Effectiveness of nitrogen abatement trading: A hypothetical market experiment

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Abstract

Degradation of water ecosystems caused by excessive loads of nutrients from agricultural sources continues to be a problem in many countries. Water quality trading (WQT) in different forms has been suggested as a promising mechanism. Common for the WQT literature, is the conclusion that a prerequisite for a trading market to run effectively is cost-heterogeneity i.e. homogeneity of traders is a trade limiting factor. However, there are very few empirical studies assessing the extent to which farmers would engage in N abatement trading and the importance of farm and farmer heterogeneity in effectiveness of N trading. An N trading scheme between agricultural sources has been implemented in a few cases, e.g. the Lake Taupo in New Zealand. However, the evaluation of the markets is yet insufficient and the literature gives little guidance on how to evaluate a priori whether a proposed trading scheme would redistribute N abatement and potentially cost savings, and which factors influence the incentives to participate in the market. In this paper we investigate how farmers might respond to an introduction of a cap and trade system. We approach this by studying farmers' choices in a hypothetical market experiment, where the individual farmer has the choice between meeting his or her own abatement requirement (requirement in kg N per hectare reduced to the root zone), and trading N abatement on a market. Given the price on N, farmers can choose if and how much additional abatement they would offer to deliver on their land. Similarly, how much of their own abatement requirement they would pay others to deliver. From the market experiment we derive demand and supply functions to analyse how farm and farmer heterogeneity influence trade of N abatement in the marked. The data is collected from a national scale survey of Danish farmers conducted during winter and spring 2016.

Our results indicate that farmers do have preferences for trading N abatement, and that trade can help meet some of the N cap given in the current regulation and eventually improve cost efficiency. Taking a CE approach has allowed an empirical testing of farmer preferences and incentives to trade. This has given useful information about who are willing to trade and

indications of how markets would operate if designed to reallocate N abatement within catchments. We found that farmer heterogeneity influences the specific demand and supply functions. Three segments were specified in each of the demand and supply groups, each with a different trade function. The three different segments can be related to farm and farmer characteristics; however the relationship does not appear to be strong based on the analysed data. The different segments can only be differentiated in terms of relatively few variables and the heterogeneity in N requirement is a key variable separating the behaviour of farmers. While much work remains in this area, the method presented in this paper can be used to investigate markets for N trading between farmers and support future designs of trading schemes. Coupling revealed demand and supply functions for different segments of farm typologies, with catchment characteristics based on agricultural databases, could prove a powerful tool for testing different trade schemes designs. The results of such analyses could be used to support the design of policy incentives used to address nutrient reductions.