Introduction

Farmers’ cropping decisions are a product of a complex socio-economic, political, cultural, and natural environment in which factors operating at a number of different spatial scales impact what farmers ultimately decide to do with their land in any given year or over a set of years. Some environmentalist interests are concerned that increased demand for corn for ethanol production is leading to conversion of non-cropland to corn production (extensification). Ethanol industry interests counter that more than enough corn supply comes from already existing cropland (intensification). In this study, we determine which response to corn demand, intensification or extensification, is supported most by an analysis of land-use/land-cover (LULC) data across the state of Kansas and measures of corn demand (ethanol plant presence and cattle feedlot operations).

Data and Methods

Our study period is 2007-2009. We created a unique value-added dataset of LULC across the state of Kansas for all years representing field-level crop coverage. USDA National Agricultural Statistical Service Cropland Data Layer (CDL) classifications for 2007-2009 were generalized at the field level using the Common Land Unit (CLU) Field Boundary data layer for Kansas that was made available in 2006 by the Farm Service Agency of the USDA and purchased from the firm Farm Market ID. Generalizing the CDL data to the CLU layer smoothed the data to allow for more accurate change detection between years. From these data, we created two dependent variables representing sequences of LULC that are consistent with the two responses: extensification: Non-cropland → Corn → Corn, dividing that area by the total rural area. We repeated this procedure for all areas where the LULC sequence was consistent with intensification: Non-corn cropland → Corn → Corn.

Our independent variables are measures of corn demand for each county. We calculated for each county the distance from the county centroid to the nearest ethanol plant (PDist) and the total head of cattle for each county (from NASS, National Agricultural Statistics Service, 2007). All ethanol plants were in operation by 2007, except for two (Rice and Republic counties), which came online in May 2008. We then performed two Ordinary Least Squares (OLS) regressions with these variables and the following control variables (precipitation index, yield).

Model

We specified the following model using OLS:

$$Y_i = \beta_0 + \beta_2 X_i + \epsilon_i$$

where $i$ is a county index, $Y$ represents intensification and extensification of corn production by county, $X_i$ is a vector of covariates in original units, and $\epsilon_i$ an error term.

Results and Discussion

Results strongly favor the intensification over the extensification response to increased corn demand from feedlots and ethanol plants. For every additional 10,000 heads of cattle, rural acreage in intensive corn production increases by .275 percent. The further a county is away from an ethanol plant, however, the lower the percentage of rural acreage devoted to intensive corn production; for every ten miles of additional distance from an ethanol plant, the percentage of rural acreage in intensive corn production drops by .907 percent. The general relationships hold and are statistically significant in the models that account for spatial autocorrelation in the respective error and spatial lag models.

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