

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

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## ABSTRACT

With recent increased US ethanol production, the agricultural economy is undergoing a structural change, warranting a re-examination of the relationships between agricultural production decisions and explanatory data. 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. First, the question of the MDP's application to endogenous price changes is addressed by incorporating the MDP into a structural partial equilibrium model for Iowa and Missouri. This model is compared to a calibrated constant coefficient model. 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 in the Midwestern US, comparing the relationships between WSG, corn, soy, and wheat. The model proved problematic with large datasets, but showed that WSG may compete with traditional crops for area. Third, the MDP was applied to US feed and residual usage. Because of the EISA, dried distiller's grains (DDG) production has increased, creating a more available alternative livestock feed. DDGs, corn, and soy meal were examined, and future use was projected. DDGs were found to compete with corn, but their soy meal relationship was unclear. DDGs use is expected to level off and decrease slightly over the next ten years.