Ensuring the Environmental Effectiveness of Linked Emissions Trading Schemes

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May, 2006

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Abstract

Linking emissions trading schemes allows the combined emissions target to be achieved at lower cost. Linking is usually environmentally neutral, but some design features can lead to poorer environmental performance if the schemes are linked. Changes to the relevant provisions can be implemented when the linkage agreement is negotiated. Environmental effectiveness also requires the administrators of the linked schemes to ensure that the stringency of the emissions cap, the accuracy of the emissions reported by affected sources, the integrity of the allowance registry, and the effectiveness of enforcement activity is maintained over time given future technological and administrative developments. This will require a process for agreeing on revisions to the regulations of the linked schemes, a mechanism to provide assurance of the environmental effectiveness of each of the linked schemes, and a procedure for terminating the linking agreement.

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[c] We would like to express our appreciation to Damien Meadows and Olivia Hartridge for their useful comments. Responsibility of all opinions and remaining errors is ours alone.

Ensuring the Environmental Effectiveness of Linked Emissions Trading Schemes

1. Introduction

Linking emissions trading schemes allows an affected source in any of the linked schemes to use allowances approved by the administrator of any of the linked schemes for compliance purposes.[1] In other words, the allowances of all of the linked schemes are equivalent for compliance purposes. Linking trading schemes allows the combined emissions target to be achieved at lower cost.

Environmental effectiveness requires the total emissions by all affected sources in the linked schemes to be less than the combined emissions target of the schemes for each compliance period. Linking emissions trading schemes can increase the level of non-compliance relative to independent operation and hence compromise environmental effectiveness. Non-compliance has the effect of increasing the supply of allowances, which reduces their price.[2] When schemes are linked the combined market is larger, so the price effect of a given level of non-compliance is smaller. Linking therefore increases the payoff for non-compliance, which raises the expected level of non-compliance.[3]

When negotiating a linking agreement, the administrators of participating schemes will therefore need to address the potential impact on environmental effectiveness. This paper discusses potential risks to environmental effectiveness when emissions trading schemes are linked and examines means to address those risks.[4] It does so in the context of greenhouse gas emissions trading schemes that might be linked to the European Union Emissions Trading Scheme (EU ETS), which has indicated a willingness to link with other schemes (European Commission, 2003 and 2004b).[5]

Issues are discussed in general terms because it is not known which schemes, if any, might link with the EU ETS. At present four schemes are operational – the United Kingdom, Chicago Climate Exchange, New South Wales, and Norway. Norway is expected to join the EU ETS by implementing the relevant directives under the provisions of the European Economic Area, so it will not raise any linking issues. The other schemes raise issues that might preclude linkage with the EU ETS.[6]

Possible greenhouse gas emissions trading schemes have been discussed in Australia (multi-state), Canada, Japan, New Zealand, Switzerland and the United States (multi-state and national). None of these potential schemes is sufficiently well developed to discuss possible linkage with the EU ETS in specific terms. None is expected to be operational before 2008.

Some provisions of a trading scheme can lead to poorer environmental performance if it is linked with other schemes. For example, if allowances have a limited life in one scheme and unlimited life in another, linking allows all of the limited life allowances to

be used for compliance whereas some might otherwise expire. Technical solutions are available to address almost all of those provisions.

Environmental risks associated with differences in the designs of the schemes can be addressed through changes to the relevant provisions when a linkage agreement is negotiated or by implementing other technical solutions when the schemes are linked. This could be difficult in practice. The design of each scheme will be influenced by its projected economic impact on the affected sources and other considerations. Changes to the design of a scheme to facilitate linkage may be resisted by some sources or other interest groups.[7]

But changing the provisions of the linked schemes is not sufficient to ensure the environmental effectiveness of those schemes for each compliance period. Environmental effectiveness also requires the administrators of the linked schemes to ensure that the stringency of the emissions cap, the accuracy of the emissions reported by affected sources, the integrity of the allowance registry, and the effectiveness of enforcement activity is maintained over time.

Technological, administrative and other changes can affect the stringency of the emissions cap, the accuracy of the emissions reported, the integrity of the allowance registry, and the effectiveness of enforcement. Technological change could increase the accuracy of monitoring systems and reduce the vulnerability of electronic registries to tampering, for example. Administrative changes, such as budget cuts, could reduce the effectiveness of enforcement activity in one of the linked schemes. Economic development could change the number of sources covered by each scheme.

Linked schemes may respond to, or be affected differently by, such changes. The administrator of one scheme might adopt the new monitoring or registry technology, while those of linked schemes do not. Administrative changes, such as budget cuts, affect specific schemes. Different responses by scheme administrators could affect the environmental effectiveness of the linked schemes. For example, increased non-compliance due to a budget cut for the administrator of one scheme can affect the environmental effectiveness of the linked schemes.

Mechanisms to maintain environmental effectiveness of linked schemes in the face of technological and administrative changes have not yet been discussed in the literature. That is the purpose of this paper. The next section discusses developments that could affect the environmental effectiveness of linked emissions trading schemes. Section three considers mechanisms to sustain the environmental effectiveness of the linked schemes over time. Conclusions are presented in section four.

2. Developments that Could Affect Environmental Effectiveness

Environmental effectiveness requires that every affected source accurately monitor and report its emissions covered by the scheme and remit valid allowances equal to its actual

emissions for each compliance period. The scheme administrator must verify the compliance of each affected source and impose the appropriate penalties on non-compliant sources.

As mentioned above, the environmental effectiveness of linked emissions trading schemes can be affected by differences in their designs and by administrative, technological and other developments. Over time technological, administrative and other developments can affect the stringency of the emissions cap, the accuracy of emissions monitoring and reporting, the integrity of the allowance registry, and the effectiveness of compliance enforcement.

Differences in Design

Haites and Mullins (2001) identifies a number of provisions where differences could lead to higher aggregate emissions if the schemes are linked. They include provisions such as the allowance lifetime, opt-in provision, non-compliance penalty, "safety valve" price[8], banking, borrowing, and internal restrictions on trading.[9] They conclude that technical solutions are available in almost all cases and that the greater the similarity of the design, the smaller the added environmental risk due to linking.

Baron and Bygrave (2002) concludes that linking schemes with absolute and relative (such as allowances per unit of output) caps can increase total emissions. They also note that complex accounting issues arise if schemes with upstream and downstream allocations are linked and fuels are traded between the two jurisdictions. They conclude that design solutions can minimize these concerns but they increase administrative costs.

Haites (2003) also concludes that it is technically possible to link national emissions trading schemes with widely divergent designs, but it is easier the greater the similarity of their designs. Blyth and Bosi (2004) concludes that linking is usually environmentally neutral, but some design features can lead to poorer environmental performance if the schemes are linked than if they remain separate. Technical solutions to protect the environmental effectiveness are usually available.

The literature on linking emissions trading schemes universally concludes that it is technically possible to link schemes with widely divergent designs, but linking schemes is easier if the designs are similar. The environmental risks associated with differences in the designs of the schemes often can be addressed through changes to the relevant provisions or adoption of technical solutions when a linkage agreement is negotiated. This may be difficult in practice, especially if the schemes are already operational.

Linking emissions trading schemes should enable the combined emissions cap to be achieved at lower cost, so there should be a net saving. However, there will also be winners and losers in each scheme. Linking will benefit the sellers in the scheme with lower prices prior to linking and the buyers in the scheme with higher prices prior to linking. Sellers in the scheme with higher prices prior to linking and buyers in the scheme with lower prices prior to linking will be worse off due to linking. Some affected

sources may be worse off due to linking despite the cost saving and so may resist a proposed link.

Developments Over Time – Stringency of the Emissions Cap

The population of affected sources in each scheme will change over time. Some existing sources will cease operation and new sources will be established. Such changes will make the existing caps more or less stringent over time. Technological change may lower the cost of reducing the emissions for some sources, making the existing caps financially less onerous. Scientific evidence and international negotiations could lead to agreements to lower the emissions caps.

In terms of maintaining environmental integrity it is sufficient that closures of existing sources in any of the linked schemes not lead to a situation where the emissions cap exceeds the "business as usual" emissions of the remaining sources. In the absence of linking, the surplus allowances in such a scheme would not be used. Linking allows the surplus allowances to be used by sources in the other schemes and so increases total emissions in such situations.

Changes to the emissions caps, source populations and emissions reduction technologies will affect the economic costs borne by the affected sources in the linked schemes. The administrators of the linked schemes probably will face pressure to ensure that economic burden is comparable for all sources in the linked schemes. This may require negotiations on changes to emissions caps and harmonization of allocations.

Developments Over Time – Monitoring and Reporting

Emissions trading schemes regulate total emissions during the compliance period. Emissions may be measured by devices designed for this purpose or be calculated from information such as the quantities of different types of fossil fuels used. Each scheme has regulations that specify the emissions to be measured, the monitoring systems to be installed to measure emissions and related data, such as fuel use by type, and how to calculate total emissions (see European Commission, 2004a, for example).

Typically, alternative devices are available to measure the emissions of a given source. The devices differ in terms of their cost, accuracy and reliability. Regulations typically require the largest sources to install the most accurate, and usually most costly, devices. For example, over 95% of the emissions in the US acid rain SO_2 program are monitored using continuous emissions monitors (CEMs), but only 36% of the affected sources are required to use CEMs to monitor their emissions.[10] The remaining 64% of affected sources use less costly monitoring methods.

In addition to specifying what type of monitoring devices each affected unit must install, the regulations cover matters such as the frequency with which the accuracy of the devices must be tested, adjustments to the data if a device is found to be inaccurate, and procedures to impute missing observations if the device is not operating. The regulations

often provide an incentive to affected sources to ensure the monitoring devices are operating accurately; an upward bias for missing observations and inaccurate data and more frequent tests for inaccurate devices.

Affected sources often are required to report data in addition to actual emissions, such fuel consumption by type and output produced. Such supplementary information can be used to help check the credibility of reported emissions. Affected sources usually resist proposals that require reporting supplementary data, especially if the data can become public. They dislike the extra administrative burden. And they are concerned that competitors may gain insights into their operation from data such as fuel consumption and output.

The EU ETS has a monitoring regulation that applies to the schemes implemented by the Member States (European Commission, 2004a). A greenhouse gas emissions trading scheme negotiating a link with the EU ETS will also have a monitoring regulation. It is not necessary that the monitoring regulations be identical. The monitoring devices installed by similar facilities could differ. The frequency of tests, adjustments for inaccurate or missing data, and supplementary data collected could differ.

However, it is essential that the administrator of each of the linked schemes believes the monitoring regulations of the other schemes provide equally accurate data on the emissions of affected sources. That might lead to harmonization of the respective monitoring regulations. Affected sources also may press the scheme administrators to harmonize the monitoring regulations to minimize competitive distortions due to differences in monitoring costs.

Over time monitoring technology will change. New types of monitoring devices may be developed. The accuracy or reliability of existing monitoring devices may improve. The relative costs of different monitoring devices will change. The administrators of the linked schemes will need to respond to such developments. They might allow the new devices as an option or make them mandatory for specified affected sources.

The administrators might respond in different ways and/or at different times. This should not matter as long as the administrator of each of the linked schemes considers the monitoring regulations of the other schemes satisfactory. However, the pressures for harmonization of the monitoring regulations will apply to changes in response to technological developments as well.

Agreement on the supplementary information to be collected and public access to reported data may prove more difficult to achieve. Supplementary information can be used to help check the credibility of reported emissions; emissions per unit of output or emissions relative to the carbon content of the fossil fuels consumed for example. Such checks can be used to help identify affected sources for compliance audits. Indirectly, then, the supplementary information contributes to environmental effectiveness.

As noted above, affected sources often resist proposals that require reporting additional data, especially if the data can become public. Legislation on access to government information differs across jurisdictions. So the administrator of one scheme might be able to keep the supplementary information confidential while the administrator of another scheme would be obligated to release such information. Such differences could lead to differences in the supplementary information collected by linked schemes and differences in the credibility checks that can be performed with possible consequences for environmental effectiveness.

Developments Over Time – Integrity of the Allowance Registry

The allowances of an emissions trading scheme exist only as entries in an electronic registry. Their integrity depends on the ability of the registry to correctly perform the necessary functions – creation, transfers, cancellation – and to withstand attempted tampering.

The EU ETS establishes requirements for the registries of participating schemes (European Commission, 2004c). Allowance transfers and other communications between participating registries are governed by the provisions of the Community Transaction Log. The Community Transaction Log is designed to be compatible with the International Transaction Log which will link national registries of Annex B parties to the Kyoto Protocol.[11]

A greenhouse gas emissions trading scheme negotiating a link with the EU ETS will have a registry. The scheme administrator may develop its own registry or purchase a commercially available registry. Or it may contract operation of the registry to an independent entity or the administrator of another scheme. If the scheme is in a country that is an Annex B party to the Kyoto Protocol and the scheme registry is also the national registry, it will need to be compatible with the International Transaction Log.

It is not necessary that linked schemes share a single registry or adopt the same registry software. However, the ability to transfer allowance easily between registries is essential for linked schemes. Thus any scheme that wishes to negotiate a link with the EU ETS will need to be compatible with the Community Transaction Log and probably the International Transaction Log. Commercially available registry systems have such compatibility so this is not an onerous requirement.

Over time the software and computer systems used by registries will change. This may lead to changes to the requirements for linking registries, such as the International and Community Transaction Logs. It is possible that those changes are backward compatible so that existing registries do not need to change. But the history of software suggests that at some point the existing registries will need to updated or replaced.

The need to protect the registries against tampering also suggests that they will need to be updated or replaced over time. Tampering with the records of allowances in any registry of the linked schemes affects the environmental effectiveness of all of the schemes. The

linked registries are only as secure as their weakest link. Thus, the linking agreement will need to specify what the requirements for the registries are and the process for changing those requirements over time.

Historically tampering with registries has not been a problem. An affected source intent on cheating probably would find it easier to under report its actual emissions. It also runs the risk that the fraudulent allowances created will be detected during compliance verification. Another person or entity would find it difficult to sell fraudulent allowances and avoid detection given that early schemes typically had fewer than 500 affected sources that are known to each other and the scheme administrator. But with over 10,000 affected sources in 25 countries and over 1 million allowances traded per day, successfully selling fraudulent allowances in the EU ETS may be easier than in earlier emissions trading schemes.

For budget or other reasons, the administrator of one scheme may be reluctant to update/replace its registry when the administrators or the other schemes believe such action is warranted. For example, updating/replacement might be resisted due to the cost or the impact it would have on the fees and/or profits of the operator if operation of the registry has been contracted to a private entity that recovers the cost through fees on transactions.[12] The linking agreement, therefore, will need to include a process for dealing with situations where the administrator of one scheme is reluctant to update/revise its registry.

Developments Over Time – Effective Enforcement

The administrator of each emissions trading scheme must enforce compliance by the affected sources. For each compliance period, the administrator must accept as accurate, or revise, the reported emissions and accept the allowances remitted to cover those emissions. If an affected source does not remit sufficient allowances, the relevant penalty must be imposed and collected.

In addition to verifying the reported emissions and ensuring that sufficient allowances are remitted, the administrator must enforce compliance with other requirements such as installation of suitable monitoring devices, testing of the monitoring devices as required, and meeting deadlines for reporting. Computer systems can help identify affected sources that are, or might be, out compliance with the different requirements. However, compliance enforcement requires staff.

The effectiveness of compliance enforcement for an emissions trading scheme can vary over time. Enforcement may become more effective as a larger body of data enables computer systems to more effectively target potential non-compliance. And as enforcement staff become more experienced, they also may be able to more effectively detect non-compliance. Enforcement may become less effective due to staff reductions or turnover. Erosion of the value of penalties due to inflation and legal decisions partially favoring affected sources could also reduce enforcement effectiveness.

Developments that affect effective enforcement are mostly unique to a given emissions trading scheme. Thus when emissions trading schemes are linked, the relative enforcement effectiveness for the schemes will change over time. This is inevitable and should not matter as long as the administrator of each of the linked schemes considers the penalties and enforcement efforts of the other schemes to be satisfactory. Changes to the enforcement effort are likely to be a bigger concern than the penalties.[13]

The enforcement effort of a scheme could deteriorate to the point that non-compliance by some affected sources is not detected or penalized. This situation could also arise due to corruption. Then maintaining the link could lead to higher non-compliance because excess emissions have a smaller impact on the allowance price, so the payoff for non-compliance is higher. If the enforcement effort of a scheme deteriorates to such a point, it must be corrected or the other schemes must terminate the link.

Schemes Linked via the Kyoto Protocol

Emissions trading schemes for greenhouse gases in Annex B parties can be linked directly or indirectly. A direct link means that an affected source in any of the schemes can use allowances approved by the administrator of any of the linked schemes for compliance. During 2008-2012 each allowance transferred from a scheme would need to be (accompanied by) a Kyoto unit.[14] An indirect link means that the administrator of a scheme freely exchanges an allowance for a Kyoto unit. If the administrators of two or more schemes allow such exchanges, the schemes are effectively linked.[15]

An indirect link does not require the scheme administrators to negotiate a linking agreement. Each national government assumes responsibility for the environmental effectiveness of the emissions trading scheme in its country. The emissions limitation commitment the national government has as an Annex B party to the Kyoto Protocol provides an incentive to ensure the environmental effectiveness of the emissions trading scheme.

The incentive on the part of the national government of an Annex B party to ensure the environmental effectiveness of linked schemes is the same if the schemes are linked directly by a linking agreement.

In either case, the incentive created by the Kyoto Protocol commitment is limited in several ways. It applies only if all of the linked schemes are in Annex B parties. The national government of an Annex B party might refuse to transfer Kyoto units under a linking agreement between a scheme established by a state or provincial government and the EU ETS. The Kyoto Protocol commitments apply only to 2008-2012 period and future international agreements might not have similar mechanisms. Finally, the incentive is not very strong if the national government does not treat the consequences of non-compliance seriously.[16] In short, the Kyoto Protocol commitment creates a useful incentive, but it may not be sufficient and it may not apply to all linked schemes.

3. Mechanisms to Sustain the Environmental Effectiveness of Linked Schemes

Clearly, developments that can affect the environmental effectiveness of linked schemes are inevitable over time. Some developments, such as monitoring technology and registry software, will apply to all of the linked schemes. Other developments, such as a reduction in the administrative staff and changes to the population of affected sources, are unique to individual schemes.

The consequences of some developments for environmental effectiveness, such as changes to monitoring technology, may be minimal. While the consequences for other developments, such as serious deterioration of the enforcement effort in a scheme, could have a significant impact on environmental effectiveness.

Clearly, some mechanism is needed to sustain the environmental effectiveness of the linked schemes over time. At least three components appear to be desirable:

- A process for agreeing on revisions to the regulations of the linked schemes;
- A mechanism to provide assurance of the environmental effectiveness of each of the linked schemes; and
- A procedure for terminating the linking agreement.

Revisions to Regulations

Every scheme will need to revise its regulations periodically in response to technological and other developments. The linking agreement should include a provision for regular meetings of the scheme administrators to discuss possible changes to their respective regulations. The administrators might meet annually or in response to specific events, such as a proposal by one of the linked schemes to link with a third scheme. The regulations might be revised at intervals of three to five years.

Possible changes could be triggered by operating experience, a desire to harmonize the regulations of the linked schemes, technological change, or other developments. The administrators could decide that all of the linked schemes should implement the same change. Or they could agree to different changes for different schemes if the impact on the efficiency and effectiveness of the trading schemes is likely to be small.

Substantial changes to the population of affected sources and proposed changes to the emissions caps may be the most difficult to resolve. The administrator of each scheme has an incentive to negotiate smaller reductions to its cap that those accepted by the linked schemes. Then the affected units in its scheme become net sellers. Since the administrator of each of the linked schemes has the same incentive negotiating mutually acceptable changes to the caps may be difficult.

Assurance of Environmental Effectiveness

Similar regulations are not sufficient to ensure the environmental effectiveness of each of the linked schemes. A separate incentive to ensure environmental effectiveness, such as

the national commitments of Annex B parties under the Kyoto Protocol, might be considered sufficient. A provision for external verification is another means of ensuring environmental effectiveness.

As discussed above, the emissions limitation commitment of an Annex B party to the Kyoto Protocol provides an incentive to the national government to ensure the environmental effectiveness of the emissions trading scheme. Although the Kyoto Protocol commitment creates a useful incentive, it may not be sufficient and it may not apply to all linked schemes.

External verification of the compliance assessment performed by each of the linked schemes is another way to ensure environmental effectiveness. External verification could be implemented in various ways. One option is third party expert reviews of the compliance assessment of the linked schemes analogous to the expert reviews of national communications under the UNFCCC and IEA reviews of member country energy policies. Reviews at three to five year intervals, and after major administrative changes, would probably be sufficient.

Another option is to have enforcement staff from one scheme participate in the compliance assessment of a sample of affected units in another scheme. In this way some staff from each scheme would be involved in the compliance assessment of another scheme. The staff involved and the affected units selected would change over time. This option would transfer expertise among the linked schemes and enable each scheme to judge the environmental effectiveness of the other schemes.

Termination of the Linking Agreement

Provisions to terminate a linking agreement in certain circumstances are an important enforcement mechanism with regard to revisions to a scheme or changes in its environmental effectiveness.[17] A linking agreement could require the administrator of each scheme to notify the other schemes of (significant) changes to its scheme at least six months before they come into effect. If the administrators of the other schemes accept the changes, the linking agreement remains in force. If an administrator of a linked scheme did not find the changes acceptable it could terminate the agreement. Unresolved concerns about the environmental effectiveness of a scheme also could be grounds for a linked scheme to terminate the agreement.

After termination neither scheme will accept allowances issued by the other for compliance purposes. As a transition, each scheme should accept allowances from linked schemes for compliance until the agreement ends or some other agreed date. This might be limited to the units they hold on the date the termination is announced.[18] Owners of allowances also should be able to establish an account in, and transfer their units to, the issuing registry for later sale.[19] Thus the owner of allowances issued by a linked scheme could use them for compliance, sell them before the agreement is terminated, or transfer them to the issuing registry for later sale.

For example, if a linking agreement between the EU ETS and another scheme is terminated effective 31 December 2011, installations in the EU ETS could use allowances from the linked scheme with vintages through 2011 for compliance. The owner of any allowances issued by the linked scheme could establish an account in its registry and transfer the units to that account.[20] The linked scheme would implement similar arrangements.

4. Conclusions

Linking emissions trading schemes allows the combined emissions target to be achieved at lower cost. Linking is usually environmentally neutral, but some design features can lead to poorer environmental performance if the schemes are linked than if they remain separate. The environmental risks associated with differences in the designs of the schemes can often be addressed through changes to the relevant provisions when the linkage agreement is negotiated.

But changing the provisions of the linked schemes is not sufficient to ensure the environmental effectiveness of the linked schemes for each compliance period over time. Environmental effectiveness also requires the administrators of the linked schemes to ensure that the stringency of the emissions cap, the accuracy of the emissions reported by affected sources, the integrity of the allowance registry, and the effectiveness of enforcement activity is maintained.

Technological, administrative and other changes can affect the stringency of the emissions cap, the accuracy of the emissions reported, the integrity of the allowances, and the effectiveness of enforcement over time. Some developments, such as monitoring technology and registry software, will apply to all of the linked schemes. Other developments, such as a change in the population of affected sources or reduction in the administrative staff, are unique to individual schemes. Some developments, such as serious deterioration of the enforcement effort in a scheme, could have a significant impact on environmental effectiveness while others, such as changes to monitoring technology, may have a minimal impact.

To sustain the environmental effectiveness of the linked schemes over time will require:

- A process for agreeing on revisions to the regulations of the linked schemes, such as an annual meeting of the scheme administrators with implementation of agreed revisions to the regulations at intervals of three to five years;
- A mechanism to provide assurance of the environmental effectiveness of each of the linked schemes, such as external verification of the compliance assessment performed by each of the linked schemes or reliance on the incentive provided by the emissions limitation commitments of Annex B parties to the Kyoto Protocol; and
- A procedure enabling either party to terminate the linking agreement with reasonable notice. The main transition issues are deciding which allowances from the other scheme can be used for compliance after the termination notice is given and moving the unused allowances into the registry of the scheme that issued them.

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Notes

[1] In this paper "allowance" includes credits issued for emission reduction projects that are accepted by the scheme administrator for compliance.

[2] Non-compliance by some sources does not necessarily mean aggregate emissions exceed the emissions cap because other sources may hold surplus allowances.

[3] An affected unit concerned only with maximizing profits would incur emission reduction costs, including the net cost of allowance purchases and sale, only if they were lower than the expected cost of non-compliance. The expected cost of non-compliance is the non-compliance penalty multiplied by the probability of non-compliance being detected. Affected sources do not know the probability of non-compliance being detected, so they can not make this calculation accurately. Firms also are concerned about the effect of non-compliance on their reputation. As a result compliance tends to be high in practice. Nevertheless a larger payoff for non-compliance would be expected to lead to more non-compliance.

[4] Unilateral links are ignored in this paper. A unilateral link is established when the administrator of one scheme allows affected units to use allowances from another scheme for compliance, but the arrangement is not reciprocal. The administrator of each scheme remains responsible for the environmental integrity of its scheme.

[5] The Directive establishing the EU ETS states that "agreements should be concluded with third countries listed in Annex B to the Kyoto Protocol which have ratified the Protocol to provide for the mutual recognition of allowances between the Community scheme and other greenhouse gas emissions trading schemes" (European Commission, 2003, Article 25). And the Linking Directive states that "following entry into force of the Kyoto Protocol, the Commission should examine, whether it could be possible to conclude agreements with countries listed in Annex B to the Kyoto Protocol which have yet to ratify it, to provide for the recognition of allowances between the Community scheme and mandatory greenhouse gas emissions trading schemes capping absolute emissions established within those countries" (European Commission, 2004b, Article 18).

[6] The treatment of emissions by electricity generators raises problems for a link with the UK scheme. The Chicago Climate Exchange is a voluntary scheme mainly for corporations in a country that has not ratified the Kyoto Protocol, with some potential overlap with the EU ETS. The NSW GHG abatement scheme is operated by a state government in a country that has not ratified the Kyoto Protocol.

[7] As discussed below, linking established schemes creates winners and losers in each scheme.

[8] A safety valve price is a price established in advance by a scheme administrator at which it will sell allowances in excess of the emissions target to enable affected units to achieve compliance. A non-compliance penalty defined strictly in financial terms poses a similar risk.

[9] If allowances have a limited life in one scheme and unlimited life in another, linking allows all of the limited life allowances to be used for compliance whereas some might otherwise expire. If the opt-in provision provides some sources with an allocation that exceeds their business-as-usual emissions, more sources could choose to opt-in if linking raises the allowance price. If the non-compliance penalty is strictly a financial penalty, linking could lead to higher total emissions if it raises the allowance price above the penalty. Similarly a "safety valve" price could lead to higher total emissions if linking raises the allowance price above this price. If one scheme restricts allowance banking while another does not, linking could allow the restriction to be circumvented possibly leading to higher total emissions. If borrowing is allowed by one scheme but not another, linking could encourage more borrowing and an increased risk that some of the borrowed allowances will not be repaid. Linking may enable an internal restriction on trading, such as the gateway in the UK scheme, to be circumvented possibly increasing total emissions.

[10] Despite the name, continuous emissions monitors do not monitor emissions continuously. Rather they are designed to operate virtually continuously and to take frequent, every 15 minutes, readings.

[11] Annex B parties are countries that have ratified the Kyoto Protocol and have an emissions limitation commitment for 2008-2012 listed in Annex B of the Protocol. Each Annex B party must establish a national registry to track holdings of Kyoto units by the government and legal entities of the country. Transfers of Kyoto units between national registries are governed by the International Transaction Log.

[12] Linking will create pressure to harmonize provisions such as registry fees. If the fees of the different registries are not the same, traders will open accounts and complete their transactions in the registry with the lower fees. They will only use the higher cost registry for transactions that can not be avoided there, such as retirement of allowances to achieve compliance.

[13] The adequacy of non-compliance penalties will be addressed when the linking agreement is negotiated by the scheme administrators. Often a penalty will include surrender of one or more allowances and a financial payment for each ton of excess emissions. In the EU ETS the penalty is loss of an allowance plus €40 (€100 starting in 2008). Such a penalty means that it is always less costly to buy the allowances needed for compliance. The financial component would not need to be identical for the linked schemes to be effective. Penalties for other forms of non-compliance, such as late submission of emissions reports, are often strictly financial penalties. Again the levels need not be harmonized as long as they are sufficient to deter non-compliance.

[14] Kyoto units are units the Annex B party can use to establish compliance with its emissions limitation commitment – assigned amount units (AAUs), certified emission reductions (CERs), emission reduction units (ERUs) and removal units (RMUs).

[15] An entity that owns an allowance issued by scheme A with a compliance obligation in scheme B can exchange the allowance for a Kyoto unit. The administrator of scheme B exchanges the Kyoto unit for one of its allowances, which can be used for compliance. In effect the scheme A allowance has been used for compliance in scheme B.

[16] An Annex B party that does not hold sufficient allowances to cover its emissions could lose 1.3 AAUs from its allocation for the next period (which has yet to be negotiated) for each tonne of excess emissions.

[17] The December 2005 Memorandum of Understanding for the Regional Greenhouse Gas Initiative (RGGI) states that "A Signatory State may, upon 30 days written notice, withdraw its agreement to this MOU and become a Non-Signatory State. In this event, the remaining Signatory States would execute measures to appropriately adjust allowance usage to account for the corresponding subtraction of units from the Program."

[18] This might be desirable if there is a large bank of allowances issued by the linked scheme in its registry. That would prevent the banked allowances from being used for compliance before the linking agreement is terminated.

[19] The owner does not have a compliance obligation in the linked scheme, so this simply provides flexibility in the timing of the sale.

[20] Allowances with 2012 or later vintages would need to be transferred since they could not be used for compliance in the EU ETS. But owners of 2011 of earlier vintage allowances could transfer them as well.