Assessing the Rationality of Farmland Price Movements
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Land in Agriculture
• Largest portion of assets on the agricultural balance sheet
• Price sensitive to adverse affects on landowners and financiers
• Price should reflect expected future cash flows

Economic Model of Land Prices
A new framework to determine if the price of farmland rationally reflects the expectation of the returns to farmland. Specifically, a full information maximum likelihood estimator with recursive covariance restrictions to estimate simultaneously the following equation system:

\[ \begin{align*}
\Delta P_{t,2} & = \alpha_{1,2} + \gamma_{1,2} P_{t-1,2} + \epsilon_{1,2} \\
\Delta P_{t,1} & = \alpha_{1,1} + \gamma_{1,1} P_{t-1,1} + \epsilon_{1,1} \\
\Delta P_{t,0} & = \alpha_{1,0} + \gamma_{1,0} P_{t-1,0} + \epsilon_{1,0}
\end{align*} \]  

The expected return to farmland, \( \Delta P_{t,2} \), is conditional on the information set, \( \Phi_t \), which is a subset of all the information observable at time \( t-1 \).

In Equation (1), the rate of return to farmland in a given year is a function of:
- Return to farmland in the previous year
- Logged-ratio of agricultural exports to agricultural imports
- Rate of change in aggregate food price less the rate of change in returns on 3-month T-bill.

In Equation (2), the annual rate of return on farmland capital is a function of:
- Expectation of the annual growth rate of returns
- Expectation of the annual return yield
- Previous two lag values of the rate of return from using land for farming, \( \bar{r}_{t-1} \), where \( \bar{r}_{t-1} \) equals:

\[ \bar{r}_{t-1} = \frac{R_{t-1} - R_{t-2} - R_{t-3}}{R_{t-1}} \]  

To assess the rationality of land price, we modify the model Schmitz (1995) develops.

In Equation (3), the change in farmland price is a function of:
- Present value of the expectation of returns
- Present value of the farmland capital accumulation

The fitted values from equations (1) and (2) represent the rational expectation of returns if the error term consists of white noise:
- Presence of information in the error suggests that:
  - Market does not make efficient use of available information
- The information set lacks sufficient information to specify the model correctly

The model is not specified correctly
- In either instance, equation (1) does not represent the rational expectation if error does not consist only of white noise

If farmland capital appreciates rationally, the change in farmland price will reflect the rate of return from using farmland capital for agricultural purposes.

Additionally, if market fundamentals determine the price of farmland, previous changes in farmland capital should have no influence on the expected rate of return on farmland capital.

Conclusions
• Throughout 63% of the sample, the standard score of the estimated change in farmland capital lies below the standard score of the estimated rate of return that rational individuals expect to earn from farming land.
• Throughout 95% of the sample, the 95% confidence interval for the standard score of the estimated rate of return encompasses the standard score of the estimated change in farmland capital.
• The expected rate of return was never negative
• The estimators generate white noise residuals
• The parameter estimates in all three equations accord to present value theory:
  - \( \beta_1 \) and \( \delta_1 \) do not statistically differ from zero
  - \( \beta_2 \) and \( \delta_2 \) do not statistically differ from one and statistically differ from zero
  - \( \delta_3 \) does not statistically differ from negative one and statistically differs from zero
• Transaction costs prevent the rate of return on farmland from equaling the rate of return on government securities:
  - Make interest rates a function of return expectations instead of an exogenous discount rate
• Results suggest that changes in the value of Illinois farmland occur as a result of return expectations
• We find no evidence of bubbles or fads. Any downward reversal in the price of farmland will follow a downward adjustment in return expectations

References
Portfolio Analysis

Present value analysis

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