

# AN ANALYSIS OF THE RELATIONSHIP BETWEEN FARM MARGINS AND LAND VALUES IN THE SOUTH AFRICAN SUGAR INDUSTRY

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## Abstract

This paper analyses the relationship between net farm incomes and market values of cane land within the South African sugar industry. A comparison is drawn between market values represented by actual sales, and productive land values, which relate more specifically to net farm incomes. The aim of the paper is therefore to estimate the degree of correlation between net farm incomes and land market values, with a view to analysing the variation in the return on investment between farming regions.

All data was sourced from the South African Cane Growers' Association and South African Sugar Association surveys that are conducted annually to collate information on grower costs, land transfers, area under cane and cane production. All data is presented on a 'per hectare under cane' basis.

*Keywords:* sugarcane, market value, productive value, net farm income, return on investment

## Introduction

The success of corporate investors can ultimately be attributed to their ability to identify and select capital investment opportunities that will maximise the wealth of stakeholders (Cronje *et al.*, 1994). The same principle can be applied to a potential investor in agriculture, who needs to compare possible returns with those of the next best alternative. Unfortunately, the decision is not always that simple and clear. A decision to invest in farming in a particular area may have a lot to do with the choice of lifestyle, location and other social factors. It is acknowledged therefore that market forces, which influence prices, will be distorted to some degree by factors such as sentiment, personal preference, perceived risk and growth potential, rather than behave strictly according to the rules of economics.

This paper analyses the relationship between net farm incomes and cane farm values, and is based largely on the premise that expected future returns should be a major driver of farmland values. Farmland is a durable asset that will provide returns into perpetuity if properly conserved. It follows therefore that, all other things being equal, higher expected returns to land should be capitalised into higher land values.

It must be noted that this paper analyses large scale sugarcane grower operations and cane farm sales only.

## Data source

Data was obtained from cost surveys done by the South African Cane Growers' Association (Canegrowers), property transfer surveys, and surveys done by the South African Sugar Association (SASA) to determine the area under cane and the final cane crush. Data collected through the Canegrowers cost survey includes all fixed and variable costs associated with sugarcane production, as well as interest, management and lease charges. However, private drawings, capital repayments on loans, and income tax payments are not included.

For the purpose of this analysis, the net farm income (NFI) was selected as the best indication of returns to cane land and management. The NFI is the total revenue (TR) less all directly allocatable variable costs (fertiliser, chemicals, labour, transport and harvesting costs), less overhead costs (depreciation, fuels, maintenance, insurance, administration and permanent labour), which can be referred to as the total fixed and variable costs (TFVC). It should be noted that, due to the inconsistencies experienced over the years with growers submitting true depreciation figures, the depreciation cost for this study has been estimated at 5% of total revenue for all regions.

The NFI represents how well the farming operation is performing, and is not influenced by the type of farm management or the form of financial management practised. Melichar (1979), however, notes that NFI is not an appropriate measure of the return to land since it represents a return to assets, management and operator's labour, implying that NFI *overstates* the return to land. Alston (1986) also supports this view, adding that using this concept of residual income as the return to land suffers from serious measurement problems and incorrectly treats land as the residual claimant for agricultural production.

In light of the above views, a further adjustment to the NFI was made to account for the cost of management and in this way attempt to arrive at an improved indicator of the return to cane land alone. An estimated cost of management of 5% of total revenue was applied to all mill areas. The NFI as used in this analysis is therefore a *modified* NFI, redefined as the total revenue less total fixed and variable costs (including depreciation), less an estimated management cost.

Despite this correction of cost data, it is still felt that caution should be exercised when comparing returns from sugarcane farming with returns obtained in other industries, investments or businesses. This study is essentially an internal comparison of mill areas, with all mill areas being treated on an identical basis, and with the comparison being considered to be of relevance.

Land values and transfer prices are presented in this analysis on a 'per hectare under cane' basis. Fluctuations in farm values per hectare under cane will occur as a result of additional land, buildings and crops being included in the sale, and as a result of premiums paid for smaller sections of land or neighbouring land (<sup>1</sup>personal communication).

## Presentation of data

To maintain confidentiality, actual purchase prices of land and land sales data are not used in this paper. All cost and sales data was converted into real terms (2001/02 season) by applying the Consumer Price Index (CPI; 1995 base year). The mean value, as opposed to a weighted mean, was then calculated for each mill area in terms of costs, income, margins, land values and cane production data.

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It is recognised that the straight mean is possibly less reliable than a weighted mean, specifically in terms of land values, which may consist of only one or two sales in any particular season. It is also recognised that the average figures used will often not reflect a wide range of net farm incomes or land values in any particular area.

Data from 1992/93 to 2001/02 (10 seasons) was used. All figures are annualised. Yields, for instance, reflect tons cane per hectare under cane rather than tons cane per hectare harvested. However, to highlight more recent trends, both five and 10-year averages were calculated.

## **Methodology**

The primary aim of this analysis is to highlight the relationship between net farm incomes and cane land values. To be able to thoroughly assess this relationship, however, it is necessary to also analyse the impact that the value-forming attributes of a sugarcane operation, such as cane and sucrose yields, have on the income and production costs associated with a cane operation, and ultimately on the value of the cane land.

### *Cane production*

The following factors are analysed as a result of their marked influence on production costs and income:

- Tons of cane per hectare per annum
- Cane quality
- Tons sucrose (or recoverable value) per hectare.

Gross income is almost entirely a function of total tons sucrose per hectare (recoverable value since 2000/01) and the sucrose price (recoverable value price since 2000/01).

### *Cane land values.*

Cane land values are primarily a function of expected cane yields. Yields generally capture the effects of climate, rainfall, effective irrigation, soil quality, temperatures and management. A sugarcane farm is purchased to carry out the business of producing sugarcane, and therefore the most important factor in the purchaser's mind is the ability of that farm to produce revenue.

### *Market values.*

The definition of market value is the price that a willing buyer would pay a willing seller on the open market at a given date. The most approved method of determining the market value of property is through the 'comparable sales' approach. This approach works on the premise that market value of a property is directly related to the prices of comparable, competitive properties (Anon, 1995).

In this analysis, comparable sales are represented by the results of the annual property transfer surveys, which are considered a reasonable indication of the market value of cane land in the various mill areas.

### *Productive value.*

The productive value of a property is directly related to the earning power of that property, and a basic premise is that the higher the expected earnings, the higher the value (Anon, 1987). Properly conserved farmland will produce annual rents into perpetuity at different points in time. This means that these returns must be adjusted for the time value of money (earlier rents are worth more than the same amount of rents earned later).

The correct method of arriving at a productive value is therefore to use the ‘income capitalisation’ approach, which analyses a property’s capacity to produce monetary benefits and converts these benefits into an indication of present value.

Income capitalisation involves a one-step conversion of the average of several years’ net income expectancies into an indication of value, by dividing the net income estimate by an appropriate income or capitalisation rate. The rate selected should represent the relationship between net income and value observed in the market, and is derived through comparable sales analysis.

By using the results of the annual property transfer surveys, which are considered acceptable as an appropriate indication of market prices of cane land in the sugar industry, and the average net farm incomes from the Canegrowers surveys, an appropriate income capitalisation (discount) rate for each mill area, as well as an overall rate for the sugar industry, can be calculated.

The productive value (PV) is calculated according to equation (1) as follows:

$$PV = \frac{NFI}{i \text{ (Ind)}} \quad (1)$$

where NFI = Net Farm Income and i (Ind) = real overall discount rate for the industry.

The difference in productive and market values, however, needs to be analysed further. Equation (1) can be considered incorrect because it ignores the potential for expected positive (or negative) growth in NFI over time. It can also be argued that because mill areas effectively operate under different market conditions, one should use the specific mill area capitalisation rate rather than an overall capitalisation rate to determine the productive value.

The distinction between the productive value and market value of land can thus be questioned on the basis of established principles of economics and mathematics.

#### *Return on investment (ROI)*

The ability of a sugar farm to produce income can alternatively be expressed as a return on an investment, which is calculated by a variation of equation (1) as follows:

$$ROI = \frac{NFI}{MV} \quad (2)$$

where MV = the market value of cane land, as opposed to its productive value (PV).

*Market value and expected growth in returns.* The concepts of market value and productive value of cane land can be explained by the ‘growth stock’ model (<sup>2</sup>personal communication).

Equation (1) *understates* the land value, as it ignores the effect of potential expected growth (g) in the NFI. If net farm incomes (NFI) are expected to grow (or fall) in real terms, then expected net farm incomes into perpetuity and current cane land value are linked by equation (3) as:

$$MV = \frac{NFI [1 + g]}{[i \quad g]} \quad (3)$$

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where MV = current cane land market value per hectare under cane, NFI = expected annual net farm income,  $g$  = the expected real (adjusted for inflation) average annual growth rate in NFI, and  $i$  = the real discount rate. According to equation (3), an increase in ' $g$ ' and a reduction in ' $i$ ', possible due to lower risk, will lead to an increase in market value (MV).

Manipulating equation (3) gives the proportional relationship between NFI and MV as:

$$\frac{[i + g]}{[1 + g]} = \frac{NFI}{MV} \quad (4)$$

Equation (4) implies that the ratio of NFI to cane land value (MV) is a proxy for the real rate at which returns to land are capitalised (discounted) into land values.

The view expressed earlier in this section that the agricultural use (productive) value and market value of land are markedly different, could therefore be questioned. By using the correct formula (3) the market value and productive value are the same.

Perceived growth in NFI and varying levels of risk associated with farming, are therefore some of the reasons behind the difference in rates of return on investments throughout the sugar industry.

## **Results**

### *Cane production, costs and income*

Table 2 shows the correlations between tons of cane and sucrose per hectare per annum and total revenue (TR), total fixed and variable costs (TFVC) and net farm incomes (NFI).

The strongest correlation can be found between tons of cane per hectare per annum (TCH) and TFVC of cane production, due largely to the impact of yields on harvesting and haulage costs, and on input costs such as fertiliser and irrigation. A strong correlation also exists between tons cane per hectare per annum (TCH) and TR, whereas an insignificant correlation exists between sucrose % and TR.

These correlation estimates demonstrate that tons cane produced per hectare per annum is still the main contributor towards total revenue and ultimately net farm income, with cane quality playing a smaller role. Note, however, that the new RV cane payment system rewards growers for better quality and, as a result, cane quality now plays a more important role in determining gross income than it did under the old sucrose payment system.

Cane quality also impacts on TFVC in that higher quality cane will cost less to transport per hectare. The age of cane at harvest plays a major role in cane quality, and in general older cane is of higher quality. However, a number of areas that harvest 12-month old cane have managed, largely through ripening, to increase their cane quality considerably and further boost their sucrose yields.

Table 1 shows the five and 10-year averages for all 15 mill areas in tons cane per hectare per annum (TCH), cane sucrose percentage (S%), and tons sucrose per hectare per annum (TSH). The tables are ranked in descending order according to 10-year averages.

**Table 1. Mill areas ranked according to sucrose percentage, tons cane per hectare per annum and tons sucrose per hectare per annum.**

Region	Mill Area	Sucrose %				Tons cane/ha/annum				Tons sucrose/ha/annum			
		Code	Rank	5-yr Avg	10-yr Avg	Code	Rank	5-yr Avg	10-yr Avg	Code	Rank	5-yr Avg	10-yr Avg
Midlands	Union Co-op	UC	1	13.61%	13.81%	KM	1	97.45	84.85	KM	1	12.56	10.91
Midlands	Eston	ES	2	13.60%	13.65%	ML	2	86.76	77.26	ML	2	11.53	10.35
Midlands	Noodsberg	NB	3	13.40%	13.47%	PG	3	78.30	75.60	PG	3	9.67	9.68
North Irrigated	Malelane	ML	4	13.29%	13.40%	UF	4	76.79	73.49	UF	4	9.73	9.39
Zululand	Entumeni	EN	5	13.07%	13.06%	FX	5	66.66	57.43	FX	5	8.26	7.04
North Irrigated	Komati	KM	6	12.89%	12.85%	EN	6	48.05	45.31	EN	6	6.28	5.92
North Irrigated	Pongola	PG	7	12.35%	12.81%	AK	7	51.03	44.81	AK	7	6.64	5.72
Zululand	Umfolozi	UF	8	12.67%	12.77%	GH	8	48.57	44.30	ES	8	6.00	5.50
Zululand	Amatikulu	AK	9	13.01%	12.77%	DL	9	47.92	41.62	UC	9	6.29	5.47
South Coast	Umzimkulu	UK	10	12.55%	12.39%	SZ	10	48.95	41.15	GH	10	5.86	5.26
South Coast	Sezela	SZ	11	12.33%	12.31%	MS	11	49.17	41.07	NB	11	5.93	5.13
Zululand	Felixton	FX	12	12.40%	12.25%	ES	12	44.09	40.27	DL	12	5.92	5.07
North Coast	Darnall	DL	13	12.36%	12.19%	UK	13	46.75	40.21	SZ	13	6.04	5.07
North Coast	Maidstone	MS	14	12.05%	11.97%	UC	14	46.25	39.65	UK	14	5.87	4.98
North Coast	Gledhow	GH	15	12.07%	11.86%	NB	15	44.23	38.06	MS	15	5.92	4.92

**Table 2. Correlation between tons cane per hectare per annum (TCH), tons sucrose per hectare per annum (TSH), total revenue (TR), total fixed and variable costs (TFVC) and net farm income (NFI).**

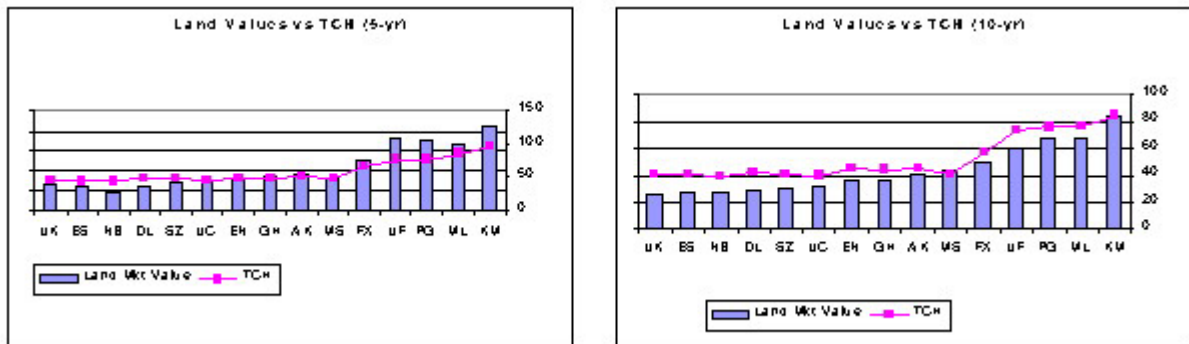
S% and	5-year	10-year	TCH and	5-year	10-year	TSH and	5-year	10-year
TR	2.74%	18.52%	TR	98.31%	93.40%	TR	98.58%	94.11%
TFVC	2.71%	10.89%	TFVC	95.77%	97.83%	TFVC	95.35%	97.48%
NFI	20.75%	40.75%	NFI	79.26%	49.15%	NFI	81.82%	53.53%

Of interest is the movement up the rankings by the Midlands mills when ranked by TSH. This is due to the positive impact of higher cane quality. The higher sucrose yields of the Midlands mills, coupled with the lower harvesting and transport costs associated with lower cane yields and higher cane quality, results in net farm incomes that are superior to a number of the coastal mills (see Table 4).

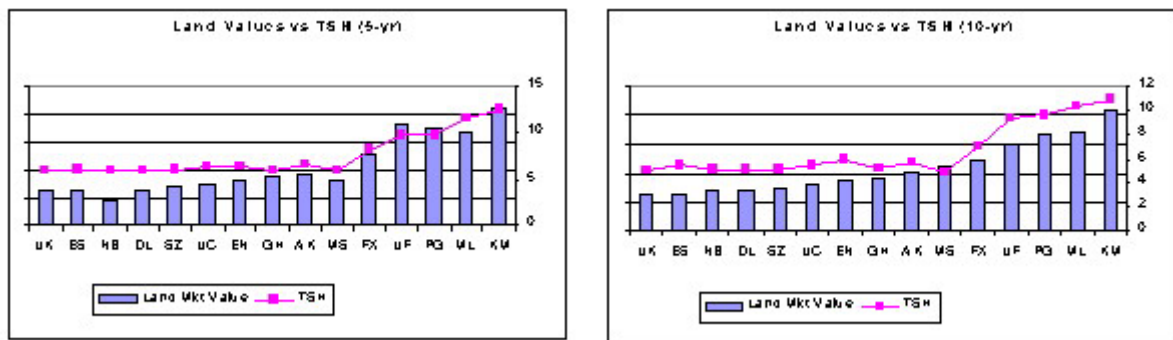
*Cane land values:* Market values.

Figures 1 to 5 show the average cane land values for all mill areas, ranked in ascending order, plotted against TCH, TSH, TR, TFVC and NFI. Table 3 shows the corresponding correlation estimates.

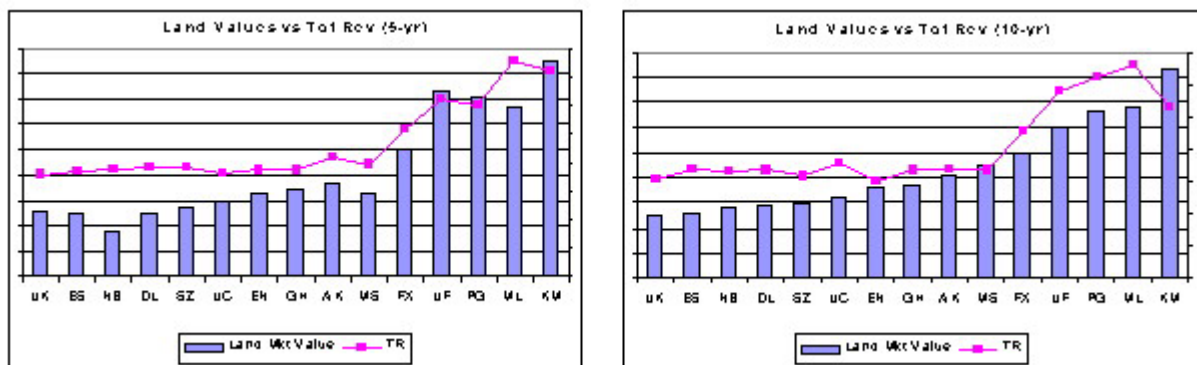
It would appear that cane land values are more closely correlated to cane yields than to sucrose yields. This is the first indication in this analysis that cane land values are possibly understated in certain areas, as a result of the market possibly not recognising the benefits of better cane quality and its impact on margins.



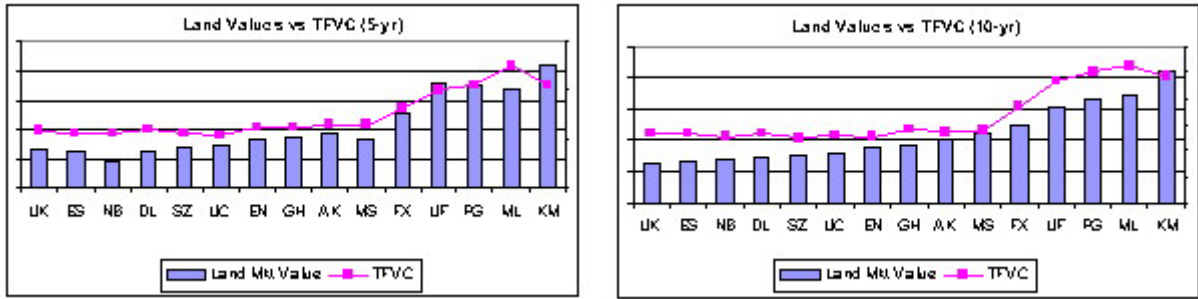
**Figure 1. Land values versus tons cane per hectare per annum.**



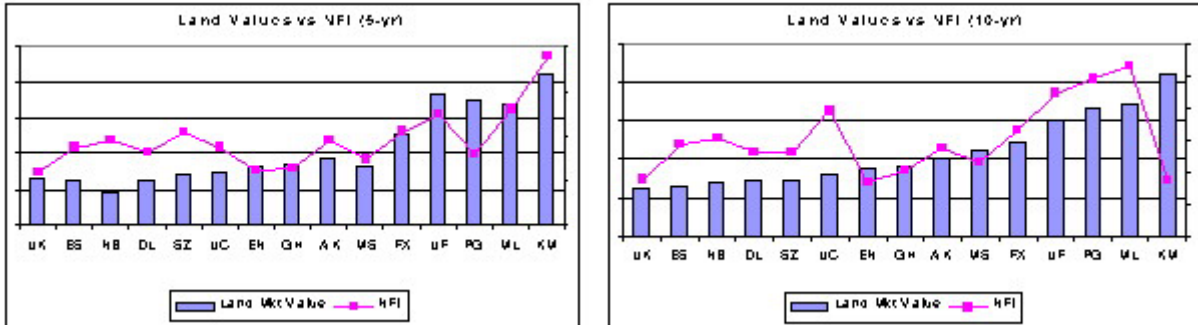
**Figure 2. Land values versus tons sucrose per hectare per annum.**



**Figure 3. Land values versus total revenue.**



**Figure 4. Land values versus total fixed and variable costs.**



**Figure 5. Land values versus net farm income.**

**Table 2. Correlation between cane land values and tons cane per hectare per annum (TCH), tons sucrose per hectare per annum (TSH), total revenue (TR), total fixed and variable costs (TFVC) and net farm income (NFI).**

Cane land value and:	5-year	10-year
TCH	97.42%	96.39%
TSH	95.62%	94.89%
TR	94.54%	87.33%
TFVC	93.33%	93.03%
NFI	71.96%	40.25%

Similarly, when charted against incomes and production costs, land values are again most closely correlated to total fixed and variable costs, which have already been shown to be very closely linked to cane yields.

*Productive values.*

Based on five years of data, the overall capitalisation rate for the sugar industry is calculated at 9.08%, while the capitalisation rate based on 10 years of data is calculated at 6.93% (see Table 4). Again mean values rather than weighted mean values were calculated.

These figures would indicate that in recent years the increase in land values has not kept pace with the increase in net farm incomes. It must, however, also be recognised that NFI averages have been affected by the drought years in the early to mid-nineties. Land values may not have shown the same response to this drought.



Should we assume that all mill areas operate under identical market conditions, this overall capitalisation rate could be used to calculate the productive values of property in each mill area. Productive values are calculated using equation (1) and are compared against current market values in Figure 6.

Based on these figures it could be concluded that premiums are possibly being paid for farms in certain areas, while other areas are seeing vastly discounted land prices.

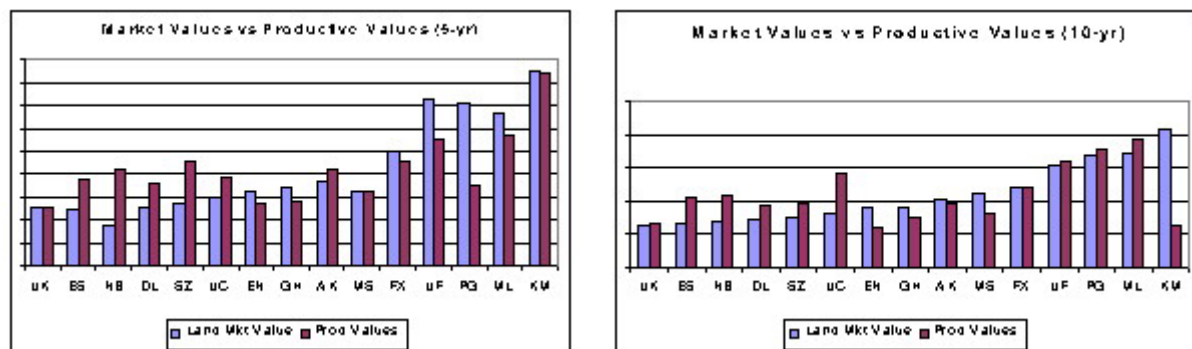


Figure 6. Market values versus productive values.

#### Return on investment (ROI)

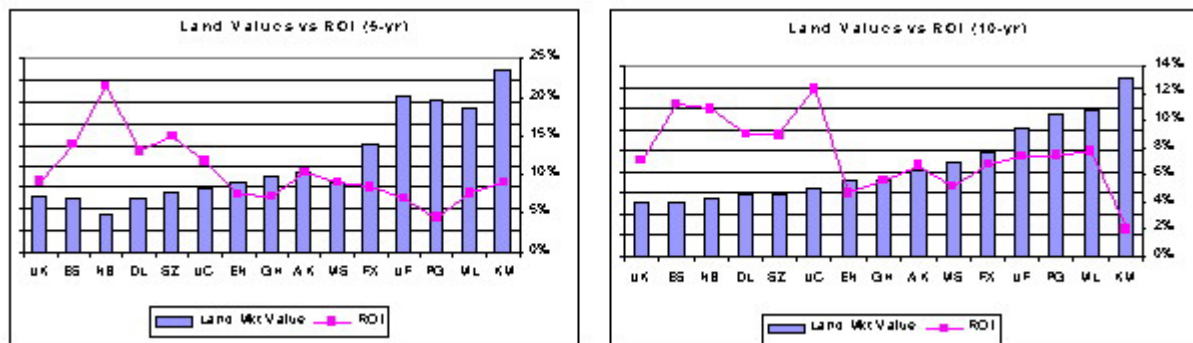
The return on investment is essentially the same figure as the capitalisation rate. Although an average return on investment for cane land in the sugar industry is calculated as currently being in the region of 6.93% (10-year), this figure does fluctuate between mill areas.

Table 4. Mill areas ranked according to cane land value (CLV), total revenue (TR), total fixed and variable costs (TFVC), net farm income (NFI) and return on investment (ROI) (per hectare).

Rank	CLV/ha		Rank	TR/ha		Rank	TFVC/ha		Rank	NFI/ha		Rank	ROI/ha			
	5-yr	10-yr		5-yr	10-yr		5-yr	10-yr		5-yr	10-yr		5-yr	10-yr		
1	KM	KM	1	ML	ML	1	ML	ML	1	KM	ML	1	NB	21.47%	UC	12.34%
2	UF	ML	2	KM	PG	2	KM	PG	2	ML	PG	2	SZ	14.86%	ES	11.10%
3	PG	PG	3	UF	UF	3	PG	KM	3	UF	UF	3	ES	14.07%	NB	10.81%
4	ML	UF	4	PG	KM	4	UF	UF	4	FX	UC	4	DL	13.05%	DL	9.01%
5	FX	FX	5	FX	FX	5	FX	FX	5	SZ	FX	5	UC	11.83%	SZ	8.93%
6	AK	MS	6	AK	UC	6	AK	GH	6	NB	NB	6	AK	10.32%	ML	7.78%
7	GH	AK	7	MS	AK	7	MS	MS	7	AK	ES	7	UK	9.07%	PG	7.38%
8	EN	GH	8	SZ	ES	8	EN	AK	8	UC	AK	8	MS	9.04%	UF	7.35%
9	MS	EN	9	DL	MS	9	GH	DL	9	ES	SZ	9	KM	8.98%	UK	7.14%
10	UC	UC	10	NB	GH	10	DL	ES	10	DL	DL	10	FX	8.30%	FX	6.80%
11	SZ	SZ	11	GH	DL	11	UK	UK	11	PG	MS	11	ML	7.72%	AK	6.68%
12	UK	DL	12	EN	NB	12	SZ	UC	12	MS	GH	12	EN	7.48%	GH	5.60%
13	DL	NB	13	ES	SZ	13	ES	EN	13	GH	UK	13	GH	7.37%	MS	5.18%
14	ES	ES	14	UC	UK	14	NB	NB	14	EN	KM	14	UF	6.89%	EN	4.70%
15	NB	UK	15	UK	EN	15	UC	SZ	15	UK	EN	15	PG	4.52%	KM	2.06%
													Industry	9.08%		6.93%

The poorest returns on investments are to be found in the areas where market values far exceed productive values for cane land. It could again be argued that premiums are being paid for cane land in certain areas, and the reasons for this need further analysis and debate. The return on investment by mill area is calculated using equation (2), and the results are detailed in Table 4.

The highest returns are being achieved in those areas where current net farm incomes are higher than current land values would reflect. Figure 7 shows the ROI for all mill areas compared with land market values.



**Figure 7. Land values versus return on investment.**

The ranking in terms of ROI again changes when compared to the rankings based on land values and revenue, with a number of north coast and Midlands mill areas moving up in the rankings. Those mills which have dropped down the rankings are generally the northern irrigated and Zululand mill areas.

Table 4 shows the rankings of all mill areas based on total revenue, total fixed and variable costs, net farm income and return on investment.

### Discussion

By applying the correct economic principles, the variation throughout the industry of the ratio between net farm income and cane land market values, can possibly be explained by looking at some of the main components of the market value formula, namely the real discount rate ( $i$ ) and the expected growth in future returns ( $g$ ). According to equation (3), it is clear that an increase in the real discount rate, and a decrease in expected growth in returns, will lead to a decrease in the market value of land, and *vice versa*.

#### *The risk factor*

The discount rate should in reality be referred to as the risk-adjusted discount rate, which reflects all the elements of risk associated with the income stream. Risk-adjusted discount rates can be used in evaluation applications to incorporate market information directly into risk analysis. In evaluation applications, these rates help adjust financial analyses for perceived risks by identifying outcomes that directly reflect the risk factors used in adjusting the discount rate (Anon, 1987).

The anticipation of receiving future benefits creates value, but the possibility of losing future benefits detracts from value. Higher rewards are required in return for accepting higher risk. The discount rate should therefore be adjusted higher for higher risk levels, and lower for lower risk situations.

In recent years we have seen a distinct northward movement of the South African sugar industry, with rapid expansion in the Onderberg region in particular. This northward shift naturally has existing cane growers reviewing their risk profiles and reassessing their futures, as the possibility of more cost effective growers entering the industry becomes more of a reality. Growers are also acutely aware of the risks associated with dryland farming, but on the other hand are also aware of the costs associated with irrigation, and the water supply problems in irrigated areas.

Also impacting on the risk factor is the issue of future investment plans of the South African milling companies and their perception of how best to maximise returns to their shareholders.

Growers need to be aware that it is the viability of the mills and not necessarily the growing sector that will determine which areas move out of sugarcane farming, and which areas remain in production. The 'opportunity cost' of cane also plays a role in determining which areas move out of cane production. Irrigated areas have a higher opportunity cost because a wider range of crops can be grown in those areas.

Milling rights (as a result of Cane Supply Agreements) and water rights will tend to reduce the risks associated with sugarcane production, assuming that viable alternatives to growing cane are limited or do not exist.

#### *Expected growth in future returns (g)*

Should growers expect returns in a particular area to grow in the future in relation to returns obtained in other areas, then market values will be higher than similar areas without any expected growth in returns.

Again the gradual northward movement of the sugar industry would perhaps indicate that the northern irrigated areas are more cost effective and as a result net farm incomes (returns) are expected to grow in these areas. At the same time returns are perhaps expected to decline in the less cost competitive areas.

Equation (2) yields a wide range of return on investment (ROI) figures across the sugar industry. Before drawing conclusions as to which mill areas represent better investments, one needs to determine whether the mill areas with lower returns are the same mill areas reflecting the lower risk levels, and possibly with the highest expected future growths in margins.

Taking all the above points into consideration, the obvious broad conclusion is that the northern and irrigated areas, or high-yielding dryland areas could be associated with lower risk levels due to their level and stability of yields, future movement of the sugar industry, and the overall viability of the milling and growing sectors. Lower risk justifies lower returns to investments in a particular area. The fluctuation in returns within the northern irrigated area is nevertheless notable and should be a consideration for potential investors in the area.

Some of the best returns on investment can currently be found in the Midlands mill areas, where margins are higher than land prices would suggest they should be. Again, by applying economic theory, these high returns can possibly be explained by the fact that farmers have built into their calculations a high level of risk associated with farming in the area, or the possibility of shrinking net farm incomes. It is possible, however, that the market is not reflecting the true level of risk associated with farming in certain areas. The Midlands mill areas, for instance, have a 24-month crop cycle that could be perceived as an advantage as a result of their lower yield fluctuations. Another explanation could be that the market has not yet taken into account the higher returns in certain mill areas, due to better cane quality.

## **Conclusions**

The South African sugar industry is characterised by a diverse range of locations, growing conditions and production costs, all of which influence the market forces that ultimately determine the value of cane land.

A primary consideration of purchasers of cane land in the sugar industry will be the income producing ability of a cane property.

The relationship between yields and cane land values is clearly displayed in this analysis, although it appears that buyers are more motivated by cane tonnage rather sucrose tonnage. The Midlands mill areas, for example, have superior sucrose yields than most of the south and north coast mill areas, yet the cane land values are the lowest in the industry.

A good trend is also observed when comparing total revenue (TR) and total fixed and variable costs (TFVC) with cane land values. Higher land values are generally associated with higher TR and higher TFVC.

However, anomalies arise when comparing net farm incomes (NFI) and returns on investment (ROI) to land values. In these cases some of the better investments are those mill areas with relatively high NFI and relatively low cane land values. The focus then moves away from the Zululand and northern irrigated mill areas, more towards the Midlands mills in particular.

Economic theory supplies some explanation for the existence of this wide range of returns to investment, by introducing the concepts of the risk factor and the expected growth of future returns.

Potential investors therefore need to decide for themselves whether the market forces which are currently operating in the sugar industry, are correctly reflecting factors such as risk and future growth of returns, and whether these factors are being fully reflected by current market values.

Expectations, perceptions and preferences play a major role in determining the price a willing buyer will pay a willing seller for a cane property, and are often responsible for market prices not necessarily tracking productive land values.

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