Scale and Transfers in International Emissions Offset Programs

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(1) Overview

Voluntary emissions offset programs between developing and industrialized countries suffer from adverse selection, because participants will self-select into the program. In contrast, pure subsidies for mitigation lead to full participation and hence efficiency, but require large financial transfers which make them unattractive to industrialized countries. We present a simple model to demonstrate the impact of three policy options on the performance of offset programs: (1) baseline scale increases, (2) offset discounting and (3) setting stringent baselines. With baseline scale increases, entire political jurisdictions such as regions or nations are assigned a single, aggregate baseline and must choose whether to participate as one entity.

We find that scale *both* improves efficiency *and* reduces transfers from offset buyers to sellers. Offset discounting means paying less than the value of abatement, or using trading ratios between offsets and allowances in a cap-and-trade system. We show that discounting is inefficient. While the conventional wisdom -- that discounting can be used to reduce the fraction of offsets that are spurious -- is invalid, discounting can make offsets more attractive to industrialized countries. Setting stringent baselines also involves a tradeoff between efficiency and transfers. We finally show that Pareto efficient policies that are individually rational for buyers and sellers entail some combination of discounting and/or stringent baselines: offset policies are never first-best, but can be efficiency improving, especially with increased scale. This paper frames the issues in terms of avoiding deforestation but the results are applicable to any voluntary offset program.

(2) Introduction, Summary and Methods

Deforestation is responsible for 15-25% of total greenhouse gas emissions, and including forests in climate negotiations appears crucial for the success of any potential climate deal. In fact, many leading academics and policy makers assert that avoiding deforestation is a key short-run, low-cost climate mitigation option (Stern, 2008). A large literature emphasizes that it is critically important to price carbon in forests (Melillo et al., 2009; Wise et al., 2009), but does not take into account the difficulty of designing effective policies to address deforestation in developing countries, where most deforestation occurs (Andam et al., 2008; Pfaff et al., 2007). Many proposals assume the application of efficient price-based policies, yet these are hard to achieve in much of the developing world.

Offset programs, a key current instrument for industrialized countries to transfer resources in order to affect deforestation in developing countries, typically give credit for forest remaining above an estimated and assigned forest baseline. Such programs suffer from serious problems such as adverse selection and spurious offsets. Adverse selection is caused by a combination of two factors: a *voluntary* element (i.e., forest owners can choose whether or not to opt in to the program) and *asymmetric information* about the baseline (i.e., the forest owners know more about their true baseline than the regulator) (Montero, 1999, 2000; Bushnell, 2011). Spurious offsets occur if the regulator overestimates the baseline deforestation rate.

Are such offset programs doomed to be economically inefficient and, perhaps, undesirable, or can they be designed in ways to make them more efficient? This paper aims to answer this important policy question from a theoretical perspective. We formally model a voluntary price-based offset program to avoid deforestation, and examine the impact of three key policy levers on the program's economic performance, attractiveness to industrialized and developing countries as a mitigation option, and environmental outcome. The first policy is to increase the scale of offset programs so that entire political jurisdictions such as regions or nations get assigned a *single, aggregate* baseline and must choose whether to voluntarily participate in an international agreement as one entity with *all* its forested land. This is in sharp contrast to small scale, plot-specific baselines and opt-in rules for small local agents (e.g., individual landowners). The second policy is to discount offsets (pay less than the value of abatement), or use trading ratios between offsets and allowances in a cap-and-trade system. The third policy is to set stringent baselines.

Specifically, we assess performance using three inter-related criteria. *Efficiency* is determined by whether land goes to its optimal use -- land that yields agricultural or timber returns exceeding the positive environmental externalities from the forest should be cleared; land with lower returns should not. The *average cost* per unit of emissions abatement through avoided deforestation is an indicator of the offset buyers' value for money. *Quality* or *environmental integrity* of offsets is measured as the percentage of offsets that are not spurious. Spurious offsets lead to a global environmental loss if their presence is not factored in through a more ambitious cap.

We use analytical results and numerical simulations from a microeconomic model of land use. This model shows that asymmetric information about the forest baseline in voluntary programs leads to trade-offs between efficiency, average cost and offset quality. We then introduce a framework to make explicit the benefits and costs of transfers between industrialized and developing countries, and present the Pareto set of individually rational policies.

We draw the following conclusions. First, baseline scale increases improve efficiency and quality and reduce infra-marginal transfers from buyers to sellers, leading to lower average cost. Second, discounting and trading ratios are inefficient (since they make participation unattractive to certain sellers of non-spurious offsets), but also reduce transfers. In addition, trading ratios between offsets and allowances have ambiguous environmental effects if the cap is not properly adjusted. While the conventional wisdom -- that discounting can be used to reduce the fraction of offsets that are spurious -- is invalid (Chung, 2007; Environmental Defense Fund, 2007; Greenpeace and Papua New Guinea, 2008; Schneider, 2009), discounting can make offsets more attractive to industrialized countries. Third, more stringent baselines also reduce efficiency and reduce average cost for industrialized countries but, in contrast to discounting, generally improve the quality of offsets. In fact, with stringent baselines, projects can be awarded *fewer* offsets than their actual emissions reductions (Bento et al., 2012). Finally, the Pareto set only contains policies that involve some combination of discounting and/or stringent baselines, to guarantee that it is individually rational for industrialized countries to participate. In an international context, offset programs are therefore never first-best, but can be efficiency improving, especially with increased baseline scale.

Our presentation focuses on deforestation but the results are equally applicable to a variety of voluntary offset programs, national and international, particularly those that involve international public goods and financial transfers between countries, and to climate agreements between industrialized and developing countries more generally.

(3) Results

See “Overview” section above. The full paper provides many numerical and graphical results (downloadable from http://bepp.wharton.upenn.edu/profile/21174/research). One key result is summarized by Fig. 1 below:

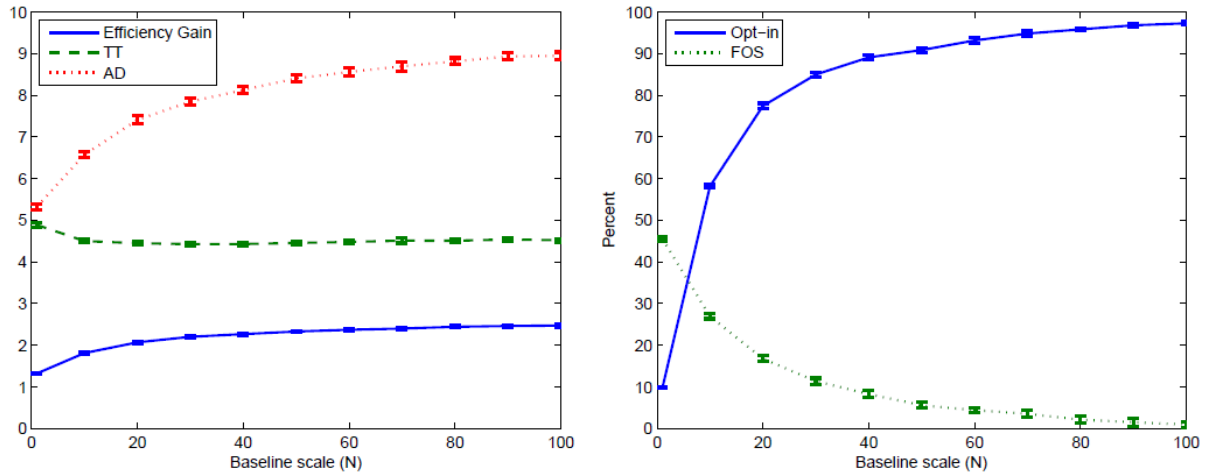

Fig. 1: A graphical representation of the impact of baseline scale on the performance criteria. Each simulation contains N_{total} = 10,000 plots. Simulations are repeated 100 times. Assigned baselines are unbiased.TT = “total transfers from industrialized to developing countries”. AD = “avoided deforestation due to the offset program”. Opt-in = “Percent of forest owners in developing countries that opt in to the voluntary offset program”. FOS = “The fraction of all offsets that is spurious”. *Efficiency gains, AD and TT are all normalized per 100 plots.*

Fig. 1 shows that as the baseline scale of the offset program is increased, the *per-plot* efficiency gain increases, more deforestation is avoided, and the fraction of the offsets that is spurious decreases.

(4) Conclusions

We have three main findings. First, under almost all circumstances, offset programs perform better when they are scaled up so that entire political jurisdictions such as regions or nations get assigned a single, aggregate baseline and must choose whether to opt in as one entity. This forces offset sellers to decide on participating with all of their forested land, rather than being offered the flexibility of plot-specific baselines under which they can opt in with several plots and opt out with others. This makes it less easy for the seller to exploit his information advantage, and leads to an efficiency gain. Second, offset discounting and trading ratios between offsets and allowances in a cap-and-trade system reduce efficiency but also reduce transfers to offset-selling developing countries. Contrary to conventional wisdom, offset discounting increases the percentage of offsets that are spurious, and even high trading ratios have ambiguous effects on global carbon emissions. Third, we show that setting more stringent baselines reduces efficiency and transfers to developing countries but, in contrast to discounting, generally improves the quality of off sets. The Pareto sets presented in the paper highlight the main rationale of using discounting and/or stringent baselines: they may be necessary to convince self-interested offset buyers to participate in the program. We then show that feasible off set programs are never first-best, but can be designed such that they yield an efficiency gain relative to no policy.