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LAND PRICES IN SOUTH AFRICA: 1960 TO 1979

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INTRODUCTION

The prices of agricultural land in South Africa have risen considerably since 1960 (Figure 1).

The purpose of this study is to try to determine the factors that could possibly explain land prices. Certain factors have been identified and an attempt has been made on the basis of statistical tests to determine what the effect of each on the fixing of land prices is.

Theoretical models have been drawn up and data covering a period of 20 years used in order to test the equations empirically by means of multiple linear regression fittings.

DEFINITION OF VARIABLES

Dependent variable

Land prices in the Republic of South Africa are regarded as a dependent endogenous variable. Land prices were measured by using the combined index of land prices as compiled on the basis of carry-overs of rural immovable property. (*Abstract of Agricultural Statistics*, 1983, p. 110.) It was assumed that land was used for agricultural purposes and that industries and mining development did not play a significant role. Land prices include the value of fixed improvements. Discounting industries and mining as a factor constitutes a limitation, because if their influence could be quantified it might be found to be considerable.

Independent exogenous variables

The hypothesis was that the demand for land, like the demand for other inputs, is a derived demand from the demand for products. The price of land will therefore depend on the productive value of land. Hasbargen (1980, p. 1) regards the specific yield capacity of land as the most important factor determining land prices. The price should therefore be a reflection of future earnings from the land. According to Collett (1969, pp. 21-26) and Nieuwoudt (1980, pp. 389-391) total expected future earnings and the competitive capitalisation rate determine the present value of land.

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The equation is therefore as follows:

$$W = f(I,r)$$

where:

W = present value of land and improvements

I = total future income from the land and improvements

r = capitalisation or yield rate

The income from the land (I) is reflected by present income from the land and expected future changes. The capitalisation rate (r) is affected by the general rate of return on long-term investment, and by the demand for land (Collett, 1969, pp. 21-26). The availability of funds may play a part here too.

Another factor that can affect land prices is the situation in relation to infrastructure, such as roads, railway lines and markets. The size of the industry, buildings and historical income records also affect the price of a particular piece of land.

The following independent variables were taken into account in this model:

(i) Inflationary trend

The question is whether the data should be deflated in an attempt to eliminate the inflationary trend. Shepherd (1966, p. 121) asserts that "this process is effective and accurate only if the relation between the price of the goods and the deflator is one to one". Agricultural prices fluctuate so much that it is seldom possible to satisfy this condition, which is why the technique is not used. The consumer price index (all items) as calculated by the Department of Statistics (*Abstract of Agricultural Statistics*, 1983, p. 103) was used in order to make due allowance for the inflationary trend over the period concerned.

(ii) Income from land

This was evaluated in accordance with physical production. Technological advancement and progress in the field of management were interpreted as a change in the volume produced (*Abstract of Agricultural Statistics*, 1983, p. 93, Volume of Agricultural Production). If the amount of land remains constant, production can increase only if better techniques, management and technology are available.

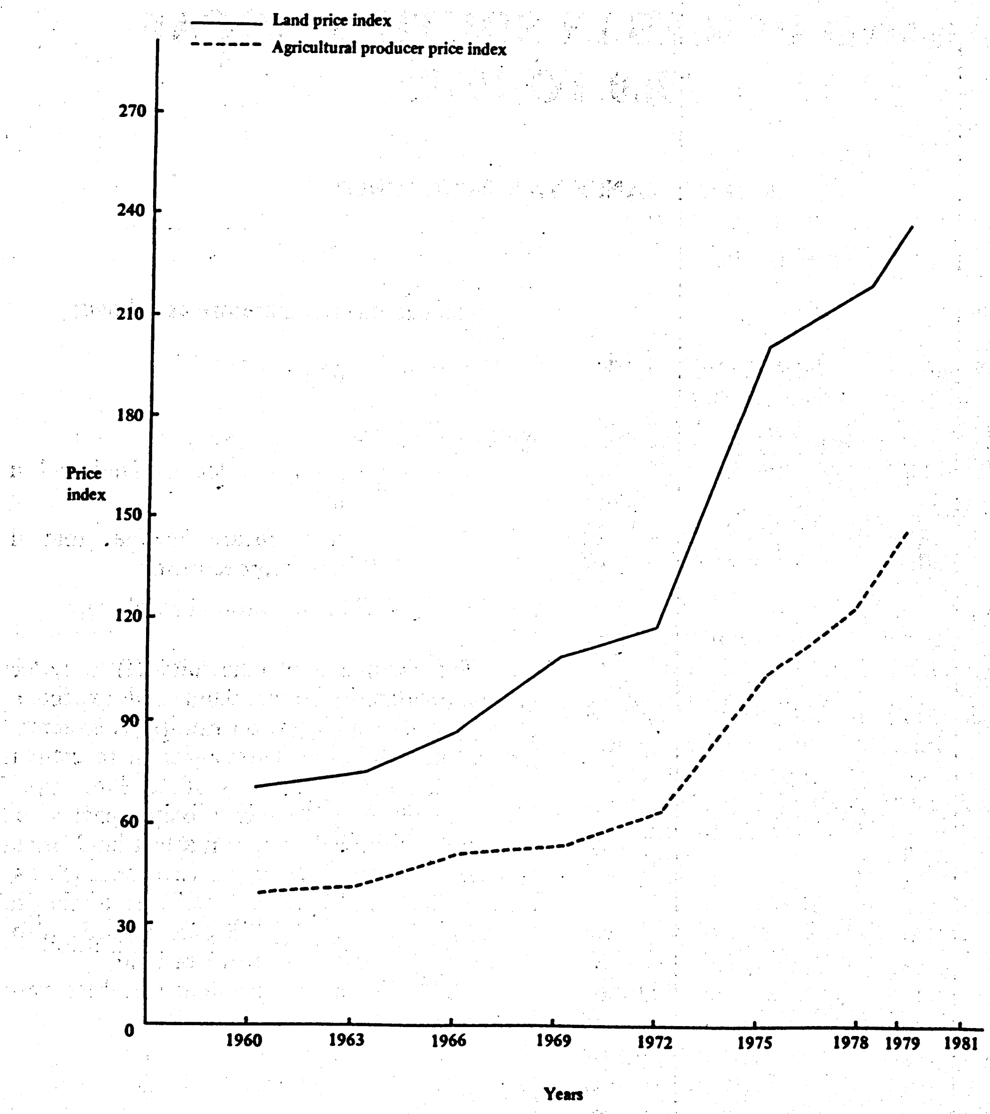

FIG. 1 - Changes in land prices and producer prices of agricultural products in South Africa: 1960 to 1979

(iii) Interest rate on long-term investment and availability of funds

This was measured in terms of the average interest rate paid on first mortgages (*South African Statistics*, 1982, pp. 20-21). This is basically the price of the funds available for the purchase of land.

(iv) Information used and statistical testing procedures

In general information is used as it occurs in the sources already mentioned. However, the inflation rate was deducted from the interest rate on first mortgages, so that the effective or real rate could be determined. The data used are indicated in Table 1. The computer calculated the real interest rate by means of certain programmed steps and therefore it is not given here in the form in which it is used in the equations.

The t-test is used to measure the statistical significance of calculated coefficients. In addition the determination coefficient (R^2) and the F-test were used to evaluate the reliability of the fitting, and the Durbin-Watson test is used to test for serial (auto) correlation. Lag variables (Intriligator, 1978, p. 176) were also used, as is shown later. Occasionally the response of the dependent variables to the explanatory variables is really only manifested after periods of a year or more.

This is frequently the result of some expectation for the future, based on behaviour in the past.

Functions were fitted to modifications of the following equation:

$$Y = f(X1, X2, X3)$$

where:

Y = Average price paid for land (land price index)

X1 = Real interest rate (RIR)

X2 = Consumer price index (CPI)

X3 = Index of the volume of agricultural production (VAPI)

The equation may therefore be as follows:

$$Y = a + b\,RIR + cCPI + dVAPI + u$$

where:

a = constant or intercept
b, c, d = coefficience of variables
u = standard error of regression

When data were fitted to the above equation it was found that better results are obtained if the constant is suppressed. The value of the constant was initially abnormally high, the standard deviation was unrealistic and the t-value of a was not statistically significant. With the omission of the constant it is therefore assumed that the intercept of the regression equation is nil and that the constant plays no further role.

RESULTS

Certain selections were fitted on the IBM computer at the University of Pretoria. These selections differ from one another only in respect of lag periods. Annual data from 1960 to 1979 were used (N=20). The results of selected fittings are as follows:

1. $Y = -4{,}387\ RIR_{t-1} + 1{,}189\ CPI_t + 0{,}602\ (0{,}223\ VAPI_{t-1} + 0{,}776,\ VAPI_{t-2})$

t = −3,808*** 6,054*** 2,824**
Standard error: = 1,152 0,196 0,213
F = 255*** R^2 = 97% d = 1,96

Standard error of regression = 11,22

2. $Y = -4{,}205\ RIR_{t-1} + 1{,}228\ CPI_t + 0{,}538\ (0{,}340\ VAPI_t + 0{,}659\ VAPI_{t-1})$

−3,612*** 6,251*** 2,617**
1,164 0,196 0,205
F = 243*** R^2 = 97% d = 1,80

Standard error of regression = 11,486

3. $Y = -4{,}114\ RIR_{t-1} + 1{,}254\ CPI_t + 0{,}501\ VAPI_t$

− 3,46*** 6,31*** 2,46**
1,18 0,19 0,203
F = 234*** R^2 = 96% d = 1,795

Standard error of regression = 11,678

4. $Y = -4{,}09\ RIR_{t-1} + 1{,}249\ CPI_t + 0{,}522\ VAPI_{t-1}$

3,57*** 6,519*** 2,57*
1,14 0,19 0,20
F = 240*** R^2 = 96% d = 1,81

Standard error of regression = 11,539

Student's t-values according to the one-sided exceedance probability table:

***p=0,005; **p=0,01 *p=0,025

Significance of F-values is as follows: ***=0,1

d = Durbin-Watson value

INTERPRETATIONS

- The coefficient of determination (R^2) of all the equations is above 95%. This indicates that over 95% of the variation in land prices can be explained by the selected independent variables.
- The high F-values indicate good fittings between model and data.
- The Durbin-Watson values (d) are all statistically significant. They indicate that there is no significant serial correlation in the models.

TABLE 1 - Data used in determining the price model for agricultural land

Year	Y	X1	X2	X3
1957	61	6,50	45,80	52
1958	60	6,52	47,40	55
1959	58	6,48	48,00	58
1960	67	6,54	48,60	62
1961	71	6,67	49,60	67
1962	73	6,84	50,30	69
1963	75	6,47	50,90	66
1964	87	6,44	52,20	70
1965	87	6,77	54,10	71
1966	87	7,52	56,00	89
1967	98	8,15	57,90	79
1968	101	8,24	58,90	82
1969	110	8,34	60,60	86
1970	100	8,63	63,80	88
1971	112	9,13	67,70	99
1972	120	9,10	72,10	94
1973	133	8,73	78,90	97
1974	158	9,70	88,10	102
1975	203	10,54	100,00	100
1976	206	10,96	111,10	106
1977	238	10,91	123,70	113
1978	220	10,92	137,20	113
1979	239	10,53	155,30	118

Y = Land price (dependent variable)
X1 = Interest rate (independent variable)
X2 = Consumer price index (independent variable)
X3 = Volume of agricultural production (independent variable)

Inflationary trend

The consumer price index (CPI) has a highly significant positive coefficient without exception, which indicates that inflation plays a primary part in the rising land prices.

Volume of agricultural production (VAPI)

A positive connection was found, which indicates that as long as production increases the price of land will increase accordingly. In some cases the coefficient of the lagged series indicates that the production of the previous year and even the two preceding years have a positive effect on present land prices. One can also detect anticipation, because the present production volume was taken in Equation 3 and this is also indicative of a positive relationship.

Availability of funds

Interest rate on first mortgages (real interest rate) RIR

As expected, the coefficient has a negative sign. If interest rates were to drop, indicating an increased money supply, the land prices would rise. With cheaper money (low interest rates) sellers tend to demand a higher price. A buyer will also borrow more money if money is inexpensive than he would borrow if he had to pay higher interest rates. As early as 1967 Van Wyk put the question to what extent the sharp increases in land prices were the result of land purchases taking place increasingly through credit financing.

Equation 1 was used to test the prediction value of the analysis further. Figure 2 shows the degree of correspondence between the actual and the

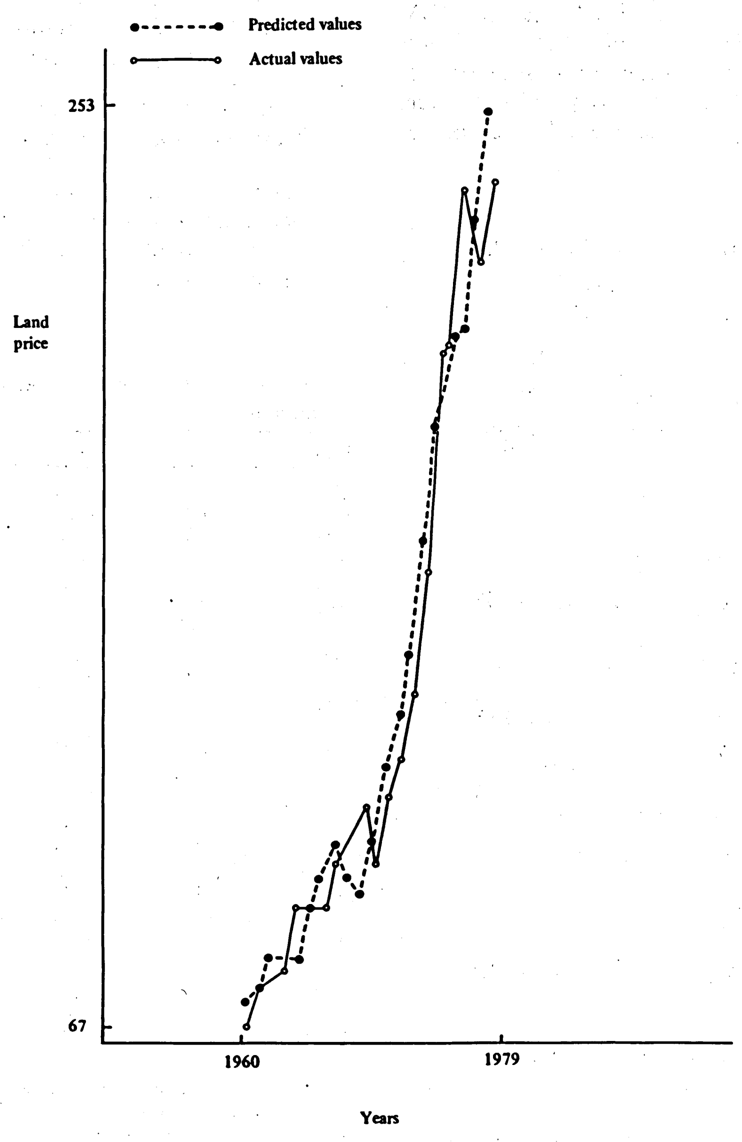

FIG. 2 - Predicted and actual values for the price of land for the period 1960 to 1979

predicted values. As might be expected from the high R^2 and F-values, this graphic prediction shows few deviations between the estimated and the actual land price index values.

CONCLUSIONS

The following conclusions may be drawn from the above analysis:

- With the ever rising rate of inflation (which is sometimes slightly lower, however) land prices will also show a rising trend.
- With the low real interest rates on first mortgages and other credit financing available for land purchases, land prices will neither show a decline within the foreseeable future nor remain stagnant.
- With the limited land available in South Africa, production will rise only with improved management and technology. The saturation point where the maximum is being obtained from the resources has surely not yet been reached. As long as the buyer expects to recover the money invested in the land he will be prepared to pay more than the land is actually worth.

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