Agriculture Sector Analysis on Intended Nationally Determined Contribution in Developing Countries: A Case Study of Vietnam

Abstracts for SAAER

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Introduction

The 19th Convention of the Parties on Climate Change (COP19) in Poland in 2013 called upon all parties to develop "intended nationally determined contributions" (INDCs). In the socio-economic context of a developing country severely affected by climate change, Vietnam strives to make ambitious yet realistic contributions. Vietnam's INDC consists of conditional and unconditional contributions to reducing GHG emissions. Unconditional contributions can be implemented using domestic resources, while conditional contributions require international financial, technical and capacity building support. Vietnam gives the highest priority to the implementation of its unconditional contributions. In forming its INDC Vietnam recognized that agriculture sector is a large emitter of GHGs. Furthermore, agriculture is identified as having substantial potential for offsetting CO_2 emissions by serving as a sink augmenting carbon sequestration. Murray et al. (2005) found in a U.S. setting that agricultural opportunities are available at a much lower cost per ton, compared with non-agricultural contributions. However, there is some uncertainty about those agricultural opportunities in Vietnam. Therefore, studies are needed on how the agriculture sector could contribute and respond to GHG reduction policies as an input to suggestions for implementing nationwide INDC. Many studies have discussed greenhouse gas mitigation potential coupled with mitigation strategies available to the agriculture sector (Smith et al. 2007, Smith et al. 2008). However, previous assessments are limited in scope neglecting major elements of the problem which are listed below.

Firstly, previous studies have emphasized practices in general and not specific nationwide mitigation policies being implemented or proposed in a developing country. Trying to evaluate INDC in the country setting is valuable especially INDC is approaching to be converted into official commitments. Moreover, even though Vietnam agreed that they would include information on contribution's objectives, timeline, implementation scope, assumptions and approaches, it is still not totally clear what is the pathway of achieving final target. In particular evidences are lacking on the optimal sequence and combination of mitigation options over time and/or under different conditions such as different mitigation incentives. Also, as suggested by the United Nations Framework Convention on Climate Change (UNFCCC), INDC actions still need to be assessed as implementation proceeds in order to verify that the contributions are fair and appropriate for the national context but sufficient enough for the overall target of the INDC commitments.

Secondly, the mitigation option assessment behind the current INDC commitments is based on small-scale projects and independent studies for each individual strategy. However, large-scale country wide mitigation efforts in agriculture are likely to have effects in the market altering agricultural production and in turn consumption. Such actions can increase farmers' opportunity costs of agricultural GHG emission reduction and thus affect mitigation opportunity desirableness and in turn performance. Thus mitigation options should be evaluated within the context of the total food production and consumption system. Thirdly, a number of studies have only examined a very limited strategy set often independently. Interactions between strategies have largely been absent from analytical models. Following arguments in Murray et al. (2005) the competition between options that draw from a common resource base needs to be considered. It is also possible that simultaneous implementation of multiple strategies can lower costs.

Methodology

In this study, all of these factors discussed above are considered simultaneously and a model is employed that can provides a sector level evaluation and suggestion for agricultural mitigation policies in INDC, taking into account strategy interaction and food market effects.

A quadratic, price endogenous mathematical programming model, VASMGHG, will be used following discussion in McCarl and Spreen (1980) and the implementation in the U.S. Agricultural Sector Model (ASM) model (Adams et al. 2005, Baumes 1978, Beach and McCarl 2010). This model simulates a competitive equilibrium for agriculture sector in Vietnam under carbon pricing. In this approach, an optimization problem is defined and solved using a set of equations that specify attainment of a competitive market equilibrium under a given set of supply and demand conditions. The objective is mainly restricted by natural and human resource endowments, commodity production technologies, supply and demand balances, trade balances, crop mix balance and also relevant policies.

Preliminary Findings

An examination of the potential role of agricultural GHG mitigation efforts in Vietnam is reported evaluating the possible implementation of a variety of agricultural practices included in INDC. Results show that Vietnam agriculture can accomplish unconditional contribution claimed in INDC with modest impacts on the food market. Furthermore, without threatening food security in Vietnam, the agriculture sector can contribute to mitigation by amounts up to 29 $MtCO_2eq$ (million tons CO_2 equivalent) employing unconditional mitigation options. Increasing mitigation requires increasing incentives, but not with perfect proportional ratio because of competitiveness of mitigation policies as well as the effects from food market. For low GHG prices or agricultural mitigation shares, prevalent strategies are reduced chemical fertilization, improved cultivation management, and improved livestock diets. At higher carbon prices, most of the emission abatement comes from soil carbon sequestration through introducing biochar. The portfolio of mitigation strategies varies depending on the total GHGs reduced, which offers the solutions for various financial conditions as well as the pathway from introducing mitigation policies to achieving INDC in 2030.

Significant differences between economic and technical potential estimates are discovered. The study suggests that the INDC overstates the potential of some strategies if considering interactions of mitigation policies and food market. In order to make INDC more achievable, the study also provides information on the distribution among different crop productions. The implementation of mitigation options varies between crops.

The effects of mitigation on food market prices is also assessed since it is the main concern for developing countries fighting against hunger and poverty. The INDC unconditional contribution achieves mitigation goals with a 2% food price increase. From the perspective of welfare, introducing environmental goals does shock the society at the beginning but the impact decreases after initiation.

The scenario simulated for 2020 gives the sense of dynamic adjustment of mitigation options for technology development and nutritional improvement. The results suggest that delaying mitigation effort will increase the total costs of achieving the INDC commitments especially when the total amount of mitigation is not large. Because of the different behavior of strategies compared with those in baseline scenario, the results indicate how a nation-wide policy will support each mitigation practice over time.