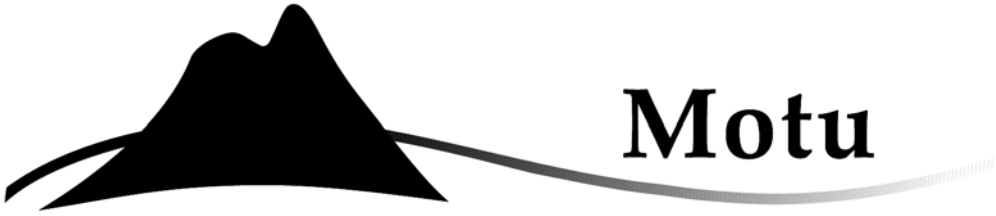

JOINT IMPLEMENTATION IN CLIMATE CHANGE POLICY

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ABSTRACT

The textbook economists' model of a tradable permit system cannot usually be applied perfectly at either the domestic or international scale because of the difficulty and/or expense of defining allocations to and monitoring emissions of some groups, as well as for political reasons. It may be impossible to bring these groups fully into a tradeable permit system but it is often possible to find compromise solutions to gain some benefits from trade. This paper explores this problem in the context of the Joint Implementation mechanism associated with the Kyoto Protocol. This paper starts by outlining the current international rules governing Joint Implementation. We provide a summary of key jargon for those who are unfamiliar with the complex Kyoto language. We then discuss two key international issues that are still unresolved: baseline development and monitoring. We then turn to domestic governance of Joint Implementation and how the private sector might engage in Joint Implementation. At this point we consider how Joint Implementation fits within the suite of Kyoto flexibility mechanisms, why sellers and buyers might choose to engage in each, and how the different mechanisms might interact in the market for tradeable units. We conclude with some thoughts about productive directions for future research.

JEL Classification: Q25, Q28

Keywords: Climate, Joint Implementation, tradeable permits, emissions trading

1 INTRODUCTION

The textbook economists' model of a tradable permit system cannot usually be applied perfectly at either the domestic or international scale because of the difficulty and/or expense of defining allocations to and monitoring emissions of some groups, as well as for political reasons.[2] It may be impossible to bring these groups fully into a tradeable permit system but it is often possible to find compromise solutions to gain some benefits from trade: lower costs of achieving the environmental outcome, greater engagement of actors in the overall process, and greater equity by allowing all groups to gain some benefit. A variety of compromise trading models suit different circumstances.

The Kyoto Protocol limits greenhouse gas emissions in the Annex B[3] (developed) countries that ratify it. To reduce the costs of achieving the overall emission limits, three trading mechanisms are available: International Emissions Trading; Joint Implementation; and the Clean Development Mechanism. They all ultimately transfer units that can be used for compliance but they are available to different groups in different time periods and have different rules.[4] The two key distinctions are first, between Annex B (developed countries) and non-Annex B (developing countries), and second, based on the quality of domestic emissions monitoring. Only countries that have ratified Kyoto can participate. Under all mechanisms, trading can be carried out either by the government, or by legal entities (companies or individuals) where the government devolves this authority. The government remains ultimately responsible for compliance.

International Emissions Trading (IET) is the simplest form of emissions trading where assigned amount units (AAUs) are simply moved from the registry of one Annex

[2] For example in the New Zealand fisheries' Individual Transferrable Quota market, recreational fishers are not included directly but do share the total allowable catch. In the US nitrous oxide program, large stationary sources are generally included in the state level trading programs but other sources can opt in.

[3] Parties assuming quantified emission reduction or limitation commitments under the Kyoto Protocol are identified in Annex B of the Protocol. These are the same as Annex I countries so we use the terms interchangeably.

[4] The different tradeable units are assigned amount units (AAUs) that are allocated to all Annex B states, emission reduction units (ERUs) created in Joint Implementation, certified emission reductions (CERs) created through the Clean Development Mechanism and removal units (RMUs) that are created through land use change in Annex B countries. For convenience in this paper we refer to the group as 'units'. We also use the term 'credit' to refer to units created through JI or CDM projects or through domestic projects.

B country to another.[5] This is available from 2008 onward. Countries that sell using this mechanism must have shown that they have adequate monitoring and enforcement of emissions (compliance with Articles 5 and 7[6]) so that sales reflect real reductions in emissions.

Joint Implementation (JI) is available to all Annex B countries. It is a project-based mechanism where reductions are established by comparison with an estimated 'baseline' (what would have happened without the project) rather than relative to the national emission limits set in Kyoto. Emission reduction units (ERUs) can be created from 2008 onward.[7] It does not require good national level monitoring. It has high transaction costs because all projects must be internationally approved.[8] Thus the main sellers should be countries that cannot engage in IET because their monitoring is inadequate. This is likely to be primarily economies in transition.

The Clean Development Mechanism (CDM) is available to sellers from developing countries only. The sources of emission reductions are somewhat limited (especially with regard to land use emissions). Like JI, it is project based and each trade requires international approval. In this case approval is needed because the seller countries do not face emissions limits so reductions can be measured only relative to agreed project baselines. Certified emission reductions (CERs) can be created from 2000 onward for use after 2008.

Thus JI fills a specific niche in the international greenhouse gas trading market. It has a range of benefits for both buyers and sellers. JI allows Parties that lag in developing their domestic climate institutions, and hence cannot participate in IET, to host projects and receive the benefits from trade. We focus most on these Parties. They

[5] For detailed discussion of international emissions trading see Kerr ed. (2000).
[6] For discussion of the monitoring and enforcement requirements involved in Articles 5 and 7 see Hargrave et al (2000).
[7] Decision 16/CP.7 of the Marrakesh Accords clearly establishes that JI projects can start as early as 2000, but that ERUs can be issued only for a crediting period starting after the beginning of 2008.
[8] The high transaction costs may be only in Track II JI – see below. Throughout this paper, and in contrast to some international discussion, transaction costs are simply the cost per transaction or trade. They do not include the fixed costs of creating regulatory infrastructure either domestically or internationally. They also do not include the real cost of reducing emissions.

need to use a particular form of JI, called 'Track II'.[9] In contrast, Track I JI is very similar to IET so we cover it only briefly.

Under JI, selling entities, those who reduce emissions, can make profit if they sell the ERUs for more than it cost to create them. These include receiving credit; technology transfer and learning if the buyer is actively involved in the project; and learning more broadly about how trading programs work, which will help them in future. Selling countries economically benefit if their companies engage in environmentally sound, profitable sales. In addition, some projects will help develop monitoring infrastructure, such as databases, that will facilitate the seller country's move toward the more efficient trading mechanism IET. For example, many countries may not have accurate data for national coal use, which is essential for estimating national emissions. The organisers of a JI project that covers the major coal users may collect data that help address this gap. The technology transfer and learning embedded in JI projects may help move the country from a high emissions path toward a less greenhouse gas (GHG) intensive path, which will make compliance with future targets easier. This is an issue of particular concern to some Annex B countries with transitional economies that may have difficulty satisfying the international monitoring requirements, Articles 5 and 7, by 2008.

JI is not an 'aid' program. The buyers primarily participate because they gain benefits from the lower AAU prices. The option of JI also offers investors security that they can acquire ERUs even if the seller or 'host' Party fails to meet its Article 5 and 7 requirements. They also might gain ancillary commercial benefits. A JI project might give a company the chance to form a joint venture with a company in a country in transition by reducing undue regulatory barriers. This can provide learning opportunities and market access. Countries whose companies buy ERUs gain direct benefit because their companies comply at lower cost and expand their market opportunities. They might also gain in the longer term from better access to AAUs from those countries through established relationships, and from better monitoring systems, which will make those countries more effective partners in global cooperation on climate change. Countries that are neighbors of economies in transition with serious local air pollution problems could

[9] We discuss why Parties would end up using Track II JI in section 5.1.1.

gain through reduced air pollution if the emissions reductions are associated with generally cleaner production. The European Union could benefit from JI because it could help the accession countries meet the European Union's environmental standards.

The situation with Joint Implementation (JI) is similar to that which arises with offsets from small sources within larger trading systems or voluntary opt-in procedures for extra sources. For example in the US Acid Rain program electric utilities were brought into the program in two phases but second phase utilities were able to opt in to the first phase if they chose.[10] JI probably won't be a major mechanism for long (if Kyoto is a success) because it is costly and environmentally more risky than IET with good national monitoring. Studying it is still useful however, as it will probably be important up until 2012 and even 2017, and it will offer lessons for the Clean Development Mechanism and for domestic programs where coverage is not comprehensive.

Key 'Kyoto' Jargon for the uninitiated

Annex I (B) countries:	Developed countries that have signed the Protocol and agreed to meet emission targets.
COP/MOP:	Conference of the Parties / Meeting of the Parties. The international decision-making bodies.
Article 3:	Specifies that Annex I countries must meet emission reduction targets.
Article 6:	Creates Joint Implementation
Articles 5 and 7:	Specify the monitoring requirements that Annex I countries must satisfy before they can participate in international emissions trading.
IET:	International emissions trading
JI:	Joint Implementation
Track II JI:	The mechanism for Joint implementation when the selling country has not satisfied Articles 5 and 7
AAUs:	Assigned Amount Units – their initial allocation is defined by the Article 3 targets
ERUs:	Tradeable emission reduction units created through Joint Implementation
PDD:	Project Design Document. This is required for Track II JI.
AIE:	Accredited Independent Entities.

[10] For discussion of the experience with this phase in and with the Acid Rain program more generally see Ellerman et al (2000).

1.1 What literature is already available on JI?

Many articles have been written on various aspects of JI. We do not attempt a complete literature survey but provide some key general references that will facilitate further exploration. Literature on specific issues that we cover later is discussed in that context.

A series of excellent early papers present the basic issues in JI and how it links to other forms of international trading. These include Tietenberg et al (1998), Mullins and Baron (1997), Nentjes (1994), Ridley (1998), and Hanafi (1998). Jepma (1995) is an edited volume with a wide range of perspectives on JI, which in 1995 still covered trade with both developed and developing countries. Zhang and Nentjes (1999), Bohm (1994) and Woerdman (2000) compare JI with a broader trading system such as IET. Kelly and Leining (2000) compares the institutions needed for JI relative to CDM. Parkinson et al (1999) consider the implications of 'interim period banking', or credit for reductions pre-2008 in both CDM and JI. Bailey and Jackson (1999) and OECD/IEA/IETA (2002) consider issues specific to dealing with economies in transition.

In this chapter we do not touch on the issue of the potential contribution of JI in terms of emissions reductions or its costs. Most models of global trading can contribute some evidence on the potential reductions from JI simply by considering Eastern Europe as a region. See for example various results from the Energy Modeling Forum.[11] Bohm and Carlén (1999) report laboratory experiments on JI trading that shed light on how actual gains might differ from potential gains. Institutions whose contributions are well worth exploring are the OECD, the International Energy Agency and the Center for Clean Air Policy.[12]

1.2 What is the history of JI and how does that affect its future?

JI began as a part of Activities Implemented Jointly (AIJ), a pilot program established in Berlin in 1995. AIJ covered both developed and developing countries (now covered by the CDM). The pilot phase provided no credit for emissions reductions

[11] For example, see Weyant (1999).
[12] Other sources are identified at : http://unfccc.int/program/coop/aij/wwwbib.html though this is a bit dated now.

but it had some real value. A lot of thinking was done about how to define the rules for trading. It introduced the idea of trading to many groups who had never considered it before so built a community of interest. As a result of the projects we learned some lessons about monitoring emissions, defining baselines and setting up contracts between very different countries with different cultures and institutions. Many projects illustrated the risks involved in what are complex projects with sometimes unreliable or unskillful partners.

On the other hand the pilot phase might have had some negative effects. There was a lot of hype about the potential benefits from involvement but many of the people who did get involved learned to their dismay that after considerable investment in project design there were few buyers and very low prices. Some proponents did not seem to fully appreciate that there would only be significant demand for credits when emissions limitations were enforced and the credits could be used to satisfy those limitations. Negative experience with low prices may reduce sellers' future enthusiasm.

Second, the nature of the projects and the players were probably not representative of the types of projects we might expect when real money is involved after 2008. The projects tended to be small so methodologies were designed that were suitable for small projects rather than tackling larger sectoral projects. The methodological issues in these two cases are very different but larger projects may well be more effective and efficient in many countries. Buyers were involved for either public relations or altruistic reasons or because they were interested in learning. This meant that they were not as concerned about commercial aspects so there were fewer incentives to cheat the system. Thus important lessons about strategic behavior could not be learned.

Because there was no credit from these programs there was also limited regulation. This led to widely varying methodologies and widely varying levels of environmental integrity; i.e. some projects did not lead to as many real reductions as they generated emission credits. The projects with poor environmental outcomes might have increased the skepticism of some environmental groups that oppose trading.

The UNFCCC site provides a lot of information about the pilot phase of Activities Implemented Jointly and specific projects developed within it.[13] None of these project created credits and many were in developing countries so not relevant to JI but the list gives a flavor for the type and size of projects that people have experimented with so far. It also gives a clear simple outline of the key issues in project definition; although this was written around 1997 these remain the key issues for JI. They provide a list of references that provide an entry point into the extensive grey literature.

Two major mechanisms have recently been set up to facilitate Joint Implementation post 2008: a buyer program, the Dutch ERUPT program,[14] and an international agency program, the Prototype Carbon Fund run as a public/private partnership by the World Bank.[15] ERUPT is particularly focused on energy related projects in Central and Eastern Europe. The Dutch government provides the funds and seeks emission reduction projects through a tendering process. The Prototype Carbon Fund has been established to demonstrate how JI (and CDM) projects can contribute to sustainable development. They are an active market creator, and are dedicated to capacity building and sharing information. No projects have been internationally approved to date.

This paper starts outlining the current international rules governing Joint Implementation. We provide a summary of key jargon for those who are unfamiliar with the complex Kyoto language. We then discuss two key international issues that are still unresolved: baseline development and monitoring. We then turn to domestic governance of Joint Implementation and how the private sector might engage in JI. At this point we consider how Joint Implementation fits within the suite of flexibility mechanisms, why sellers and buyers might choose to engage in each, and how the different mechanisms might interact in the market for tradeable units. We conclude with some thoughts about productive directions for future research.

[13] (unfccc.int/program/coop/aij/)
[14] For details see www.senter.nl/asp/page.asp?id=i000000&alias=erupt
[15] For details see prototypecarbonfund.org.

2 CURRENT INTERNATIONAL FRAMEWORK

2.1 International Governance of Joint Implementation

In the 1997 Kyoto Protocol, Article 6 creates the mechanism of Joint Implementation (JI). This Article enables Annex B Parties to meet a portion of their Article 3 emission reduction or limitation commitments by transferring or acquiring emission reduction units (ERUs) generated in projects in Annex B countries that reduce anthropogenic emissions by sources or enhance anthropogenic removals by sinks.

In the 2002 Marrakesh Accords, two decisions advanced the development of JI. Decision 15/CP.7 reinforces three important principles governing JI. First, Annex I country purchases of JI credits must be in addition to their own efforts to reduce emissions rather than simply replacing them; this is known as 'supplementarity'. Second, JI must maintain the environmental integrity of the Kyoto Protocol, i.e. JI trades must not lead to higher global emissions. Third, trade in ERUs does not alter commitments in Annex B.[16]

Decision 16/CP.7 creates detailed draft guidelines for implementing JI. These guidelines are provided as recommendations to the COP/MOP. If they are accepted, through a decision at the first meeting of the COP/MOP following entry into force of the Kyoto Protocol, they will become final. The next section presents an overview of these recommendations: the governing institutions for JI; the project eligibility and participant requirements; and the ERU verification, issuance, and carry-over procedures.

2.1.1 Governing Institutions

Under Decision 16/CP.7 the ultimate governing authority for JI is the *COP/MOP*, which has the role of developing the rules, modalities and guidelines for implementation. The COP/MOP also appoints and oversees the Article 6 Supervisory Committee (see below).

[16] This is included because if future negotiations are conducted in terms of reductions from current Annex B commitments, which is not unlikely, and those commitments could be altered through trade, countries who sell credits would end up with lower future allocations of credits. This could deter trade.

Both buyer and seller (host) Parties must designate a. The focal point of the host Party must confirm that a JI project assists the host country in achieving sustainable development.[17] When the host country is in full compliance with its Article 5 and 7 requirements as well as the recording of its assigned amount and its commitment period reserve, the host has the authority to verify and issue ERUs. [18]

When the host Party is not in full compliance, it can issue ERUs only after the Article 6 Supervisory Committee has verified them.[19] This committee manages the accreditation of Independent Entities (see below), and can recommend the format of the Article 6 *Project Design Document* (PDD) as well as revisions to the guidelines and criteria for baselines and monitoring.

Accredited Independent Entities (AIEs) are legal entities that fulfill a list of operational and competency requirements laid out in Appendix A to the decision. AIEs are tasked with reviewing the PDD prepared by project participants, making it available for public comment, determining project eligibility, reviewing the monitoring report, and giving recommendations on verifying ERUs.[20],[21]

2.1.2 Eligibility of projects and participants

JI project activities essentially are bound by the same limitations imposed on domestic activities under Article 3 and hence IET (e.g., they are restricted to the gases,

[17] This does not really have any bite. The essential thing is that the seller country can control approval of sales. Beyond that, if they do not care about sustainable development there is no mechanism to make sure that they require it. It is also not clear why the buyer country should need to approve the international trade. The buyer government has complete control over how ERUs are used by companies for compliance with any domestic regulation they impose. If companies want to buy ERUs that cannot be used for domestic compliance, why stop them?

[18] The commitment period reserve is the requirement that each Annex B Party must maintain in its national registry either 90 percent of its assigned amount or 100 percent of five times its most recently reviewed inventory, whichever is lower. The commitment period reserve is intended to guard against overselling by Annex B Parties.

[19] The Supervisory Committee has ten members: three from Annex I Parties with transitional economies, three from other Annex I Parties, three from non-Annex I Parties, and one representing the Small Island Developing States. Decisions are made by consensus when possible, and otherwise by a three-fourths majority of present and voting members.

[20] Unless someone (Party in the project or 3 members of the Supervisory Committee (SC)) raises an objection, then the AIE judgment is automatically accepted by the SC. If not, then the SC conducts a review.

[21] The *UNFCCC Secretariat* conducts administrative duties. It records the designated focal points for Annex I Parties, maintains the lists of Annex I Parties eligible to participate in JI and AIEs, manages public comments on PDDs, and reports the approval of PDDs and the verification of ERUs by AIEs.

sectors and source categories listed in Annex A of the Protocol as well as the source and sink categories defined in Articles 3.3 and 3.4).[22] Decision 16/CP.7 of the Marrakesh Accords, states that Annex I Parties are to "refrain" from using ERUs from nuclear facilities to meet their commitments. This is not really enforceable in IET because AAUs are fungible, but it does restrict JI.

All JI projects must satisfy three criteria: they must have the approval of the Parties involved; the reductions in emissions by sources or enhancement of removals by sinks must be "additional to any that would otherwise occur; the acquisition of ERUs must be supplemental to domestic actions by Annex I Parties for meeting the Article 3 commitments."

Article 6 enables Annex I countries to authorize their legal entities to engage in generating, transferring or acquiring ERUs.[23] The ultimate burden of compliance with the Protocol requirements stays with the national government of the Annex I Party.

2.1.3 ERU Verification, Issuance, and Carry-Over Procedures

The Marrakesh Accords create a two-track procedure for verifying ERUs as follows[24]:

Track I: The first track applies to host Parties that are in compliance with their Article 5 and 7 requirements for national inventories, national registries, and reporting. These Parties can verify and issue ERUs with no international oversight. This self-verification does not undermine the environmental integrity of the Protocol because any over-crediting of JI project activities by the host Party will be reflected in the difference between the national emissions inventory and the Party's assigned amount. Thus, as long

[22] In particular JI projects involving forest management, cropland management, grazing land management, and revegetation are subject to the restrictions applied under Article 3.4, which include a country-specific cap on credited removals by sinks from forest management, and the crediting of the other activities on the basis of changes relative to the Party's base year.

[23] Parties cannot acquire ERUs if they are not in compliance with the national inventory, registry, and reporting requirements under Articles 5 and 7 of the Protocol. The third requirement is unlikely to be binding as most buyer countries will be in compliance with Articles 5 and 7 and, if they were not, would be unlikely to be interested in buying ERUs as they would be unlikely to be planning to comply with their emission limits (they could not prove they were in compliance in any case). This is a strange limitation. Having anyone buy ERUs (or AAUs or CERs), regardless of their status, can only strengthen the agreement because it makes the effective cap tighter. Buying should really be encouraged not limited unless parties are concerned with costly overcompliance.

[24] This approach was recommended in Kelly and Leining (2000).

as the host Party complies at the close of the first commitment period, then any over-crediting of JI projects will not represent a liability to the atmosphere, but simply a cost to the host Party. If the Party fails to comply with its commitment, it will face punitive measures on that basis and no additional punitive measures specific to JI will be needed. It clearly will be in the interest of the host Party to develop domestic procedures for project approval, additionality assessment, baseline development, and monitoring that are transparent to project participants and that prevent accidental over-crediting of JI project activities. Essentially from an international perspective, Track I ERUs are the same as AAUs that a government has agreed to sell but with a different name; i.e. track I JI is equal to IET.[25]

Track II: The second track applies to host Parties that do not comply with their Article 5 and 7 requirements. This track provides for independent review of the project and verification of the ERUs by AIEs under the oversight of the Article 6 Supervisory Committee.[26] Project participants are required to complete a PDD that demonstrates Party approval of the project, the additionality of the project, and the inclusion of a baseline and monitoring plan in accordance with criteria defined in the Marrakesh Accords.[27],[28] No ERUs are created until reductions actually take place and are monitored and verified by the AIE.

This system allows countries to undertake JI projects, but creates appropriate safeguards to prevent an unregulated flood of ERUs and AAUs from Annex I countries whose noncompliance cannot be detected because they are not properly reporting their national inventories. In addition to these formal mechanisms, there will be pressure from civil society to ensure environmental integrity. The public might punish firms that

[25] JI Track I has the probably non-binding disadvantage of a restriction on nuclear activities.
[26] The nuclear power restrictions will bind on this group.
[27] Project participants must document the analysis of the environmental impacts of the project in accordance with host country procedures, and must complete an environmental impact assessment if the project participants or host country deem it necessary. These are at the discretion of the Parties.
[28] Once the PDD has been submitted to an AIE, the PDD is made available for public comment for a 30-day period. If the AIE approves the project, it makes its decision and the rationale publicly available. Project approval becomes final 45 days later, unless a Party involved in the project or three members of the Supervisory Committee request a review by the Supervisory Committee. The decision of the Supervisory Committee is final. Project participants can then submit to the AIE a report documenting reduced emissions by sources or enhanced removals by sinks in accordance with the approved monitoring plan. The verification decision of the AIE is made public, and becomes final 15 days later unless a review is requested by a Party involved in the project or three members of the Supervisory Committee.

knowingly purchase unsound ERUs (or CERs). Thus it may be in the interest of project participants to support domestic and international procedures that build investor confidence in the environmental integrity of the ERUs from their projects.

The Annex I host Party issues ERUs once they have been verified under either track described above.[29] Each ERU is labeled according to the specific JI project from which it was generated, the host Party, and verification by the host Party or the Supervisory Committee. Once an ERU has been issued, it can be cancelled or retired by the host country to meet its commitment, traded through IET, or banked.[30],[31]

Under Decision 16/CP.7, any administrative costs arising from ERU verification relating to the function of the Article 6 Supervisory Committee shall be borne by both the Parties included in Annex I and the project participants according to a decision to be made at COP/MOP1. In addition, Annex I parties are "invited" to finance the administrative expenses for operating JI by making contributions to the UNFCCC Trust Fund for Supplementary Activities to facilitate preparatory work by the secretariat. There are some vague provisions also encouraging Annex I countries to facilitate the participation in JI by the 'economies in transition'.

Thus project participants will probably have to pay some amount toward general JI administration by the Supervisory Committee. Track II participants will need to pay fees for ERU verification by an AIE. Plus it is possible that project participants would have to pay fees to their governments' focal points for host country and buyer country project approval. If they (and even the Parties they belong to) do not bear the full

[29] The issuance procedure formally consists of the conversion of assigned amount units (AAUs) or removal units (RMUs) to ERUs. An RMU is one metric tonne of carbon dioxide equivalent produced by the enhancement removals of sinks under Articles 3.3 and 3.4 of the Protocol.

[30] "Retirement" refers to the units that are applied by the owner Party to meet its national commitment, and therefore cannot be carried over or traded to another Party. "Cancellation" is the term applied to the units that need to get destroyed in order to adjust assigned amount for net emissions (if any) under Articles 3.3 and 3.4. "Cancellation" also refers to the destruction of credits that are found to be invalid for whatever reason (fraud, etc.).

[31] Two restrictions are placed on carry-over: Parties can carry over ERUs only to a maximum of 2.5 percent of its assigned amount; ERUs converted from RMUs cannot be carried over. These restrictions are not likely to bind, because ERUs, RMUs and AAUs are fungible for compliance purposes. Parties could retire ERUs or RMUs and bank AAUs instead.

costs of verifying their project, JI will be more attractive to Parties and project participants than is efficient.[32]

The largest outstanding international issue is how to set baselines for projects under Track II. The problem is very similar to the setting of CDM baselines. We discuss this in some detail in the next section. We also touch on outstanding concerns about optimal Track II monitoring.

3 BASELINES FOR TRACK II JI PROJECTS

The draft JI agreement specifies that

> *The baseline for an Article 6 project is the scenario that reasonably represents the anthropogenic emissions by sources or anthropogenic removals by sinks of GHGs that would occur in the absence of the proposed project.*

and that

> *A baseline shall be established:*
> *(a) On a project-specific basis and/or using a multi-project emission factor;*
> *(b) In a transparent manner with regard to the choice of approaches, assumptions, methodologies, parameters, data sources and key factors;*
> *(c) Taking into account relevant national and/or sectoral policies and circumstances, such as sectoral reform initiatives, local fuel availability, power sector expansion plans, and the economic situation in the project sector;*
> *(d) In such a way that ERUs cannot be earned for decreases in activity levels outside the project activity or due to force majeure;*
> *(e) Taking account of uncertainties and using conservative assumptions.*

Conceptually this is fine but in reality accurate baselines are extremely difficult, if not impossible, to create. Essentially we are trying to predict the future behavior of humans in the context of economic changes they do not fully control. This is something we are invariably bad at, and we will never get a chance to observe how well we did because the project, by definition, will change behavior.

If a baseline is set too high (emissions would have been lower than predicted), when emissions are actually measured, the difference between baseline and measured emissions will overstate the true effect of the project. This over-rewards participants and

[32] The Parties may decide to subsidise the mechanism to faciliate participation by economies in transition.

creates an environmental integrity problem; the excess ERUs will be used to allow higher actual emissions elsewhere. In contrast if the baseline is set too low, participants will be under-rewarded. If participants are aware that the baseline is too low when the project begins, they might choose not to participate even though they could have reduced emissions in a cost-effective way. If the participants are not aware that the baseline is too low, they will find it hard to reduce monitored emissions far below the baseline. The risk of a baseline that is too low raises uncertainty and makes JI projects less attractive.

Given this impossible task we need to find a satisfactory compromise that achieves sufficient accuracy to assure reasonable environmental integrity, minimizes random variation, for equity reasons, and particularly avoids the potential for strategic bias that rewards less honest people. The tradeoff is that the baseline must also have relatively low cost: financially, in delays, and in terms of the skills required. This is important because otherwise potential participation in and gains from the program will be severely limited.

OECD (2000) offers an in-depth discussion of these issues and gives some suggestions for solutions in specific sectors: cement, iron and steel, electricity generation and energy efficiency. Fischer (2002) offers an economics-focused assessment of three options for baseline setting: historical emissions, average industry emissions, and expected emissions.

3.1 Methodological challenges

3.1.1 Prediction

Predicting the future is hard. That said, it is less hard in some situations than others. It is easier in relatively stable sectors and countries. Predicting emissions in the US is much easier than in Russia for both economic and political reasons. Predicting emissions from large utilities is probably (though not always) easier than from the renewables sector simply because utilities have been around a long time. The law of large numbers makes prediction more accurate as project scale increases. Many of the idiosyncratic factors that have large effects in small projects will balance each other out in a large project. In a large project, there are fewer avenues for ‘leakage’, where a

project affects emissions outside the project, as many are captured within the project (see further discussion of leakage under 'monitoring') so estimating a baseline outside the project boundaries is less critical. Short-term predictions can be either less accurate because of transient shocks that would smooth out over several years, or more accurate because they do not need to deal with unpredictable technology shifts and major policy changes. Thus encouraging larger projects and requiring only medium-term predictions (see section below on adjusting baselines) could improve the quality of prediction. Baselines will never be perfectly accurate. Thus we need to trade off the benefits of engaging extra actors in the mitigation effort against the environmental risk that JI projects impose.[33]

3.1.2 Who should create the baseline?

The draft Annex B decision implicitly assumes that the project participants choose their own baseline and then justify it. This might need to be challenged. The choice of best baseline designer involves two tradeoffs: between knowledge and incentives, and between skill and cost. Those directly involved in the project have the best knowledge about what would have happened without the project. This argues for having them involved in the baseline setting process. However they also have the incentive to overstate baseline emissions because they directly profit. The challenge is to elicit their information but not allow it to create bias. Any non-transparent, non-replicable analysis provided by the participants (buyer or seller) is unreliable.[34] If in the PDD they can be required to provide information that can be cross-checked (in random audit), their input will be useful.

Creating a baseline (particularly using more aggregate approaches) requires skills that participants may not have. This problem can be addressed partly by creating standard methodologies and partly by using consultants and AIEs. There is a tradeoff between requiring high quality and controlling cost. Even consultants can be captured by project participants so the methodologies need to be simple so others can understand

[33] Not using Track II JI at all is one extreme solution that avoids all environmental risk. Rentz (1998) argues for the other extreme.
[34] This problem is discussed in detail by Wirl et al (1998).

them and the information used should be auditable. Complex models may be more accurate when used correctly but they are also more subject to manipulation.[35]

3.1.3 Adverse selection

If all baselines were perfect, it would not matter which projects went ahead and which did not for environmental integrity. If, however, there are errors (even if they are unbiased over all potential projects) and the project developers can identify the errors because they have private information, the errors will lead to systematic bias that will harm the environment. Projects with overly generous baselines will be more likely to be done. The errors will no longer wash out over a large number of projects. If there are errors that no one can predict, project developer behavior will be unaffected and there will be no bias.

3.2 Possible methodologies

(i) Regional/sectoral top-down / bottom-up, or engineering-based, modeled baselines;

For the best long-term, unbiased predictions that minimize leakage, the larger the scale the better. Baselines estimated at a national or regional scale using historical data combined with bottom-up modeling offer the least biased and potentially most accurate predictions. These are the type of models that underlie integrated assessment models used in developed countries.[36] They are general equilibrium models so control for leakage within (and potentially outside) the country.

To provide detailed bottom-up information for all sources is however prohibitively expensive so these models would not to be accurate if applied at the source level. For small projects, these are often of limited value. The error on each project would be unacceptably high and with adverse selection, the degree of bias could be considerable. They might best be used to create regional baselines or baselines for specific sectors, while controlling for its interactions with other sectors and regions

[35] For more discussion of these issues in the context of deforestation baselines see Kerr et al (2002)
[36] e.g. the Anthropogenic Emissions and Policy Analysis (EPPA) Model, web.mit.edu/globalchange/www/eppa.html

through the general equilibrium model. If a country can create and monitor a national 'project', which would make a national baseline useful, it can use IET.[37]

(ii) Sectoral benchmarking;

This is a simpler system that tries to balance the benefits of scale with sector-specific detail without having prohibitively high transaction costs. Multi-project baselines or 'benchmarks' project a business-as-usual emission rate per unit of output (e.g., tons CO_2/kWh for the power sector, or tons CO_2/ton of cement for the cement industry) based on aggregated data for a region, sector, project type or technology. Individual projects compare their emission rates to the multi-project baseline emission rate (OECD/IEA, 2000; Lawson et al, 2000).

As with any more aggregated baseline a benchmark may have high variance of errors for individual projects. With adverse selection this can create bias in project choice and loss of environmental integrity. Making the benchmark more stringent can reduce this problem (Lawson and Helme, 2000), but may come at the cost of loss of participation. On the other hand, the lower transaction costs, relative to project-specific baselines, may compensate developers for the greater stringency needed.

A shortcoming of this approach is that it simply estimates emissions rates. It does not take account of changes in production levels. Thus it is vulnerable to leakage through changes in production levels. It is appropriate only for projects that focus on upgrading technology. It also leaves open the question of how best to generate the baseline from aggregated data.

(iii) Project-specific;

These use detailed information and assumptions about plant specific fuel use, technology use and output levels over a period of time. In some ways this is most accurate because of the specific detail it uses. However it suffers from leakage because of the small scale, and from potential manipulation by project developers because the data are less replicable. It is also costly because it requires technical capacity and needs to be repeated for every project. Establishing simple standardized methodologies that use

[37] In contrast, in the CDM national baselines could allow for national 'projects' or be an input into negotiations leading to countries taking on emission limitations.

project specific data only where it can be audited can minimize costs and potential for manipulation.

(iv) Revelation mechanisms?

An area that deserves more examination is the possibility of creating a mechanism that induces unbiased revelation of private information about baselines. Wirl et al (1998) show the incentive to distort baselines in a principal-agent framework and show that an exogenous baseline avoids manipulation. They also illustrate how the efficiency loss required to ensure honest revelation in their model sharply reduces the predicted emissions reductions that could be achieved through Joint Implementation and that those who already have relatively low emissions do most reductions. Baselines are set so low, that many genuinely valuable projects are unprofitable.

Kerr (1995) shows how private information about both costs of emissions reduction, and the risk associated with emissions reduction, can be partially revealed by requiring project organizers to choose between a number of contracts that offer a combination of a credit price and a total number of credits for the project. She models the situation where a fund tries to maximize reductions from a fixed budget. Reductions that would have happened anyway are simply zero cost reductions. The result is that those who have genuinely high baseline emissions will choose small reduction projects with a small number of credits but also a high credit price while those with low baselines will choose to have a large number of credits with a low price per credit. This relies on a negative correlation between the average cost of reducing from a given emissions level (a higher baseline implies higher costs of reduction from any given level of emissions because there are fewer free or cheap ‘reductions’) and the optimal number of emission reductions offered. If a project developer lies about the cost of reducing to a certain level of emissions (or equivalently lies about their baseline / marginal abatement cost curve - an artificially high baseline lowers the cost of 'reductions'), i.e. says it is high, then they are 'punished' by only being able to have a small project. The appropriate schedule of average payment per credit awarded and total contract size induces accurate revelation. Different schedules might need to be developed for different countries and sectors. This approach might be applied to setting different rules for small and large projects (see

section 3.2.2). Hagem (1996), Janssen (1999) and Fischer (2002) also consider the issues of incomplete information, adverse selection and strategic behavior in Joint Implementation.

Ausubel et al (2003) develop a mechanism to reveal baselines in an auction context.[38] They solicit baseline information at the same time as bids by making payments dependent on average industry bids as well as the individual's information. It would be interesting to adapt both of these approaches to a trading situation and do empirical work to explore how they might be applicable in practice. If they could be made to work, they could produce unbiased baseline predictions but a lot of uncertainty would remain. This uncertainty would be borne by the project participants.

3.2.1 Updating baselines

Over anything other than the immediate future, the main source of error in un-manipulated baselines will be exogenous changes in technology, and global and local macroeconomic and political shocks. These could quickly lead baselines that are fixed at the beginning of the project to be hopelessly inaccurate. One way to address this problem is to update the baseline as information on these shocks is revealed.[39] In some circumstances this reduces uncertainty for both the international community and the project developer (the shocks should affect the baseline and the actual measured emissions roughly equally so the updating of the baseline offsets the exogenous shift in emissions and reduces total risk).[40] In others there is a tradeoff between imposing risk on investors and reducing environmental risk.

Baselines should be updated only in response to changes that the project developers cannot possibly affect. Otherwise updating will invite strategic behavior. Benchmarks are a form of updateable baseline because the baseline automatically shifts with the level of output. However output is not exogenous. If a project developer makes good profits from credits on each unit of output, they will have an incentive to inflate

[38] This mechanism was developed for the UK emissions trading tender for allowances but was not used.
[39] This approach has been proposed in CDM through the use of 'growth baselines' that adjust to GDP growth.
[40] The effect of baseline updating on uncertainty is often misconceived because people forget that the shocks on baselines and actual emissions are correlated. Several papers state that updating baselines increases uncertainty for project organisers.

output inefficiently thus increasing total emissions and raising the overall cost of emission reductions (Fischer 2001). The benchmark emission rates could themselves be updated by using data on emissions rates in parts of industry that are not involved in climate change regulation. As more and more countries and companies are involved in regulation however, this updating would become less accurate.[41] The formula by which baselines will be updated needs to be defined clearly in advance to reduce uncertainty and avoid difficult ex-post negotiations.

3.2.2 Transaction costs and participation: Different rules for small projects?

The CDM has a 'fast track' to facilitate participation by those who offer small projects. The rules are less stringent. Is this appropriate? Not in general. In expectation, there is at least as much environmental risk from a large number of small projects as from one large project. If all are equally biased, the total environmental integrity loss will be the same. If the rules can be made less stringent for small projects, they should also be able to be less stringent for large projects.

One legitimate reason for a difference in rules is a desire to stimulate participation by groups who can offer only small projects. This could be either for equity reasons or to engage these groups so they can participate more fully in future. These projects could lead to learning and technology development. If this is the justification, the relaxed rules should not be for small projects per se but for specific types of projects offered by specific types of groups regardless of the project size. Otherwise large projects might be broken into small parts to fit the rules. This mistake should not be repeated in Joint Implementation.

If 'small' can be defined in terms of the number of credits gained relative to the total level of emissions, and companies that would genuinely have high emissions in the baseline case also find it more expensive and difficult to create a project that will move them to very low emissions, then it might be possible to offer 'small' projects more generous baselines without tempting those who want to produce large numbers of credits to participate. This would be an application of the ideas on revelation mechanisms.

[41] There would both be technology leakage from the regulated sectors, price leakage and bias because the companies and countries excluded from regulation would not be a random sample.

Whether it could be applied is partly an empirical question about the correlation between high baseline emissions and 'small' optimal projects.

3.2.3 Baselines and limitations that are stricter than BAU

A strange baseline setting problem arises in Joint Implementation and nowhere else. It primarily affects countries whose emissions limitations are strictly binding. Even if the economy were saturated by projects that reduced emissions relative to business as usual, the country might still not be in compliance. Some rule has to be set to allocate the nationally required emission reductions across projects. This could be in the form of emissions limitations (e.g.: allowances that are tradeable or not) beyond which JI credit can be earned. Alternatively the government takes on the cost of making the national reduction. In the symmetric case, countries with non-binding limitations, where governments need to allocate the rewards from 'hot air', most people assume that governments will capture these gains.

3.3 Monitoring

Under the international rules described above, AIEs approve a monitoring plan and actual monitoring reports before they verify ERUs. The draft JI decision is clear on the need to collect and archive data and have quality control processes for monitoring. The method of monitoring is not completely specified yet however. OECD/IEA (2002) discuss monitoring and leakage in detail. As with baselines, project implementers have the best information, however they have an incentive to understate actual emissions to increase their rewards. Hargrave et al (2000) discuss the problems that arise with national level monitoring and propose possible solutions. Many of these insights apply to individual JI projects as well.

Basically there is a choice between deterrence and prevention. If deterrence is used, all information and methods used in the monitoring plan must be documented and auditable but auditing could involve considerable effort. Then projects should be randomly audited and those (and their AIEs) that are found to have misled the Supervisory Committee should be punished. This allows detailed monitoring that

accurately matches true emissions. It depends on being able to impose credible severe penalties.

At an opposite extreme, the monitoring process could be made much more transparent so that cheating is avoided. This requires the use of simple standardized methodologies and readily observable verifiable information. Third parties could check all project reports quickly before the ERUs are verified. The advantage of this is that cheating is completely avoided. The disadvantage is that the simplicity required is likely to make the measurement of emissions much more inaccurate. This imposes uncertainty on project participants who could make certain reductions but then receive a different number of credits. The participants would probably redirect their efforts to create measurable reductions rather than real reductions so some efficiency is lost. The ideal solution is probably somewhere between these two extremes with elements of both. One option is to have a simple default process but make detailed audits voluntary. This would reduce participant's uncertainty and redirection of effort but would induce environmental bias because only those who expect to gain credits through the detailed audit would volunteer. Fines are limited at an international level so simple monitoring should probably be emphasized.

Ideally the process of monitoring JI projects should help countries build the monitoring infrastructure to meet their Article 5 and 7 commitments and simultaneously create domestic programs that allow them to evolve toward efficient regulation and use of IET. Thus applying the methods required by IPCC best practice guidance for national inventories to individual projects wherever possible would be sensible.

3.3.1 Leakage

Not only the effects within the project boundary (directly controllable by the participants) but also the indirect effects their actions have outside must be measured to assess the true environmental effect. The effects outside are called 'leakage'. For example a project that increases the efficiency of cars will directly reduce emissions but indirectly, by lowering the cost of driving, might lead car owners to drive more and even purchase more cars. The severity of leakage will depend on the project but could be large.

Assessing leakage requires monitoring emissions outside the project and also estimating a baseline for those emissions. Leakage can be assessed by using theory to identify paths of effect,[42] informed judgments on their relative importance, data on the scale of relevant variables (how many cars are there and how much do people drive now) and estimates of relevant elasticities. Ex-post, monitoring information could be used to assess the extent of leakage (for example updating the number of cars actually affected and the real price of gasoline). The baseline could be determined explicitly or implicitly by using a model of emissions generation and assuming which key variables are affected by the project and to what extent. The appropriate baseline depends on the form of monitoring – it needs to be consistent. Project participants may have some information on the type and scale of leakage, but they have incentives to understate any leakage that would reduce the credits created and overstate any positive effects. They will not provide unbiased information.

In relative terms, increasing the scale/scope of the project reduces the leakage problem because more effects are captured within the project. In absolute terms of course a larger project might create more leakage.[43]

4 NON-INTERNATIONAL ISSUES: DOMESTIC GOVERNMENTS AND THE PRIVATE SECTOR

4.1 Domestic governance of JI

A country that engages in JI is essentially allowing the project to sell some of its AAUs. If it complies with Articles 5 and 7, it is concerned with maximizing the value of the AAUs it holds and, hopefully, with compliance with its targets. The country needs to be sure that it is getting good value in return for the project. If the project is freeing up AAUs through genuine reductions the government does not lose any AAUs on net. If however the project is over-rewarded, the government loses. It either has fewer AAUs to sell through IET, or it has to buy more AAUs to comply. These countries will have a

[42] Geres and Michaelowa (2002) discuss qualitative effects of leakage.

[43] However projects are designed, leakage of effects to non-Annex I countries through relocation of economic activity and changes in the terms of trade is always a problem. This leakage arises with or without trading but is probably reduced by trading because the costs of emission reduction are lower.

keen interest in the quality of the international approval process and may want to add additional layers of supervision if they are unsure. Their JI office will be a control point and they probably won't want to completely delegate power to trade to legal entities.

The exception to this will be where the government has a domestic emissions permit system (tradeable or not) and it is confident about their level of enforcement and that there is no domestic hot air within its system. In this case it can be confident that any sales of permits outside the country will correspond to a tighter cap and hence lower emissions inside the country. In this case it could devolve trading responsibility to legal entities and simply act as a rubber stamp.

If the country is not able to comply with Articles 5 and 7, then it cannot sell 'hot air' and may not have any concerns about compliance with targets.[44] The AAUs it holds have no obvious value to it. In this case its only concern with the project might be to do with its domestic effects: technology transfer, foreign investment, environmental effects…. These effects could be addressed through existing regulations relating to these issues. The country may however be interested in promoting Joint Implementation projects because they might bring in revenue, technology and transfer of skills. The country's JI office might be focused on marketing rather than control.

Thus the countries that are most likely to sell through JI are least concerned about the approval process. Even countries that are not in compliance with 5 and 7 may however see this as a transitional phase. They may want to use Joint Implementation to reduce their future emissions by changing technology, to increase information about firm emissions and to evolve toward a situation where they do comply with 5 and 7 and can have effective domestic regulation. Whether JI is the best way to achieve this is a serious question. If JI is project based while national inventories are top-down (i.e. calculated from aggregate national data on production and trade flows), JI might not help build monitoring systems that much. If the government is thinking of moving toward a tax on fossil fuels (at the producer/importer level) or an upstream tradeable permit system, JI has

[44] 'Hot air' is AAUs that were allocated in Annex B countries but that are not needed for domestic compliance even when the country makes no effort to control emissions. The hot air arises primarily because of the unanticipated severity of the economic collapse in Eastern Europe and the Former Soviet Union.

few lessons to offer. JI might lead inexorably toward cumbersome facility level trading and regulatory systems.

Buyers, including buyer countries, are not internationally liable for the quality of the credits they buy internationally. Therefore they should have no legal concern about approving a purchase of JI credits. A rubber stamp should be sufficient. The only exception to this would be if, for political reasons the government wants to limit the purchase of ERUs and also select which ERUs will be purchased.[45] This could arise for example if they want to use purchases of ERUs to reward (or punish) some countries for cooperation (or not) on other issues, or if they have a domestic constituency that objects on environmental or other grounds to purchases of ERUs from certain sources and countries.[46]

If for whatever reason a country wants to engage extensively in JI it might want to reduce transaction costs by establishing bilateral arrangements with buyer countries to encourage investment. If buyers are concerned about the quality of ERUs for domestic reasons these bilateral agreements might provide some efficient quality assurance. The seller government might also provide some services to potential investors to reduce the costs of producing a Project Design Document. They might even want to facilitate sector-wide projects that could have much lower transaction costs relative to the ERUs they create.

4.1.1 European Union issues

Some interesting baseline issues are raised by the advent of the European-Union-wide GHG trading system and the accession of central and Eastern European countries to the European Union (EU).[47] It is not clear how the EU will allocate emission allowances to the accession countries that will potentially be eligible to join the trading system as of 2005. The trading allowance allocation system being recommended for industries in Western European countries is based in part on business as usual and, after 2008, will need to be tied in some way to the overall EU commitments under Article 3. It is not clear how hot air will be treated in this case.

[45] If they simply wanted to limit purchases they could run a first-in-first-served system.
[46] Discrimination of this type could raise WTO issues but it is not clear.
[47] Some of these issues are discussed in van der Gaast (2003).

In the case that they did not join the EU trading system, it is not clear whether Track II JI baselines for accession countries would be tied to EU standards if accession countries are required to meet those EU standards for environmental performance. This could significantly reduce the perceived benefit of investing in JI projects in accession countries. Accession countries that did not join the EU trading system but do comply with 5 and 7 would certainly be able to trade their hot air outside the EU. These countries could self-certify their JI baselines so their baselines would not have to meet EU standards for environmental performance.

4.2 Contract design between buyers and sellers

A contract for ERUs could be as simple as a purchase contract, where the price and timing of delivery and payments are the only issues, or as complex as a joint venture. Many commentators on JI assume that the buyer is an investor involved with the project from the start. In some cases this might be efficient because the buyer might bring technology and skill to the project. In others the potential seller might be able to contract for the technology separately or purchase it locally and may have plenty of skill. Not all projects require very advanced technology. Foreign investment and particularly joint ventures are complex to organize and the extra lure of ERUs might not overcome the barriers that often limit such projects.

Where the contract is a simple purchase contract, the buyer will want to pay on delivery to ensure performance while the seller might want the money in advance to ease credit constraints and facilitate the investment needed to achieve the emission reductions. Compromises between these desires might affect the price paid.

If the contract is a joint venture it will need to deal with financial and in-kind contributions by both parties, sharing of profits and ERUs (these are fungible if there is a market for ERUs), and risk sharing. The investor may not be interested in being the ultimate user of the ERUs; they may simply see them as another product. As JI becomes more valuable and hence more commercial, the usual contracting risks will arise and the usual problems of less capable actors being exploited by more capable ones (in which ever country these are) will arise. If buyers are systematically more informed and have

access to better contracting advice, they may bargain more effectively and gain more from the contract. This is no different from any other interaction among unequal commercial players.

The possibility of joint ventures is also not unique to JI. Under IET companies might still find it worthwhile to form joint ventures for specific projects in countries that can reduce emissions effectively with some technological input. Depending on the form of domestic regulation, their reward would be designated in either lower regulatory burdens or taxes or in AAUs that they can sell. The only reason there would be any difference between investor behavior under JI and IET would be if a seller government chose to give special regulatory treatment to investors that engage in JI, thus making investment easier. There is no obvious reason for seller governments to do this however.

5 COMPARISONS BETWEEN MECHANISMS

5.1 Joint Implementation and International Emissions Trading

5.1.1 When would a seller choose to use Track II JI rather than IET?

This is a two-step question. First, will the country be able to use IET? Second, if they can, how great are the benefits relative to using JI? As with most two-step problems, it is easiest to think about the second question first.

5.1.1.a How great are the benefits from using IET rather than Track II JI?

The factors that affect the relative attractiveness of IET (or Track I JI) versus Track II JI include: the net benefits from allowing trade from a non-project based domestic regulatory system, the transaction costs of using the international Track II accreditation process relative to a domestic process, the likelihood that commitment period reserve restrictions will bind; and the effect of using Track II accreditation on public perceptions of the environmental integrity of the trade.

1 Net benefits from trading non-project-based units

(i) Gains from international trade derived from non-project-based regulation

IET allows trading of AAUs that are not needed for compliance. They do not have to be associated with any specific regulation or project. This is immediately

relevant for countries with hot air. Hot air can be legally traded under IET but not under JI because of the additionality requirement. It is also directly relevant for countries that can make reductions through the use of nuclear energy; these reductions cannot be traded under JI. It will also be relevant for countries with significant real potential to reduce emissions at low cost. If a country has a relatively generous target under Article 3 and relatively inefficient current use of fossil fuels (or high but controllable emissions of other GHGs) they could potentially be a large seller if they have efficient domestic regulation.

Any efficient regulation will need to go beyond small projects so the country is likely to want to be able to trade reductions from policies such as emissions trading, emissions taxes, promotion of energy efficiency, building standards, transport policies, and strategic infrastructure investments. If a country thought these policies might be used to exactly achieve Article 3 compliance but no more, it could allow any credits from projects that go beyond the effects of broad government policies to be sold. Thus broad policies would be used domestically but all international trading would be through projects. This would be hard to judge and implement however.

Another common reason why countries might want to allow flexible entity-level trading based on broad policies, even if they are unlikely to be a large net seller (or may even be a net buyer), is if they want to use a domestic emissions trading system. They might want to avoid the problems of market power or lack of liquidity that can arise in a small country.[48] They might also want to automatically link the stringency of their domestic system to the international market by allowing free trade and price equalization across systems.[49]

(ii) Domestic regulatory set-up costs

The domestic regulatory costs of a project-based trading mechanism under either IET or Track I JI are identical. There is no reason to use different rules. Thus here we focus on the differences between IET and Track II JI.

[48] For discussion of market power in international trading markets see Kerr (2000b). Market power has been exacerbated by the withdrawal of the US, a major buyer, from the Protocol.
[49] For discussion of the integration of domestic regulatory systems with international emissions trading see Kerr (2000c).

Many countries have already participated in the Activities Implemented Jointly pilot phase. Thus they are familiar with the domestic institutions required to participate in this process. Those for Track II JI will be similar. This might make it attractive. They avoid the need to be able to certify their own baselines or monitor emissions from their own projects. They already have focal points designated for giving domestic approval. They may be comfortable with the quality of the international certification process. If they do not intend to demonstrate compliance with their targets, they may not be that concerned with the true additionality of the credits and the effect of the sales on their ability to comply anyway. In any case, many have hot air that they will be unable to sell under JI so they are at little risk of non-compliance unless low environmental integrity JI projects happen on a large scale.

If a country chooses to use projects under IET they must certify baselines and verify monitoring themselves. They could simply copy the international JI process, prepare a PDD and hire AIEs to certify and verify. They would face slightly lower costs than under JI if they could avoid costs associated with the Article 6 Supervisory Board. Alternatively they could use this system as a base and adjust it to their own requirements. Their system could be stricter (because they really bear the environmental liability which will be measurable in the national inventory – though not associated with specific projects) if they don't have confidence in the international system. It could be more relaxed if they were willing to trade off administrative simplicity, which will encourage more projects, with greater risk bearing by government. In either case it could be better adapted to the specific needs of the country.

If the country chooses to create a non-project-based domestic regulation and allow trading on the basis of it, the initial set-up costs would probably be much higher. For example, creating an effective domestic tradeable permit system requires both up-front costs and ongoing monitoring and administration. These costs would need to be weighed against the likely gains both domestically and through international trading. The government could also decide to set up domestic emissions trading in some sectors but have project-based reductions in others.

(iii) Uncertainty for the government under IET vs. JI

Two forms of uncertainty arise. The first is how many real additional reductions a specific project or action creates – how many AAUs the project frees up for the government. A domestic trading system that is well enforced offers complete security on this. It is essentially a large 'project' with a baseline defined as the 'cap'. The government knows exactly how many emissions it will have from the sources covered by the trading system. If the sources choose to reduce emissions even further and sell internationally it does not affect the government at all. These AAUs could be sold as soon as the trading system is created and the entities that sell them will be liable under domestic law if they are unable to comply with their domestic limitations after they sell AAUs. With any other sort of project (without a fixed cap) there is uncertainty on actual emissions until they occur and are monitored.

Even once monitored, the real reductions from projects will always be uncertain because of uncertainty in the baseline. In a domestic trading system the baseline never needs to be formally agreed. Estimates of it will enter implicitly into negotiations on how strict the cap should be and how permits should be allocated across sources but it creates no uncertainty for government. The target is designated in emissions levels and so is the cap.

The second form of uncertainty for government is in national performance. In both JI and IET what ultimately matters for the validity/additionality of credits is national performance not performance in any specific project or sector, so this uncertainty is identical. Any JI project (track I or II) is only really valid if the country complies overall.[50]

A final issue is about the potential timing of sales under the different systems. ERUs can be traded as soon as they are verified. Project accounting may well move faster than national accounting. If IET could not occur until national accounts were finalized, this would be a significant advantage for JI. However AAUs could be traded any time from 2008 onward. Countries with good monitoring systems will know roughly

[50] If a country operates under Track II during the commitment period but by the end of the period has a monitoring system that demonstrates that they are out of compliance with their Article 3 commitments, the ERUs they created are still valuable but the government is penalised for non-compliance.

how many they are likely to have to spare quite quickly. Legal entities within domestic trading systems will also know early on. Both countries and firms can make fine adjustments at the end of the commitment/domestic-regulation period.

The only real limitation on early trading in IET comes from the commitment period reserve. This is likely to bind strongly only on countries that intend to be out of compliance. These are the targets of the restriction. For others this might simply alter the timing of sales. Countries that are severely affected by the restrictions on the timing of sales could choose to submit projects for verification under Joint Implementation Track II to avoid the restriction.

2 Transaction Costs of each trade under JI (Track II) vs. IET

The time and cost burden of verifying ERUs through track II will determine the desirability of using it for JI projects on a voluntary basis. Trading under IET would likely involve lower transaction costs than JI. The transaction costs for both include finding a trading partner; getting government approval for the trade; meeting any international requirements; and monitoring emissions.

For any IET trade, the identity of the trading partner is irrelevant so this is much easier. It could be done through an anonymous market. In contrast, in JI the partner needs to get approval from their host government and because the ERUs come from an identifiable project some partners might have direct concerns about the perceived environmental integrity of the project. This makes matchmaking harder.

For IET, government approval could be as simple as delegating power in a domestic tradeable permit market. Alternatively it could be a rigorous process of baseline setting and verification of emissions before trade if the government uses a project-based system and is concerned about the additionality of trades. In JI, government approval will only be complex if the country decides to put additional limitations on purchases of ERUs because they do not fully trust the international system to protect the environmental integrity of the Protocol or because they have objectives in seller countries, such as environmental sustainability, that are not addressed in the Kyoto Protocol. In contrast however, there are no international requirements (as yet) for IET

whereas JI projects have to go through the international certification and verification process.

Finally, if IET occurs as an adjunct to a domestic emissions trading system, no additional emissions monitoring is needed for international trade. Monitoring is an intrinsic part of the domestic system. If the IET trade is project-based, monitoring costs will be similar to JI if the stringency of the verification is similar to the international requirements. Otherwise it could be more or less costly.

Overall, transaction costs per trade are likely to be much higher under Track II JI than under IET that links to a domestic trading system. The transaction costs under a project-based IET system could be either higher or lower than under Track II JI but these will be tailored to the needs of the specific country. If they impose higher transaction costs it will be because they want a higher level of certainty about additionality than they believe the international rules achieve. Higher JI transaction costs will reduce the overall gains that can be realized under JI.

3 Public perceptions of environmental integrity

The most reassuring thing for those who are skeptical of the trading system should be compliance with Articles 5 and 7 and then compliance with Article 3. If a seller complies with all three, the environmental integrity of a seller's contribution to the agreement is (as far as possible) assured. If a country or company wants to avoid buying 'hot air' it should buy only from countries that either cancel their hot air or sell only through JI Track II.

If a buyer chooses to buy from countries that might not be in compliance with at least one of 5, 7 and 3, they might be concerned about perceptions of the environmental integrity of the units they purchase. If the seller country is not in compliance with 5 and 7, the buyer can buy only through JI Track II so has few choices: only to buy or not to buy. If however, the seller is considered to be at risk of non-compliance only with 3, the buyer has a choice between purchasing through IET (maybe even insisting on project-based credits) or through JI Track II. They are not legally liable for compliance of the countries they purchase from, but might be held morally liable if

people think the company/country knows it is purchasing shaky credits. Track II JI might offer some assurance that the ERUs meet certain standards.

5.1.1.b Will the country be able to use IET?

The previous section discussed the pros and cons of IET relative to JI. A country will have this choice only if they comply with Articles 5 and 7. Each country needs to make a decision about how much effort to put into complying with Articles 5 and 7 by 2008. Many countries will comply so that they can prove that they have met their Kyoto targets. Others, particularly economies in transition, may find the cost of proving compliance high and may not care enough about the international rewards from proving Kyoto compliance.

Compliance might be considered to be a function of capacity but capacity is often strongly correlated with willingness to comply. A country that can make huge gains from trading under IET rather than JI will probably be able to find the resources (or get their potential buyers to provide them) to build adequate monitoring systems. If JI is seen as an unattractive high-transaction-cost way to trade, those who want to trade, even if they have little or no hot air, will want to invest in monitoring systems as a precursor to gaining the benefits of IET. Some will however find it either impossible or not worthwhile (probably indistinguishable) to comply by 2008 and will be forced to use JI if they want to trade at all.

5.1.2 When should buyers use one mechanism rather than the other?

All tradeable units are economically equivalent from the buyer's point of view. Buyers should ultimately be willing to pay the market price minus the transaction costs they bear. Higher transaction costs make otherwise equal projects different. If buyers face different transaction costs, they will be willing to pay less for the units that involve the higher transaction costs. JI credits will tend to receive less than AAUs sold directly through IET. If the seller decides to bear the transaction costs, the seller will receive a higher price but this should just compensate them for the higher costs they bear (unless they are more efficient at managing the trade). Some domestic governments might put restrictions on the number of both JI and CDM credits that can be used domestically in

part because of concerns about the environmental integrity of these credits. These restrictions are not yet decided but will affect buyer options.

Many people believe that in Joint Implementation, the buyer might have a greater tendency than in IET to be an investor in the project as well as a simple purchaser of ERUs. If a buyer is an investor as well, they will prefer projects that have lower risk as well as lower prices. Projects in countries with stronger institutions and greater human capital will tend to be less risky.

The role of buyer as investor may however be more a function of the countries involved than of the mechanisms themselves. To reduce emissions efficiently, companies in economies in transition may need capital and expertise from more advanced countries regardless of the form of trading they might use for the reductions they generate. Thus economies in transition may tend to engage in JI, may be more risky locales for projects, and may tend to have active involvement of buyers in projects but these may not be directly related.

5.2 Joint Implementation and the Clean Development Mechanism

5.2.1 What is the difference between the suppliers?

Joint Implementation will mostly involve economies in transition while the Clean Development Mechanism involves developing countries. Neither of these is a homogeneous group. There are four key differences between the groups. First, the developing countries that will engage in CDM are non-Annex B Parties. They do not have emission reduction or limitation commitments and are not subject to the same national inventory, registry and reporting requirements as Annex B Parties. Even though the main participants in JI will not be in compliance with these requirements (those who can use Track II only) they might be expected to be working toward compliance. Second, the economies in transition are expected to want to behave in the near future like other Annex B parties that have strong monitoring systems and truly binding limits. Many are candidates for accession to the EU. Most aspire to be considered equal to developed OECD countries. They might be concerned about creating a reputation for compliance. Third, the potential scale of CDM provision from developing countries is much higher so

any problems in implementation will be magnified. Fourth, the ability of the government to design and effectively implement regulations without risk of corruption or incompetence varies both between and within groups. Developing countries may be generally less capable however, some 'developing countries' have advanced strong governments while some economies in transition have relatively weak governments. These differences have motivated different international rules and will also affect the level of supply (and possibly demand) for CERs relative to ERUs.

5.2.2 How are the international rules different?

Although both JI and the CDM are project-based mechanisms and are subject to similar additionality requirements under the Kyoto Protocol, these mechanisms and their governing rules are different. The Protocol requires that CDM projects achieve the dual purpose of assisting non-Annex B Parties (i.e., developing countries) in achieving sustainable development and contributing to the ultimate objective of the Convention, and of helping Annex B Parties to meet a portion of their Article 3 commitment.

Under the CDM, eligible project activities exclude avoided deforestation and the 'land use, land use change and forestry' (LULUCF) activities defined in Article 3.4. The only eligibility requirement for non-Annex BParties to host CDM projects is ratification of the Protocol. The governance of the CDM is similar to the Track II governance of ERU verification by the Article 6 Supervisory Committee, but involves different bodies. A ten-member CDM Executive Board governs the registration of CDM projects and the certification of their emission reductions. In-depth project review for validation and verification of emission reductions is undertaken by Designated Operational Entities (DOEs).

JI projects can begin as early as 2000 but ERUs can be issued only for activities undertaken after the beginning of 2008. The Article 6 Supervisory Committee will not be appointed until the first meeting of the COP/MOP following entry into force of the Protocol. Once the Supervisory Committee has been appointed, it will take time to finalize the rulemaking for verifying ERUs under track II. In contrast, the CDM was designed to start generating CERs as early as the year 2000. The first CDM Executive Board was appointed immediately after the approval of the Marrakesh Accords, and

launched into designing the accreditation process for DOEs and developing the project design document and baseline guidelines. At the time of this writing, the CDM Executive Board was preparing to approve the accreditation of DOEs and begin registering the first CDM projects.

The different governance structures, and underlying that, different levels of trust of sellers and different concern about the potential scale of implementation problems, will have a major effect on the relative transaction costs borne by CDM projects relative to JI projects. The CDM process involves more subjective issues and may be more political. It could involve longer time lags and a greater demand for substantiation of project claims (e.g.: baselines, monitoring and sustainability). In addition the direct costs payable for international certification are likely to be different. The JI payment sharing rules are not yet defined. Under the CDM, project participants will have to pay fees to the DOEs to get their projects validated and their CERs verified. In addition, a share of the proceeds from CDM projects (2%) must be applied to support adaptation activities in non-Annex B countries. An additional share, as yet undecided, will be taken to cover the administrative costs of the CDM. Transaction costs might be much higher in the CDM than under JI.

5.2.3 Should buyers treat these mechanisms differently in practice?

As discussed above buyers should only treat units differently if they have different transaction costs or if buyers are restricted in the use of one type of tradeable unit. CDM credits may well face the highest transaction costs of all the mechanisms so the sellers will tend to receive less than the market price. Buyers are restricted by the international rules in their use of CDM credits (e.g.: for LULUCF credits[51]) and individual countries may put on other limitations. Where buyers are involved as investors in the project and bear project risks they will take into account the relative riskiness of different project partners. They might find some developing countries highly risky while others are relatively good risks. Similarly they will have different attitudes to risk in different economies in transition. It is hard to say how the 'average' risk will vary across the two groups.

[51] There is a cap on each Annex I country's use of CDM LULUCF credits equal to 1% of base year emissions times 5.

5.3 The joint market for AAUs, ERUs and CERs

The market price for tradeable units will be set by demand and supply. If demand rises the price will rise; if supply rises the price will fall. All countries will have emissions abatement opportunities ranging from near zero cost to extremely high cost. Their marginal reduction should cost the same as the market price net of transaction costs. Thus no instrument intrinsically offers 'cheaper reductions'. However the marginal cost curve for reductions will be more elastic in some countries and the total level of emissions and hence potential scale of reductions varies enormously.

Many people argue that because economies in transition are currently very inefficient and because they have high levels of capital turnover (because their stock is so old) they have a flatter cost curve and hence large numbers of cheap emission reduction opportunities. Developing countries may have similar opportunities – they are also extremely large in terms of population and at least some (e.g. China) have high growth so high levels of new investment. In addition, Russia in particular has a lot of 'hot air', which is essentially zero cost tradeable units. Thus the supply of ERUs (and possibly AAUs from economies in transition) and CERs is potentially huge and could lower the market price enormously. How much this potential can be realized depends partly on the monitoring requirements and transactions costs involved in the mechanisms. Given the impossibility of estimating accurate baselines, few projects would actually be feasible if Parties were unwilling to risk some loss of environmental integrity. If some economies in transition can comply with Articles 5 and 7, they can sell their hot air and also avoid the transaction costs involved in JI; this would greatly increase their supply.

Realizing this potentially large supply also depends partly on the inherent difficulties in investing in technology change in countries with relatively undeveloped institutions and economic systems. It is not chance that these countries have less efficient technology and high emissions per unit output. Changing that is not easy and may not be as cheap as engineering models suggest. Foreign investment in both economies in transition and also many developing countries is challenging for reasons that have nothing to do with climate change regulation.

All these uncertainties, as well as the inherent difficulty of modeling the future, means that the actual level of market price is extremely hard to predict. Model estimates vary widely but real uncertainty may be greater still as models find it difficult to account for transaction costs or weak legal institutions that deter investment.

All this discussion assumes that the market operates competitively. Unless countries devolve a lot of the trading to legal entity level (as the EU seems to be moving to do) trading will have a strongly political aspect. This might make ERUs more valuable because countries prefer to pay money to countries they are comfortable giving aid to. Conversely it might make them less valuable if ERUs are seen to be less environmentally sound because of problems with baselines and monitoring and concern about future commitments of economies in transition. Political influence might limit buying of CERs for similar reasons. Pressures to show serious efforts to reduce domestic emissions (partly motivated by the desire to reduce the need to buy in future) might reduce demand even though domestic reductions are much more expensive than even genuine reductions elsewhere. These political influences are hard to predict.

6 CONCLUSION – FUTURE RESEARCH NEEDS

We have laid out the current international rules and key outstanding issues. Many questions still remain. Some require detailed knowledge of specific projects and industries and of the monitoring data involved so are not ideal for economic research. Many, however, could be informed by good economic research. Here we suggest some research directions on baselines, leakage and the general benefits from trading.

JI advocates and international regulators tend to focus on accounting methods to generate baselines. As economists we know that they have serious flaws. Our experience with domestic environmental regulation tells us that regulators are unlikely to ever have good information on firm level behaviour. We believe it would be worth seriously exploring the possibility of using incentive mechanisms to encourage self-revelation of unbiased baselines by firms in the way that tradeable permit markets encourage revelation of abatement costs. Some preliminary work has been done but much remains. This research needs to have strong theoretical foundations, good

connections to the nature of the actors and the problems, and probably needs empirical support. Any solutions would have to be simple and practical.

Useful empirical work could be done on estimating baselines, and comparing different formulations (varying by scale, updating and basic methodology) with out-of-sample experience.[52] Evaluating the bias in actual baselines submitted to the Article 6 Supervisory Committee and working out how much could be ascribed to strategic behaviour also would be useful. The research could be done using historical data in areas with no JI projects.

The problem of measuring leakage would be ameliorated by good empirical work. Identifying the key paths of leakage in different types of project and summarising our experience about their likely scale and on what that scale depends would be useful. Some research could draw together existing estimates of key elasticities from the literature with careful documentation of where and how they apply. In some cases we do not have estimates of key elasticities, or we have them only in developed countries such as the US. Elasticities may not translate well from developed to developing countries or to economies in transition. These could be estimated. The aim could be to develop standard methodologies for specific types of projects or to create rules of thumb about when leakage is and is not material.

A final area of useful research that people do not commonly associate with this area would involve the economics of foreign investment. What can we learn from the literature or from existing experience about the barriers to investment, and especially foreign investment, in economies in transition. How much impact are they likely to have on the efficiency of the mechanisms? In what ways might JI or IET reduce these barriers? Could their design be changed to enhance this? Although there is currently very little JI action, there are plenty of investments, or non-investments, in the sectors that will be involved that could provide qualitative and quantitative data.

[52] See for example, Kerr et al (2003) for discussion of deforestation baselines in the CDM.

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