



Additionality, common practice and incentive schemes for the uptake of innovations



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ABSTRACT

Crucial components of carbon offset trading schemes are the determination of whether a technology or practice is innovative (i.e. not common practice), and whether the practice is adopted as a result of incentives (termed additional). Under schemes such as the Clean Development Mechanism (CDM), early adopters of carbon reducing technologies receive tradable carbon credits that can be sold to businesses to offset their emissions. However, frameworks for distinguishing early adopters are inconsistent, and the effect of incentive schemes on uptake is poorly understood. In this study we: 1) review measures of common practice taken from the literature with the purpose of informing a standardised approach; and 2) using the Bass model we explore the effects of incentive schemes on adoption with the purpose of establishing the proportion of uptake attributable to the scheme. We found that a fixed common practice threshold of approximately 20% adoption is well supported by a wide range of approaches, and that 85–95% (approximately) of early adoption can be attributed to incentives, such as offset schemes. Although we focussed on carbon reducing technologies, our results have broad implications for general practice and product diffusion, and the effect of promotions on adoption.

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1. Introduction

Incentive schemes have been recently established to reduce greenhouse gas emissions including the Alberta-based Offset Credit System, the Clean Development Mechanism (CDM) and the Carbon Farming Initiative (CFI, Australia). In general terms, these schemes issue credits for practices or activities that lead to greenhouse gas abatement, which can then be sold to individuals, businesses or governments to offset their emissions. These markets in tradable credits have defined the need to develop consistent and robust measures to determine which activities are eligible. A core criterion for eligibility is whether the abatement is additional. For example, the Kyoto Protocol (1998) mandates that tradable credits should be ‘real, measurable and additional’. Here, we define additionality as abatement

that would not have occurred in the absence of a specific incentive scheme that promotes it – that is, it would not have occurred under business-as-usual (BAU) (Anon., 2011; Climate Action Reserve, 2010).

Assessing additionality is one of the most controversial and debated concepts in the environmental policy literature (Muller, 2009; Schneider, 2009; Shrestha and Timilsina, 2002; Streck, 2010). In general, approaches to additionality determination are considered lengthy and unpredictable (Streck, 2010), and clear, consistent and objective methodologies are required to reduce policy uncertainty, increase investment and thereby reduce emissions more effectively (Michaelowa, 2012; Shrestha and Timilsina, 2002; Streck, 2007, 2010; Trexler et al., 2006). Recent schemes, such as the Australian CFI have proposed a more objective and consistent approach to additionality assessments – they suggest that if an activity is not a common practice then it should qualify as additional. Common practice infers that the practice is well established

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and no longer in its early stages of adoption. It is called a standardised approach to additionality as it is based on uniformly applicable criteria such as activity adoption-level data. Standardised approaches are understood to have several advantages over project-specific approaches that examine projects on a case-by-case basis (e.g. legal, regulatory or financial tests). Generally, they reduce delays associated with case-by-case evaluations, are administratively easier to apply, improve consistency across determinations, and alleviate uncertainties for investors (Climate Action Reserve, 2010).

Thus, within the framework of additionality assessments, two distinct criteria emerge: whether the adoption of a practice is directly attributable to an incentive (that is would not have occurred under a business-as-usual scenario); and whether the practice is within the early stages of adoption and thus is not a common practice. For effective policy implementation, these two criteria require an unambiguous means of evaluation. Concerning the first criterion of additionality, we are unaware of any standardised quantitative approaches to assessing whether practice adoption is directly attributable to an incentive scheme. However, for the second criterion of common practice, two general approaches have been proposed in the literature: market penetration levels (Kartha et al., 2005), and adoption based on the diffusion of innovations theory (Mathur et al., 2007). Each defines a threshold adoption level beyond which the activity is deemed common practice and credits are not tradable.

Our motivation for this paper is to establish how innovation diffusion theory can contribute to a standardised determination of these two assessment criteria for offset schemes, although the results also have broader implications for general incentive schemes, practice diffusion and product promotions.

A substantial body of literature exists that addresses the impact of advertising and marketing on the uptake of particular technologies or products, as well as, more recently, the effect of government incentive schemes on practice adoption and the reduction of emissions (Greene et al., 2005; Guidolin and Mortarino, 2010; Heinz et al., 2013; Higgins and Foliente, 2013; Higgins et al., 2011, 2012, 2014; Islam, 2014; Kalish and Lilien, 1983; Koeppl and Urge-Vorsatz, 2007; Lund, 2006; Newell et al., 2006; Tang et al., 2013). However, accurate predictions of how such schemes impact on adoption numbers is complex, is not well understood, and is not consistent across the literature. Complex approaches are available (for example, Refs. (Higgins et al., 2011; Kuehne et al., 2011)), but in those cases considerable data are required for predictions. In specific cases, where data are available, such models have advantages; however, for new innovations, and early in the adoption process when additionality decisions are required, it is likely that data are few. To our knowledge, there is no previous study that compares and tests a variety of thresholds for common practice determination, or provides general measures that distinguish additional adoption from business as usual (BAU). This work aims to address these issues. Using models that are appropriate when data are few, we reveal generic trends relevant to a large class of different practices, which are highly relevant for robust and standardised policy formulation concerning the two criteria.

The purpose of this study is threefold. First, we review measures of common practice reported in the literature, and compare distinct approaches for determining common practice thresholds. We consider market penetration and two innovation diffusion approaches, and how they can inform a standardised

approach to a general definition of common practice and threshold evaluation. Our preliminary threshold analysis was provided to, and informs, Australia's CFI (Woodhams et al., 2012), which considers the adoption of emission reducing land management practices. Second, we explore the effects of incentive schemes on uptake using the Bass model. We do not distinguish between specific incentives in this paper (they may be financial incentives, loaded taxes, marketing, promotions, advertising, carbon price, or the like) and herewith refer to them collectively as promotions or incentives. Rather we analyse the general impact of such incentives on measures of additionality by estimating the proportion of adoption directly attributable to the incentive (adoption which would not have occurred under business as usual), and consider a broad range of possibilities to provide information under uncertainty. We focus on robustness and commonality in such measures, which can inform and validate additionality determination in an objective and consistent way. The third objective is to estimate the relative increase in adoption over a longer target period, which follows as a direct result of the scheme, and to establish the reduction in time until penetration targets are achieved. The purpose is to gain insight into how government incentives for emission reductions could contribute to meeting long-term targets.

For each of the above objectives we do not develop new models. Rather, we establish how results from the literature, and the Bass model in particular (which is widely accepted as the best predictor of adoption under uncertainty), can expose general adoption characteristics to inform robust policy concerning additionality assessments.

The paper is organised as follows. We first review the literature on common practice thresholds and diffusion theory in Section 2, introducing the Bass model for innovation uptake. In Section 3 we present our analysis. We determine an appropriate common practice threshold, based on commonalities between a wide range of quantitative and qualitative approaches (Section 1), and conjecture how promotional schemes might impact on uptake to determine the proportion of adoption due to an incentive scheme and that due to BAU (Sections 2 and 3). In Section 4 we extend these results to consider how schemes can contribute to long-term targets, in terms of adoption numbers and time frames. In Section 4 we summarise our results, and then interpret their meaning within a policy context in Section 5. Finally, we provide concluding remarks in Section 6.

2. Background

2.1. Thresholds for common practice

The concept of a common practice threshold is not straightforward to quantify – whether a practice is common or not, is, in reality, an arbitrary definition. Thus we draw on the literature for a general view of how early adoption has been defined. Our findings are discussed below and summarised in Table 1.

In the literature, comparable thresholds are also referred to as 'tipping' points, or 'takeoff' points, or defining a 'critical mass', with the understanding that at this point adoption of a particular practice becomes self-sustaining (Phillips, 2007). A number of approaches can be used to inform the establishment

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