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An Empirical Structural Model of Productivity and the Conservation Reserve Program Participation

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Through annual rental payment and long-term contract, the Conservation Reserve Program (CRP) provides financial incentives for landowners to idle environmentally sensitive farmland. In 2011, CRP paid \$1.7 billion to idle about 31 million acres, which is roughly equivalent to the size of total farmland in Iowa. In the last few years, however, CRP has faced a number of significant challenges. Record-high commodity crop prices had a significant impact on the CRP enrollment. Figure 1 shows that CRP land went down by 10 million acres between 2007 and 2012, which account for 27% of total enrolled acres in 2007. Following the changes in market conditions, the 2014 Farm Bill allows participants to terminate the contract prior to its expiration without penalty. The 2014 Farm Bill also reduces the cap of CRP acres by 8 million acres. Despite an extensive literature on CRP, we lack evidence on how landowners react to changes in agricultural market conditions and CRP payment rates and how the factors affect the program enrollment and contract

- A 10% increase in farm productivity leads to a CRP payment premium of \$4.9-\$8.02 per acre.
- Impact on CRP would be significant if agricultural prices remain high and landowners can flexibly withdraw the CRP contracts.
- Increasing CRP payment can offset effects of high agricultural prices to some extent, but it will significantly increase the program cost.

- Define an indicator function to deal with landowners' self-selection:

- Identification of the coefficients comes from the dynamics of the productivity that follows the first-order Markov process:

where λ_{kt} is the inverse mills ratio (IMR) from the probit regression.

- The profit function associated with the optimal land allocations is written as

- The optimal output supply and acreage allocations are obtained from the first-order conditions of the profit function.

- For farmer k in state s at time t , the output supply and two land use equations are specified as

$$I_{\alpha}^a = \theta_1 + \theta_{11}n_{-1} + \theta_{12}x_{-1} + \theta_{13}b_{1-1} + \theta_{14}I_{1-1} + \theta_{17}n_{14} + \eta_{17}^a. \quad (3)$$

$$l_{kt}^c = \theta_2 + \theta_{21}p_{st} + \theta_{22}r_{st} + \theta_{23}b_{kt} + \theta_{24}L_{kt} + \theta_{25}\omega_{kt} + v_{kt}^c \quad (4)$$

- To deal with the endogeneity, the CRP payment function is specified as

where m_d is the county market rental rate. $\mathbf{z}_{kt}$ collects the farm-level demographic variables.

- Use the inverse to proxy for the productivity, i.e., $b^{-1}(\omega_{kt}, m_{ct}, L_{kt}, \mathbf{z}_{kt}) \equiv \omega(b_{kt}, m_{ct}, L_{kt}, \mathbf{z}_{kt})$.

To what extent do agricultural market conditions and CRP rental rates affect landowners' CRP enrollment?

- Incorporate landowners' CRP decisions in profit-maximizing land allocation model and explicitly account for
 - Endogeneity of CRP payment and self-selection of landowners into CRP.
 - Linkage between landowner's bid and agricultural productivity.
- Analyze CRP payment premium of productive landowners.
- Simulate the land use changes at alternative agricultural prices and CRP payment across the Corn Belt states.

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