The Waxman-Markey approach to offsets: Application to Nitrogen fertilizer on wheat

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Waxman-Markey specifications for offsets were uniquely detailed and rigorous.

- Leakage
- Additionality
- Permanence
- Verification that practices are implemented
- Somewhat unclear about whether offsets would be crop-by-crop and practice-by-practice or more encompassing.

Of course, it is unclear how well we would have been able to accommodate these elements in practice.

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Analysis of offset rules for reducing Nitrogen fertilizer use on wheat

Farmers who grow wheat would be eligible for offset payment for agreeing to apply N below the baseline rate.

- Simulate rules to address each* of the W-M issues.
- Focus on low-transactions cost approaches.
- Analysis assumes that contracts to apply a specific N rate can be verified.
- Payment is based on N application rate, not measured N_2O.**
- Linear quantification: 1 kg N = 0.01 kg N2O

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Procedure

1. Assign field-specific baselines using prevailing practices based on 2009 Agricultural Resource Management Survey data (non-irrigated wheat.) n = 1,605 in 17 states.
2. Introduce a safety-margin a la Waxman-Markey. Several approaches considered.
3. Payment is for an agreement to apply N below the baseline.
4. Use cost estimates to predict new, additional participants. Farmer costs are reduced production minus fertilizer savings.

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Baseline rates

Assign field-specific baselines equal to *prevailing application rate* for each Major Land Resource Area (MLRA), state, soil, climate, and wheat productivity index, minus a safety margin.

- Farmer and broker can both look these up.
- Not based on farm records.
- Close to MSU/EPRI proposed protocol.
- Easy to update annually as wheat or fertilizer prices change and as climate changes.
- Results not much changed if instead base the baseline on "best practice" application.

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Additionality

Additionality =

Emissions under farm's business-as-usual application rate

minus

Emissions under new, contracted application rate.

- By simulating participation as if an offset market were operating in 2009, we can observe "business-as-usual" application rates.
- Careful with terminology! *Baselines ≠ Business-as-usual*

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Additionality

- By using actual application rates, we can also estimate farm-specific costs & predict which farms would have found it advantageous to reduce N further, thereby providing reductions that were *additional.*
- Some farms have $B > N_{2009}$ and do not reduce further – they provide offsets that are *non-additional*.
- Why this focus on additionality?
  - Non-additional credits raise costs, in terms of overall emissions.
  - Leakage only occurs when credits are additional. No change in behavior = no leakage.

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Safety Margin

- Analysis uses a safety margin that is proportional to the variance in Nitrogen application rates.
  - More variable rates == Larger safety margin

- Other safety margins also analyzed.
  - E.g., only farms in “low variability” regions are eligible for offsets.
  - E.g., safety margin proportional to negative skewness. Greater negative skewness == larger safety margin.

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Table 1. Results

	Safety margin (standard deviations below mean)		
	0	0.6	1.0
Participants – proportion	0.53	0.30	0.18
Participating acres (million acres)	21.5	10.8	6.0
Non-additional credits (million lbs. N)	395.2	161.5	80.8
Additional N reduction	117.5	58.7	32.9
Offsets	506.0	216.1	109.7
Additional/ Non-additional	0.30	0.36	0.41

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Results

- Nitrogen reduction is about half as expensive as reducing greenhouse gas emissions from point sources.
- We project a substantial quantity of non-additional credits.
  - Additional reductions are about 30-40 percent as large as non-additional credits.
  - This occurs because N application rates are highly variable in the cross-section.
  - We need a ratio of Additional/Non-additional ≈ 2 to pass a standard benefit cost test.
  - Higher safety margins reduce non-additionality but not by enough. Low participation rates.

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Discussion, cont.

- Different approaches to the safety margin can help but don't dramatically change the results.
- Similar results for Yes-No practices such as No-Till or Fall application.
  - Again, cross-sectional variability is high even within region/soil/climate/NCCPI.
- What are our options for improving additionality?
  - Can previous practices on the farm be used to condition the baseline and improve additionality?

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Substantial conceptual and empirical issues arise when previous farming practices are used to condition the baseline.

- *MORAL HAZARD*. Farmers change behavior just to qualify.
- *COMPLEXITY*.
  - Costs of keeping and interpreting farm records. Regulation needed to define for eligible farm records?
  - No longer a simple transaction between farmer and broker.
  - How to deal with ownership changes or incomplete records? If farm records not available, use the "prevailing practices" approach? Yikes!

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Using previous farm practices to condition the baseline, cont.

- To avoid moral hazard, use a base year rather than preceding year.
- How well do past practices predict future practices?
  - This problem especially keen when the policy uses a base year.
  - *ADVERSE SELECTION.* Farms for which prediction overestimates N application rates (etc.) are more likely to enter. In other words, *non-additionality*.

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Concluding comments

Remaining issues:

- Leaves unclear how policy would treat other practices that might accompany reduced N application rates.
- Leaves unclear how to deal with fields that might shift into or out of wheat as a result of offset opportunities.
- Would offset rules be issued one-by-one or would we have to wait until an entire body of offset rules was ready to issued?

Economic analysis of these alternatives would be complex.

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