Linking agricultural subsidies and ambient water quality to reduce nutrient loss

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Introduction

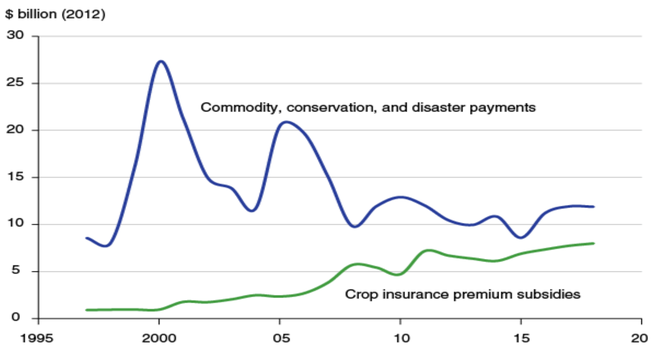
This research proposes and tests two new policy mechanisms that link eligibility for agricultural subsidies to ambient pollution levels.

Objectives

1) **To determine how subsidy reduction policies perform relative to ambient taxes.**
2) **To determine how individual assurances (protection against regulation) affect technology decisions and ambient pollution levels.**

- ❑ **Despite billions of dollars spent annually to fund voluntary conservation programs, agricultural nonpoint source (NPS) pollution remains a persistent problem in U.S. watersheds.**
- ❑ **Conservation compliance requirements are used in some federal programs in an effort to reduce soil erosion & runoff.**
  - ➢ Producers must comply with specific conservation standards in order to maintain eligibility for federal assistance programs, such as subsidized crop insurance (Ribaudo 2015).

Figure 1. Crop insurance subsidies are increasing, and are subject to environmental compliance restrictions



Sources: USDA, Economic Research Service analysis of Office of Budget and Policy Analysis data on actual expenditure for 1997-2013; projections for 2014-2018 based on spending levels provided in the 2014 Farm Act and Congressional Budget Office estimates.

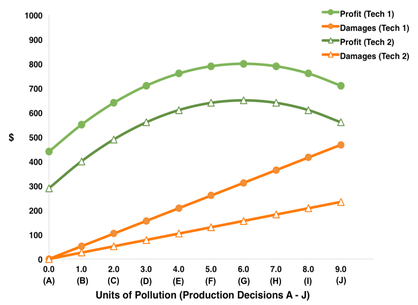
  - ➢ Conservation compliance has been tied to tax credits in state-level programs (e.g., Florida Everglades Agricultural Privilege Tax and the Wisconsin Farmland Preservation Tax Credit).

- ❑ **Conservation compliance requirements are typically connected to individual actions (e.g., input use, BMP adoption) without measuring the resulting environmental outcomes.**

Experimental Design

- **Student subjects (n=156) act as managers of generic firms**
- **Avg. earnings = $30 for 90-minute session**
- **Groups of six to represent watersheds**
- **Subsidy = 400 exp. dollars per round**
- **Each round, subjects make two decisions:**
  1. Production decision – 10 levels
  2. Technology decision – 2 technologies:
     1. Conventional technology (Tech 1)
     2. Costly, pollution-reducing technology (Tech 2).

Figure 2. Relationship between pollution, income, and damages



Experimental treatments *(within subject design)*

T1. No policy (*control*) (5 rounds)
- Pollution does not affect farm profit

T2. Ambient tax (5 rounds)
- Linear tax (equal to marginal social damages) on each unit of pollution that exceeds an announced threshold for each group (threshold = 18 units)

T3. Subsidy reduction (5 rounds)
- Participants lose some or all of the 400 exp. dollar subsidy if the total pollution from their group exceeds the announced threshold (18 units).
- Amount of subsidy reduction increases linearly (equal to marginal social damages) with each unit of pollution over the target, but cannot exceed the subsidy amount.

T4. Subsidy reduction with assurance (5 rounds)
- Subsidy functions the same as T3, but Individuals who adopt technology 2 do not lose any subsidy regardless of the ambient pollution level for their group.

- *Participants' earnings depend on their firms' profits in the first four parts of the experiment and money earned during an adapted Holt-Laury (2002) lottery.*

Results

Table 1. Mean group-level outcomes for four policy treatments

	No Policy (T1)	Ambient Tax (T2)	Subsidy Reduction (T3)	Subsidy Reduction with Assurance (T4)	Social Optimum
Group Emissions	**34.2** [33.8,34.6]	**19.5** [19,19.9]	**19.7** [19.2,20.2]	**20.0** [19.6,20.4]	**18**
Proportion using Technology 2	**0.03** [0.015, 0.039]	**0.08** [0.067, 0.103]	**0.07** [0.049, 0.087]	**0.50** [0.458, 0.550]	**0**
Group Profit	**4,730** [4,711, 4,750]	**4,239** [4,215, 4,263]	**4,255** [4,228, 4,282]	**4,120** [4,097, 4,142]	**4,260**
Social Net Benefit	**2,952** [2,942, 2,961]	**3,226** [3,213, 3,240]	**3,233** [3,217, 3,248]	**3,078** [3,057, 3,099]	**3,324**

Figure 3. Adoption of the Costly, Pollution-Reducing Technology

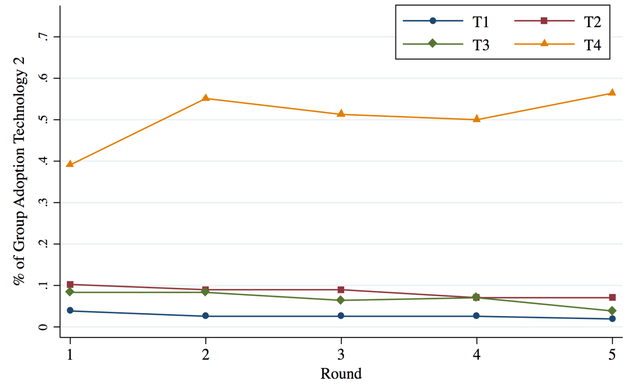
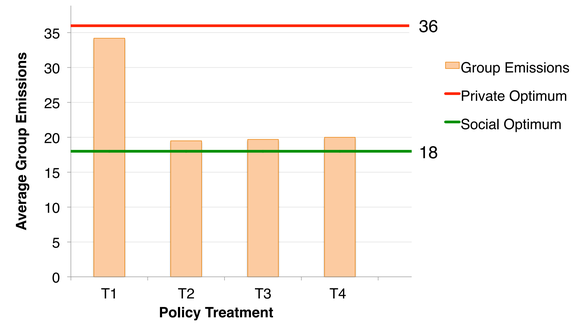


Figure 4. Mean group emissions for each treatment by round



Conclusions

- ❑ **Testing new conservation compliance mechanisms is important because the 2014 Farm Bill expands the use of conservation compliance requirements in federal programs.**
- ❑ **Subsidy reductions (T3) perform similar to ambient taxes (T2) when there are no individual assurances.**
- ❑ **More subjects choose Technology 2, when using this technology protects them from group-level penalties (T4).**
- ❑ **Coupling subsidy reductions with individual assurances (T4) results in lower social net benefit relative to ambient taxes and subsidy reductions alone.**

Literature cited

Holt, C.A., and S.K. Laury. 2002. "Risk aversion and incentive effects." *AER* 92(5): 1644–1655.

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USDA Economic Research Service (ERA).2014. "2014 Farm Act Continues Most Previous Trends In Conservation." Accessed May 23, 2016.