Transaction Costs for Nonpoint Source Water Quality Trading Credits: Implications for the Chesapeake Bay

Kurt Stephenson & Gwen DeBoe
Department of Agricultural & Applied Economics
Virginia Tech
Nutrient trading programs often plagued with relatively few NPS trades

Desire to see NPS trades increase, particularly for working agricultural lands
Objectives

- Identify sensitivity of transaction costs to different types of NPS crediting activities and monitoring regimes.
- To examine to what degree alternative designs can lower transaction costs.
Conceptual Framework: Transactions costs of Implementation

Transaction Costs

(1) Legislative Environment
(2) Regulatory Design
(3) Implementation

Credit Creation
- Search for program participants
- Service provision
- Certification of service provision
- Credit registration & reporting

(Market) Transactions
- Assessing the market
- Trading partner search & contracting
- Demonstrating eligibility to trade
- Trade Approvals
- Market support functions

Monitoring & Enforcement
- Third party accreditation
- Monitoring
- Enforcement
Virginia Nutrient Trading (stormwater offsets)

Legend:
- Service flow
- Money flow

P Requirements via Land Use Restriction

Credit Providers

Monitoring Enforcement

Credit Providers

Certification Verification Enforcement

Offsite P requirements

Fee

Monitoring Enforcement

Credit Providers

Registry

Credit Providers

Compliance Conditions Enforcement

Permittee (Developer)

Local Stormwater Program

Legend:
- Service flow
- Money flow
Nutrient Stormwater Offsets Straightforward

- “Permanent Credits”: One time certification
- Performance criteria straightforward (e.g. native 400 stems/ac)
- Remote verification
What might future transaction costs look like?

- Severe data limitations (confidentiality, lack of experience, etc.)
- Method:
  - Gather data from other water quality programs (Ohio (EPRI), Oregon (Willamette Partnership))
  - Consult with credit providers
  - Use NRCS data on transactions costs of getting conservation on the ground
Analysis of transaction costs

- Which transactions costs did we focus on?
  - Costs of “Credit Creation” (primarily credit provider)
  - Costs of agency certification and verification monitoring

- Did not focus on:
  - Market exchange costs
  - Negotiation costs between credit provider & agency, permittee & agency
  - Unique contracting issues
Transaction costs: “Credit Creation”

- Estimated transaction costs associated with executing NRCS conservation contracts
- Transactions costs of credit creation depend on the type of practice(s) used
  - Simple project (e.g. ag. land conversion, cover crop)
  - Moderate project (livestock exclusion fence + watering)
  - Complex project (e.g. livestock waste management + prescribed grazing; enhanced nutrient management)
Ex-Post Monitoring

- Monitoring/Verification of credit generating activities

- Costs are a function of
  - Type of Monitoring (on-site, remote, etc)
  - Frequency of Monitoring
  - Coverage
Ex post Monitoring regimes

- Virginia DEQ (remote monitoring)
- Willamette Partnership (onsite, remote)
- EPRI (Ohio Basin) (annual on-site)
Putting this all together, how might transaction costs change with project complexity and ex post monitoring regime?
## Estimate Credit Creation Costs and Monitoring Costs for Multiple Types of Projects

<table>
<thead>
<tr>
<th>Ex post monitoring</th>
<th>Simple Project</th>
<th>Moderate Complex</th>
<th>Complex</th>
</tr>
</thead>
<tbody>
<tr>
<td>Remote Verification</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mixed Type Verification</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>On-site Verification</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Projects have different durations and thus different number of credit contract renewals

<table>
<thead>
<tr>
<th>Ex post monitoring</th>
<th>Simple Project</th>
<th>Moderate Complex</th>
<th>Complex</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>30 yr 10 yr</td>
<td>30 yr 10 yr</td>
<td>30 yr 10 yr</td>
</tr>
<tr>
<td>Remote Verification</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mixed Type Verification</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>On-site Verification</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## Examples of Credit Generating Practices

<table>
<thead>
<tr>
<th>Ex post monitoring</th>
<th>Simple Project</th>
<th>Moderate Complex</th>
<th>Complex</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>30 yr 10 yr yearly</td>
<td>30 yr 10 yr yearly</td>
<td>30 yr 10 yr yearly</td>
</tr>
<tr>
<td>Remote Verification</td>
<td>Land Conversion</td>
<td>Stream Fencing</td>
<td>Wetland restoration</td>
</tr>
<tr>
<td>Mixed Type Verification</td>
<td>Buffers</td>
<td></td>
<td>Animal Waste Facility</td>
</tr>
<tr>
<td>On-site Verification</td>
<td>Cover Crops</td>
<td></td>
<td>Enhanced N Mang</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Estimating Transaction Costs

To make equivalent across BMP type:

- Assume each BMP type generates credits for 30 yrs
- Calculate present value of credit creation and monitoring costs
- Normalize in reference to the low cost alternative (remote verification, permanent simple project)
Examples of Credit Generating Practices

<table>
<thead>
<tr>
<th>Ex post monitoring</th>
<th>Simple Project</th>
<th>Moderate Complex</th>
<th>Complex</th>
</tr>
</thead>
<tbody>
<tr>
<td>Remote Verification</td>
<td>30 yr, 10 yr, yearly</td>
<td>30 yr, 10 yr, yearly</td>
<td>30 yr, 10 yr, yearly</td>
</tr>
<tr>
<td>Mixed Type Verification</td>
<td>Land Conversion</td>
<td>Stream Fencing</td>
<td>Wetland restoration</td>
</tr>
<tr>
<td>On-site Verification</td>
<td>Buffers</td>
<td>Cover Crops</td>
<td>Animal Waste Facility</td>
</tr>
</tbody>
</table>

Highest transaction cost

Lowest transaction cost
## Magnitude of Transaction Costs Relative to the Lowest Cost Alternative

<table>
<thead>
<tr>
<th></th>
<th>Simple</th>
<th>Moderate Complexity</th>
<th>Complex</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>30 yr</td>
<td>10 yr</td>
<td>3 yr</td>
</tr>
<tr>
<td>Remote Verification</td>
<td>1.0</td>
<td>1.3</td>
<td>3.0</td>
</tr>
<tr>
<td>Mixed Verification</td>
<td>1.3</td>
<td>1.5</td>
<td>3.6</td>
</tr>
<tr>
<td>Onsite Verification</td>
<td>2.9</td>
<td>3.1</td>
<td>4.3</td>
</tr>
</tbody>
</table>

Assuming minimal cost to renew 3 or 10 year credit contract
### Relative Magnitude of Transaction Costs Relative to the Lowest Cost Alternative

<table>
<thead>
<tr>
<th></th>
<th>Simple</th>
<th></th>
<th>Moderate Complexity</th>
<th></th>
<th>Complex</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>30 yr</td>
<td>10 yr</td>
<td>3 yr</td>
<td>30 yr</td>
<td>10 yr</td>
<td>3 yr</td>
</tr>
<tr>
<td>Remote Verification</td>
<td>1.0</td>
<td>2.1</td>
<td>6.6</td>
<td>1.5</td>
<td>3.2</td>
<td>9.6</td>
</tr>
<tr>
<td>Mixed Verification</td>
<td>1.3</td>
<td>2.3</td>
<td>7.3</td>
<td>1.8</td>
<td>3.4</td>
<td>10.3</td>
</tr>
<tr>
<td>Onsite Verification</td>
<td>2.9</td>
<td>3.9</td>
<td>7.9</td>
<td>3.4</td>
<td>5.0</td>
<td>10.9</td>
</tr>
</tbody>
</table>

Assuming full renew 3 or 10 year credit contracts
Transaction costs: What have we learned?

- TCs of creating credits from management and structural BMPs substantially higher than for credits from land conversions.
- TC highly sensitive to frequency of credit renewals.
- Verification protocols are important driver of transactions costs.

Acknowledgement: Funding provided by USDA, Office of Environmental Markets

Contact: Kurt Stephenson: kurts@vt.edu