Public Abstract

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Title:EXTENSIONS OF A MAXIMUM ENTROPY ESTIMATED MARKOV DECISION PROCESS IN THE UNITED STATES AGRICULTURAL ECONOMY

With an increase in the US focus on biorenewable energy, more forces are competing for agricultural land. This structural change in the agricultural economy warrants re-examination of the relationships between agricultural production decisions and the factors which influence those decisions. However, relevant data may be limited. To address this issue, a maximum entropy estimated Markov decision process model (MDP), a model ostensibly robust with limited data, is employed to examine agricultural decisions in three studies.

First, the question of the MDP's application to endogenous price changes is addressed by incorporating the MDP into a structural partial equilibrium model examining corn and soybean production in Iowa and Missouri from 1995-2005. This model is compared to a calibrated constant coefficient model and shocked to examine performance differences. The MDP was found to be more responsive to changes in price than a traditional model, although constraints on the model estimates were required to cause the model to follow economic response expectations.

Second, the MDP was applied to a newly acquired satellite imaging dataset showing warm season grass (WSG) area, a possible cellulosic ethanol feedstock, in the Midwestern US from 2001-2009, comparing the relationships between WSG, corn, soy, and wheat. The model proved problematic with large datasets, but showed the possibility of WSG competing with traditional crops for area, responding to shocks in both its own price, and that of corn.

Third, the MDP was applied to US feed and residual usage. Because of the increase in ethanol production, dried distiller's grains (DDG) production has increased, creating a more available alternative livestock feed. DDGs, corn, and soy meal were examined from 2003-2012, and future use was projected. DDGs were found to compete with corn, but their soy meal relationship was unclear. DDG use is expected to level off and decrease slightly over the next ten years.