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Accounting for Transaction Costs in Point/Nonpoint Water Quality Trading Programs in the Chesapeake Bay Watershed

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*Poster prepared for presentation at the Agricultural & Applied Economics Association 2012
AAEA Annual Meeting, Seattle, Washington, August 12-14, 2012*

The views expressed in this poster are those of the authors' and do not necessarily reflect those of the Economic Research Service or the U.S. Department of Agriculture

Introduction

Water quality in the Chesapeake Bay cannot sustain desired levels of fisheries, recreation, and other ecosystem services. Since the creation of the Chesapeake Bay Program in the early 1980's, voluntary-based approaches by watershed states have failed to measurably improve the Bay's water quality. In response, the U.S. Environmental Protection Agency has established a Total Maximum Daily Load (TMDL) which sets pollution reduction targets for the watershed states. State Watershed Implementation Plans, which detail how the Bay states will meet their pollution allocations, all include the development of point/nonpoint water quality trading programs. These will allow regulated point sources (primarily Publicly Owned Treatment Works (POTWs)) to offset discharges from future growth with reductions in unregulated nonpoint sources, primarily agriculture.

Point/nonpoint trading has not been very successful to date, at least in terms of the participation of potential traders and the number of trades between regulated sources and farms (Breetz et al., 2004). One issue that is frequently mentioned is high transaction costs. Successful air emissions trading programs, such as the Acid Rain Program, have been characterized by low transactions costs, largely because they involved limited numbers of easily-measurable pollution sources. While "high" transaction costs have been a common characterization of a water quality trading program, estimates of the true nature of these costs are lacking. A more exact knowledge of these costs is important because high transaction costs can affect the optimal choice and design of policy instruments such as trading, thus affecting economic efficiency and reducing the overall benefits (Stavins, 1995; McCann et al., 2005).

A full accounting of transaction costs would include *ex ante* and *ex post* program activities such as research, enactment or litigation, design, support and administration, contracting, monitoring and detection, and prosecution and enforcement (McCann et al., 2005). Knowledge of these costs would provide an assessment of how transactions costs might influence the supply and demand for credits, as well as a more realistic measure of the economic benefits of trading.

Objective

We examined transaction costs in Pennsylvania's water quality trading program. This is the only program in the Chesapeake Bay watershed that is actively trading. Using completed trades as a baseline, we estimated the transaction costs borne by buyers and sellers. Data from Pennsylvania are used to assess the potential impact of transaction costs on the percentage of POTWs that might benefit from trading.

Data and Methodology

Pennsylvania's Nutrient Credit Trading Program started trading in 2006 (see box for program features). Trading is an important component of Pennsylvania's plan to meet the Chesapeake Bay TMDL. There are over 1,000 POTWs in Pennsylvania, and there is a general lack of funding to assist municipalities with upgrading their plants (Century Engineering, 2011). Trading offers the opportunity to achieve TMDL goals at a reduced cost.

Salient Features of Pennsylvania's Nutrient Trading Program

- Trading can occur among sources within a watershed on the condition that the discharges covered by the trades, plus those of other dischargers, do not exceed the cap load.
- All sources must meet legal baseline requirements
 - Point sources must meet the effluent limit of the NPDES permit
 - Nonpoint sources must meet existing state erosion and nutrient management laws.
- Nonpoint sources must meet a baseline requirement of a buffer around surface water or a 20 percent reduction of the farm's overall nutrient balance beyond baseline compliance.
- Credits must be measured and accounted for each year.
- A delivery ratio calculated for each water segment is used to estimate deliverable credits.
- Trades can occur bilaterally (buyers and sellers seeking each other out) or through scheduled auctions conducted for the state.
- A contract between a buyer and seller can be for one year or multiple years.
- Verification is the responsibility of the credit creator, not the state.

The PA trading program places requirements on the regulatory agency, credit creators, and credit buyers:

Agency tasks

1. Certification –Credit generator proposal submission and approval. Agency reviews:
 - a. Technologies proposed
 - b. Credit calculation methods
2. Verification – Agency concurrently reviews verification plan. Plan must demonstrate that:
 - a. Baseline requirements met
 - b. Pollutant reduction activity conducted
 - c. Who the primary verifier will be
3. Contract Approval
4. Registration of credits –State accounts for and tracks verified credits (registry)
5. NPDES permits and tracking – State ensures point sources have enough credits and allowances at end of permit year
6. Enforcement

Credit generator (farmer) tasks

1. Identify best management practices (BMPs) for baseline and credits
2. Calculate credits to be offered, using on-line worksheets
3. Develop verification plan
4. Submit credit/verification proposal to State
5. Seek trading partner
6. Negotiate price and length of contract
7. Enter into legal contract with point source
8. Install and maintain BMPs

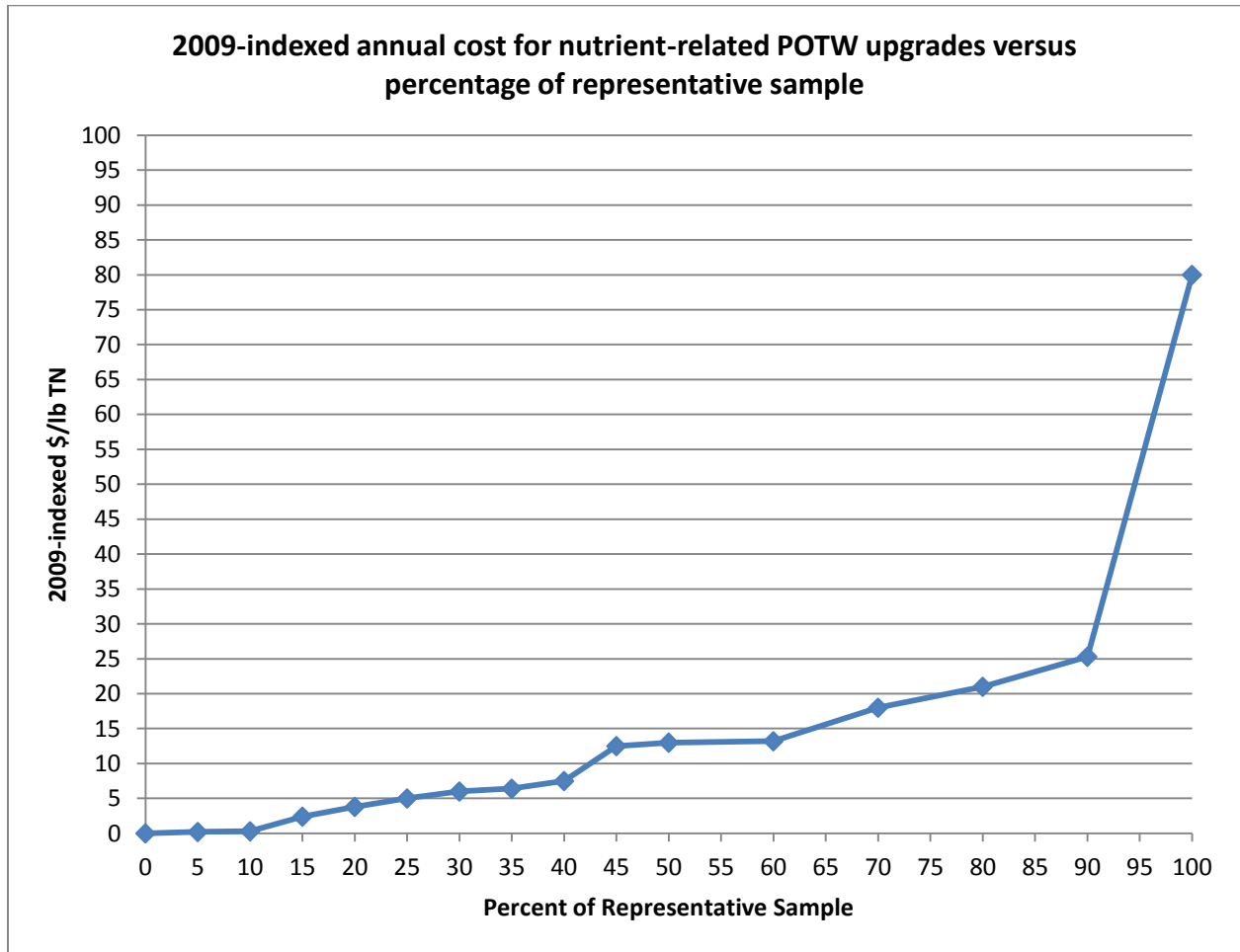
Credit buyer tasks (POTWs)

1. Evaluate benefits of trading versus technology upgrade (costs and risks)
2. Seek trading partners
3. Negotiate price and length of contract
4. Enter into legal contract with nonpoint source
5. Submit annual report to State

Data and Methods

We obtained data on the distribution of annual nutrient-related upgrade costs for POTWs from a study completed for the PA Legislative Budget and Finance Committee. We use the resulting figure to estimate the percentage of POTWs that would benefit from trading for a particular

credit price. We obtained data on 17 trades that have actually occurred in Pennsylvania from Pennsylvania Department of Environmental Protection.



Source: Chesapeake Bay Tributary Strategy Compliance Cost Study. Legislative Budget and Finance Committee, PA General Assembly, 2008.

Pennsylvania point-nonpoint trades for nitrogen abatement with agricultural sources, 2006-2012

Trade number	Trade type	Contract type	lbs N/yr	price (\$/lb/yr)	farmer payment (\$)	BMP
1	bilateral	long term	223.00	9	2,007.00	poultry export
2	bilateral	long term	1,592.00	9	14,328.00	poultry export
3	bilateral	long term	20,000.00	5	100,000.00	poultry export
4	bilateral	long term	635.00	10	6,350.00	poultry export
5	bilateral	long term	8.00	15	120.00	poultry export
6	auction	long term	21,000.00	3.04	63,840.00	
7	auction	long term	41,000.00	2.75	112,750.00	
8	bilateral	long term	546.00	15	8,190.00	poultry export
9	bilateral	long term	8,432.00	4.5	37,944.00	no-till
10	auction	spot*	41,744.00	2.75-3.04	121,057.60	poultry export
11	bilateral	spot	40,000.00	4.5	180,000.00	poultry export
12	bilateral	spot	21,993.00	3.1	68,178.30	poultry export
13	bilateral	spot	12,721.00	5.5	69,965.50	poultry export
14	auction	spot	5,059.00	3.1	15,682.90	nutrient management and poultry export
15	auction	spot	500.00	3.1	1,550.00	nutrient management
16	bilateral	spot	1,722.00	5.75	9,901.50	nutrient management
17	auction	long term	55,224.00	4	220,896.00	poultry export

*spot contracts are for meeting end-of-permit-year credit needs

Source: Pennsylvania Department of Environmental Protection,
<http://www.dep.state.pa.us/river/Nutrient%20trading.htm>

While transaction costs borne by the regulatory agency would affect overall efficiency impacts of a trading program we focus on the costs that would affect incentives of buyers and sellers. The transaction costs we quantify include:

- Finding trading partners and verification plan - \$0.05 per pound N if use clearinghouse; \$0.10 if bilateral (Pennvest, 2012).
- Farmer credit estimation and verification costs - 5% of total farmer payments (Newburn and Woodward, 2011)
- Purchaser reporting costs - \$30.29 per year (EPA)

We assume that the POTWs would evaluate the cost of upgrades in response to the TMDL, and not in response to the trading program itself. We do not include the cost of negotiating and entering into a contract, although we expect such costs to be small.

Results

The weighted average price for a nutrient credit in completed trades is \$3.79 per pound of N. We assume that the price is influenced only by actual abatement costs. This does not include the costs of farmers meeting baseline requirements. Data on the POTW treatment costs indicates that 80% of POTWs would benefit from trading at this credit price, ignoring uncertainties that point sources believe exist in trading with nonpoint sources, and transaction costs.

Transaction costs amount to only \$0.26 per pound of N. If transaction costs were 0 only an additional 1 percent of POTWs would benefit from trading.

As a point of comparison, we compared these costs to those borne by farmers who have to meet the nonpoint source baseline before generating credits for sale. We estimate that meeting the baseline requirement could cost \$25 per pound of N (Ghosh et al., 2011). At this price only about 10% of POTWs would benefit from trading. We do not know the percentage of farms that meet the baseline requirements (estimates range from 20 to 60 percent), but it seems clear that meeting the baseline requirements poses a much greater impediment to trading than transaction costs.

Discussion

Transaction costs borne by buyers and sellers do not appear to be high enough to significantly limit trading in Pennsylvania. The cost of meeting baseline conditions appear to be a much more important factor in determining whether trading can meet the expectations of significantly lowering the compliance costs for POTWs. If encouraging trading between regulated point sources and nonpoint sources is a goal of state and federal governments, then selection of a baseline seems the most important factor for encouraging trades, aside from the uncertainties a trading program may initially entail.

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