Financial Analysis Used in Clean Development Mechanisms: Fact or Fiction?

Hui Chen
University of Colorado at Boulder
419 UCB
Boulder, CO 80309-0419
Hui.chen@colorado.edu

Peter Letmathe
RWTH Aachen University
Templergraben 6452062 Aachen
Germany
Peter.Letmathe@rwth-aachen.de

Naomi Soderstrom*
University of Colorado at Boulder
419 UCB
Boulder, CO 80309-0419
Naomi.soderstrom@colorado.edu

Current draft February 16, 2012

Preliminary and incomplete;
Please do not quote without permission.

* Corresponding author. The authors gratefully acknowledge funding from a Leeds School Sustainability Research Grant. This work has benefitted from input by workshop participants at University of Auckland, George Washington University, University of Houston, LaTrobe University, Monash University, University of Melbourne, University of New South Wales, and University of Otago. Jessica Weber and Sven Raak have provided valuable research assistance.

Financial Analysis Used in Clean Development Mechanism Projects: Fact or Fiction?

Abstract: This paper explores incentives for companies to bias financial investment analyses of
4 5
These environmental projects are primarily hosted in developing countries and result in issuance of carbon emissions permits (Certified Emission Reductions) that can be used as offsets to satisfy carbon emission limitations in the European Union. We examine a sample of projects that have at least one publicly-traded participant. We find that on average, the financial analyses included in the CDM application by host firms contain items that tend to downwardly bias the value of the project to increase the probability of UN approval. Cross-sectional analysis indicates that deviations from benchmark Internal Rates of Return (IRR) are related to the level of corruption in the host country and the anticipated benefit from the Certified Emission Reductions

1. Introduction

In an effort to reduce greenhouse gas (GHG) emissions in line with the Kyoto Protocol (United Nations 1998), in 2003, the European Union (EU) adopted a market-based cap and trade system for carbon emissions (European Union, 2003). The system places a cap on the amount of carbon dioxide generated by key industries. If industry members cannot achieve designated targets, they must turn to alternative sources of pollution permits (also called allowances).

The Kyoto Protocol identifies several flexibility mechanisms to help companies meet emissions targets. The most controversial is the Clean Development Mechanism (CDM), in which a company in a country with an emission reduction or limitation agreement under the Kyoto Protocol can offset emissions by implementing an emission reduction project in a developing country. CDM projects, if approved by the UN, can earn saleable Certified Emission Reduction (CER) credits, each of which represents one ton of Carbon Dioxide (CO2) and can be counted toward meeting Kyoto targets. CERs are interchangeable for this purpose with permits

6 6 6 -ETS). CDM

projects include, for example, installation of a more energy-efficient boiler, or development of a rural electricity plant that is designed to have low carbon emissions.

Our study examines incentives underlying the current CDM structure and investigates financial analysis methods that are mandatorily disclosed in CDM project proposals. To increase the probability of approval by the UN, the project host firms may strategically manipulate the reported financial information. Using data manually-collected from the application reports filed by the CDM host firms, we find the firms are indeed engaged in information manipulation consistent with their underlying incentives.

The primary reason for the controversy surrounding CDM is the difficulty in judging whether emission savings are real. The baseline is unobservable (i.e., the comparison is what emissions would have been in the absence of the project) (Carbon Trust, 2009). In addition, it is questionable whether the approved projects are the best solution. For example, in the early years of the program, many CERs were associated with refrigerant-producing factories that generate the extremely detrimental GHG HFC-23 as a byproduct. These projects were expected to account for 20% of all credited emission reductions by 2012. Paying for facilities to destroy the gas would have cost approximately 1/100 to 1/40 the value of the granted CERs. While the environmentally troublesome incentives for HFC-23 were addressed by the CDM Executive Board (hereafter, Executive Board), similar issues are likely to exist for other projects (Carbon Trust, 2009). Even in less dramatic cases, environmentalists are concerned that cash flows are misdirected towards projects which do not reflect the most important environmental impacts (Bode, and Michaelowa, 2003; Duschke and Bode, 2006; Paulsson 2009). Finally, there is a risk of false credits, where projects that would have been built without grants of CERs are awarded CERs.

The UN mandates that CDM p to be approved, where *anthropogenic emissions of greenhouse gases by sources are reduced below those that would have occurred in the absence of the registered CDM project activity.* [1] Additionality includes justification from both an emissions standpoint as well as from an investment standpoint; the project should become financially viable based upon the value of CERs. Otherwise, companies would have economic incentives to pursue the project in the absence of the CDM program and no CERs are necessary to make the project attractive. While

[1] Report of the Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol on its first session 2005, p. 16

the additionality requirement justifies the CER subsidy granted to host firms, it also provides incentives for companies to understate the financial benefit of projects in order to justify additionality.

The Executive Board has provided guidance for assessment of additionality (CDM Executive Board 2008). Th *Tool for the demonstration and assessment of additionality* is mandatory for CDM projects that use an emission-reducing methodology that has been previously approved by the Executive Board. Applicants must perform some type of investment analysis, unless the project generates no financial or economic benefits other than CDM-related income. The tool allows several forms of investment analysis for establishing investment additionality, including discounted cash flow techniques such as NPV and IRR analysis.

Direct application of these traditional analyses is problematic for environmental projects in general (White et al. 1993, GEMI 1994). For example, there has been discussion in the literature about what is the appropriate discount or hurdle rate for environmental projects (see, for example, Weitzman 1998, Pindyck 2007). The additionality tool (CDM Executive Board 2008) suggests several potential rates depending on project circumstances, including local commercial lending rates, the WACC, or a required rate of return derived from national authorities or internal sources. Applicants thus have apparent flexibility in determining the appropriate benchmark.

In the case of CDM projects, there are additional complications introduced by the institutional setting. Because revenues from CERs are a key feature of a CDM project, estimation of benefits associated with CERs is obviously critical. However, there is no standard methodology for such estimation. Given incentives under the CDM, companies can choose incentives for all parties in the CDM process and a lack of sufficient monitoring, companies also have incentive to go beyond the flexibility inherent in the tool and deliberately make errors in their project analyses in order to reduce the apparent financial viability of the project.

These types of errors are often readily observable for experts with a technical or financial background. Since most projects include the transfer of standard technologies previously unavailable or prevalent in developing countries or a specific region, auditors with a technical background can often better detect manipulation of technical parameters and cash flow-related errors. In contrast, auditors with a financial background often have no expertise in identifying manipulations of technical errors as inputs for the financial analyses. Since project partners often do not know if their auditor(s) have a more sophisticated technical or financial background, we believe that an incentive exists for firms to distribute errors over both technical and financial areas of the report. This behavior would reduce the overall probability that detected errors in one area leads overall rejection.

Alternatively, the nature of the auditing firms (designated operating entities, or DOEs) may make it unlikely that errors in the financial analysis are detected (Schneider, 2007). The vast majority of the DOEs, e.g., TÜV Süd, have their primary expertise in technical areas and certifying management systems rather than in financial analysis. Thus, any reputational impact for DOEs of financial errors being discovered by third parties will be lower because financial expertise is not seen as their core competency.

A third argument is the reliance on precedence. Many Project Design Documents (PDDs) are based upon similar projects from the same country, and PDDs submitted later may not be subject to the same level of scrutiny as the earlier ones. If earlier PDDs contained errors that have not been detected or corrected, then similar errors may be included in subsequent projects.

Existence of the precedent also can be used as an alibi to reduce reputation loss of the DOE if errors are detected.

In this paper, we focus on the demonstration of investment additionality. Prior literature has focused on the nature of information included in applications, such as whether detailed costs have been provided versus only the result of calculations, and descriptive statistics for the required rates of return used for the projects (Schneider 2009). Other studies provide in-depth case analyses of projects to highlight specific issues (e.g., Michaelowa and Purohit 2007). Michaelowa (2007, referenced in Schneider 2009) notes that some Indian wind power projects have failed to include tax benefits in calculation of project financial viability.

We examine a sample of CDM projects for which at least one participant is publicly traded and for which there exists a financial analysis (e.g., IRR or NPV) of cash flows associated with the project. We first provide a descriptive analysis of the organizations that are participating in these projects, both host companies, where the project will be located, and other participants, who may provide technical or financial expertise to the project and are likely recipients/users of any CERs resulting from the projects. We then examine cash flows included in the financial analyses and find errors in the types of items included. For example, we find that multiple projects incorrectly include financing costs, which is specifically prohibited by the additionality tool. Overall, our corrections include increases as well as decreases in the reported Internal Rate of Return (IRR). Our adjustments do not change the average IRR, but greatly increase the variance. Thus, more projects would fail to meet the additionality criterion and should have been rejected. This is consistent with incentives to decrease reported IRR to better justify additionality. Cross-sectional analysis of reported IRR relative to benchmark indicates that deviations from benchmark due to financial analysis method are related to the level of corruption in the host country, the magnitude of profit from CERs, the nature of the project participants, and the type of project.

Our analysis focuses on the development of CDMs -- the institutional structure, the political environment and in particular, the additionality tool as an emerging managerial accounting standard for valuing environmental investments. The insights we can gain are not only relevant for CDM and other instruments targeting climate change but also cast light on the development of accounting standards for environmental issues (Cook, 2009). The next section provides further background on CDMs. After that, we discuss related accounting issues and provide a literature review. We then provide theoretical and hypothesis development and describe our empirical method. Subsequent sections describe our sample and provide preliminary results. The final section concludes.

2. Background

2.1. CDM Background

The CDM was developed as a means of achieving carbon emission reductions to satisfy requirements under the Kyoto treaty. The institutional framework for the CDM is headed by the COP/MOP[2] which consists of contract parties of the Kyoto treaty. The CDM framework is supported by several institutions, which ensure that CDM methodologies are updated and improved over time and that the process of project registration fulfills standards set by different participants within the framework. Operating under the leadership of COP/MOP, the CDM Executive Board supervises current processes within the CDM. The main tasks of the CDM Executive Board are (Umweltbundesamt, 2009):

Approval of new methodologies for baselines and monitoring

[2] COP/MOP stands for Conference of the Parties, serving as the Meeting of the Parties to the Kyoto treaty.

Approval and registration of CDM projects

Issuance of CERs

Development and maintenance of the CDM register

Accreditation of the Designated Operational Entities (DOEs), who audit project documents

Development of recommendations to the COP/MOP.

The CDM Executive Board is supported by several work groups, which make suggestions to enhance existing methodologies, and prepare drafts of methodologies for small scale projects and new sectors (e.g., afforestation). The CDM Registration & Issuance Team, the Accreditation Panel and the Assessment Team review project activities and prepare decisions for the CDM Executive Board.

Designated National Authorities (DNAs) represent the contract partners of the Kyoto treaty. DNAs for countries of both host and non-host participants must implement a formal process and approve CDM projects. In addition, the DNAs usually provide further assistance in the registration process, e.g., through guidelines, etc.

Designated Operational Entities (DOEs) are independent organizations, which audit all project documents and play a major role in the validation process. The DOEs also verify the : , the DOEs are not only responsible for inspecting compliance with accounting standards but also for evaluating and approving project proposals. This requires a considerable amount of technical and economic expertise.

Figure 1 depicts the stages in development of a CDM project. Each project must be documented in a project design document (PDD). The PDD provides the basis for validation and registration. The PDD includes a general project description, information about the applied baseline and monitoring methodologies, duration of the project activity and proposed crediting period, calculation of GHG emission reductions, information on environmental impacts, and stakeholder comments. Each project must specify a proposed methodology for carbon emission reduction. The CDM Executive Board has already approved a variety of methodologies for different types of projects, but project developers can suggest alternative methodologies, which must then be approved by the CDM Executive Board. Annexes of the PDD provide further information about participants in the project activity, public funding, financial analysis results, etc.

Upon completion of the PDD, the project developer submits the project to a DOE for validation. A letter of approval from the DNA of the host country (to ensure that the projects contribute to the sustainable development priorities of the country) and the DNA of any Annex I country participating in the project is also required. Questions asked in the course of DOE validation include: Does the PDD meet CDM requirements? Is the chosen methodology appropriate and correctly applied? Is the additionality criterion fulfilled? Are all necessary documents available and complete? If these criteria are met, the DOE validates the project and sends the DNA approval letter(s) and all documentation to the CDM Executive Board in a request for registration. If the project is registered, the project developer monitors emission reductions and provides a monitoring report to a second DOE for verification. The second DOE uses the monitoring report and information collected through on-site inspections to develop a verification report. If the monitoring is deemed satisfactory, the DOE certifies the claimed reductions to the CDM Executive Board. Finally, the Executive Board issues the CERs and project participants can sell or use them. Ownership of CERs is registered by the responsible national registries.[3] If one of the steps is not successfully completed, the project developer has the option to resubmit the revised documents and repeat the procedures.

The most important criterion for approval of a project is additionality. Due to its importance and difficulty to demonstrate, the CDM Executive Board has approved a methodological (hereafter to guide project developers in establishing additionality. The additionality tool was initially adopted on October 22, 2004 (CDM Executive Board 2004). The current version (5.2) dates from August 26, 2008 (CDM Executive Board 2008). It directs project developers to identify alternatives to the project activity, then analyze financial aspects of the proposed project relative to the alternatives, identify barriers to project implementation, and compare the proposed project to common practice in the relevant sector and region. Financial analysis techniques allowed include simple cost analysis, investment comparison analysis, or benchmark analysis. Although use of the additionality tool is voluntary for projects proposing new methodologies, its use is mandatory for projects using approved methodologies. The tool serves as the most important methodological guidance to meet additionality requirements.

2.2. Accounting for Environmental Issues

From a financial accounting perspective, the primary issues related to climate change are disclosure and recognition of amounts associated with emissions trading (permits issued, purchased/sold, or developed via the CDM), and future risks to the company related to climate change. Neither US GAAP nor IFRS provides formal guidance for recognition or disclosure of associated financial impacts in company financial statements (Fornaro et al. 2009). Both standard setting bodies have periodically floated suggested methods to account for emissions permits.

[3] This process description is primarily based upon discussion in Paulsson (2009).

However, both have withdrawn their suggestions and accounting for emissions permits remains an unresolved issue.

In 2010, the US Securities and Exchange Commission (SEC) issued interpretive guidance for application of countries published a GRI-based sustainability report (GRI 2010). The Carbon Disclosure Project (CDP) was initiated in 2000. CDP surveys companies annually about business risks and opportunities related to climate change, including measurement of emissions.[4] Stanny (2010) investigates the nature of disclosures to CDP. She finds that the number of firms and the types of information disclosed are increasing over time. However, even in the most recent year of her sample (2008), while 70% of firms respond to the survey, only 41% disclose emissions and only 30% disclose their accounting methodology. Matsumura et al. (2010) employ voluntary disclosures from CDP and Ceres to investigate the relation between carbon emissions and firm value. They find that increases in carbon emissions are associated with decreases in firm market value, increases in the cost of debt, and decreases in the cost of equity capital. Griffin et al. (2010) supplement CDP disclosures with a model predicting GHG disclosures for non-respondents. They find a significant association between disclosed and estimated GHG emissions information and stock market valuation. They also find a significant stock market reaction around the date a company discloses new information related to climate change.[5]

Relevant managerial accounting research has focused on the nature of accounting technologies used to include sustainability or environmental aspects of an investment. Bebbington et al. (2007) note that cost-benefit analyses are frequently employed in such exercises and that the model does not always fit well. For example, many of the calculations are subjective and political judgements   what and whose costs and benefits to count   can greatly impact outcomes. In addition, many cost-benefit analyses rely on technical input from experts

---

[4] Note that accounting in this discussion is different from Carbon Accounting, which is a technical method concerned with quantifying emissions that can be bought and sold in accordance with a particular set of legal standards and limits (Kolk et al. 2008).

[5] In addition to research specifically on carbon-related disclosure, there is also a growing stream of research on more general environmental disclosures (e.g., Clarkson et al. 2007, Clarkson et al. 2010, Clarkson et al. 2011, Dhaliwal et al. 2010, and Plumlee et al. 2008).

that can obfuscate the underlying values and assumptions. The result is that non-experts cannot be effective participants in the process (Bebbington et al. 2007).

Empirical analyses of CDM projects have focused on the nature of information included in applications. Schneider (2009) focuses on whether detailed costs have been provided versus only the result of calculations and provides descriptive statistics for the required rates of return used for the projects (Schneider 2009). Michaelowa (2007) and Michaelowa and Purohit (2007) provide in-depth case analyses of projects, noting inconsistencies and weaknesses in the analyses and treatment of the additionality test by the DOEs. These analyses provide evidence that project developers can obfuscate the attractiveness of their projects to increase the likelihood of the projects passing scrutiny (Michaelowa and Purohit 2007).

Lohmann (2009) discusses theoretical and practical problems associated with accounting models used for CDM projects. For example, there is an assumption underlying the CDM program, that carbon saved via emission reduction is identical to carbon represented by an emissions allowance. This is the result of a political process rather than accounting reality. Calculatio because numerous assumptions are required in the calculation. In addition, Lohmann argues that Executive Board members included carbon consultants and officials from credit-buying countries, who would profit from a high volume of approved projects. The result is that rule-setting and implementation of CDM regulation was likely lenient.

Lohmann (2009) further discusses some of the perverse incentives generated by the way that CDMs have been implemented. For example, the accounting requirement that projects show they are economically unviable without the financial benefit of CERs gives green technology developers an incentive to keep their products slightly more expensive compared to a less environmentally favorable alternative. It also encourages project developers to pay higher prices for the environmental alternatives.

3. Hypotheses Development

When a potential CDM project host firm files for the application of UN approval, it has private information s true value. The UN, the DOE, or any other third party would not be able to learn this private information costlessly. As a rational economic agent, a host firm can use its private information about the project in its own favor. Further, the additionality requirement provides the host firms with incentives to downwardly bias the pre-CER financial benefit of the project (e.g., show a negative NPV, or an IRR below the hurdle, or benchmark rate). Of course, host firms also face potential costs from manipulating the reported information, which includes possible rejection if the manipulation is uncovered. The host firms thus must tradeoff the benefits and costs of information manipulation when they prepare and submit the application.

The UN rationally anticipates a certain degree of information manipulation in the host applications. On the one hand, it has political incentives to accept proposals to justify the existence of the CDM and demonstrate that it has an impact on carbon emissions; on the other hand, the UN may face censure and may lose the authority to approve projects, (and in the extreme, jeopardize existence of the CDM,) if projects with too egregious errors are accepted. This means that while projects that (slightly) exceed the benchmark rate may be approved, there is a general incentive to bias cash flows downward so that projects do not exceed the rate by more than the Executive Board is willing to tolerate. In early stages of CDM development, market size in terms of the value of issued CERs was small and the instrument was unknown to most other potential stakeholders. Thus, the level of external scrutiny was likely low. Consistent with prior literature, we expect that there will be manipulation of information provided in the project financial analyses (Au Yong 2009; Paulsson 2009).

The first type of information manipulation we explore is the use of (intentional) in accounting techniques adopted in investment analyses. Critics of the use of such investment cost-benefit analyses for environmental projects argue that in this setting, such analyses are particularly subjective and can be manipulated (Bebbington et al. 2007, Lohmann 2009). The additionality tool (CDM Executive Board, 2004) contains guidance for applying firms about which cash flow assumptions should be included in project investment analyses. However, this guidance has not been consistently followed. For example, Schneider (2009) notes that in violation of the guidance, 58% of 93 projects he studied used an internally-derived benchmark rate rather than following the typical requirement to use a rate derived from external data.

Violations of the guidance tool and standard cash flow analysis could result because: 1) the applying firms do not have basic accounting or finance expertise to analyze the investment properly; or 2) the applying firms make purposeful mistakes to bias the report. Many CDM host firms are small companies located in developing countries. It is possible that they do not have enough accounting or finance knowledge to prepare a correct analysis. Errors stemming from ignorance should be randomly distributed including both value-increasing and value-decreasing effects. However, if the host firms make deliberate choices to bias analysis in their favor, these errors should on average decrease the value of the project. Empirically, we expect to observe both positive and negative valuation errors due to the lack of sophistication of some companies and lax monitoring by the CDM Executive board. If, however, firms follow incentives to bias project valuations to justify additionality, then on average, we should find a negative bias in the project valuations.

H1: Project investment analyses contain errors that downwardly bias the project values.

It may appear unrealistic that applying firms would adopt such obvious manipulation methods 9

lack of monitoring by the CDM Executive Board, the apparent lack of financial expertise required for DOEs,[6] 3

of analysis technique is possible and realistic. As presented in Table 1, these manipulations entail errors in the way that cash flows are included in the analysis, such as including non-cash items or financing costs as cash flows, and others. We examine the prevalence, magnitude, and direction of these manipulations. While these types of manipulations can either increase or decrease the resulting IRR, a systematic increase resulting from our correction of these errors is consistent with a bias in the analysis to facilitate justification of additionality.

The financial portion of the additionality criterion implies that the IRR for any approved

considering the specific characteristics of the project type, but not linked to the subjective profit 45 6 3

2008, p. 6). The most frequently used benchmark is a hurdle for internal rate of return (IRR). The existence of a benchmark changes the incentives for firms to bias project valuations downwards.

:

:

benchmark, then there is no need to bias the valuations. We therefore expect projects with higher valuations relative to benchmark to exhibit more bias.

[6] The focus for certification of DOEs is primarily based upon technical, not financial expertise. In the 55 page document, the only mention of investment-related expertise required for certification is in Paragraph 44, which

\+ 2

45 45 6 3 63 ! !

H2: Project investment analyses contain errors that downwardly bias the project IRRs relative to their benchmark.

The second source of manipulation that we examine is through misstating/biasing

3

directly examine biases in the cash flows, nor can we correct the reported cash flow values as we can with accounting technique errors. However, once we correct for the errors in analysis technique, we can examine remaining differences :

benchmark IRR. These differences will be due to actual project characteristics and any bias. Because we do not know the true cash flows, we can only examine bias in cash flows indirectly by focusing on factors that would be likely related to bias, but unrelated to project characteristics. Our remaining hypotheses thus concern specific factors that are related to bias. We do not differentiate in our hypotheses between bias introduced by manipulation of analysis technique versus by manipulation of cash flows project before it can be submitted for registration. Having a project registered results in additional development and resources (related to the CERs) flowing into the country. Thus, DNAs have a basic incentive to approve projects. The extent to which DNAs may be willing to

H5: The difference between the reported and the benchmark IRR is related to the type of participant firms.

4. Research Method

4.1. Research design

Our investigations start with examination of financial analysis methodology employed in a sample of CDM projects, where one or more of the project participants is publicly traded.[7] Sample projects contain : [8] Where possible, we calculate a reported IRR both with and without inclusion of cash flows from CERs. We next : flows for errors we have identified. This allows us to 1) see the impact of the expected CER grant on IRR; and 2) to derive an estimate of the magnitude of error related to analysis methodology.

We first test Hypothesis 1 by examining whether our corrections in accounting technique likely represent random error or deliberate bias. Random errors should be unbiased and thus have zero mean. Biases that make projects look less financially favorable should result in our adjustments significantly increasing the IRR. Our second analysis (testing Hypothesis 2) compares our adjustments to the benchmark IRRs to see if there are differences in the impact of our adjustments for projects relative to their distance from the benchmark IRR.

Our third analysis intends to test Hypotheses 3, 4 and 5 by relating the reported (and our : -sectional analyses in an attempt to isolate bias from random error. The reported IRR provided in the PDD can have two

[7] Our initial sample was drawn to conduct a market-based study. We are currently augmenting the sample with projects that do not have a publicly-traded participant.
[8] Some project documents present the cash flows, but use a cash flow analysis method other than IRR, such as NPV :

major areas of error/bias. The first is in the analysis methodology and the second is in the cash flows. Our adjusted IRR corrects for errors/bias in the methodology, leaving error/bias in the cash flows.[9] Our first cross-sectional model explores factors associated with the error/bias in the cash flows. The second model isolates the errors/bias in the methodology and explores related factors.

Additionality requires that the investment be financially unviable in the absence of CER revenues. Although not all projects provide a benchmark, additionality implies that the IRR for the project should be viewed relative to a benchmark and that the pre-CER IRR should be less than the benchmark. Due to the political nature of the CDM, however, projects whose IRR exceeded the benchmark have been approved by the Executive Board. We therefore examine the absolute distance between the project (either reported or adjusted) and benchmark IRR as a measure of error/bias and rely on our independent variables to help us differentiate between the two.

Model (1) below explores factors associated with the distance between our adjusted IRR and

$$\begin{aligned} \text{IDIFFB} = {}_{0} \quad & {}_{1}\text{IRRCER} + {}_{2}\text{INVESTMENT} + {}_{3}\text{CORRUPTION} \\ & + {}_{4}\text{NPRIVATE} + {}_{5}\text{NPUBLIC} + {}_{6}\text{NGOVT} + {}_{7}\text{POWERGEN} \\ & + {}_{8}\text{ENERGYEFFIC} + \varepsilon \end{aligned} \qquad (1)$$

Where:

IDIFFB = benchmark - adjusted IRR without CERs[10]
IRRCER = change in IRR projected to come from CER grants
INVESTMENT = initial investment in Euros translated as of registration request date
CORRUPTION = 10-Transparancy :[11]

[9] We intend to model expected cash flows associated with each type project more directly in future analyses .

[10] The benchmark is either reported in the PDD, or is imputed from projects using the same methodology in the same year and in the same country. In one exception, one methodology did not have any projects reporting benchmarks for a year, but in other years had the same benchmark as a different methodology. We used the benchmark for the second methodology in the same year as the imputed benchmark.

NPUBLIC = number of publicly-traded non-host participants
NPRIVATE = number of privately-held non-host participants
NGOVT = number of governmental agencies that are non-host participants
POWERGEN = 1 if the goal of the project is power generation, 0 otherwise
ENERGYEFFIC = 1 if the goal of the project is energy efficiency, 0 otherwise

IRRCER is the increase in IRR reflected in the PDD that is due to CERs.[12] A significant positive coefficient on IRRCER is more likely to be the result of bias rather than error. Note that we include controls for project type, so any difference that we see is likely driven by incentives.

Our models include several controls for characteristics of the underlying project. INVESTMENT controls for size of investment. Larger projects are likely to require more complicated financial analyses, which could be more subject to error. However, companies that have larger projects are more likely to have accounting expertise to do the analysis properly. We thus have no sign prediction for INVESTMENT. We also include dummy variables to represent the type of project. These variables control for underlying characteristics of the project, including the average profitability relative to benchmark for the type of project and ability to estimate cash flows. We include three basic project types: GHG destruction, power generation (POWERGEN), and energy efficiency (ENERGYEFFIC).[13] We use GHG destruction projects as the basis for the regressions.

---

[11]The index is produced annually. It is based upon different assessments and business opinion surveys carried out by independent institutions. Factors included relate to administrative and political aspects of corruption. Areas covered by the surveys include bribery of public officials, kickbacks in public procurement, embezzlement of public funds, and questions concerning strength and effectiveness of public sector anti-corruption efforts. (Transparency International 2010, http://www.transparency.org/policy_research/surveys_indices/cpi). The original index is out of 10, with a larger score indicating less corruption. We invert the score to facilitate interpretation of coefficients.
[12] A richer research design would include interaction terms for projects reported to be under the benchmark without CERs for many of our variables. Sample size limits our ability to do this in the current draft. We are currently increasing the sample size and will include interaction terms in later drafts.
[13] Project categorizations are based on CDM Executive Board (2010b), which describes the methodologies currently authorized by the Executive Board. Sample projects include 15 different methodologies that fall into six basic categories. Due to sample size, we combine the methodologies as follows: Power Generation includes electricity generation, energy for industry, and renewable energy; Energy Efficiency includes energy efficiency and GHG

In addition to examining errors/bias in cash flows for the projects, we also investigate whether the methodological errors that we identify are related to bias. Model (2) is similar to model (1), but employs the difference between the reported IRR and the benchmark as the dependent variable (IDIFFBTHEM). IDIFFBTHEM is a function of errors in cash flows, errors in methodology, and underlying project characteristics. We isolate the errors in methodology by including IDIFFB as a control variable. INVESTMENT and the dummy variables for project type control for project characteristics.

$$\begin{aligned} IDIFFTHEM = {}_0 \quad {}_1IDIFFB + {}_2IRRCER + {}_3INVESTMENT \\ + {}_4CORRUPTION + {}_5NPRIVATE + {}_6NPUBLIC + {}_7NGOVT \\ + {}_8POWERGEN + {}_9ENERGYEFFIC + \varepsilon \end{aligned} \qquad (2)$$

Where:

IDIFFBTHEM = benchmark - reported adjusted IRR without CERs Other variables are as defined earlier

4.2. Sample and results

The sample of projects was drawn from the IGES CDM Project Database (http://www.iges.or.jp/en/cdm/report_cdm.html#cdm_a), which contained all CDM project activities listed on the UNFCCC website of 1 February 2010. The first CDM project was registered in late 2004 (Norton Rose 2009), so the projects represented in the entire database span late 2004 through January 2010. We investigated listed project participants to identify projects with one or more publicly-traded participants. We next examined these projects to see if the application included a financial analysis with sufficient cash flow information to calculate an IRR. Our resulting sample comprises 74 projects with during the time period 2006-2009, with a total of 91 unique participants. Table 2 presents the sample development.

formation avoidance, and GHG destruction is a category by itself. We intend to expand the number of categories with our larger sample.

Table 3 presents additional descriptive statistics for the sample. Panel A lists the number of projects by host country. CDM projects take place in a wide range of countries, on several continents, although most of the projects are in Asia. Unsurprisingly, China and India have the largest number of projects (43 and 23, respectively). Panel B presents the non-host participants. In the case of companies with offices in multiple countries, the country of each participating office is listed.[14] Related to our sample selection process, the largest number of participants is publicly traded. However, many projects include participants from private companies, such as consulting firms, and governmental agencies. Given that the CERs assist companies in Annex I countries to comply with emission limitations under the Kyoto Protocol, it is unsurprising that the non-host participants are primarily European. Japan has the largest number of non-host participants, however. Great Britain also has a large number of non-host participants. Many of these organizations are banks or private companies that are involved with CER trading.

Panel C of Table 3 presents the distribution of total participants across projects. The average number of participants is three, with a majority of projects having two participants. Fifteen projects list only the host organization. While these organizations may not be able to directly use CERs derived from the project, they can sell the CERs either privately or via a market such as the ECX markets organized by IntercontinentalExchange. Two projects have over 20 participants. The majority of participants in these projects are governmental organizations from several countries.

Panel D of Table 3 presents descriptive statistics for the projects. The mean (median) level 46 from project registration; the mean (median) number of CERs is 17 million (676,000). CER prices

[14] In some cases, multiple offices of the same company participate in a project. These offices are included separately in Panel B to depict the international nature of the efforts. These offices are not duplicated in empirical analyses.

used in the analyses range from ( ) (-

, which indicates the strength of incentives to get projects approved.

Evidence from case studies (e.g., Michaelowa 2007) indicates that both hidden and more obvious errors exist in project analyses. We examine the cash flow analysis provided in the PDDs and correct them for any apparent errors. Appendix 1 contains our protocol for coding the data from the PDD. Table 4 displays IRR-based calculations for sample projects. The first column contains the IRR based on numbers reported in the PDD, excluding the value of projected CERs. Across all projects, the average IRR is 8.1%. The value of CERs contributes a significant amount to project IRR. Including them (reported in the second column), increases the average IRR to 14.2%. As reported in the seventh column of the table, the average increase in IRR is 6.2%, which is significantly greater than zero ($p < .0001$) and comprises over 40% of the average IRR.

The third column of Table 4 reports descriptive statistics concerning the absolute distance between reported IRRs without CERs and the (imputed) benchmark. The average difference from the benchmark is 3.7%. Untabulated results indicate that 86% of the reported IRRs without CERs are below the benchmark. This is consistent with the additionality criterion, although theoretically, all of the projects should be below benchmark.

The next set of columns in Table 4 report IRRs after our adjustment. Our average adjusted IRR excluding CERs is 7.3%. On average, our adjusted IRRs do not significantly differ from the reported IRRs ($p > .10$), although the range of the adjusted IRRs appears much larger than for the reported IRRs. The reported IRRs range between -8.9% and 14.3%, whereas our adjusted IRRs range between -23.8% and 19.5%. In addition, our adjustments affect how close the IRR is to the benchmark for projects that are over versus under the benchmark. An untabulated analysis indicates that the difference between reported IRR and benchmark for projects that are over (under) the benchmark is 5.2% (5.4%), with the difference between the two not statistically significant. However, the difference between the adjusted IRR and benchmark for projects that are over (under) the benchmark is 1.3% (4.1%), with the difference between the two statistically significant ($p < .0001$). In summary, while the average statistics do not support a bias in our adjustments overall, the dramatic increase in variation of the IRRs following adjustment and the difference in distribution for projects that are over versus under the benchmark indicate that: 1) for some projects, the adjustments were non-trivial; and 2) the impact of our adjustments is consistent with a downward bias in the reported IRRs, particularly for projects with IRRs over the benchmark.

Table 5 reports results of estimating models (1) and (2). Model (1) examines factors associated with the distance between our adjusted IRR and the benchmark. Results indicate that projects with a greater number of CERs have a greater distance between the pre-CER IRR and the benchmark ($p < .01$). This is consistent with increased incentives to justify additionality by understating cash flow.

Results for Model (1) also indicate that the degree of corruption in the host country is positively related to the distance between our adjusted IRR and the benchmark ($p < .05$). While consistent with a greater degree of bias in countries with more corrupt governments, it is also possible that errors in cash flows are less likely to be identified in these settings. Future analysis based on a larger sample size will enable us to better distinguish between errors and bias.

Model results also provide evidence that it is important to control for project type. Projects associated with energy efficiency have a greater distance between the adjusted IRR and the benchmark ($p < .09$). Untabulated results indicate that the adjusted IRR for these projects average -3.5%, whereas the other types of projects have an average positive IRR (4.4% and 8.2% respectively for GHG destruction and power generation projects).

The second column of Table 5 presents results of estimating model (2). Because we include a control for the distance between our adjusted IRR and the benchmark, this model focuses on errors/bias related to analysis methodology. Similar to the results for model (1), coefficients on IRRCER and CORRUPTION are significantly positive ($p < .0001$ and $p < .05$ respectively). Both are consistent with a bias in the way that the methodology was employed.

Results for model (2) also indicate that the level of scrutiny of project analysis methodology depends on the type of non-host participation. Projects with a larger number of publicly-traded participants have a smaller deviation from the benchmark IRR ($p < .007$). Projects with a large number of private-owned participants have a similar effect, demonstrating

role in monitoring the host firms. Projects with a larger number of governmental agency participants have a larger deviation from the benchmark ($p < .008$). Finally, similar to results for model (1), energy efficiency projects have a larger absolute deviation from the benchmark IRR.

5. Discussion and Conclusions

Climate change presents increasing challenges on issues involving accounting regulators and practitioners. As the market approach to control climate change has become a dominant approach in practice by governments and businesses, v related research in the current accounting literature. To our knowledge, this study is the first to investigate accounting methods used for valuation of a broad cross-section of CDM projects and their implications for equity markets. We hope to provide a deeper understanding of project characteristics that are associated with errors and bias included in investment analyses.

Our results show that firms go beyond inherent flexibility available within required methodology. The degree of error and bias seems to depend on a variety of factors such as project-related CER revenue (as proxy for the strength of the incentive), the host countr corruption index (utional framework), and the level of scrutiny by non-host partners.

Results are preliminary due to small sample size. More sophisticated models are necessary to increase confidence that our results are due to bias rather than error. Thus far we have concentrated on accounting errors in the financial analysis but have not considered technical errors, which are likely embedded in the PDDs. Although we were not able to detect non-obvious errors, our results provide evidence that project partners intentionally bias their financial analyses towards meeting the additionality criterion. However, measuring non-obvious errors indirectly, e.g. by comparing projects of the same type in more detail or in the same market, or by interviewing project partners can be promising avenues for future research.

References

Au Yong, H.W. (2009). Investment Additionality in the CDM. Technical Paper. Edingburgh, Econometrica Press.

3 3 3 7 ! ! (2
assessment *Ecological Economics* 61: 224-236.

Bode, S., Michaelowa. A. (2003). Avoiding perverse effects of baseline and investment additionality determination in the case of renewable energy projects. Energy Policy 31(6), 505-51.

4 7 ! ! Carbon market doubled in value in 2008 World Bank
http://www.carbon-financeonline.com/index.cfm?section=lead&action=view&id=12101

Carbon Trust (March 2009). "Global Carbon Mechanisms: Emerging lessons and implications

Clarkson, P. Li, Y., Richardson, 8 7 ! ! (
+
Accounting Organizations and Society 33(4-5): 303-327.

4 4 ! 6 tal reporting and its relation to
Abacus 47(1)

4 2 ! ! 6 + costless activity to market operations. Accounting, Organsations and Society34(3-4), 456-468.

Dhaliwal, D., Li, O., Tsang, A, and ! !
+
paper.

Doran, Kevin L., & Quinn, Elias L. 2009. Climate Change Risk Disclosure: A Sector by Sector Analysis of SEC 10-K Filings from 1995-2008. *North Carolina Journal of International Law and Commercial Regulation*, 34: 101-147.

Dutschke, M., Michaelowa, A. (2006). Development assistance and the CDM how to interpret
. Environment and Development Economics 11, 235 246.

8 6 : 8 6 : 4 -effective pollution prevention initiatives: incorporating the environmental costs into business decision
5 4 +8 6 :

Global Reporting Initiative (GRI) (2010) Global Reporting Initiate and Carbon Disclosure Project release linkage document
http://www.globalreporting.org/newseventspress/pressresources/2010/gri+and+cdp+linkage+document.htm

8 5 ! !

Ha 3 ! ! (7 + 4 5
3 +:
http://www.internationalrivers.org/files/Failed_Mechanism_3.pdf

9 4 - *Natural Resources Journal* 6: 195-222.

Johnston, D. M., Sefcik, S. E. and Soderstrom, N. S. (2008) The value relevance of greenhouse gas emissions allowances, *European Accounting Review*, 17(4): 749 766.

2 5 !!) 4 +

!! 5 4 5 -Handbuch Leitfaden f ür Antragsteller, Berlin

United Nations (1998) Kyoto Protocol to the United Nations Framework Convention on Climate Change. Available at: http://unfccc.int/resource/docs/convkp/kpeng.pdf

UNFCCC. (2001). Report to the Conference of the Parties on its seventh session. Part two: Action taken by the conference of the parties. United Nations Framework Convention on Climate Change, FCCC/CP/2001/13/Add2, Marrakesh.

Young, B., Suarez, C., and K. Gladman (2009) Climate Risk Disclosure in SEC filings. Ceres and Environmental Defense Fund http://www.ceres.org/Document.Doc?id=473

Weitzman, M. L. (1998) Why the far-distant future should be discounted at its lowest possible rate. *Journal of Environmental Economics and Management* 36: 201 8.

2 5 3 4 2 +2 pollution prevention through innovative project financial analysis with applications to the 6 2

Figure 1
Project Stages for a Successfully Implemented CDM Project*

Project Status	**Participants**	**Resulting documents**
Development	Project owner/project developer	Project design document (PDD)
Approval	Host country DNA (+Annex1 country DNA)	Letter of approval
Validation	DOE_1	Validation report
Registration	CDM Executive Board	CDM Executive Board decision
Monitoring	Project owner	Monitoring report
Verification	DOE_2	Verification report
Certification	DOE2	Certification report
Issuance of CERs	CDM Executive Board, CDM registry	

* Projects that fail to pass a stage can be revised and resubmitted.

Adapted from: UNFCCC (2001)

Table 1
Sources of Errors/Biases in Investment Analysis Technique

Seemingly obvious sources of errors and/or bias
Inclusion of depreciation or other non-cash items as cash flows
Inclusion / exclusion and choice of income tax rate
Calculation of Equity IRR versus Project IRR
Inclusion of financing costs in cash flows
Project Life

Table 2
Sample Development

		Remaining Projects
Original Sample of Projects	2420	
- Projects without publicly traded partner	2112	318
- Projects which did not conduct either a Benchmark or investment comparison	143	175
- Projects with incomplete data	101	74
Final Sample		74

Table 3
Descriptive Statistics for Projects and Participants

Panel A: CDM Projects by Host Country

Table 3 continued
Descriptive Statistics for Projects and Participants

Panel C: Total Number of Participants per Project

Number of Participants	Number of Projects
1	15
2	32
3	18
4	3
5	2
7	1
9	1
23	1
26	1
	74
Average Number of Participants	2.97
Standard Deviation	3.85

Panel D: Project Features

	Investment !!! Euro)	CERs Expected by ! ! !!!
All Registered Projects		
Mean	43,029	17,349
Standard deviation	155,034	37,675
Minimum	142	43
Median	11,210	676
Maximum	1,314,124	24,857
N	74	74

Table 4
Reported and Adjusted Internal Rates of Return for Projects 2006-2009

	Reported IRR Excluding CERs	Reported IRR Including CERs	|Reported IRR minus Benchmarkl	Adjusted IRR Excluding CERs	Adjusted IRR Includin CERs	|Adjusted IRR minus Benchmark|	Increase in IRR due to CERs	Adjusted Minus Reported IRR
<u>All Registered Projects</u>								
mean	8.1%	14.2%	3.7%	7.3%	14.0%	5.4%	6.2%***	-0.8%
stdev	3.9%	3.9%	3.2%	5.6%	5.8%	5.0%	4.9%	4.2%
min	-8.9%	7.2%	0.0%	-23.8%	3.1%	0.0%	1.4%	-14.9%
median	8.4%	14.3%	3.0%	7.4%	13.2%	4.4%	4.4%	-0.2%
max	14.3%	26.2%	18.9%	19.5%	32.0%	33.8%	25.9%	10.8%
N	74	74	74	74	74	74	74	74

Notes:

*** $p < .0001$.

Table 5
Ordinary Least Squares Regression of Distance between IRR and Benchmark

Dependent variable	*Based on Adjusted Estimate*	*Based on Estimate from Project Design Document*
	IDIFFB	*IDIFFBTHEM*
	Coeff. (*p-value*)	Coeff. (*p-value*)
INTERCEPT	-0.380	-0.200

Appendix 1

Protocol for Calculating IRRs

Procedure for calculating average operating costs and average other costs

1. Go to Cash Flow table or IRR/NPV calculation (usually an appendix named “financial analysis,” “investment analysis enclosure,” or “IRR calculation”)

Remark 1: All data should be based on cash flows usually labelled as 4 ash Flows or IRR calculation.

Remark 2: In most cases the cash flows are included in an Excel table which allows us to do the calculation below.

2. Project Life

- 4 iod which includes cash flows for IRR / NPV calculation.
- Remark: The project life starts with the first period with operating costs > 0
- **Input** project life into the database

3. Calculate operating costs other costs for each period during the project’s lifetime

- Operating costs include operational costs, maintenance costs, fuel costs, labor costs, and material costs. These costs are sometimes documented separately. However, most of the time, they are summarized under O & M or costs. If there are no details provided, assume that they are already included.
- Other costs: all costs before income / profit taxes, e.g., sales taxes / added taxes /charges / monitoring costs / annual registration etc.
- Do not include any interest payments
- Remark: Please take into account that some projects include several asset units for which operating costs are documented. In this case, we should just add operating costs of different assets.

4. Calculate average operating costs

- Average operating costs = sum of operating costs in all periods during lifetime / lifetime
- **Input** average operating costs into the database

5. Calculate average other costs

- Average other costs = sum of other costs in all periods during lifetime / lifetime
- **Input** average other costs into the database

6. Remarks

Input remarks into the database: Here it should be documented if any problems occurred when average operating and average other costs were calculated. Document also if any counterintuitive or interesting results or issues were covered.