Discounting Offsets: Issues and Options

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Abstract
This paper describes the different types of discounting, their objectives and their potential impacts on carbon markets. Discount factors can be used to strengthen the environmental integrity of offsets and to give preference to certain projects types or geographic regions. Applying a discount can also, in theory, enable the use of offsets to provide a net environmental benefit. At the same time, discounting could have potentially negative effects on the efficiency of carbon markets and might increase the fraction of non-additional credits. All discounting approaches face the difficulty of having to establish the right discount rate that is politically acceptable, maximizes benefits and minimizes negative effects. While discounting is no silver bullet – its potential pitfalls are significant – it should be considered by policy makers as a mechanism to address specific objectives, in particular to remedy perverse incentives and to maximize the environmental benefit of offset markets.
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INTRODUCTION

Analysts and policy makers have proposed discounting as a method to address the risks and uncertainty associated with GHG offsets, to favor some offset sources over others, or to achieve emissions reductions beyond the cap (ACESA 2009, CEJAPA 2009, UNFCCC 2008 a and b, Michaelowa 2008, Schneider 2009). Under a discount, an offset that is estimated to represent one metric ton of GHG reduction or removal would be multiplied by a discount factor (between 0 and 1), such that the offset would count as less than one metric ton of allowance-equivalent compliance credit (or towards facility emissions in direct offsetting context). Discounting can be applied to all offsets or targeted to specific project types, locations or other criteria. This scoping paper describes the different types of discounting, their objectives and their potential impacts on carbon markets.

Ideally, offset rules and protocols contain adequate safeguards to cover for risk (e.g. of non-additionality or for reversals of sequestered carbon) and uncertainties (e.g. those associated with baselines or measurement). However, experience has shown that protocols intended to be rigorous can still allow, for instance, a substantial number of non-additional credits (Schneider, 2007). Therefore, discounting can serve as tool, however rather blunt, to account for such risks. Discounts to address risks and uncertainties can be applied before or after offset credit issuance. For example, some Clean Development Mechanism (CDM) and Climate Action Reserve (CAR) protocol apply discounts to account for uncertainty in measurement methods.

Discount factors can be used as a tool to further strengthen the environmental integrity of offsets and complement good offset program design which includes having stringent additionality and monitoring requirements and using conservative baselines. Discounting factors can be used to give preference to certain projects for example because they deliver higher co-benefits or facilitate more long term mitigation benefits than other project types. Parties to the Kyoto Protocol have proposed differential discounting of specific project types under the CDM (UNFCCC 2008 a and b). Recent U.S. proposed federal legislation has included a 20% discount on international offsets, as compared with no discounting for domestic projects (see the American Power Act (APA), the American Clean

1 Risk and uncertainty of offsets can be addressed through a range of other measures not further discussed in this paper. These include for example, baselines that are set below BAU or shorter crediting periods (Schneider, 2009) or a tax on offset profits (Muller 2007).

2 We do not discuss multiplication factors, i.e. applying a factor above 1 which would result in giving more than one credit per ton of avoided or sequestered CO2e. This option was discussed by the Ad Hoc Working Group of the Kyoto Protocol (UNFCCC 2008 a and b) and several others (e.g. Bakker et al 2009). We are excluding this option because of its risk to undermine the environmental integrity of an offset program. Theoretically a multiplier above 1 for certain types of offsets could be compensated by multipliers that are below 1 for other offset types.
Energy and Security Act (ACESA) and the Clean Energy Jobs and American Power Act (CEJAPA)).

Applying a discount can also, in theory, enable the use of offsets to provide a net environmental benefit. For example, if the discount rate is set at 20% for all offsets used under a cap-and-trade program, then each offset will generate an added 25% environmental benefit. If one offset ton already represents exactly one ton of actual emissions reduced or removed, then the discount allows the cap-and-trade to achieve reductions beyond what is required by the cap.

At the same time, discounting could have potentially negative effects on the efficiency and integrity of carbon markets. To first order (i.e. not accounting for the resulting impact on offset prices), by reducing the emissions-equivalent value of offsets, discounting will reduce the revenue flowing to offset projects. This revenue reduction is likely to have the greatest impact on the viability of projects most dependent on offset revenue. Projects highly dependent on offset revenue are also those more likely to be additional. Discounting, on the other hand, tends to have limited impact on projects that are likely to proceed without offsets revenue (i.e. non-additional). As a result, discounting, if not done in a selective manner, could reduce the proportion of accepted offsets that are likely to be additional. Discounting could also impair economic efficiency, to the extent that it reduces the supply or distorts the cost of mitigation opportunities by making certain types of mitigation more expensive. In other words, the objective of prioritizing certain project types over others potentially leads to higher mitigation costs. Finally, discounting offsets after the point of offset issuance can create distortions unless all markets apply identical discounts (e.g. US and EU with respect to the CDM). We highlight the pros and cons of different discounting mechanisms throughout the paper, and focus specifically on economic effects in Chapter 4.

OBJECTIVES FOR DISCOUNTING OFFSETS

In this chapter we discuss the different policy objectives of discounting, and the forms of discounting that could be used to achieve these objectives. We elaborate on the most important policy objectives and illustrate with examples from existing or proposed discounting schemes. We outline challenges for each specific approach and conclude with a broader discussion of challenges faced by all discounting approaches. (For a summary of approaches, benefits and challenges, see table 1 at the end of the paper.)

1 To illustrate: if 125 tons of offsets are discounted 20%, then they would yield 100 allowance-equivalent credits. If instead of reducing its own emissions by 100 tons (or purchasing allowances), a capped entity complies with its obligations by purchasing these 100 discounted credits, then 125 tons of emissions reductions would be achieved (assuming each offset ton represented an actual, additional ton of reduction). Overall emissions reductions are therefore 25% greater (125/100) than if the entity had reduced their own emissions by 100 tons or purchased 100 tons or allowances.

The environmental benefits of offset programs can be increased by achieving more emissions reductions than required by the emissions cap (achieving net atmospheric benefits) or, less ambitiously, by accounting for the risk of over-crediting and therefore ensuring that emissions are not inadvertently higher than the cap:

**Achieve greater emissions reductions than required by emissions cap**

Offsets are a tool to increase economic efficiency and allow entities in a cap-and-trade program to meet their reduction obligations at lower cost. They allow greater flexibility in the location or sector where the emission reductions occur, but do not lead to global emissions reductions beyond the levels set by the cap. Discounting offsets is one way to increase mitigation levels beyond the cap and create an offset mechanism ‘with atmospheric benefits’ (Schneider 2009). Current global mitigation efforts are well below the reductions required to maintaining “the increase in global temperature below 2 degrees Celsius”, as articulated in the Copenhagen Accord. Discounting offsets could therefore be one of many policy tools to accelerate GHG mitigation action (Schneider, 2009, Bakker et al 2009).

**Account for the risk of over-crediting**

The risk of crediting more offsets than have likely occurred is one of the principal rationales for discounting. There are many sources of uncertainty in offset quantification, such as the determination of additionality, uncertainty in baseline assessment, measurement or monitoring. Such uncertainty can vary considerably between project types. Discounting offers a possible tool to mitigate the resulting risk of over-crediting. The objective of discounting in such cases is to increase probability that the total number of offsets issued or used correspond to an equivalent number of emission reductions or removals. Potential challenges of such an approach include the risk of creating economic distortions and inefficiencies. Discounting may also hamper the use of more effective measures to address over-crediting (see discussion below).

**Address non-additional offset projects**

Additionality has been at the crux of the debate regarding offsets. There is no bullet-proof way to ascertain the additionality of most offset projects. Numerous studies have shown that a large number of credits generated under the CDM may be non-additional (Haya 2010, Michaelowa and Purohit 2007, Schneider 2007, Wara and Victor 2008).

Discounting offsets has been proposed as a means to mitigate the impact of non-additional offsets credits (Schneider 2009). For example, policy makers could impose an across-the-board discount of offsets (at issuance or use for compliance). Such a strategy would not target specific non-additional projects but is meant to strengthen the overall environmental integrity of the system by compensating for potential non-additional credits that enter the market. Discount rates could also be applied specifically to offset project types or locations believed to have a higher likelihood of non-additionality.

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5 For a tracking of current efforts see Climate Interactive Scoreboard: http://climateinteractive.org(scoreboard, accessed Feb 16, 2010.
However, the effect of discounting on addressing non-additionality is far from straightforward. Discounting reduces the effective payment per ton of emission mitigation. To first order, this effect is likely to have the greatest impact on the projects that are most likely to be additional, i.e. those most dependent on carbon revenue for their viability. However, for projects that would go ahead regardless of carbon revenue, the reduction in revenue will have much less effect. Therefore to the extent that discounting results in dissuading additional projects from proceeding, while non-additional projects continue to generate offset credits, the proportion of credits from non-additional projects could actually increase. Furthermore, it is possible that discounting offsets could undermine efforts to establish stricter additionality requirements, since it could be argued that discounting offsets sufficiently addresses additionality concerns (INR and RAN 2009).

Another challenge is determining the appropriate discount rate – a challenge that exists regardless of the rationale for discounting. If the goal of such a discount is for the total number of credits used to represent, as close as possible, the total number of emissions reduced or removed, then the discount rate may need to exceed the fraction of non-additional projects by a significant amount where discounting discourages additional, more than it discourages non-additional, projects. If the conditions under which the likelihood of non-additional projects are relatively high – for instance, if it can be linked to project type, location, or other indicator – then selectively discounting these conditions at a higher rate, can mitigate against high discount rates for other sectors, and the effect that this can have on the supply of (additional) offset projects.

**Compensate for high baselines**
Baseline determination is closely linked with additionality assessment. In principle, a project-specific baseline is the full specification of what would have otherwise occurred absent the offset program; additionality is simply the finding that the project is not same as the baseline scenario. However, in practice, offset protocols address baseline and additionality determination using different methods, and each thus introduces a different source of uncertainty and risk of over-crediting.

For some project types, such as forest management projects, baseline methodologies are subject to large uncertainties, as it is difficult to predict what land use and management practices would have been followed in the absence of a project. Differences in baseline methodologies for forest management projects can result in significant differences in offsets credited for a given project (see Galik et al 2008). Similar outcomes can be attributed to other offset project types (Lazarus et al 2010). Some project types are inherently more prone to shifting baselines and to baselines that are difficult to establish. For example in sectors with rapidly changing technologies or in the forestry sector where carbon stocks can fluctuate from decade to decade, depending on the historical distribution of tree ages within the project boundary and fluctuation in demand for wood products. Discounting could be used to address the potential for inflated baselines quantification methodologies; however, selecting the appropriate discount rate poses many of the same challenges as selecting a baseline methodology (if the precise rate of over-crediting in baselines were known, the baseline could be directly adjusted to reflect this).
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Control for imprecise measurement
Imprecision can arise from uncertainty in measurements. Discounting to account for such uncertainty can be used to mitigate the risk of overestimating emission reductions. For example, CAR considers the sampling uncertainty in forest carbon stock measurements and discounts accordingly. CAR’s protocol for landfill methodology discounts offset credits by 20% for the uncertainty associated with monthly rather than continuous landfill gas flow monitoring. Similarly, some CDM monitoring methodologies require the use of a “conservativeness factors” to address uncertainties in the calculation of emission reductions (Schneider, 2009).

Direct economic and other benefits to specific regions, sectors, or technologies
Proposed US legislation discounts international offsets, in order to favor investment in sectors, such as agriculture and forestry, most likely to supply domestic offsets. Internationally, some analysts and policy makers have proposed discounting mechanisms to direct greater investment to less developed countries relative to more advanced developing economies such as China or India. For example, Castro and Michaelowa (2009) investigate an approach that discounts CERs based on (higher) per capita income and (higher) per capita emissions. A discounting scheme could also be designed to promote co-benefits: To help achieve this objective, a project or project type with limited or no co-benefits could receive a higher discount rate, while a project with high co-benefits might receive no discount (Bakker 2009, Schatz 2008, Schneider, 2008, UNFCCC 2008b). The Gold Standard, developed by several NGOs under the leadership of the WWF has developed a specific sustainability matrix to evaluate the co-benefits of CER and VER projects. One possibility would be to set discount rates according to this sustainability matrix (Bang and Gil 2005).

Such selective discounting could face several challenges: It is unlikely that projects in LDCs and with high co-benefits alone could deliver enough offsets to satisfy the demand (see discussion on economic impacts in section 3). It is also particularly difficult to establish the empirical basis for selecting discount rates. Such rates may therefore seem arbitrary and politically challenging to determine.

Encourage advanced developing countries to move from CDM to own-country climate commitments or other instruments
Discounting offsets could also be a way to foster deeper reductions in countries that are currently unwilling to take on binding GHG emission reduction commitments (Bakker et al 2009, Chung

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6 If the 90% confidence interval around the mean estimate of the carbon stock is less than 5% of the mean estimate of the carbon stock, there is no discount applied. If the 90% confidence interval is between 5 and 20% of the mean estimated carbon stock, then the number of creditable offsets is discounted by the proportion that is the 90% confidence interval divided by the mean estimated stock. If the 90% confidence interval is greater than 20% of the mean estimated carbon stock, a 100% discount is applied (e.g. no offsets are awarded) CAR Forest Project Protocol, Version 3.0, September 1, 2009.

7 One of the dual goals of the CDM was to promote sustainable development in host countries, a goal that has for the most part not been achieved (Holm Olsen 2007, Sutter and Parreño 2007, Schneider 2007).
2007, Castro and Michaelowa 2009). Castro and Michaelowa argue that by diminishing offset revenue through selective country discounting, incentives for CDM projects are lessened and might therefore lead to more domestic action that is not tied to offset revenue.

The recent conflict surrounding CDM wind projects from China illustrates how offset programs can potentially hamper other policy action and how discounting could be used to reduce such policy disincentives. In China, the government provides a preferential “feed-in” tariff for electricity generation from wind projects. This tariff has been high enough that projects might appear financially attractive without CDM credits. The government reduced this tariff, which led to the recent rejection of several Chinese wind projects by the CDM Executive Board, based on the concern that tariffs were reduced merely to make the projects appear additional and thus capable of securing CDM credit value. This situation illustrates the challenges of providing positive signals for governments to implement climate-friendly policies (Point Carbon, 2010).

**Address situations where projects are eligible for multiple policy incentives in addition to GHG offset credits**

The challenge of ensuring additionality of individual projects while encouraging the adoption of climate mitigation policies, and other incentive policies, is not unique to the CDM. It also arises when a project is eligible for payments for multiple ecological services (e.g. wetland protection or conservation reserves), a situation often referred to as “stacking”. If all payments are needed in order for a project to proceed, environmental integrity and economic efficiency is retained. However, where one or more payments are not needed, then awarding all payments is both inefficient and, in an offsetting context, detrimental to the environmental outcome. A possible approach to address multiple incentives or stacking is partial discounting to reflect the incentive provided by multiple policy measures. Yet it remains unclear how feasible and effective such an approach would be as it would require coordination among the incentive providers, for example between host governments and CDM administrators to find the balance between the offset discount rate and level of domestic incentive, which might involve a level of negotiation among parties that might be excessive for a market-based instrument.

**Prioritize reductions in capped sectors and countries (supplementarity)**

Discounting could be used as an additional policy tool to enforce supplementarity alongside with limits on offset use such as the limits set by EU-ETS or the proposed US cap-and-trade system (Schneider 2009, Castro and Michaelowa 2008). An offset discounting policy could be used to strengthen supplementarity because discounting offsets could make them more expensive and therefore less attractive for capped entities compared to allowances or internal reductions. As with other rationales of discounting, and for supplementarity itself, this approach could be criticized for creating economic inefficiencies, since it could lead to higher-cost mitigation actions in developed countries.

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Limit windfall profits (and minimize perverse incentives)
Discounting could target project types, such as HFC23 destruction, that are known to have abatement costs (less than $1/tCO2e) far lower than the market price for offsets (e.g., $10-20/tCO2e for CERs). The resulting rents or windfall profits can also lead to potential perverse incentives, for example to maintain high rates of HFC23 emissions, a waste gas emitted during HCFC22 production, or to produce HCFC22 solely for the purpose of generating HFC23 (Wara and Victor 2008) Discounting could be an effective tool to reduce such windfall profits (Bakker et al 2009, Schatz 2008). By curtailing these large profits, discounting could also limit potential perverse impacts. On the other hand, it may be that other policies, such as direct regulation or more stringent baselines are more effective in curtailing windfall profits than applying discounts.

Allow early offsets that are not fully compliance-grade
Discounting according to uncertainty could be used in a new mandatory program that looks to reward early action. Some pre-existing voluntary offsets might not fully meet the quality criteria of compliance offsets. Yet it could be politically infeasible to deny early offset recognition to offsets in existing voluntary offset registries. Discounting could offer a means of limiting credit awarded to offsets that meet some but not all promulgated criteria. Yet such an approach could face political opposition, particularly because it is difficult to establish the empirical basis for selecting discount rates.

Summary of Challenges to Discounting
In the sections above we elaborated on specific challenges to discounting, which are considerable. All discounting approaches face the difficulty of having to establish the right discount rate that is politically acceptable, maximizes benefits and minimizes negative effects. Discounting creates economic distortion to the extent that a discounted offset represents more than a ton of emission reductions, and thus its price per ton exceeds the actual abatement cost. Discounting could render otherwise cost-effective projects unprofitable, hamper projects most dependent on offset revenue, and therefore increase the fraction of non-additional credits. As a result, policy makers should consider targeting discounts to those project circumstances that are least likely to produce these negative effects (e.g. project types with typical incremental costs well below expected offset prices). Furthermore, it could prove difficult to coordinate the implementation of discount rates across different ETSs and offset programs. Unilateral implementation strategies can create further market distortions, as is discussed in the next section.

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9 It might also reduce resistance from countries to expand the Montreal protocol, since their revenue would decrease if the offsets were to be discounted. Such an expansion would likely lead to a more permanent and wide-ranging reduction of these potent GHG and ozone depleting gases (Wara and Victor 2008).
IMPLEMENTATION STRATEGIES FOR DISCOUNTING OFFSETS

Policy makers and analysts have proposed a variety of mechanisms for discounting offsets in order to achieve one or more of the objectives noted above. A single discounting mechanism could in fact achieve multiple objectives. For example, an across-the-board pre-issuance discount for offsets could create an offset program capable of providing atmospheric benefits, incentivizing domestic action in the capped country, and encouraging domestic action in more prosperous developing countries that do not currently have a cap. This section reviews some key distinctions in terms of where and how discounts can be implemented.

Pre-Issuance Discounts

Offsets can be discounted either prior to credit issuance or at the time that offset credits are used for compliance. To date, discounting has been implemented exclusively at the pre-issuance (or supply) level. These pre-issuance discounts are typically embedded within offset methodologies or protocols in order to achieve several of the objectives noted above, such as to:

- Control for imprecise measurement (random uncertainty), for example, through “conservativeness factors”, discounts that are applied in several CDM methodologies to address random uncertainty in measurement and monitoring methods (e.g. estimation of landfill baseline emissions in the CDM methodology AM0025).\(^{10}\);
- Address identifiable sources of potential over-crediting within individual offset protocols (bias), for example, by the application of leakage or other factors; or
- Account for non-additionality, for example, through proportional additionality provisions, such as those used in the Alberta Offset Systems’ tillage/soil sequestration protocol, which effectively discounts estimated removals by the fraction of historical no-till and reduced till activity.

Pre-issuance discounting can be implemented at different points of the project cycle. In addition to the use of discounting within specific methodologies, discounts could be applied after monitoring and verification of emission reductions, just before offset issuance. Such discounts could be applied across the board on all offsets issued, or based on specific criteria such as country of origin or the technology used.

Pre-issuance discounting leads to fewer offsets being issued. A key advantage of discounting prior to issuance, rather than at the point of use/compliance, is that offset credits once issued would have a value equivalent to an allowance, and would be treated similarly in all compliance venues.

Post-Issuance Discounts

In addition, or as an alternative, to discounting offsets prior to issuance, emission trading programs can apply discounts at the point offsets are used for compliance. Such post-issuance discounts effectively assign an offset a lower compliance value than emissions allowances. For example, the

\(^{10}\) Source: [http://cdm.unfccc.int/Panels/meth/meeting/08/032/mp_032_an14.pdf](http://cdm.unfccc.int/Panels/meth/meeting/08/032/mp_032_an14.pdf)
ACESA and CEJAPA bills would require 1.25 international offset units be submitted for every unit (ton) of compliance obligation; in other words, international offsets would be discounted by 20% (1 - 1/1.25) relative to an emissions allowance.

Post-issuance discounts are straightforward to apply, although the rate chosen may appear rather arbitrary; for example, the authors here have not unearthed a well-articulated rationale for the 20% discount in the US federal bills. Furthermore unilateral, post-issuance discounting may make linking of different emission trading schemes difficult and complex (Schatz 2008, Schneider 2009). If one emission trading system (ETS) unilateral sets a post-issuance discount rates on an offset commodity (e.g. CERs), while another system that recognizes the same offset commodity does not, a serious market distortion could occur. Such offsets could then be used for compliance in the ETS where they are not discounted, freeing up excess allowances that could then be used for compliance in the other ETS (that discounts the same offsets), thereby undermining the intent and effectiveness of a post-issuance discounting policy.

Changing discount rates over time
Discounting rates can be fixed or vary over time. Varying discount rates might have the advantage of allowing policy makers to set the discount rate in a way that regulates demand and supply and therefore price. (The current economic downturn and its impact on allowance prices and offset demand and supply illustrate how quickly and unpredictably such changes can occur). Varying discount rates would further allow for discounting to be used as a transitional mechanism to foster additional mitigation (for example through successively higher discounting rates). However, the flexibility of varied discount rates needs to be balanced with the need for investment certainty. If discount rates are adjusted at known intervals (e.g. at the end of a crediting period) or when a certain threshold is reached (e.g. penetration rate for a new technology) it might be possible to use varying discount rates to account for economic and technological developments and at the same time preserve investment certainty (Schneider, 2009).

(Dis) FAVORING PARTICULAR PROJECT TYPES
Discounting based on project type could be implemented either prior to issuance or at the point of offset use (post issuance). Such discounting can be designed to address one or more objectives described in the prior section, such as to:

- mitigate risk of over-crediting for certain project types where the potential for non-additional offset credits is particularly high,
- prioritize particular sectors or technologies, such as those with perceived long-term transformational benefits (technology learning or spillover effects), with high co-benefits, with less activity to date (Schatz 2008, UNFCCC 2008b), or
- limit windfall profits and potential perverse incentives.

As noted above, ideally, project protocols would have sufficiently conservative additionality and baseline provisions, such that discounting by project type would be unnecessary for managing over-crediting risk. However, this goal can prove difficult to attain. Furthermore, there will be instances where the cap-and-trade program accepting the offsets for use may not be the same as, and have full
authority over, the offset program that has issued the credits. The cap-and-trade program administrator may choose to discount offsets issued by the separate offset program, as it may have no other options to adjust offset value for quality and integrity concerns.

Prioritizing certain technologies and sectors, the second objective listed above, could be difficult to implement, since the process for determining which technologies, sectors, or project types possess greater long-term transformational or spillover benefit would require considerable judgment. Limiting windfall profits might be easiest objective to attain, insofar as some project types, such as high GWP gas destruction projects, have clearly identifiable high profit margins that might also create perverse incentives.

(Dis) Favor Particular Geographic Locations
Favoring specific geographic locations has been proposed to achieve a variety of policy objectives, such as to:

- Direct economic and other benefits to specific regions
- Encourage advanced developing countries to move from CDM to own-country climate commitments or other instruments
- Encourage investment and development co-benefits in less developed countries (LDCs).

The proposed US cap-and-trade legislation, for example, proposes to discount all international offsets. Beginning in 2018, a covered entity would have to purchase 1.25 international offset credits in lieu of 1 allowance (ACESA Sec. 722, p. 743, CEJAPA Sec. 722, p. 491 and 494). The provision can be interpreted as a means to favor investments in sectors that are likely offset sources in the US, agriculture and forestry, in particular.

Others have proposed geographic discounting as a way to engage developing countries in emission reductions (Chung 2007, Castro and Michaelowa 2009). A discounting mechanism could differentiate between non-Annex 1 (NA1) countries and serve as a transitional tool to move toward NA1 country mitigation obligations and create opportunities to speed the development of new low-carbon technologies. Chung, the negotiator for Korea, put it bluntly: “Agreeing on the CERs Discounting Scheme will have a better political chance than agreeing on imposing emission reduction targets on developing countries.” (Chung 2007). Such an approach would also be in line with the UNFCCC’s principle of common but differentiated responsibilities and capabilities, and the Bali Action Plan, which calls for nationally appropriate mitigation actions to be undertaken by developing countries (Bakker et al, 2009).

Both Chung (2007) and Michaelowa (2009) explore the possibilities of having a range of discounting rates according to a country’s wealth: from high discounting rates for offsets from high

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11 The group of NA1 countries is comprised of nations with very large differences in terms of per capita income, level of development, and per capita GHG emissions. It includes very wealthy nations such as Singapore and the United Arab Emirates but also the group of LDCs.
income NA1 countries to no discount rates for LDCs. Yet such an approach would not necessarily lead to more projects in LDCs. Castro and Michaelowa (2009) show in their economic analysis that even if discounting factors were set in such a way that China’s CERs were discounted, the abatement potential in LDCs remains small, since real mitigation opportunities can only be realized once LDCs overcome their significant financial, technical and institutional barriers.

**ECONOMIC IMPLICATIONS OF DISCOUNTING**

In the absence of an offset limit, the market-clearing price and quantity of offsets are determined by the intersection of the offset supply curve with the demand curve describing emissions reductions available from capped entities. Discounting effectively increases the cost of producing each sellable offset, for example, a 33% discount rate increases costs per ton by half, a 50% rate doubles and a 67% rate triples the cost per ton. The increased cost to the producer leads to a decrease in supply. Figure 1 shows the effect of a system-wide discount on the price and quantity of compliance-equivalent offsets purchased in the market. The supply curve for offsets shifts to the left (reflecting the reduced quantity) and up (reflecting the decreased incentive to offset producers) (Bakker et al, 2009; Schneider, 2009).

![Figure 1. Economic Impact of System-wide Offset Discounting](source)

A reduction in quantity, or a shift in the curve to the left, is most intuitive: for example, a project that would have delivered 100 offset credits in the absence of a discount would now be able to deliver

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12 Similarly, the German emissions trading association BVEK (2008) suggested to base discount rates on the per capita emissions and per capita economic capacity (Schneider, 2009).
only 80 tons of allowance-equivalent offset credits. The decreased incentive for offset producers, or a shift in the curve upward, is more complicated, and affects (in this example) whether the project with the discounted 80 tons of allowance-equivalent offset credits can be cost-effective at all.

These effects can be illustrated by a very simplified example. Assume for the project noted above that a developer needs to recover $1,000 to cover costs and a sufficient profit. If the market price for offsets is $10 per ton, this developer would undertake the project since $10/ton x 100 tons = $1,000. Under a 20% discount on offsets, however, the project would only generate 80 tons of offset credits. Since the cost of the project would remain unchanged at $1,000, the developer would need the expected price of offsets to be $12.50 per ton ($1,000/80) to make the project viable. Whether 20% discount could induce an increase in the market price of offsets up to $12.50 would depend on the shape of both curves in the chart above. In general, for the price to rise steeply, the supply of internal reductions would need to be relatively inelastic (steep “demand” curve) compared with a much more elastic supply of offsets (shallow “supply” curve).

Therefore, under a discount, projects with marginal costs close to the offset price may no longer be cost-effective. If different discount rates are set for each supplying region, e.g. offsets from developing countries have a higher discount rate than those produced in the US, projects in developing countries will be less competitive compared to those using the same technology in the US. Projects with higher marginal abatement costs will get crowded out fastest in countries with the highest discount rates (Castro and Michaelowa 2008). Projects with marginal costs significantly below the offset price would be unaffected, including, notably, projects that would have happened in the absence of a carbon price (and that are therefore non-additional). Thus, discounts may tend to differentially reward projects with higher incidence of non-additionality at the expense of projects with greater certainty of emissions benefits.

Depending on how discount rates are set and how they interact with other policies the impact of discounting on the price of offsets and allowances is far from straightforward and may include several non-obvious effects. Schneider (2009) illustrates the complex interactions between supplementary and discounting. Even under assumed perfect market conditions, the results vary greatly depending on how the discounting rate and the limit on offsets are set. If a discount rate is applied uniformly to all offsets, we see the following interaction between discounting rates and offset limits: If the supply of discounted offsets remains larger than the amount that can be used under supplementarity rules, offset prices will be lower than allowance prices and the level of domestic reductions will be set by the limit on offset use. If, on the other hand, the supply of offsets falls below the demand because of discounting, offset and allowance prices will be the same and higher than in the previous case. This would result in more domestic abatement than would be required by the offset limits alone (Schneider, 2009).
CONCLUSIONS

The discounting of offset credits can address a wide range of objectives, from directing investment to specific sectors and regions to compensating for over-estimation of emission reductions. It is not surprising, then, that policy makers and analysts have proposed a variety of specific mechanisms for discounting offset credits, and in some cases, put them into practice, as described above.

While discounting of offsets offers the ability to address concerns that are prominent in climate policy debates, specifically around the credibility of offsets, it is not without its drawbacks as well. Criticisms of discounting have generally centered on the potential for creating economic distortions and impeding development of an offset market. As one offset market trade group puts it, “discounting unnecessarily hampers market efficiency and prevents businesses from using the most cost-effective means to address global warming” (Carbon Offset Providers Coalition, no date).

Other observers such as Michaelowa (2008) counter that fewer market inefficiencies are created through discounting than are through other approaches used to address similar policy goals, such as limits on the use of offsets, as used in the EU ETS and RGGI, and proposed elsewhere, to address supplementarity and concerns about offset quality. Policy makers should thus consider targeting discounts to specific project types or circumstances that pose particular concern – e.g. non-additionality, windfall profits, or perverse incentives – or opportunities for environmental benefit (e.g. incremental costs well below expected offset prices).

As summarized in Table 1 on the following pages, there are potential benefits and concerns associated with targeting varying policy objectives through discounting. Ultimately, design and implementation details will determine how well discounting might work at achieving specific objectives, as listed in the table below. Further research can help identify possible policy interactions, economic impacts, and environmental benefits associated with specific offset discounting proposals.

In summary, discounting approaches offer the potential to address a number of major concerns with the current offsets market. While discounting is no silver bullet – its potential pitfalls are significant – it should be considered by policy makers as a mechanism to address specific objectives, in particular to remedy perverse incentives and to maximize the environmental benefit of offset markets. Furthermore, targeting discounts to specific project types and circumstances that pose greater risks (e.g. of perverse incentives or over-crediting) can help to contain the potential negative impacts on the carbon market as a whole.
Table 1. Discounting Objectives, Added Benefits, and Potential Concerns or Challenges

<table>
<thead>
<tr>
<th>Discounting Objective</th>
<th>Potential Mechanisms</th>
<th>Benefits of Achieving the Objective through Discounting</th>
<th>Potential Concerns or Challenges</th>
</tr>
</thead>
<tbody>
<tr>
<td>All objectives</td>
<td>Most discounting mechanisms (pre-issuance or post-issuance)</td>
<td>May reduce economic distortion to the extent projects are otherwise over-credited. Possible added benefits: support for offsets among current skeptics.</td>
<td>Creates economic distortion to the extent that an offset represents more emission reductions than its discounted value. May be difficult to establish empirical basis for selecting discount rates, and thus appear arbitrary. Difficult to coordinate discounts across ETSs and offset programs. Could render otherwise cost-effective projects unprofitable; could increase the fraction of non-additional credits if not well targeted.</td>
</tr>
<tr>
<td>Achieve greater emissions reductions than required by emissions cap (net atmospheric benefits) or Account for the risk of over-crediting</td>
<td>Differential discount by region, sector or technology (post-issuance)</td>
<td>May foster uptake of new technologies. Could gain favor of key domestic constituencies. Target development benefits in LDCs. Increase the delivery of co-benefits.</td>
<td>May dissuade use of more effective means to address over-crediting or lead to less ambitious emissions targets. Creates economic distortion (per above); picks winners. Unlikely that LDCs alone could meet offset demand. Unlikely that projects with high co-benefits alone could meet offset demand.</td>
</tr>
<tr>
<td>Direct economic and other benefits to specific regions, sectors, or technologies</td>
<td>Differential discount by region (post-issuance)</td>
<td>Could foster greater domestic action in NA1 countries.</td>
<td>Effectiveness of strategy could be questioned. Could discourage developing country participation in climate regime.</td>
</tr>
<tr>
<td>Encourage advanced developing countries to make own mitigation commitments</td>
<td>Discount based on impact of other incentives</td>
<td>Helps to allow “stacking” of incentives while limiting economic inefficiency and harm to environmental integrity.</td>
<td>Requires potential difficult coordination among incentive providers.</td>
</tr>
<tr>
<td>Address situations where projects are eligible for multiple policy incentives</td>
<td>Across-the-board discount (post-issuance)</td>
<td>Supports goals of UNFCCC and Bali Accords. May be more efficient than offset use limits.</td>
<td>Leads to economic inefficiency: domestic A1 mitigation is likely more expensive than action in NA1 countries.</td>
</tr>
<tr>
<td>Prioritize reductions in capped sectors and countries (supplementarity)</td>
<td>By project type (e.g. for HFC23 destruction)</td>
<td>Already practiced in some form (e.g. Chinese tax on HCFC offset revenue).</td>
<td>Other non-offset policies may be more efficient.</td>
</tr>
<tr>
<td>Limit windfall profits and perverse incentives</td>
<td>By offset program (post-issuance)</td>
<td>Offers an politically more acceptable alternative than full rejection of early action offsets.</td>
<td>Politically challenging. Difficult to establish empirical basis for selecting discount rates.</td>
</tr>
<tr>
<td>Allow early offsets that are not fully compliance-grade</td>
<td>By offset program (post-issuance)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
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