In the presence of supplementarity restrictions tax revenues would fall to around $1

billion in the 2% case, or to as little as $250 million if restricted demand coincides with a glut in supply. Even with a 10% tax, revenues would be less than $5 billion.

On the positive side, supplementarity limits help to reduce the distortionary effect the levy has on the carbon market by making the demand response less elastic (although that also reduces the gains from trade, Fankhauser and Hepburn 2009; Edmonds et al 2008). Even without constraints on demand, the deadweight loss from the levy is fairly small. However, it rises disproportionally as the tax rate rises, putting a de facto limit on the revenue potential of the tax.

With free trading of credits, the credit price is not very sensitive to a levy. With supplementarity restrictions, credit suppliers can pass on the levy to buyers and so the credit price is very sensitive to the levy.

The ability to pass on the tax determines the allocation of the tax burden between buyers and sellers. In a world of tight restrictions, the tax is passed on and the incidence of the levy mainly falls on the buyers of credits. The revenue raised could be rightfully seen as additional adaptation finance provided by developed countries.

But in a world with no restrictions on the use of credits, the incidence of a levy is mostly borne by the suppliers of emissions credits, that is developing countries. They could foot over two-thirds of the total tax bill. The CDM levy becomes a South-South transfer from CDM host countries like China and India to highly vulnerable countries elsewhere in the developing world. This is another reason why the revenues from the levy will have to be complemented by additional adaptation funding, this time from developed countries.

References

S. Agrawala and S. Fankhauser (2008). *Economic Aspects of Adaptation to Climate Change. Costs, Benefits and Policy Instruments.* Paris: OECD.

Barker, T., I. Bashmakov, L. Bernstein, J. E. Bogner, P. R. Bosch, R. Dave, O. R. Davidson, B. S. Fisher, S. Gupta, K. Halsnæs, B. Heij, S. Kahn Ribeiro, S. Kobayashi, M. D. Levine, D. L. Martino, O. Masera Cerutti, B. Metz, L. A. Meyer, G.J. Nabuurs, A. Najam, N. Nakicenovic, H. H. Rogner, J. Roy, J. Sathaye, R. Schock, P. Shukla, R. E. H. Sims, P. Smith, D. Tirpak, D. Urge-Vorsatz and Z. Dadi (2007). "Technical Summary", in: B. Metz, O. Davidson, P. R. Bosch, R. Dave and L. A. Meyer (eds) *Climate Change 2007: Mitigation. Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change.* Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

Benitez-Ponce, P.C., I. McCallum, M. Obersteiner and Y. Yamagata (2007). "Global Potential for Carbon Sequestration: Geographical Distribution, Country Risk and Policy Implications", *Ecological Economics* 60(3): 572-583.

Bouwman, A.F., T. Kram, and K. Klein Goldewijk, eds. (2006). *Integrated Modelling of Global Environmental Change. An Overview of IMAGE 2.4,* Netherlands Environmental Assessment Agency (MNP), Bilthoven.

Edmonds, J., L. Clarke, J. Lurz and M. Wise (2008), "Stabilizing CO2 concentrations with incomplete international cooperation", *Climate Policy*, 8:4, 355-376.

Eliasch, Johan. 2008. "*Climate Change. Financing Global Forests.*" The Eliasch Review, London: Earthscan.

European Commission (1996). *POLES 2.2.* European Commission DG XII, EUR 17358 EN, Brussels.

Fankhauser, S. (2009). "The costs of adaptation", *Wiley Interdisciplinary Review Climate Change*, forthcoming.

Fankhauser, S. and C. Hepburn (2009). *Carbon markets in space and time.* Background paper to the Lazerowicz Review, Vivid Economics, May.

Harmeling, S., C. Bals, W. Sterk and R. Watanabe (2009). *Funding Sources for International Climate Policy. A Criteria-based Analysis of the Options Discussed under the UNFCCC.* Briefing Paper, GermanWatch and Wuppertal Institute for Climate, Environment and Energy; www.germanwatch.org/klima/fundso09e.htm

Hoogzaad, J., A. Korthuis and C. Streck (2008). "A call to Reform", in: *Carbon Finance*, October 2008.

IETA. 2008. *State of the CDM 2008: Facilitating a Smooth Transition into a Mature Environmental Financing Mechanism.* International Emissions Trading Association, Geneva, Switzerland

Müller, B. (2008). *International Adaptation Finance: The Need for an Innovative and Strategic Approach.* Economic Working Paper 42, Oxford Institute for Energy Studies, Oxford, UK.

Parry, M. N. Arnell, P. Berry, D. Dodman, S. Fankhauser, C. Hope, S. Kovats, R. Nicholls, D. Satterthwaite, R. Tiffin and T. Wheeler (2009). *Evaluating the Costs of Adaptation to Climate Change. A critique of the UNFCCC estimates*, draft, Grantham Institute on Climate Change, Imperial College London, May.

Stern, N. (1987). "Optimal Taxation" in: *The New Palgrave: A Dictionary of Economics*, London: Macmillan.

Streck, C. and J. Lin (2008). "Making Markets Work: A Review of CDM Performance and the Need for Reform." *European Journal of International Law* 19 (2): 409-442.

Wara, M. (2007). "Is the Global Carbon Market Working?" *Nature* 445: 595-596.

Annex: Full set of results

1. High Supply – High Demand

Improved CDM and credits from REDD. No supplementarity restrictions on demand.

Table A1: 2 percent Tax Rate

$0.8 tax	Without Tax	With Tax	Change
Credit Price $/tCO2	41.5	41.8	1%
Quantity of CDM Credits Sold (Mt)	2517	2503	-1%
Government Tax Revenue ($M)	0	2002.5	
Change in Demander Surplus ($M)	0	753.1	
Change in Supplier Surplus $M	0	1257	
Deadweight Loss $M	0	7	

Table A2: 10 percent Tax Rate

$4.1 tax	Without Tax	With Tax	Change
Credit Price $/tCO2	41.5	42.8	3%
Quantity of CDM Credits Sold (Mt)	2517	2456	-2%
Government Tax Revenue ($M)	0	10068.5	
Change in Demander Surplus ($M)	0	3232.5	
Change in Supplier Surplus $M	0	6962	
Deadweight Loss $M	0	126	

2. High Supply – Low Demand

Improved CDM and credits from REDD. Supplementarity restrictions on demand.

Table A3: 2 percent Tax Rate

$0.2 tax	Without Tax	With Tax	Change
Credit Price $/tCO2	11.2	11.4	2%
Quantity of CDM Credits Sold (Mt)	1252	1252	0%
Government Tax Revenue ($M)	0	250.4	
Change in Demander Surplus ($M)	0	250.4	
Change in Supplier Surplus $M	0	0	
Deadweight Loss $M	0	0	

Table A4: 10 percent Tax Rate

$1.1 tax	Without Tax	With Tax	Change
Credit Price $/tCO2	11.2	12.3	10%
Quantity of CDM Credits Sold (Mt)	1252	1252	0%
Government Tax Revenue ($M)	0	1377.3	
Change in Demander Surplus ($M)	0	1377.3	
Change in Supplier Surplus $M	0	0	
Deadweight Loss $M	0	0	

3. Medium Supply – High Demand

Improved CDM but no credits from REDD. No supplementarity restrictions.

Table A5: 2 percent Tax Rate

$1 tax	Without Tax	With Tax	Change
Credit Price $/tCO2	52.4	52.7	1%
Quantity of CDM Credits Sold (Mt)	2038	2027	-1%
Government Tax Revenue ($M)	0	2026.6	
Change in Demander Surplus ($M)	0	609.7	
Change in Supplier Surplus $M	0	1424	
Deadweight Loss $M	0	7	

Table A6: 10 percent Tax Rate

$5.2 tax	Without Tax	With Tax	Change
Credit Price $/tCO2	52.4	53.9	3%
Quantity of CDM Credits Sold (Mt)	2038	1981	-3%
Government Tax Revenue ($M)	0	10298.9	
Change in Demander Surplus ($M)	0	3014.0	
Change in Supplier Surplus $M	0	7435	
Deadweight Loss $M	0	150	

4. Medium Supply – Low Demand

Improved CDM but no credits from REDD. Supplementarity restrictions on demand.

Table A7: 2 percent Tax Rate

$0.4 tax	Without Tax	With Tax	Change
Credit Price $/tCO2	21.8	22.2	2%
Quantity of CDM Credits Sold (Mt)	1252	1252	0%
Government Tax Revenue ($M)	0	500.8	
Change in Demander Surplus ($M)	0	500.8	
Change in Supplier Surplus $M	0	0	
Deadweight Loss $M	0	0	

Table A8: 10 percent Tax Rate

$2.2 tax	Without Tax	With Tax	Change
Credit Price $/tCO2	21.8	24	10%
Quantity of CDM Credits Sold (Mt)	1252	1252	0%
Government Tax Revenue ($M)	0	2754.6	
Change in Demander Surplus ($M)	0	2754.6	
Change in Supplier Surplus $M	0	0	
Deadweight Loss $M	0	0	

5. Low Supply – High Demand

No changes to the CDM from today. No supplementarity restrictions on demand.

Table A9: 2 percent Tax Rate

$1.3 tax	Without Tax	With Tax	Change
Credit Price $/tCO2	64.8	65.2	1%
Quantity of CDM Credits Sold (Mt)	1560	1545	-1%
Government Tax Revenue ($M)	0	2008.1	
Change in Demander Surplus ($M)	0	621.0	
Change in Supplier Surplus $M	0	1399	
Deadweight Loss $M	0	12	

Table A10: 10 percent Tax Rate

$6.5 tax	Without Tax	With Tax	Change
Credit Price $/tCO2	64.8	66.5	3%
Quantity of CDM Credits Sold (Mt)	1560	1495	-4%
Government Tax Revenue ($M)	0	9714.7	
Change in Demander Surplus ($M)	0	2596.5	
Change in Supplier Surplus $M	0	7331	
Deadweight Loss $M	0	213	

6. Low Supply – Low Demand

No changes to the CDM from today. Supplementarity restrictions on demand.

Table A11: 2 percent Tax Rate

$0.8 tax	Without Tax	With Tax	Change
Credit Price $/tCO2	40.3	40.9	1%
Quantity of CDM Credits Sold (Mt)	1246	1245	0%
Government Tax Revenue ($M)	0	995.6	
Change in Demander Surplus ($M)	0	747.3	
Change in Supplier Surplus $M	0	249	
Deadweight Loss $M	0	1	

Table A12: 10 percent Tax Rate

$4 tax	Without Tax	With Tax	Change
Credit Price $/tCO2	40.3	43.6	8%
Quantity of CDM Credits Sold (Mt)	1246	1236	-1%
Government Tax Revenue ($M)	0	4945.7	
Change in Demander Surplus ($M)	0	4096.6	
Change in Supplier Surplus $M	0	869	
Deadweight Loss $M	0	20	