Heteroscedasticity and Estimation of Agricultural Debt

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### 1. Introduction

There are two purposes for this manuscript. First, we test for heteroscedasticity; it is one of the few empirical studies that found significant evidence that this change occurs over time. Second, we provide tests for heteroscedasticity. In order to scale the problem, we then divide through by expected return on agricultural assets.

### 2. Risk-Bearing Theory

The basic setup follows from Equation (1):

\[
\begin{align*}
\text{(3)} & \quad \delta(t) = \alpha + \beta \cdot x(t) + \epsilon(t) \quad \text{expected return on agricultural assets,} \\
\text{(4)} & \quad \omega(t) = \alpha + \beta \cdot x(t) + \epsilon(t) \quad \text{cost of return on agricultural assets.}
\end{align*}
\]

In this study, we use a linear profit function based on input and output prices:

\[
\text{Profit} = \sum_i (Q_i - Q_i^{*}) \cdot (P_i - P_i^{*}) + \sum_i Q_i \cdot (P_i - P_i^{*})
\]

where \(P_i\) is the profit per crop, \(Q_i\) is the price index for commodity, \(P_i\) is the price index for livestock, \(Q_i^{*}\) is the price index for seed, \(Q_i^{*}\) is the price index for fertilizer, and \(w_i\) is the price index for feed; all price indices are in the U.S. level.

### 3. Econometric Specification

#### 3.1 Expected Profit

Several approaches have been used to model expected profit. For example, Moss, Shonkwiler and Forst (1977) and a time series (autoregressive) specification to model expected returns on agricultural assets.

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