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Temporal spillovers in land conservation☆

Sarah Jacobson*

Department of Economics, Williams College, 24 Hopkins Hall Drive, Williamstown, MA 01267, United States

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ABSTRACT

Temporal spillovers occur when a conservation program changes what happens to land outside the temporal window of the conservation contract. This may happen when conservation improves land so that returns to non-conservation uses are increased, or when landowners' preferences become more pro-conservation as they see land flourish under conservation, for example. These post-contract changes may occur on the extensive margin (acres of land conserved) or intensive margin (intensity of land in a given use). If temporal spillovers exist, benefits from conservation programs estimated by focusing solely on the effects that occur during the conservation contract will overstate or understate the true benefits of the program. I lay out a simple model of temporal spillovers. I test this model in the context of the United States Conservation Reserve Program (CRP). I use a pre-analysis sample specification step to choose counterfactual land most like the CRP land. On the extensive margin, I find that CRP causes some land to be 20–25% more likely to be farmed, potentially offsetting some environmental benefits. However, farmed ex-CRP land is slightly more likely to use a conservation practice. This is a mitigating factor on the intensive margin.

Payment for environmental services programs are popular conservation tools because these incentive-based methods can achieve conservation goals at low social costs. However, when researchers seek to understand the net benefits from these programs, they generally focus only on the effects that occur when the land is in a conservation contract. Many conservation contracts lock conservation in for a fixed term renewable upon reapplication, so land may go into and out of such contracts. If conservation changes properties of the land or landowner, then it may change the use the land is put into after the contract ends (as compared to what would have happened had the land not joined the program). We must ask, therefore: do the benefits estimated from acres in conservation overstate or understate benefits from the program because of effects that occur outside of the contract period? I call such temporally shifted effects "temporal spillovers," and in this paper I demonstrate the general importance of these effects in a simple model, and I find evidence of their existence in the United States Conservation Reserve Program (CRP).

I use the word spillover to refer to effects that occur outside the window of treatment, either spatially or temporally. Such unintended consequences may arise in many ways, and have been referred to by different terms. Spatial "slippage" may occur when conservation increases land scarcity, causing other acreage to be contemporaneously brought into production

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* Tel.: +1 413 597 2476; fax: +1 413 597 4045.
E-mail address: Sarah.A.Jacobson@williams.edu

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because of higher returns, as discussed in the context of the CRP in Wu (2000) and related articles and in the context of a Mexican program in Alix-Garcia et al. (2012). Localized crowd-in and crowd-out associated with CRP and other programs is explored in Parker and Thurman (2011). Unintended consequences have been noted outside the window of treatment in other environmental policy situations. For example, "leakage" (e.g. Fischer and Fox, 2012) in an emissions reduction policy occurs when parties that are not subject to the policy increase emissions and thus offset the policy's gains, and "rebound" (Borenstein, 2013) occurs when improvements on one dimension (e.g. fuel economy) are offset by losses on another dimension (miles driven).

Temporal spillovers can be caused by temporary contracts like those used in some land conservation programs, including REDD+ contracts. Kerr (2013) notes that non-permanence of REDD+-type conservation contracts can act like "leakage" across time. If land that enters such contracts simply shifts intensive use to a post-contract period, some environmental benefits may be reduced. The program's net benefits are further reduced if participation in the program causes an increase in later intensive use, as may be the case if conserved land becomes improved in quality. These temporal spillovers matter because if we study a program's impact by examining outcomes that occur only during a contract period, we may overstate the program's benefits.

I investigate whether evidence exists of temporal spillovers from the Conservation Reserve Program (CRP), the United States' largest conservation program, in a nationwide land use analysis. Paying careful attention to the specification of counterfactual land, I ask: how did CRP experience affect the land's later use? In particular, does CRP participation increase or decrease environmentally friendly land use in the long run, on both the extensive and intensive margins? A naïve analysis without careful specification of counterfactual land shows that ex-CRP land is farmed at a lower rate than other land. However, by comparing ex-CRP land to the most comparable non-CRP land, I find that the CRP causes at least some parcels to be 20–25% more likely to be farmed after exiting the contract, which is an environmentally negative effect on the extensive margin. This is evidence of a temporal spillover that reduces the program's environmental benefits. Selective exit from CRP could temper the implications of my results, but I provide suggestive evidence that the temporal spillover effect is robust to this. This result is novel in the literature but is not unexpected since the land should have improved while in the program. On the other hand, CRP land is slightly more likely to use conservation farming practices, and this is an environmentally positive correlation on the intensive margin. However, I cannot infer whether the increased conservation practice use is caused by CRP participation. Thus, I show that temporal spillovers of conservation programs may have deleterious environmental effects on the extensive margin, but intensive margin outcomes may work in the opposite direction.

1. Background

The CRP was created with the 1985 Food Security Act. Since 1990, 30–35 million acres of US farmland have enrolled in the program. Farmers bid to enroll a parcel of agricultural land by proposing a desired payment amount and choosing a conservation practice to implement (usually, planting an approved cover crop). The government makes contracts with the best bids. Each contract lasts for 10–15 years, during which time the landowner receives annual payments as well as cost-shares covering up to 50% of the costs of conservation activities. When a contract ends, the landowner may try to re-enroll or may put the land to some other use. The CRP seeks to reduce erosion by giving a break in intensive cultivation and by using conservation cover crops to rebuild soil. The program also aims to improve agricultural productivity, and has broader environmental goals. There is evidence of success with regard to these goals: CRP reduces erodibility (e.g. Uri, 2001), with substantial benefits (e.g. Feather et al., 1999).

This land improvement could have unintended consequences, causing negative temporal spillovers, since the improved land is more agriculturally productive. By increasing returns to farming, CRP may make land more likely to be cultivated later than it would have been had it never entered the CRP. This effect is reinforced by an interaction between the CRP and other agricultural payments. Land removed from CRP can be immediately added back into a farm's crop "acreage bases," which are used to calculate direct and counter-cyclical payments from the government. This is often not true for land that was simply idled (Young et al., 2005). In other words, CRP land returned to cultivation may yield higher government payments as compared to land that was idled and then returned to cultivation.

An alternative hypothesis is that "CRP endures:" participation in the CRP makes land more likely to be conserved later. This could happen if time in conservation changes landowners' preferences, increasing quasi-rents to conservation for participating land and rendering it more likely to remain conserved. Some previous research (e.g. Chouinard et al., 2008; Sheeder and Lynne, 2011; Wallace and Clearfield, 1997) supports this hypothesis. The CRP could also cause more conservation later if crucial local input or output markets, particularly those in which there are returns to scale, are compromised when too much land in an area exits farming.[1]

The CRP may therefore cause an increased or decreased likelihood of farming on land that exits the program. This may reduce or increase the net environmental benefits produced by the program. In addition to the extensive margin effects

[1] Program enrollment can also affect later land use if program payments loosen credit constraints, as suggested in Alix-Garcia et al. (2012). However, this is unlikely to be an issue in the context of US farmers.

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