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

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Introduction

In forming its INDC Vietnam recognizes that agriculture sector is a large emitter of GHGs and also has substantial potential for offsetting CO_2 emissions with low cost. However, there is some uncertainty about those agricultural opportunities in Vietnam. Evidences are lacking on the optimal sequence and combination of mitigation options over time and under different conditions of mitigation efforts in agriculture are likely to have effects in the market altering agricultural production and consumption. Such actions can increase farmers' opportunity costs of agricultural GHG emission reduction and thus affect mitigation opportunity desirableness and in turn performance. Interactions between strategies also have largely been absent from analytical models.

 $\begin{array}{c|c} \textbf{Model} \\ \\ Max & \sum_{h} \int_{0}^{Z_{h}} P_{ah} & (Z_{h}) & dZ_{h} & - \sum_{i} \int_{0}^{X_{i}} P_{si} & (X_{i}) & dX_{i} \\ s.t. & Z_{h} & - \sum_{\beta} \sum_{k} C_{hgk} Q_{\beta k} & \leq 0 & \text{ for all } h \\ & - & X_{i} & + \sum_{\beta} \sum_{k} a_{i,k} Q_{\beta k} & \leq 0 & \text{ for all } i \\ & & \sum_{k} b_{j,k} Q_{\beta k} & \leq Y_{j,\beta} & \text{ for all } j \text{ and } \beta \\ & Z_{h}, & X_{i}, & Q_{\beta k} & \geq 0 & \text{ for all } j, h, k \text{ and } \beta \end{array}$

A quadratic, price endogenous model is employed that can provides a sector level evaluation and suggestion for agricultural mitigation policies in INDC, 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, taking into account strategy interaction and food market effects. 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.

Findings

• Agricultural abatement curve is estimated for GHG reduction with optimal portfolios of the INDC options.



• The effects of mitigation on food market prices (Fisher Index) are also assessed.



• Significant differences between economic and technical potential of mitigation policies are discovered. *Note: green line for technical potential and black line for economic potential.*



Conclusions

- Vietnam agriculture can accomplish unconditional contribution (6.4 MtCO₂eq) claimed in the INDC with modest impacts on the food market.
- Increasing mitigation requires increasing incentives, but not with a relation of proportionality.
- The INDC overstates the potential of some strategies when considering interactions of mitigation policies and food market.
- Delaying mitigation effort will increase the total costs of achieving the INDC commitments especially when the total amount of mitigation is not large.