The Effect of Green Payments on the Diffusion of Conservation Technologies

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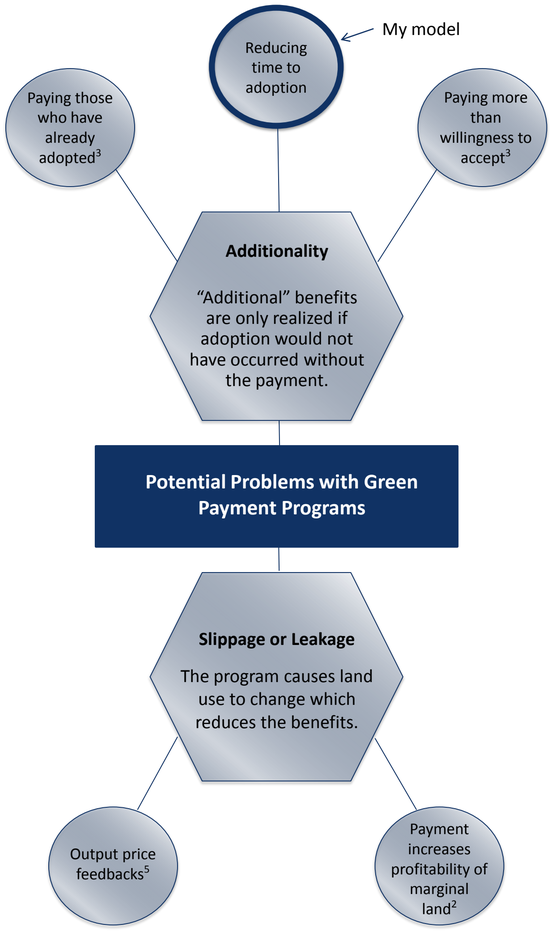
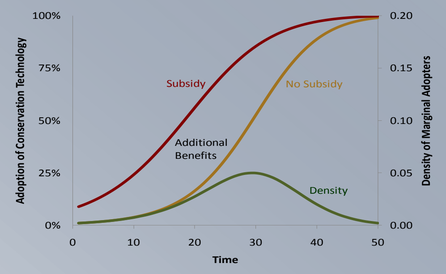
Main Point

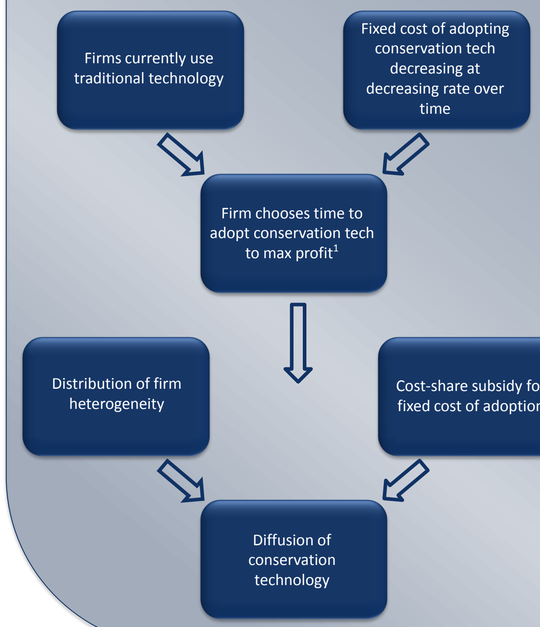
The benefits from green payments for the adoption of a conservation technology or practice are reduced if the technology would have eventually been adopted regardless of the green payment. This source of additionality is likely a significant concern for some technologies subsidized by EQIP.

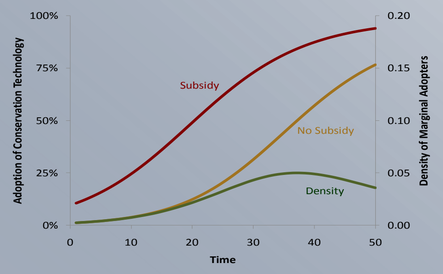
Previous Literature



Model

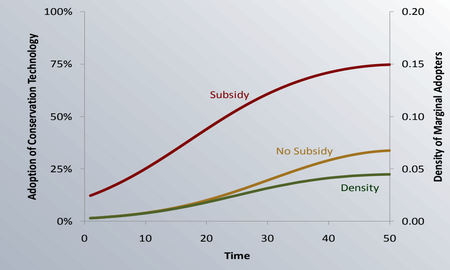






In these graphs I illustrate the results of my analytical model, which is described in the diagram to the left. The graphs are for illustrative purposes only; the parameter values do not pertain to any particular technology or subsidy program.

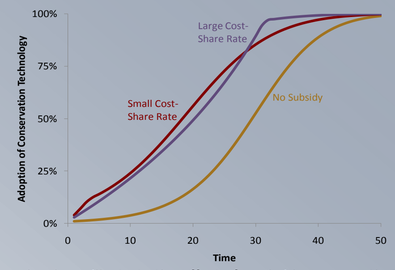
In the three graphs above I show the effect of a cost-share subsidy on technology diffusion under three different diffusion scenarios. In the first scenario the diffusion process leads to all firms adopting the conservation technology. In this case, the subsidy merely reduces the time to adoption of the technology. The additional benefits of the subsidy are proportional to the area

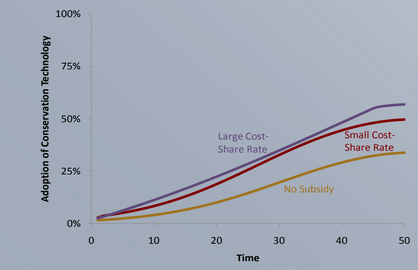


under the red curve and above the gold curve. The benefits of the program are overestimated if it is assumed that the technology would not have been adopted without the subsidy.

The second and third graphs show the effect of the subsidy if the diffusion only leads to partial adoption of the technology. The vertical distance between the diffusion curves is proportional to the density of marginal adopters. In my example, the vertical distance between the curves increases through the last period if total adoption without the subsidy is less than about fifty percent.

Cost-Share Subsidy with Budget Constraint





The two graphs above illustrate the effect of a subsidy program that specifies a cost-share subsidy rate and a total budget for the program. I fix a budget constraint and then specify a "small" and "large" cost-share rate in each graph.

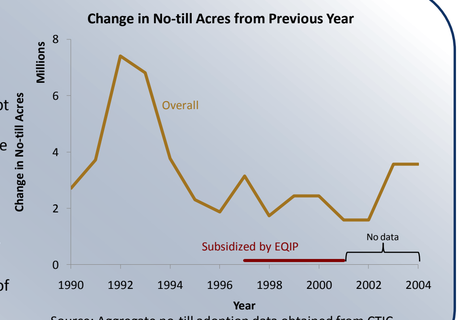
If a sufficiently high cost-share rate is specified, then the budget is constraining. The diffusion curve is convex while the budget is constraining because the fixed cost is decreasing over time. There is a tradeoff when specifying a subsidy rate given an allocated budget. A larger cost-share rate makes the budget more constraining and may actually lead to less adoption in the early periods, but in the end will lead to greater adoption of the technology, if the technology is not fully adopted without a subsidy.

In the case where a larger cost-share rate leads to greater adoption in early periods (such as the right graph), it is important to note that more money is spent with the larger cost-share rate. The preferred cost-share rate will depend importantly on the discounting of environmental benefits in the future.

No-till and EQIP

The source of additionality identified in my model is likely a concern for any technology whose adoption is increasing over time. The Environmental Quality Incentives Program (EQIP) in the U.S. offers cost-share subsidies to farmers to adopt a number of different conservation technologies or practices. EQIP requires that farmers have not already implemented the practice, but this does not eliminate the additionality concern.

In the graph to the right I show that the increase in the number of no-till acres far exceeded the number of acres which received EQIP subsidies from 1997 to 2001. Given that so many farmers adopted no-till without any subsidy, one must wonder how long it would have been until farmers who received the subsidy would have adopted no-till anyway? Do the environmental benefits from the additional years of adoption exceed the costs of the program?



Source: Aggregate no-till adoption data obtained from CTIC (Conservation Technology Information Center) and EQIP subsidy data obtained from NRCS.[4]

References

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[3] Kurkalova, L., C. Kling, and J. Zhao. 2006. "Green Subsidies in Agriculture: Estimating the Adoption Costs of Conservation Tillage from Observed Behavior." *Canadian Journal of Agricultural Economics* 54(2):247-267.

[4] Natural Resources Conservation Service. 2003. "Environmental Quality Incentives Program Benefit Cost Analysis." Available at: http://www.nrcs.usda.gov/programs/Env_Assess/EQIP/EQIP_EA_finals/FINAL_BC_Analysis.pdf

[5] Wu, J. 2000. "Slippage Effects of the Conservation Reserve Program." American Journal of Agricultural Economics 82(4):979-992.