RECENT TRENDS IN AGRICULTURAL LAND PRICES IN SOUTH AFRICA: A PRELIMINARY INVESTIGATION USING COINTEGRATION ANALYSIS

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Abstract

The main objective of this paper is to report preliminary findings on the recent trends in agricultural land prices in South Africa against the backdrop of growing concerns over their rising levels. Given the important role of land prices, the impact such increases would have on significant national development efforts, including the on-going land reform programme and other aspects of agricultural restructuring, provide strong justification for this investigation. The cointegration approach was employed within a framework that allowed for both long-run and short-run dynamics of the relationships to be identified. Building on previous structural modelling of farmland prices in the country, and using much expanded time series spanning forty-nine years, it was possible to establish some patterns of causation in the relationships between farmland prices and a range of macro-aggregates, including interest rate on debt, the rate of inflation, Gross Domestic Product, among others. Although the important role of foreign buyers is suggested by some of the results, there is need for further studies on this subject, using alternative data sets. The finding of a Granger causality relationship between farmland prices and GDP is interesting to the extent that it reflects buying power and confirms impressions about the crucial role of farmland prices in national economic management and the successful implementation of the on-going agrarian reforms in South Africa.

JEL classification: C22, E3, Q15, Q18, Q24,

1 Background

In South Africa, land remains an emotive issue largely due to its history rather than its contribution to national output. According to the Reconstruction and Development Programme document (RDP), land is a "basic need" of the people of South Africa (ANC, 1994). However, agriculture, easily the main user of land worldwide, accounts for only 4.5% of South Africa's GDP, and roughly 11% of formal employment opportunities (Verschoor, 2003). Ultimately, land must play a more important role in a transformation process where a significant segment of the population is unemployed and do not have the skills for meaningfully participating in the economy outside agriculture. At present, unemployment rates are officially about 23% while unofficial figures claim as high as 45% particularly among the black population. The structure of the agricultural economy of South Africa means that land is the central productive resource and its ownership patterns are crucial where opportunities need to be equalized in the absence of alternative opportunities elsewhere in the economy (Bell, 1990; Van Zyl, Kirsten, and Binswanger, 1996). Rising price of farmland in the country will therefore be a source of considerable concern.

2 Importance of Agricultural Land Prices

Prices would normally signal the market possibilities on the basis of which prospective investors would make a decision. In the South African context, policymakers are understandably uncomfortable at the prospect of high agricultural land prices since these would only worsen the existing skewedness of land distribution in the country. In the 11 years since pluralistic democracy was introduced, efforts to redress the imbalance have

been feverish although the disparities remain. There is an understandable sense of unease among policymakers (Lyne and Darroch, 2003; Moyo, 2004).

There are four other reasons why it is important to analyze agricultural land prices in general and these have been well-handled in a growing body of literature. In the first place, the cost of farmland is a major share of the overall cost of production in agriculture (Mishra, Moss and Erickson, 2004; Lence and Miller, 1999). Van Schalkwyk (1995) has demonstrated this fact for the South African agricultural sector where, as is true for the United States of America and elsewhere (Schmitz, 1995; Schmitz and Moss, 1996), changes in agricultural land prices have a direct effect on farm wealth.

A second reason is the very close link between agricultural land prices and the solvency of the farm sector (Mishra, Moss and Erickson, 2004). Farmland prices would have a strong bearing on what happens on the farm. This mandates explicit effort to analyze their significance, particularly how they are determined and what specific influences they have on the economy in general.

A third crucial reason for analyzing agricultural land prices is their use in the estimation of sector productivity and competitiveness. It is standard analytical procedure in policy analysis to construct enterprise budgets needed to calculate an array of partial equilibrium measures that provide useful insights into the health of a farm business (Monke & Pearson, 1989; Tsakok, 1990).

Finally, policy makers, in designing agricultural support programmes, find that farmland prices are the most convenient indicators of the sector's economic performance. Agencies that design support programmes must have a rule-of-thumb measure for determining the need for assisting farmers.

3. Objectives

Against this background, this paper takes as a point of departure the groundswell of concern about the rising prices of farmland in South Africa and the considerable debate it has generated. Taking note that an elaborate and comprehensive programme is currently underway to empower black farmers targeted under the Broad-based Black Economic Empowerment in Agriculture or AgriBEE as it is popularly known, this is obviously an important question that has important practical implications and therefore deserves urgent academic as well as policy response. The central question this paper addresses itself to is what are the key drivers of the rising prices of agricultural land in South Africa today and what is their pattern of action.

4. Model Structure and Data

According to Gujarati (2003), asset prices normally follow a random walk in the sense that they are subject to periodic swings of a stochastic or random nature. Economic theory predicts that, at least in the short-term, agricultural land prices and the range of market fundamentals will tend to drift apart (Lloyd and Rayner, 1990). This inherent non-stationarity of the relevant variables creates the justification for the use of co-integration methodology and error correction.

In a highly simplified framework, in which agricultural land is viewed rightly as a productive factor or asset, farmland price can be sensitive to the actual rate of return in the year of purchase. The actual rate of return on farming operations can be influenced by a number of variables, including the rate of inflation, net farm income, interest rates on debt, level of farm debt, total land available for agricultural production, the value of agricultural production, the general health of the economy as measured by the gross domestic product, among other factors. Since theoretically these relationships can also work in the opposite direction, it is therefore possible to apply both the residual-based approach and the first-order vector autoregression model of the types:

$$m_t = \alpha_0 + \alpha_1 y_t + \alpha_2 r_t + \mu_t \text{----------(1)}$$

which depicts a linear combination of a number of integrated series represented by m_t as the dependent variable, and y_t and r_t, respectively, as the explanatory variables, in the residual-based case using single-equation OLS techniques,

and, for the VAR model,

$$Y_t = AY_{t-1} + ... + AY_{t-p} + BX_t + \varepsilon_t \text{----------(2)}$$

where Y_t is a vector of endogenous variables, X_t is a vector of exogenous variables, while $A_1 \ldots A_p$ and B are matrices of coefficients to be estimated. The term, ε_t is a vector of innovations that impact on the endogenous variables and while being correlated with their current period values are definitely uncorrelated with their previous period or lagged values.

Prior to estimating the VAR model, unit root tests were conducted on the variables using the Augmented Dickey Fuller (ADF) procedure as follows:

$$\Delta P_t = \propto_0 + \delta P_{t-1} + \sum_{t-1}^{k} \beta \Delta P_{t-1} + \varepsilon_t \text{ ----------(3)}$$

The VAR model allowed for Granger-Causality Test to be carried out on the data. The purpose of Granger Causality tests is to examine the direction of causation in the economic relationship established by the co-integration analysis (Gupta and Mueller, 1982) as suggested by equation (4).

$$\left.\begin{aligned} P_t &= \sum_{i=1}^{m} \lambda_i P_{t-1} + \sum_{j=1}^{m} \delta R_{t-j} + \mu_t \\ R_t &= \sum_{i=1}^{n} \alpha_i R_{t-1} + \sum_{j=1}^{n} \beta_j P_{t-j} + \nu_t \end{aligned}\right\} \text{ ----------(4)}$$

where

P_t is agricultural land price series

R_t is the net farm income series.

α, β, and λ are vectors of the key variables, and

μ_t and ν_t are uncorrelated error terms.

In order to carry out the foregoing procedures, time series data were obtained for the period 1955-2003 on nine variables, namely, farmland prices (LRLPH), net farm income (LNFI), interest on debt (LINTD), influence of foreign buyers (LFBYIST), inflation (LINF), farm size (LFAMHA), farm debt (LFAMDBT), gross domestic product (LGDP), and value of farm production (LVALHA). All the variables were log-transformed and indexed. Both the Microfit and E-Views econometric packages were employed to run the relevant tests. The results are presented in the sections that follow.

5 Results and Discussions

The results of the unit roots tests in Tables 1. Using the residual-based approach, cointegration relationship was established and the result is presented in Table 2. In the next sub-section, the findings with respect to the unit root tests are presented while the results of the cointegration tests are taken up in the sub-sections that follow.

5.1 Unit Root Tests

The Unit Root tests showed that all the variables required one differencing in order to become stationary, thus making them all *I*(1), which makes the application of VAR more convenient than would otherwise be the case.

Table 1: Statistical properties of variables and results of unit root tests

Variables	Methods				Data generating process	
	DF/ADF/ Perron	Lag length	Intercept/trend/none	DW	Level of Integration	Coefficient
LGDP	DF	--	c	1.97	I(1)	-3.11**
LINFL	DF	--	none	1.94	I(1)	-6.24*
LVALHA	DF	--	c	1.96	I(1)	-5.44*
LFAMDBT	DF	--	c	2.13	I(1)	-4.24*
LINTD	ADF	1	c & t	1.95	I(1)	-5.44*
LRLPH	DF	--	none	2.05	I(1)	-3.82*
LNFI	DF	0	c & t	1.87	I(1)	-4.25*
LFAMHA	ADF	--	c & t	2.10	I(1)	-3.83*
LFBYIST	DF	--	c & t	1.99	I(1)	-6.33*

*, ** and *** stand for level of significance at 1%, 5% and 10% respectively
c stands for intercept and t for trend

5.2 Results of Cointegration Tests

Cointegration was established by means of both residual-based approach and Johansen's reduced rank procedure. It is clear from Table 2 that long-run relationships exist between farmland prices and a range of factors such as farm debt, influence of foreign buyers, gross domestic product, and value of farm production. Annual dummies were included based on the results of recursive analysis of the coefficients of the respective variables which indicated structural breaks in the data. Table 3 presents the results of error correction and confirms important short-run relationships.

The results of the estimation carried out on E-Views are presented in Table 4 and suggest that up to eight cointegrating relationships are feasible in the model. We are able at least to reject the null hypothesis of no cointegration in as many as 6 cases at 5% and looking at the calculated statistics, there is no doubt that a 10% test will accept the alternative hypothesis, H_A: r = at most 8 cointegrating equations.

Table 2: Results of residual-based approach to establish long-run relationship

Variables	Coefficient	Standard Error	Probability
Intercept (C)	-3.285	4.663	0.486
LFAMDBT	-0.819	0.144	0.000
LFAMHA	1.285	0.968	0.193
LFBYIST	0.269	0.058	0.000
LGDP	-0.492	0.118	0.000
LINFL	0.036	0.039	0.367
LINTD	-0.189	0.120	0.124
LNFI	-0.069	0.043	0.123
LVALHA	1.773	0.119	0.000
DUMMY74	-0.268	0.076	0.001
DUMMY77	-0.185	0.059	0.004
DUMMY80	0.140	0.070	0.054
DUMMY94	-0.165	0.093	0.087
DUMMY00	0.134	0.074	0.077

$R^2 = 0.98$, $\bar{R}^2 = 0.97$, DW = 1.65

Table 3: Results of the OLS regression to estimate short-run equation - Error correction

Variables	Coefficient	Standard Error	Probability
Intercept (C)	-0.012	0.015	0.416
DLFAMDBT	-0.058	0.039	0.144
DLFAMHA	0.086	0.341	0.802
DLFBYIST	0.051	0.025	0.049
DLGDP	-0.117	0.073	0.121
DLINFL	0.003	0.015	0.832
DLINTD	0.057	0.042	0.185
DLNFI	-0.043	0.012	0.001
DLVALHA	1.068	0.058	0.000
RESID (-1)	-0.302	0.116	0.014
DUMMY74	-0.071	0.013	0.000
DUMMY94	0.029	0.013	0.037
DUMMY00	0.169	0.018	0.000

$R^2 = 0.96$, $\bar{R}^2 = 0.94$ DW=2.1

Table 4: Cointegration test results generated by E-Views

Hypothesized No. of Cointegrating Equations	Eigenvalues	Likelihood Ratio Statistics	Critical Values	
			5%	1%
r=0	0.883256	350.1976	192.89	205.95
At most 1	0.850465	251.4002	156.00	168.36
At most 2	0.684145	163.9899	124.24	133.57
At most 3	0.533673	110.9763	94.15	103.18
At most 4	0.444446	75.88429	68.52	76.07
At most 5	0.357864	48.84600	47.21	54.46
At most 6	0.219113	28.47006	29.68	35.65
At most 7	0.214407	17.09311	15.41	20.04
At most 8	0.122144	5.992540	3.76	6.65

6. Granger Causality

Table 5 presents the results of the Granger causal relationships examined by the model. Strong Granger causal relationships are revealed between farmland prices and farm debt and the Gross Domestic Product, suggesting a unidirectional causality from farmland prices to those variables. In the other direction, the rate of inflation, interest on debt, net farm income, and farm value per ha were shown to Granger cause farmland prices. Of particular interest from the point of view of current debate is the fact that the proxy for foreign buyers neither Granger caused farmland prices nor was Granger caused by it.

Table 5: Granger Causality Test Results

Null Hypothesis		F-statistics	Prob.
Farm debt does not Granger Cause farmland prices	47	1.39746	0.25848
Farmland price does not Granger Cause Farm debt	47	3.87025	0.02866
Farm size does not Granger Cause Farmland prices	47	1.21663	0.30645
Farmland price does not Granger Cause Farm size	47	0.06891	0.93352
Foreign buyers does not Granger Cause Farmland prices	47	0.65929	0.52249
Farmland prices does not Granger Cause Foreign buyers	47	0.91901	0.40679
GDP does not Granger Cause Farmland prices	47	1.21721	0.30629
Farmland price does not Granger Cause GDP	47	5.69080	0.00650
Inflation does not Granger Cause Farmland prices	47	2.24237	0.11877
Farmland price does not Granger Cause Inflation	47	1.38386	0.26180
Interest on debt does not Granger Cause Farmland prices	47	5.16633	0.00986
Farmland price does not Granger Cause Interest on debt	47	0.23895	0.78852
Net farm income does not Granger Cause Farmland prices	47	9.17397	0.00049
Farmland price does not Granger Cause Net farm income	47	0.29410	0.74672
Farm value per ha does not Granger Cause Farmland price	47	2.19881	0.12354
Farmland price does not Granger Cause Farm value per ha	47	0.89278	0.41714

7. Conclusion

Preliminary indications are that a long-term relationship exists between farmland prices and a number of important macro-aggregates, especially farm debt, value of farm production, interest rates, the rate of inflation and the GDP. Important short-run

relationships were also established. Granger causality was confirmed in a predominantly unidirectional pattern between farmland prices and some of the modeled variables. The existence of strong causation from farmland prices to the GDP is an interesting finding from the point of view of economic policy management and overall agricultural restructuring in the country. More insights are however needed for more definitive conclusions on the patterns of causation and the structures of both the short and long-run relationships between farmland prices and other economic variables. More work is also needed to identify and isolate the policy and non-policy effects on farmland prices.

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