Are Fundamentals Driving Agricultural Land Values? Evidence from Panel Data with Cross Section Dependence

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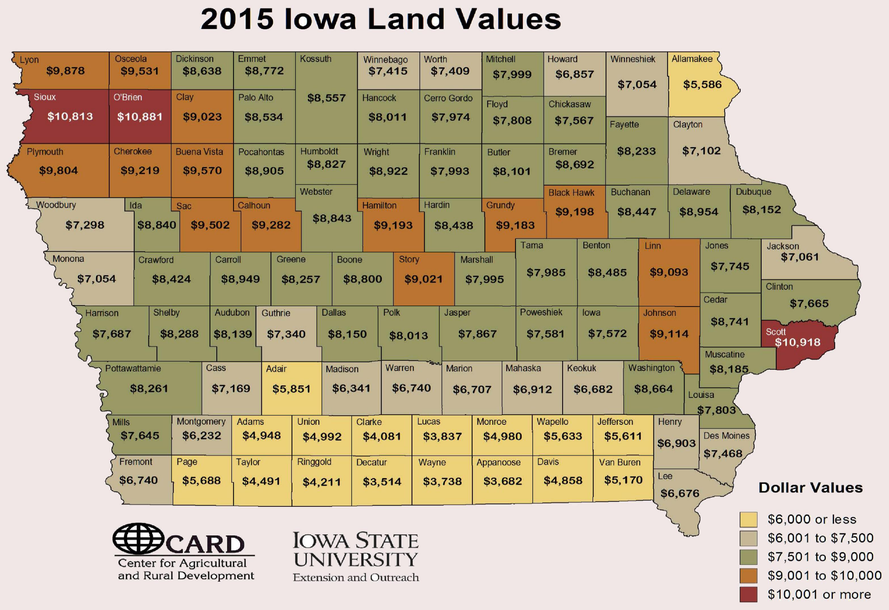
Introduction

Increasing farmland values have given rise to questions about the factors driving farmland values higher. Are current farmland values "reasonable" or rather represent some type of asset "bubble" ?

Seminal work on farmland values generally failed to support the implications of the present value model. How can we explain failure of Present Value Model? Are "fundamentals" really not sufficient to explain the movements in relative farmland prices?

We investigate the suitability of panel unit root tests for testing the Net Present Value (NPV) hypothesis for Iowa farmland, and to provide empirical guidance on how to tackle the cross-section dependence issue when using panel time-series data. We focus on panel unit root tests based on *i-) common factor* extraction (Bai and Ng;2004), and *ii-) block bootstrapping* approach (Palm et al.;2011).



Methodology

Net Present Value Model

$$(p_{i,t} - c_{i,t}) = k_i/(1-\rho_i) + E_t\left[\sum_{m=0}^{\infty} \rho_i^m (\Delta C_{i,t+1+m} - r_{i,t+1+m})\right]$$

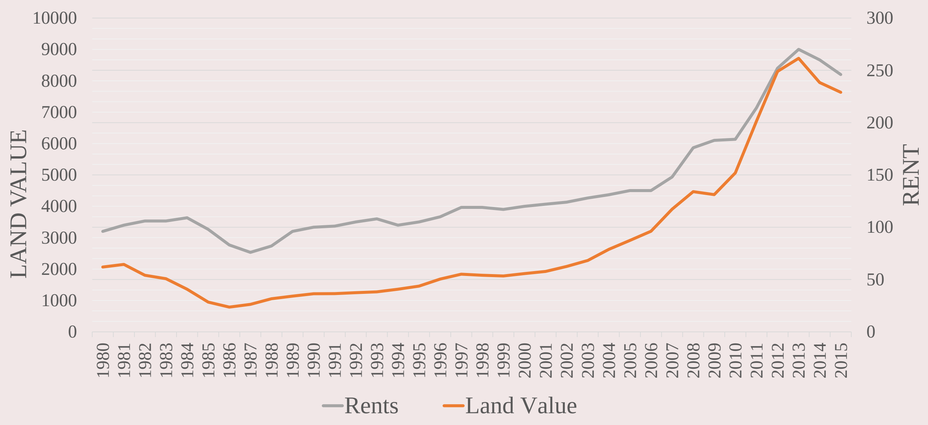
$(p_{i,t} - c_{i,t})$ is log of ratio of the price to cash rents per acre of farmland and $r_{i,t}$ is log of the real gross rate of return on an acre of land. Market efficiency requires stationarity of $(p_{i,t} - c_{i,t})$ ratio, implying that short-run deviations from the steady-state level of (relative) farmland prices will be eliminated quickly.

Unit Roots in Panel Data with Cross Section Dependence

- Panel unit root tests that do not allow for dependence among cross-section units exhibit non-trivial size distortions. We use two distinct approaches to testing for unit roots in panel under cross section dependence.
- *Common factors approach* approximates contemporaneous error correlation by a factor model such that $Y_{i,t} = \lambda_i F_t + E_{i,t.}$
- *Block bootstrapping* approach allows for cross-section dependence in the data without having to explicitly model the dependence structure. Instead, contemporaneous error correlation (both temporal and cross-sectional) is preserved by drawing a *block* of errors to bootstrap the test statistics.

Data and Findings

County-level farmland prices and cash rents between 1987 and 2015 for 78 Iowa counties are used to construct a balanced panel of the log of cash rents-to-price ratio. The data are provided by the Iowa State University, Extension Department.



Findings (continued)

First Generation Panel Unit Root Tests

Test	Deterministic Terms Added	
	Constant Only	Constant and Linear Trend
Levin, Lin & Chu t*	-0.804 (0.210)	-7.020*** (0.000)
Im, Pesaran and Shin W-stat	9.674 (0.999)	-6.026*** (0.000)
ADF - Fisher Chi-square	6.799 (0.999)	113.223 (0.996)

Numbers in parenthesis are p-values. *** indicates significance at the 1% level. Number of augmented terms were selected for each cross section unit separately based on SIC criterion. First generation panel unit root tests over-reject the null of panel unit root due to cross-section dependence.

Cross-Section Dependence (CD) Test

Test Statistic	Average Correlation Coefficient	1% critical value
139.269***	0.974	2.575

CD test points to strong cross-section dependence among local Iowa farmland markets.

Panel Analysis of Non-Stationary in Idiosyncratic and Common components (PANIC)

Test Statistic	1% Critical Value	5% Critical Value	10% Critical Value
ADF Test on the Estimated Common Factor			
-0.314	-3.743	-2.997	-2.629
Pooled Test on Idiosyncratic Components			
-10.026***	-3.433	-2.862	-2.567

Number of augmented terms were selected for each cross section unit separately based on SIC criterion.

Cross-Sectional Dependence Robust Block Bootstrap Panel Unit Root Tests

Test	Test Statistic	5% Critical Value	Block Length
Pooled	-10.376	-12.639	6
Group_mean	-11.001	-13.465	6
Median	-9.751	-13.398	6

Discussion

Common factor models point to a single nonstationary common factor in the data that drives dependence across Iowa counties. Once this unobserved common factor is accounted for in the data, remaining county-specific idiosyncratic components become stationary and cross-sectionally independent. Overall, common factor approach does not provide evidence in favor of the NPV hypothesis.

Block-bootstrap approach provides similar conclusions in terms of the panel stationarity of cash rents-to-value ratios for Iowa farmland markets, suggesting factors other than economic fundamentals may be driving farmland values in Iowa.

References

Bai, J., and S. Ng. (2004). "A PANIC Attack on Unit Roots and Cointegration." Econometrica 72:1127-1177.

Palm, F.C., Smeekes, S. and Urbain, J.P. (2011) "Cross-sectional dependence robust block bootstrap panel unit root tests", Journal of Econometrics, 163, 85-104.

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