IMPACT ON LAND PRICES OF EXPORT DEMAND FOR SOUTH AFRICAN DECIDUOUS FRUIT: 1972-1992

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Abstract

This is the first local study of the linkage between export demand for deciduous fruit and South African deciduous fruit farm incomes and land prices. Export demand is expected to affect land prices through the derived demand relationship and capitalization formula. By analyzing the relative role of export demand, the study extends past research by van Wyk (1967), Behrmann and Collett (1970), Nieuwoudt (1980), Janse van Rensburg (1983) and Kassier (1985) which showed a close relationship between land prices and expected returns to farming. Ordinary Least Squares analysis of real annual farm income and land price data for the major apple producing area of Elgin in the Cape Province during 1972 - 1992 supported *a priori* expectations of the linkage between export demand, farm income, and land prices. Lagged net revenue (total revenue less marketing costs) per hectare and lagged farmland prices per hectare had positive effects on land prices, while land prices were negatively related to lagged interest rates. When lagged net revenue per hectare was split into net export realisation revenue, net domestic realisation revenue and processing revenue, all three variables impacted positively on land prices, but only the export coefficient was statistically significant. These results imply that investor expectations about future net export revenue and interest rates, seem to drive farm land prices. Export enhancing policies to establish stable long-term export markets must account for the impact of macroeconomic linkages and global market forces on farm incomes and farm assets. Persistently high future local inflation rates could maintain downward pressure on the Rand exchange rate. Coupled with real income growth (increased demand) in developed countries, this will increase export revenues and land prices over time. New entrants will thus find it increasingly difficult to acquire farm land to produce for export markets.

Uittreksel
Invloed van die vraag na uitvoere van Suid-Afrikaanse sagte vrugte op grond pryse: 1972-1992

Hierdie ondersoek is die eerste plaaslike studie oor die skakels tussen sagtevrugte-uitvoervraag en Suid-Afrikaanse sagtevrugte boerderyinkomste en - grondpryse. Die verwagting is dat uitvoervraag grondpryse deur die afgeleide-vraag-verhouding en kapitalisasieformule sal beïnvloed. Deur die relatiewe rol van uitvoervraag te ontleed, gaan die studie verder as navorsing deur Van Wyk (1967), Behrmann en Collett (1970), Nieuwoudt (1980), Janse van Rensburg (1984) en Kassier (1985), wat 'n noue verwantskap aangetoon het tussen grondpryse en verwagte rendemente op boerdery. Kleinste-kwadrate-ontleding van reële boerderyinkomste- en grondprysdata vir die hoof-appelproduserende Elgin-gebied in die Kaapprovinsie gedurende 1972 - 1992, het *a priori*-verwagtinge oor die skakel tussen uitvoervraag, boerderyinkomste en grondpryse bevestig. Vertraagde netto inkomste (totale inkomste minus bemarkingskoste) per hektaar en vertraagde landbougrondpryse per hektaar het 'n positiewe uitwerking op grondpryse gehad, terwyl daar 'n negatiewe verhouding tussen grondpryse en vertraagde rentekoerse was. Toe vertraagde netto inkomste per hektaar onderverdeel is in netto uitvoerrealisasiewaarde, netto binnelandse realisasie-inkomste en verwerkingsinkomste, het al drie veranderlikes 'n positiewe uitwerking op grondpryse gehad, maar slegs die uitvoerkoëffisiënt was statisties beduidend. Hierdie resultate impliseer dat dit lyk asof landbougrondpryse deur beleggerverwagtinge oor toekomstige netto uitvoer en rentekoerse gedryf word. Uitvoerverhogingsbeleide om stabiele langtermynuitvoermarkte daar te stel, moet verantwoordelik wees vir die impak van makro-ekonomiese verwantskappe en wêreldwye markkragte op boerdery- inkomste en boerderybates. Gepaard met 'n groei in reële inkomste (groter vraag) in ontwikkelde lande, sal dit uitvoerinkomste en grondpryse mettertyd opstoot. Nuwe toetreders sal dit dus toenemend moeilik vind om plaasgrond te bekom om vir uitvoer- markte te produseer.

1. Introduction

Past studies on factors affecting farm land prices in South Africa have shown that land prices are closely tied to expected returns from farming (Waldeck, 1943; van Wyk, 1967; Behrmann and Collett, 1970; Nieuwoudt, 1980; Janse van Rensburg, 1984; Kassier, 1985). Similar findings have been reported by numerous researchers in the United States (US) (Melichar, 1979; Doll *et al*, 1983; Phipps, 1984; Belongia, 1985; Robison *et al*, 1985; Burt, 1986). The papers by Melichar and Nieuwoudt emphasised that real land values will rise if there is real growth in returns to land. Runge and Halbach (1990) supplemented the US analyses by studying the relative role of grain export income in determining returns and hence land prices in the major US grain regions. No study of the link between export income and land prices has been attempted in South Africa. The aim of this paper is to fill the gap by examining the impact of export income on deciduous fruit farm land values. This sector is chosen as some 65% of total annual deciduous fruit production in South Africa is exported (Cleasby, 1991).

Study results could provide useful insight into the impacts of export-enhancing policies on farm land values. This is especially relevant as world markets open up to South African products in the post-sanctions era and policy makers need information about the potential effects of land reform measures. The paper first

gives an overview of the theory of land price determination and secondly discusses data sources and the land price model. Empirical results and policy implications are then considered.

2. Theoretical Framework

Since land is an input in agricultural production, it is plausible that the demand for land and other inputs is derived from the demands determining farm income. An expected change in farm income should therefore lead to a change in aggregate demand for land and a change in land prices. The relative role of the export market in conditioning expectations of input values is an additional aspect of the linkage from farm income to input usage. The capitalization formula commonly used to explain land value changes is dependent on expected income streams (Runge and Halbach, 1990).

New understanding of asset valuation under inflation and new empirical evidence (Melichar, 1979; Nieuwoudt, 1980) suggests that farm land prices can be explained by capitalizing long term expected future patterns of earnings growth. This indicates that farm land values behave in a similar way to "growth stocks" in equity capital markets (Phipps, 1984; Barry *et al*, 1988). To illustrate, first consider the present value of a perpetual series of returns, which respond to inflation the same as the nominal discount rate, as given by equation (1):

$$V_o = R/i \qquad (1)$$

where V_o = present land value,
R = real (current) return (rent), and
i = real capitalization rate (nominal discount rate minus the anticipated inflation rate).

Equation (1) assumes that land has an infinite life and presumes no real growth in returns. If real earnings are expected to grow over time, equation (1) can be modified to give equation (2):

$$V_o = R(1 + g)/i - g \qquad (2)$$

where g is the annual real expected growth rate in R.

The theoretical models described above show how important variables may interact to influence land values. They serve as a guide in evaluating the potential response of land values to expected changes in these variables (Barry *et al*, 1988).

If changes in world market conditions cause income expectations to change quickly, land values as expressed by the capitalization formula can also change abruptly. The "elasticity of expectations" pertaining to farm revenues appears to be fundamental to land price determination (Hicks, 1946). Thus, the capitalization formula implies that land prices are highly sensitive to changes in expected long-term growth rates in farm land returns.

Economic theory thus suggests a derived demand relationship between export income and land values in the export-orientated deciduous fruit sector. Due to incomplete information about export market prospects and time lags in adjustments, this relationship is likely to be imperfect. Expectations about export earnings potential, including forecast errors, are hence likely to be important in determining farm land values. This implies an empirical model in which gross deciduous fruit farm revenues are first attributed to their various sources, and land values are then expressed as a function of these sources to determine the relative significance of exports over time. Consistent with the capitalization formula, an interest rate variable must also be included in the model. Participants in the land market know past but not current land values, interest rates and deciduous fruit farm incomes. Assuming expectations of future variables are based on past values supports the use of lagged variables in the structural model (Phipps, 1984). Data sources and the estimated land price model for the South African deciduous fruit sector are discussed in the next section.

3. Data Sources And Land Price Model

3.1 Data Sources and Study Area

A fundamental assumption common to past land value studies is that the value of land is equal to the present value of the returns expected from the land. The rent a tenant would pay to acquire control of the land is one measure of this return (Robison *et al*, 1985). As land rental data were not available for deciduous fruit production areas, returns to land were estimated by annual net realisation revenue (gross revenue net of marketing costs) per hectare.

Given that data from a homogeneous production area was required, the Elgin apple production area in the Cape Province was chosen to represent the deciduous fruit sector. Elgin is the largest apple production area in South Africa, with 37,6 percent of total trees in production (Nel, 1991). Elgin fruit growers have formed various co-operatives, organisations and associations, not only to assist in packing, cold storage, marketing and represent members, but also to undertake research and extension with a minimum of Government aid. This enabled comprehensive production, revenue and marketing cost data for this area to be collected.

Total annual gross product revenue per hectare is made up of the relative export and domestic (fresh and processed) contributions from apple sales. Earnings in excess of marketing earnings provided by general export incentive scheme (GEIS) payments since 1981 were also included (Ferrandi, 1993). Net export and domestic realisation revenue per hectare is calculated by subtracting export and domestic marketing costs from gross export and domestic revenues respectively. As there are no marketing costs for processed fruit, total annual net realisation revenue per hectare is the sum of net export realisation revenue, net domestic realisation revenue, processing revenue and GEIS payments (if any).

Land value per hectare data incorporates values for land and buildings, which are reported together. Values were based on *bona fide* sales of tracts of apple farm land that were made from 1972 to 1992. As far as could be possibly identified, transactions between family members, sales of State land and expropriations were specifically excluded from the analysis. Information on land transactions supplied to the Caledon Regional Services Council by the Cape Town Deeds Office formed the basic source of information from 1972 to 1987. The remaining land value information from 1988 to 1992 was supplied by Mr Kees Post, an estate agent who has worked in the Elgin area for over twenty years.

3.2 Land Price Model

Time series data on incomes, interest rates and land prices was analyzed by Ordinary Least Squares (OLS) regression using the MINITAB computer package. The dependent variable in the land price model is real land value per hectare (LV) which is a function of lagged real net realisation revenue (returns proxy), lagged real interest rate and lagged real land value. All variables were expressed in real terms by deflating nominal values

using the Consumer Price Index (CPI) with 1990=100. As outlined in section 2, lagged variables reflect the role of investor expectations in conditioning land values.

Real net realisation revenue per hectare (NRR) is described for the Elgin area in equation (3) as the sum of three components: total expected annual net realisation revenue due to export market demand (NERR), total expected annual net realisation revenue from domestic demand (NDRR) and total expected revenue from deciduous fruit processing (PR):

$$NRR = NERR + NDRR + PR. \quad (3)$$

The dependent variable LV is in turn a function of the lagged real net realisation revenue (LNRR) derived from these demand sources. Lagged Land Bank mortgage interest rate (LIR) is used as a proxy for the capitalization rate, while lagged land prices (LLV) reflect the time lag in adjustment response. Equation (4) gives the initial empirical model estimated by OLS:

$$LV = \alpha_0 + \alpha_1 LNRR + \alpha_2 LLV - \alpha_3 LIR \quad (4)$$

where the parameters α_1, α_2 and α_3 indicate the anticipated sign of the coefficient to be estimated for each variable. Theory outlined in Section 2 suggests that LV should be positively related to LNRR and LLV, but negatively related to LIR.

To examine the relative role of exports in determining revenue, and hence land values over time, LNRR was divided into its revenue components. LV was then estimated as a function of real lagged annual export (LNERR), domestic (LNDRR) and processing (LPR) net realisation revenues separately, lagged land values and lagged Land Bank mortgage interest rate, as in equation (5):

$$LV = \alpha 0 + \alpha_1 LNERR + \alpha_2 LNDRR + \alpha_3 LPR + \alpha_4 LLV - \alpha_5 LIR \quad (5)$$

The variables LNERR, LNDRR and LPR are expected to be positively related to LV. Equation (5) is crucial to establish possible relative links from export and domestic net realisation revenues to land values.

The elasticity of land value with respect to changes in real net realisation revenue components, real Land Bank mortgage interest rates and real lagged land values can also be estimated. These estimates show the changes that may occur in land values due to a ten percent change in the lagged value of each variable, *ceteris paribus*.

4. Empirical Results

The initial model combining all revenue components was specified by taking the natural logs of both the dependent and predictor variables, with all variable values being expressed on a per hectare basis. Equation (6) reports the estimated model (round brackets below reported coefficients give corresponding t-statistics):

$$LLV = -3.11 + 1.17\ LLNRR + 0.286\ LLLV - 0.437\ LLIR \quad (6)$$
$$(-0.85)\ (3.97)\ (1.77)\ (-3.69)$$

$\bar{R}^2 = 72{,}8\%$ h = 1,914

All coefficient signs agree with *a priori* expectations: the log of the land value per hectare (LLV) is positively related to the log of lagged total annual net realisation revenue (LLNRR) and lagged land value (LLLV), but negatively related to the log of lagged Land Bank mortgage interest rate (LLIR). The Durbin h statistic indicates acceptance, at the 5% significance level, of the null hypothesis that there is no serial correlation. However, as this test is only applicable in large samples (Gujarati, 1988), it must be interpreted with caution.

The chosen variables account for 72,8 percent of the total variation in the log of land value per hectare. The estimated coefficients for LLNRR and LLIR are significant at the 1% significance level, while that for LLLV is significant at the 10% level. All three variables therefore appear to influence deciduous fruit land values. Total lagged net realisation revenue is the most important factor driving farm land prices, as illustrated by the coefficients which give direct estimates of elasticities. *Ceteris paribus*, a 10% increase in the log of LNRR results in approximately a 12% increase in LLV.

To examine the relative role of exports in determining returns, and hence land prices over time, LLV was estimated as a function of the log of lagged annual export (LLNERR), domestic (LLNDRR) and processing (LLPR) net realisation revenues, lagged land values and lagged Land Bank mortgage interest rate, as reported in equation (7):

$$LLV = 1.43 + 0.739LLNERR + 0.069LLNDRR + 0.015LLPR + 0.251LLLV - 0.464\ LLIR \quad (7)$$
$$(0.18)\ (3.85)\ (0.11)\ (0.07)\ (1.30)\ (-3.22)$$

$\bar{R}^2 = 71{,}7\%$ h = 3,655

The chosen variables account for 71,7 percent of the total variation in the log of land value per hectare. The coefficients for the export component of annual net realisation revenue (LLNERR) and LLIR are significant at the 1% significance level. The coefficients for the annual domestic (LLNDRR) and processing (LLPR) revenue components of LLNRR are not statistically significant, while the LLLV coefficient is only significant at the 20% level. The Durbin h statistic indicates serial correlation in the error terms, implying unbiased but inefficient OLS estimators. The signs of all coefficients agree with *a priori* expectations. The relative sizes of the direct elasticity estimates show that the export revenue component is the primary factor driving land values.

Equation (8) presents a more parsimonious equation (LLNDRR and LLPR excluded) than equations (6) and (7), but fits the data just as well:

$$LLV = 2.39 + 0.732\ LLNERR + 0.242\ LLLV - 0.473\ LLIR \quad (8)$$
$$(0.98)\ (4.34)\ (1.56)\ (-4.12)$$

$\bar{R}^2 = 75{,}2\%$ h = 2,409

The variables in equation (8) represent the best fit to the data, accounting for 75,2 percent of the total variation in the log of land value per hectare. The coefficients for the export component (LLNERR) and LLIR are significant at the 1% significance level, while the LLLV coefficient is significant at the 15% level. The Durbin h stastic implies acceptance, at the 1% significance level, of the null hypothesis that there is no serial correlation. The signs of all coefficients agree with *a priori* expectations. *Ceteris paribus*, a 10% increase in LLNERR, LLLV or LLIR would result in a 7.3% increase, 2.4% increase or 4,7% decrease in LLV respectively. The export revenue component again has the greatest impact on LLV, and is the major determinant of apple land values.

5. Policy Implications

The positive relationship between expected export revenue and land value implies that export enhancing policies which create stable long-term export markets and raise expected real deciduous fruit (apple) income will put upward pressure on (apple) farm land values. Real income growth in developed countries is a likely source of increased demand for deciduous fruit exports (Cleasby *et al*, 1991) which could boost net export revenues and hence land prices over time. Producer expectations about future apple exports, in particular, seem positive as some 30 percent of the total area planted to apples is new orchards still to come into production (Nel, 1991).

Relatively low rates of current return to land will be the likely consequence of higher land values caused by real growth in deciduous fruit income. This would create cash flow difficulties and large increases in debt for less established, less wealthy farmers wanting to buy deciduous fruit farmland. In the interests of promoting land ownership by emergent commercial farmers denied access to land in the past, it may be considered desirable to assist these persons in making/surviving such investments through, for example, interest rate subsidies. However, the negative relationship identified between land value and interest rate implies that such aid will likely be capitalized into higher land values. New entrants are thus likely to face still greater obstacles to entry over time. Policy actions resulting in increased land values will tend to depress the current return to assets, and thus aggravate the problems they seek to address. There may be scope for phasing out such subsidies over time to reduce upward pressure on land values, but this would require political commitment.

Future deciduous fruit (apple) farm land values will likely continue to be driven by world supply and demand conditions. This will probably be in contrast to less export orientated sectors such as maize and sugar. Land values in these sectors could be affected more by future changes in domestic agricultural policy, particularly if a new Government is more consumer orientated (less producer protection/price support implies lower land values). Land values are also likely to rise if increased spending on social programmes by a new Government raises expected inflation rates and reduces real interest rates and the Rand exchange rate.

6. Conclusion

Lagged export income and lagged land values impact positively on current deciduous fruit (apple) land values, while the lagged capitalization (interest) rate has a negative association. Results implied acceptance of the hypothesis that there was no serial correlation in the final empirical model. The inclusion of lagged variables supports the hypothesis that investor expectations have a role in conditioning land values.

The growing openness of the South African agricultural economy is likely to have important impacts on farm land markets. Export enhancing policies to establish stable long-term export markets with the lifting of sanctions against South Africa must account for the impact of macroeconomic linkages and global market forces on deciduous fruit farm incomes and land values. Persistently high future local inflation rates could maintain downward pressure on the Rand exchange rate. Coupled with real income growth (increased demand) in developed countries, this may increase expected export revenues and land prices over time. New entrants will thus find it increasingly difficult to acquire farm land to produce for export markets. Interest rate subsidies to assist new entrants will likely be capitalized into higher land values.

More research is needed into the relative impact of export and domestic incomes on land values in other local agricultural sectors. This study has shown that future deciduous fruit (apple) farm land values will probably be affected more by changes in world supply and demand conditions than changes in domestic agricultural policy.

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