MARKETING MARGIN ANALYSIS OF SOUTH AFRICAN POTATOES

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Determination of marketing margins in the South African potato industry requires knowledge of the industry itself and of marketing margin theory. An analysis conducted on national level to determine factors influencing the margin of potatoes, was also applied on regional level. The markets of Cape Town, Durban, Bloemfontein and Johannesburg were analyzed to detect regional differences. In each region, the producer price proved to be the main determinant of price margins for potatoes. A strong interrelationship exists between the Johannesburg, Bloemfontein and Durban markets.

BEMARKINGSMARGE ANALISE VAN SUID-AFRIKAANSE AARTAPPELS
Die bepaling van bemarkingsmarges in die Suid-Afrikaanse aartappelbedryf verg kennis van die bedryf en van bemarkingsmargeteorie. 'n Ontleding wat op nasionale vlak gedoen is om faktore wat die marge van aartappels beïnvloed, te bepaal, is ook op streeksvlak toegepas. Die markte van Kaapstad, Durban, Bloemfontein en Johannesburg is ontleed om streeksverskille te bepaal. In elke streek het die produsenteprys geblyk die belangrikste determinant van prysmarges van aartappels te wees. Daar bestaan 'n sterk interverwantskap tussen die Johannesburg, Bloemfontein en Durban markte.

1. INTRODUCTION

Marketing margin embodies changing efficiencies in input use as well as the various simultaneous shifts in supply and demand relations, and thus reveals the combined effects of changes in factor productivity, input prices, relative factor usage, and profits. As a result, margins become critical determinants of returns to marketing agents as well as of retail food prices (Waugh, 1964), and measure the performance of the food industries (Azzam, 1992).

Results from marketing and marketing margin research can have a variety of implications for both private company managers and public policy makers. Firm managers can be assisted in the development of strategic marketing plans by utilising improved estimates and forecasts of price spreads (Barallat, Lee and McLaughlin, 1987). Improved knowledge of margins aids in precise identification of the optimal time to market their products. The persistent nature of issues, such as marketing firms pricing their services "too high" relative to farm prices, initiated substantial marketing margin research.

Regarding potatoes, Figure 1 presents the relationship between quantities marketed and deflated producer prices. Figure 2 represents the deflated retail and producer prices and Figure 3 depicts the price margin. The producer prices were evaluated as the average price of all grades of potatoes, therefore the consumer prices (retail prices) were evaluated as a national average.

Figure 3 shows a fluctuating margin with a cyclical trend. The question to be asked is whether the margin is justified? This margin consists of profit and costs. The middleman must pay for inputs through profits. The national margin embodies the fluctuating margins of different regions. It is therefore possible for some regions to have an inclining margin that would not be detected by a national analysis.

2. PRICE MARGINS AND ITS MODELLING

Questions which studies indicated that some questions have sought to answer were, whether or not, changes in farm prices are promptly and fully reflected in retail prices, whether margins are too large, whether marketing margins remain constant per unit sold or vary with the volume sold, and whether and to what degree, changes in margins influence farm and retail prices.

An important issue in marketing margins is the incedence of a change in charges associated with marketing agricultural commodities. Fisher (1981) explored the effects on retail and producer price of a shift in the supply curve for marketing services. Such a shift could be caused by changes in exogenous factors. His theoretical illustration shows that for most agricultural products, the major adjustment to a change in marketing charges will be made by producer prices. Farmers therefore have a strong economic interest in promoting efficiency in the marketing sector of their produce.

According to Hallet (1981), changes in the farm-retail spread over a certain period of time are mainly due to changes in the cost of all factors involved in processing and distributing. This author concluded, that the size of the farm-retail spreads over periods of time are determined by changes in farm and retail prices. The elasticities of supply for processing and distribution inputs, consumer demand and producer supply are also important determinants of the nature, size and variation of the marketing margin (Nicholls, 1941).

Buse and Brandow (1960), together with Breimeyer (1957) came to the conclusion that the widening or narrowing of margins as volume through marketing channels increases, depend, to a large extent, on the characteristics of the particular commodity and the amount of time allowed for prices to adjust.

It should be realised, that the efficiency of marketing is not necessarily reflected by the size of the marketing margin (Hallet, 1981) and will not evolve automatically (Harrison *et al.* 1974). Parker (1962) suggests in his work that margin fluctuation mainly caused by the fact that efficiency in production outstripped improved efficiency in market services.

Marion (1986) claims that considerable research has been devoted to analysing the extent to which margins, prices and profits in the food industry may have been intemperate. Marketing margins have been examined beyond this by a number of researchers (Breimeyer, 1957; Buse and Brandow, 1960; Houston, 1962; Bester, 1963; Parish, 1967; Wollen and Turner, 1970; Whetham, 1972; Harrison *et al.* 1974; O'Connell and Connolly, 1975; Antrobus, 1979; Lamm and Westcott, 1981; Williams, 1986; 1993; Srivasta and Bisaria 1987; Digby, 1989 and Wann and Secton, 1992).

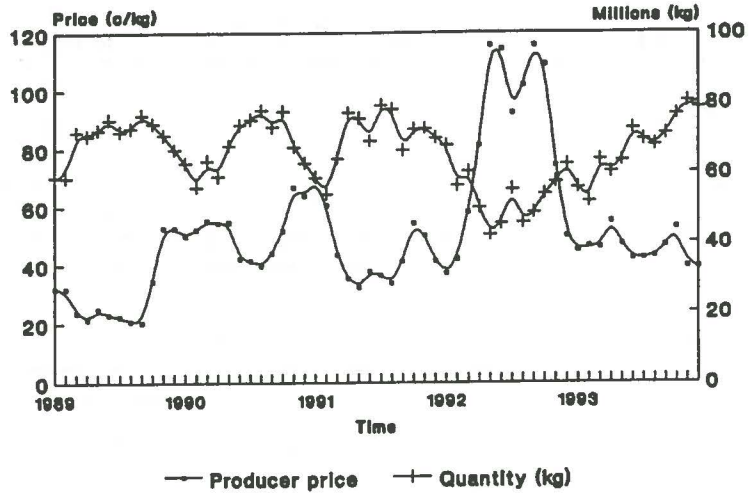

Figure 1: **Relationship between producer prices and quantity marketed**

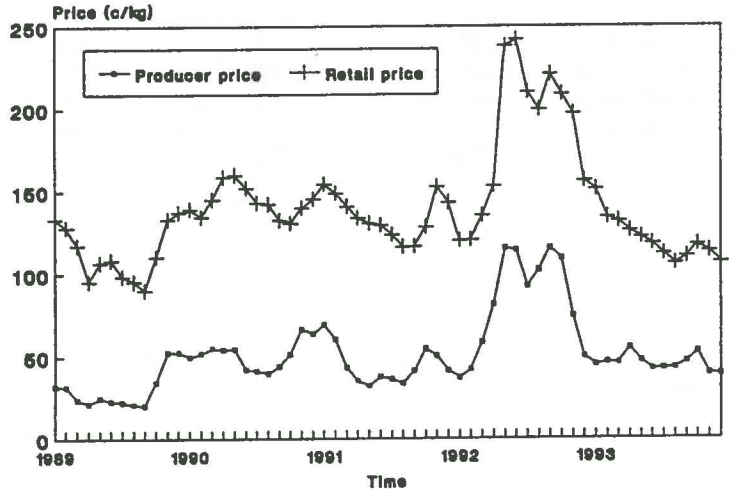

Figure 2: **Deflated producer and retail prices (1989-1993)**

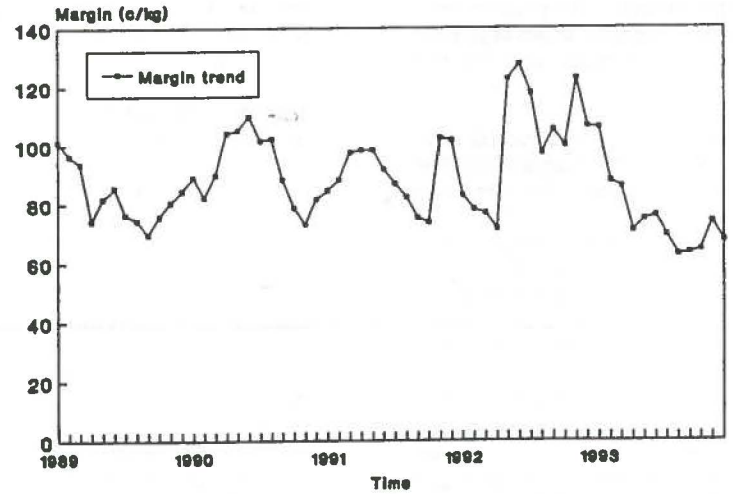

Figure 3: **Price margin trend for deflated prices (1989-1993)**

The emphasis, however, has shifted from simple cost analysis to modelling marketing margin behavior.

Several earlier studies involved partial evaluations of aspects concerning the marketing margin or farm retail spread. Gardner (1975) investigated the effects of three distinct forces affecting food system equilibria shifts in retail demand, shifts in farm commodity supply and demand and shifts in marketing input supply . Amongst others, Heien (1980) and Holloway (1991) developed marketing margin models based on the work by Gardner (1975). Heien (1980) found Gardner's approach an excellent vehicle of analysis, providing many interesting insights into the determinants of the farm-retail price spread. Different approaches towards modelling marketing margins were selected for a review.

Econometric model:

Ordinary least squares (OLS) equations were used under three alternative lag structures: an almon polynomial lag, an arithmetic lag and an unconstrained lag structure. A three month lag structure was selected since most potatoes are sold within three months after production and because the input costs are assumed to be transmitted through the system relatively quickly.

Multivariate time series model:

"Transfer functions" allow a multivariate time series model to incorporate a structural relationship between a set of exogenous or input time series, Y_t. When the residual noise unexplained by input variations is modelled using a univariate ARIMA process, the resulting models are called "transfer functions with-added-noise" models. Box and Jenkins (1976) detailed the necessary conditions and accompanying (Portmanteau) tests required for the use of the procedure. The procedure is applied below to the same variables judged *a priori* to be determinants of farm-retail margin behaviour in the econometric model. Each of the input series had to be "pre-whitened", so that the resulting residual terms can be judged to come from white noise processes. Portmanteau tests were used to verify this procedure in each case.

Forecast models:

Box and Jenkins (1976) authors computed a composite forecast from arithmetic averages of the forecasts provided by the econometric and univariate ARIMA models. Forecasts were generated one month in advance using two "naive" models based on linear and quadratic trends of the price spread data, and respectively, estimated by OLS for the period under examination, in their case 1970-1981.

Parker and Zilberman (1993), combined the hedonic price framework with the economics of marketing margins. A conceptual model is described for analyzing marketing margin behaviour, assuming a competitive marketing services industry.

Lyon and Thompson (1993) assessed the effects of temporal and spatial data aggregation on the performance of alternative marketing margin models using monthly, quarterly, and semi-annual data for milk from three cities. Non-nested tests for multivariate and single equation models with serial correlation are used to choose among alternative models at each aggregation level. Since model choice is affected by temporal and spatial aggregation, it becomes more difficult as data are temporally or spatially aggregated. To test relationships between model specification and aggregation, the following models were specified empirically as linear, seemingly unrelated regression (SUR).

3. DATA EMPLOYED

To apply the marketing margin models (derived from Gardner's (1975) work) many variables are essential to determine effects. This study employed data consisting of monthly observations for the years 1985-1993. Producer prices, retail prices and quantities sold of potatoes, onions and tomatoes, on both national and regional level, were obtained from the Potato Producers Organization (1994), the Directorate Marketing (1994) and the Central Statistical Services (1994). The producer prices of each product were deflated by the producer's price index (PPI) and the retail prices together with retail and wholesale wages were deflated by the consumers price index (CPI). The margin values of tomatoes and onions were also deflated by the CPI. Because of the lack of available time series data for variables such as transport and packaging costs, a proxy was used for the input costs. Retail and wholesale industry wages were used as this proxy for marketing input costs, and were obtained from the Central Statistical Services (1994).

Four regions were selected for regional analysis, namely the fresh produce markets of Cape Town, Bloemfontein, Johannesburg and Durban. These markets were selected according to data availability and the respective locations of the markets. Therefore, the possibility exists that marketing margin behaviour may be related to spatial factors.

Winters' (1960) three-parameter trend and seasonality forecasting method was used to forecast missing values due to the unavailability of regional retail price data. The Winters' method is based on three smoothing equations, one for stationary, one for trend, and one for seasonality (Makridakis & Wheelwright, 1983). The forecasting procedure, embodying these three equations, basically deals with selecting the forecast with the lowest Mean Absolute Percentage Error (MAPE) and Mean Square Error (MSE).

4. MODEL SPECIFICATION

The models listed below were based on the models by Lyon and Thompson (1993). There was, however, no binary variable included in any of the equations below, as there was no significant change in the structure, prices or legislative measures of the potato industry in the period under consideration. Since Lyon and Thompson (1993) obtained no significant results with the PR*Q variable in their relative model, the retail price (PR) was replaced with the producer price (PP) due to the fact that potato prices are supply driven.

Four marketing margin models (markup model (**MU**), relative model (**RL**), marketing cost model (**MC**) and the rational expectationss hypothesis model (**REH**)) respectively were given by the following equations:

$M_{it} = f(PP_{it}, W_t)$
$M_{it} = f(PP_{it}, P_{it}*Q_{it}, W_t)$
$M_{it} = f(Q_{it}, W_t)$
$M_{it} = f(PP_{it}, PP_{i(t-k)}, W_t)$

where:

$M = \frac{(KHP_{it} - PP_{it})}{KHP_{it}}$ = marketing margin, specified as

PP_{it} = Producer price of potatoes;
i = national level, Cape Town, Durban, Johannesburg or Bloemfontein;
t = time index, t = 1, 2, ...T;
PP_{it} = producer price in R/kg or R/ton;
W_t = wages for the retail and wholesale trade on a national average;
$(PP*Q)_{it}$ = product of producer price and total quantity of potatoes marketed on the respective national fresh produce markets;
Q_{it} = total quantity of potatoes marketed; and
$PP_{i(t-k)}$ = producer prices, lagged for a certain period; K = 0, 1,2 ...N.

5. ESTIMATION PROCEDURE

A total of 75 regressions were performed, 15 on the national level and 60 on the regional level, whereafter the "ideal" model was built for each region (market). Single equations were estimated by a multivariate procedure. Seemingly unrelated regression (SUR) estimation was used to account for contemporaneous correlation across markets.

The models were initially performed in the linear form ($Y = \alpha + \beta X$) with the variables as Lyon and Thompson (1993) specified them. In the following regressions, other variables that might have an effect on the margin of potatoes, in South Africa were included. Variables that were added to the first models were all significant at the 5% level. Variables were selected on a national basis and the same variables were included in the regressions on regional basis due to the fact that policy was determined on a national level. To select the best functional form, the linear form, a semi-log function in the form ($Y = \alpha + \beta \ln X$) and the double-log ($\ln Y = \alpha + \beta \ln X$) were fitted. The determinants for selecting the variables present in the final regression were the test of logic, the significance level and the consistency of each variable.

Due to the importance of correlation between markets, the seemingly unrelated regression (SUR) model being a recursive model have to be discussed briefly. SUR estimation is simply the application of generalized least - squares estimation to a group of seemingly unrelated equations. The equations were related through the nonzero covariances associated with error terms across different equations (those for Cape Town, Johannesburg, Durban and Bloemfontein) at a given point in time. Therefore, the parameters could be estimated consistently. If this was not efficient, the ordinary least squares estimation procedures were used (Greene, 1993). The generalized regression model applies to the stacked regression (Greene, 1993):

$$\begin{bmatrix} Y_1 \\ Y_2 \\ \vdots \\ Y_m \end{bmatrix} = \begin{bmatrix} \chi_1 & 0 & \cdots & 0 \\ 0 & \chi_2 & \cdots & 0 \\ \vdots & & & \\ 0 & & \cdots & 0 \end{bmatrix} \begin{bmatrix} \beta_1 \\ \beta_2 \\ \vdots \\ \beta_m \end{bmatrix} + \begin{bmatrix} \epsilon_1 \\ \epsilon_2 \\ \vdots \\ \epsilon_m \end{bmatrix}$$

$$= \chi\beta + \varepsilon$$

Therefore, the most efficient estimator is the generalized least squares method. The model has a particularly convenient form. For the *t*th observation, the M * M covariance matrix of the disturbances was:

$$\sum = \begin{bmatrix} \sigma_{11} & \sigma_{12} & \cdots & \sigma_{1m} \\ \sigma_{21} & \sigma_{22} & \cdots & \sigma_{2m} \\ & & \vdots & \\ \sigma_{m1} & \sigma_{m2} & \cdots & \sigma_{mm} \end{bmatrix}$$

Thus, SUR estimation was used to account for contemporaneous correlation between error terms across markets; the error term vector of each system was assumed distributed $N(O, \sum \otimes I_t)$, where $\sum$ is a (3x3) covariance matrix (Greene,1993).

6. RESULTS

The best results were obtained from performing the regressions in linear form. Results were evaluated according to the following criteria: (a) significance, (b) consistency and (c) the test of logic. The linear functional form were tested by fitting a semi-log and a double-log function to the data, but yielded no significant improvement. More significant and consistent answers were obtained from the linear models. Consequently, the discussion in this section only deals with the linear results.

National results for both the theoretical models and the adapted models were at first interpreted according to it's performance in the single equation approach and, secondly, according to it's performance in the systems approach. The regional results are discussed in terms of the performance of the variables within each market for both the single equation approach and the systems equation approach, after which a "ideal" model is build for every region or market.

National results

The single equation multiple regressions yielded some interesting results. Table 1 and 2 are summarise the results. The first variable, the national average producer price of potatoes (NPP), proved to be significant at the 0,0001 level. The elasticity varied between -0,24 and -0,14 indicating that if the producer price of potatoes increases by one per cent, the margin would decrease by 0,14 per cent. The inverse relationship between producer price of potatoes and the margin of potatoes proved to be consistent with *a priori* expectations. According to the partial R^2, NPP explains more than 70 per cent of the variability in the potato price margin associated with the variability of the variables in each of the **MU** and **RL** models. Wages paid in the retail and wholesale industry (WAGEF) yielded divergent results which proved to be statistically insignificant.

Although significant results were obtained, no tentative conclusion can be drawn concerning the producer price multiplied by the quantity marketed (NPPQ) as an explanatory variable, i.e. it was only used in the **RL** model. The quantity marketed (Quant) and the 12 month lagged producer price (NPP12) were included in only the **MC** model and the **REH** model, respectively, and will be judged by it's performance in the single equation and systems equation approach for both the theoretical and adapted models.

The systems approach tests the interrelated behaviour of the different models. The elasticity of NPP decreased for the theoretical models with the lowest elasticity at -0,07. The adapted models revealed constant elasticities ranging between -0,16 and -0,17. The inverse relation between NPP and the margin proved to be consistent. The proxy for

Table 1: Elasticities obtained for the RSA (theoretical model)

Model	Single equation approach				Systems equation approach			
	MU	RL	MC	REH	MU	RL	MC	REH
NPP	-0,24****	-0,17****		-0,17****	-0,10****	-0,14****		-0,07****
WAGEF	-0,02****	-0,00048	-0,15****	-0,04****	-0,05***	-0,04***	-0,12****	-0,07***
NPPQ		-0,11***				-0,04****		
QUANT			0,38****				0,18****	
NPP12				-0,009				0,01***
R^2	0,75	0,76	0,33	0,39	System weighted R^2 = 0,65			

Significance levels: * = 0,1; ** = 0,05; *** = 0,01; **** = 0,001

Table 2: Elasticities obtained for the RSA (adapted model)

Model	Single equation approach				Systems equation approach			
	MU	RL	MC	REH	MU	RL	MC	REH
NPP	-0,24****	-0,14****		-0,24****	-0,17****	-0,16****		-0,17****
WAGEF	-0,02****	0,014	-0,16****	-0,03	-0,06****	-0,04***	-0,15****	-0,06***
NORP9	0,05**	0,05**			0,003	0,009		
TOMMM	0,07**	0,10***			0,007	0,02		
NPP9	0,07**	0,07***	0,11***	0,07**	0,09****	0,09****	0,11***	0,09****
NPPQ		-0,15****				-0,05****		
QUANT			0,35****				0,26****	
NPP12				-0,03**				-0,003
R^2	0,77	0,80	0,36	0,76	System weighted R^2 = 0,64			

Significance levels: * = 0,1; ** = 0,05; *** = 0,01; **** = 0,001

marketing costs (WAGEF) yielded significant results in being consistent in the negative relationship with the margin of potatoes. Its elasticity ranged between -0,04 and -0,15, therefore would the margin decrease with -0,04 per cent if the wages increase with 1 per cent. The logical expectation would be that a positive relationship exist between marketing costs, and the potato price margin. To explain this controversy, it can be seen from Figure 3 that the margin size fluctuates, but have a static real trend. Furthermore it should be kept in mind that the margin is expressed as a percentage of retail price

Assuming the margin stays the same, the above indicates that an increase in the marketing costs will result in decreased profits obtained by the marketing agents. The marketing cost therefore increases as a percentage of the margin, resulting in a relative "decrease" of the margin. This suggests that the potato industry have an efficient marketing system.

The relationship between price-cost margins have been conclusively examined (eg. Collins and Preston, 1968; and Schroeter and Azzam, 1991). Their main finding was that a close statistical relationship exists between the lack of competition and high price-cost margins. It is therefore likely that the negative relationship of marketing costs (wages) and the marketing margin will not exist in industries where competition are limited or monopolies exist, for example the maize industry. The 9 month lagged retail price of onions (NORP9), and the margin of tomatoes (TOMMM), yielded insignificant results.

To summarize, NPP proved to be significant and consistent throughout the national analyses. It contributed the most to explaining the variation of the potato price margin associated with the variation in the variables. WAGEF performed somewhat inconsistently in the single equation approach, but more consistently in the systems approach. Caution should be taken in the interpretation of the relationship between marketing costs (margin costs) and the potato price margin, since the potato industry is operating under free market principles. The positive relationship would therefore not prevail in other industries where, for example, monopolies exist. NPPQ proved to be significant, but the size of the elasticities varied from -0,04 to -0,15 in the two approaches. The significance of this variable is therefore examined on regional level before any conclusions are drawn.

QUANT obtained significant answers with its elasticities ranging between 0,18 and 0,38. This implies that the margin would increase by 0,18 per cent if the quantity increases by 1 per cent. Tomek and Robinson (1990: 109) cited: "It may be more realistic to assume that economies of scale in providing marketing services exist....Under these circumstances, one would expect to find lower margins associated with a larger volume of production." The positive relationship indicates that no economies of scale exist in the potato industry, which is most unlikely for an industry operating under free market principles.

The **MU** model explained 75 and 77 per cent for the two approaches respectively ; the **RL** model 76 and 80 per cent; the **MC** model 33 and 36 per cent; and the **REH** model 39 and 76 per cent for the single equation approaches. The two systems equation approaches explained 65 and 64 per cent of the variation, respectively. From the above, it was evident that the **MC** model does not explain the variation in the margin satisfactory.

Regional results

Variables which were included in the national analyses, were fitted on regional level to illustrate regional differences. The summarised results for the theoretical model are presented in Table 3, and those for the adapted models in Table 4.

Correlation coefficients were calculated to determine the interrelated effect of the different markets (Table 5). The variables were significantly correlated at the 0,005 level. The high correlation coefficients between Johannesburg, Durban and Bloemfontein indicate the interdependence between different producer prices at different markets. This was an early indication that the margins of these markets will also be highly correlated, because the producer price seems to influence the margin of potatoes most.

The estimation procedure of the regional models were as follows:

- Apply different national models for 4 different markets (Cape Town, Johannesburg, and Durban)
- Two approaches were followed, i.e. theoretical model and adapted model for (1) the single approach and (2) the systems equation approach, where the 4 different markets were used simultaneously for each model, i.e. **MU**, **RL**, **MC**, and **REH**, so that the regional interrelationships can be recognized.
- The consistencies of variables in the above estimation procedure resulted in the selection of variables for the "ideal" margin models.

Cape Town

PP proved to be significant and consistent in the two approaches, contributing the most of all the variables in the adapted model in explaining the variation in the margin of potatoes associated with the variation in the variables. In both the theoretical model and the adapted model, significant and consistent answers were obtained for WAGEF. PP9 contributed insignificantly in explaining the margin of potatoes. Q seemed to have a significant influence on the margin of potatoes and obtaines consistent elasticities ranging between 0,17 and 0,24. The positive relationship between the price margin of potatoes and CQ was, however, in conflict with logic. Consistent answers was obtained by tomato margin with elasticities between 0,11 and 0,10. This implied that if the margin of tomatoes increased by 1 per cent, the margin of potatoes will increase by 0,10 per cent. PP12 proved to be significant and obtained small elasticities ranging from 0,08 to 0,09, implying that if the marketing margin of potatoes increased by 0,08 per cent 12 months after the producer price of potatoes increased with 1 per cent. This implied that high prices in the previous season will result in higher margins in the current period. ORP9 was significant at the 0,001 level, with a constant elasticity of 0.2. The effect of a price change in the retail price of onions on the margin of potatoes was small and take 9 months to manifest itself. Both ORP9 and CTMM seem to have a complementary relationship with the potato price margin for Cape Town.

Bloemfontein

The results yielded by for Bloemfontein differed substantially from those obtained for Cape Town. BPP and WAGEF proved to be significant and consistent in the systems equation approach. BTPP9 contributed insignificantly in explaining the margin of potatoes. BQ

Table 3: Elasticities obtained on regional level (theoretical model)

Model	Single equation approach				Systems equation approach			
	MU	RL	MC	REH	MU	RL	MC	REH
Cape Town								
CPP	-0,32****	-0,30****		-0,34****	-0,39****	-0,30****		-0,41****
WAGEF	-0,16****	-0,16****	-0,15**	-0,12****	-0,17****	-0,15****	-0,16****	-0,22****
CPPQ		-0,02				-0,014**		
CQ			0,17****				0,22***	
CPP12				0,09***				0,08**
R^2	0,71	0,43	0,10	0,47				
Bloemfontein								
BPP	-1,3****	-2,0****		-1,43****	-1,5****	-1,5****		-1,5****
WAGEF	-1,69****	-1,88****	-2,2****	-1,8****	-1,6****	-1,6****	-2,0****	-1,8****
BPPQ		1,24****				0,10		
BQ			2,3****				0,81****	
BPP12				0,16				0,17*
R^2	0,71	0,76	0,66	0,75				
Johannesburg								
JPP	-0,74****	-1,0****		-0,78****	-0,76****	-0,78****		-0,79****
WAGEF	-0,34****	-0,41****	-0,79****	-0,4****	-0,33****	-0,33****	-0,65****	-0,41****
JPPQ		-0,33***				0,017		
JQ			1,11****				0,5****	
JPP12				0,007				0,02
R^2	0,80	0,81	0,39	0,82				
Durban								
DPP	-1,2****	-1,4****		-1,2****	-1,17**** -	-1,2****		-1,2****
WAGEF	-0,93****	-1,04****	-1,39****	-1,01****	0,91****	-0,98****	-1,2****	-1,03****
DPPQ		0,59***				0,10		
DQ			1,7****				0,69****	
DPP12				0,087				0,02
R^2	0,79	0,80	0,62	0,82	0,67	0,70	0,42	0,71

Significance levels: * = 0,1; ** = 0,05; *** = 0,01; **** = 0,001

Table 4: Elasticities obtained on regional level (adapted models)

Model	Single equation approach				Systems equation approach			
	MU	RL	MC	REH	MU	RL	MC	REH
Cape Town								
CPP	-0,40****	-0,40****		-0,34****	-0,4****	-0,4****		-0,4****
WAGEF	-0,11***	-0,11***	-0,12**	-0,2****	-0,13****	-0,12****	-0,12**	-0,2****
CTPP9	-0,11**	-0,11**	-0,02	0,001	-0,11***	-0,10**	-0,03	-0,01
CTMM	0,10*	0,10*			0,10*	0,11**		
CORP9	0,2****	0,21****			0,2****	0,2****		
CPPQ		0,04				0,09	0,24***	
CQ			0,18**					
CPP12				0,09**				0,08**
R^2	0,54	0,53	0,05	0,47				
Bloemfontein								
BPP	-1,05****	-1,4****		-1,03****	-1,14****	-1,17****		-1,16****
WAGEF	-1,55****	-1,73****	-2,36****	-1,9****	-1,80****	-1,8****	-2,2****	-1,86****
BTPP9	0,09	0,01	0,43*	0,28	0,12	0,16	0,53***	0,04
BTMM	0,71***	0,52**			0,25**	0,26**		
BORP9	0,43*	0,41*			0,07	0,10		
BPPQ		0,87***	2,17****			0,11		
BQ							0,65***	
BPP12				-0,09				-0,15
R^2	0,78	0,80	0,67	0,75				
Johannesburg								
JPP	-0,76****	-0,95****		-0,76****	-0,76****	-0,82****		-0,78****
WAGEF	-0,31****	-0,37	-0,86****	-0,43****	-0,37****	-0,38****	-0,72****	-0,41****
JTPP9	0,10	0,09	-0,37***	0,17**	0,001	0,01	0,18*	0,009
JTMM	0,25***	0,2**			0,06	0,05		
JORP9	0,17**	0,19***			2,13	0,09*		
JPPQ		0,28**				0,07		
JQ			1,07****				0,57****	
JPP12				0,0004				0,02
R^2	0,85	0,85	0,42	0,83				
Durban								
DPP	-1,18****	-1,46****		-1,2****	-1,2****	-1,29****		-1,2****
WAGEF	-0,94****	-1,09****	-1,6****	-1,04****	-1,0****	-1,03****	-1,44****	-1,04****
DTPP9	0,06	0,10	0,27*	0,15	-0,005	0,009	0,2*	0,003
DTMM	0,37****	0,33***			0,13***	0,01**		
DORP9	0,35**	0,23			0,13	0,14		
DPPQ		0,54**				0,17		
DQ			1,9****				0,8****	
DPP12				-0,07				-0,01
R^2	0,83	0,84	0,66	0,82	0,74	0,75	0,43	0,71

Significance levels: * = 0,1; ** = 0,05; *** = 0,01; **** = 0,001

Table 5: Correlation matrix between producer prices in Cape Town, Johannesburg, Durban and Bloemfontein

Correlation	KPP	BPP	JPP	DPP
KPP	1			
BPP	0,32	1		
JPP	0,27	0,96	1	
DPP	0,30	0,96	0,99	1

seemed to have a significant influence on the margin of potatoes and obtained consistent elasticities within the single equation and the systems equation respectively, but not if it is simultaneously evaluated in both the approaches. The latter is another indication that the different markets do influence each other. The positive relationship between the price margin of potatoes and BQ was in conflict with logic. Significant elasticities were obtained by BTMM ranging between 0,25 and 0,71, significant at a 0,1 level. This suggests a complementary relationship between tomatoes and potatoes for Bloemfontein.

Johannesburg

Results obtained for Johannesburg differ significantly from those obtained for Cape Town and Bloemfontein. The only variables that performed significantly, were JPP and WAGEF. JQ obtained significant results, but the positive elasticities were implicating that no economies of scale existed in the potato industry, which was not the logical expectation for a industry operating under free market principles.

Durban

The existence of regional differences was proved again by the Durban market, yielding different results than the above three markets. DPP proved to be significant and consistent in both the theoretical and the adapted models, contributing the most of all the variables in the single equation, adapted model in explaining the variation in the margin of potatoes associated with the variation in the variables. Significant and consistent answers were obtained for WAGEF. DTMM yielded significant, results with the elasticities varying between 0,01 and 0,33.

The "ideal" regional models

Models were developed out of the previous results. All the statistical significant and consequent variables were included in each region's equation. The equation for each region was specified as:

MC = f(CPP, CPP12, ORP9, CTMM);
MB = f(BPP, BTMM);
MJ = f(JPP); and
MD = f(DPP, DTMM;

where:

MC = Margin of Cape Town, expressed as a percentage of retail price;
MB = Margin of Bloemfontein, expressed as a percentage of retail price;
MJ = Margin of Johannesburg, expressed as a percentage of retail price;
MD = Margin of Durban, expressed as a percentage of retail price;
NPP = Producer price of potatoes for Cape Town (C), Bloemfontein (B), Johannesburg (J) or Durban(D)
CP12 = 12 Month lagged producer price of potatoes for Cape Town;
ORP9 = Retail price of onions, lagged for 9 months;
CTMM = Marketing margin for tomatoes in Cape Town (C), Bloemfontein (B) or Durban (D)

A model was build for each region containing the most significant variables which was presented in Table 6. The variables were all significant at the 0,05. The margin of the Cape Town market appeared to be influenced by it's producer price, the retail price of onions, lagged for 9 months, the margin of tomatoes, and the producer price of potatoes, lagged for 12 months. All of the variables were significant at the 0,001 level. A proc stepwise regression was done and CPP contributed 28 per cent (partial R^2) to the explanation of the margin of potatoes of the total R^2 of 42 per cent. The margin of potatoes was much more sensitive to producer price in the Bloemfontein, Durban and Johannesburg markets, than in the Cape Town market, indicating that a change in producer price is more rapidly passed through to consumers in Bloemfontein, Johannesburg and Durban. The reason for Cape Town's margin being affected differently was that this region is less

Table 6: SUR regression results for the markets of Cape Town, Johannesburg, Durban, and Bloemfontein

Model	Variable	Coefficient	Elasticity	Significance
MC	Intercept	0,50740800	-	0,0001
	CPP	-0,00042800	-0,410	0,0001
	KTMM	0,00008150	0,002	0,0005
	KPP12	0,00014500	0,090	0,0100
MB	Intercept	0,334310	-	0,0350
	BPP	-0,001552	-1,66	0,0001
	BTMM	0,000503	0,02	0,0001
MJ	Intercept	1,075586		0,0001
	JPP	-0,000969	-1,01	0,0001
MD	Intercept	0,898223	-	0,0001
	DPP	-0,001361	-1,39	0,0001
	DTMM	0,000188	0,005	0,0030

Table 7: Cross model correlation for the marketing margin of potatoes in Cape Town, Johannesburg, Durban and Bloemfontein

Correlation	MC	MB	MJ	MD
MC	1			
MB	0,39725	1		
MJ	0,40928	0,68038	1	
MD	0,4828	0,7854	0,91524	1

influenced, i.e. it is a market more in isolation than the other markets. The cross model correlation between the four markets is given by Table 7. BPP obtained an elasticity of 1,66, significant at the 0,0001 level. The margin has therefore got a high price elasticity, which indicates the sensitivity of the margin. BPP obtained a partial R^2 of 40 per cent in the stepwise procedure; the model R^2 63 per cent. The elasticity of BPP was -1,66, significant at the 0.0001 level. The margin of potatoes was not very sensitive for a change in the margin of tomatoes, and a complementary relationship existed between these products in Bloemfontein and Durban. The partial contribution of BTMM in explaining the margin of potatoes was 22 per cent of the model's 63 per cent.

JPP obtained a partial R^2 of 73 per cent in the stepwise procedure. This suggests that the producer price in Johannesburg is the main single factor influencing the margin of potatoes in that area. The elasticity for JPP in the systems approach was -1,01, significant at the 0,0001 level. DPP obtained an elasticity of -1,39, significant at the 0,0001 level, and explained 58 per cent of the margin of potatoes (partial R^2).

The producer price of potatoes was the main factor influencing the margin of potatoes. Regional differences were detected in the different elasticities of the producer prices of the four markets. The margin of potatoes was the most sensitive for a change in producer price in the Bloemfontein, Johannesburg and Durban markets. A complementary relationship seemed to exist between the margin of tomatoes and the margin of potatoes in the markets of Bloemfontein, Johannesburg and Cape Town.

The high cross model correlation between the markets are presented in Table 7. The high correlation between Johannesburg (MJ), Bloemfontein (MB), and Durban (MD) indicated a high interdependence between these markets. The producer prices and quantities of these markets were highly correlated.

Producers situated in a favourable position would therefore have a competitive advantage above regions without real access oppurtunities. Price risk can be reduced if more than one exist. The high cross model correlation between Johannesburg, Durban and Bloemfontein was also reflected by the sensitivity of the marketing margin of potatoes in all three markets for a change in producer price. Agricultural policy for the potato industry should therefore take the existence of regional differences into account. This implies that a national agricultural policy for potatoes were non-optimal in various regions.

An analysis of the residuals revealed some interesting facts. Small residuals were obtained for Cape Town and Durban markets. Bloemfontein and Johannesburg yielded big residuals up to the end of 1990. The residuals, however decreased after this period. Small residuals for the full time under consideration suggested that no changes in agricultural policy occurred.

7. CONCLUSION

Margin analysis is gaining in importance, and is supported by the perceived strong economic interest in promoting efficiency in the marketing sector. Modelling marketing behaviour thus has become a relevant research topic again.

Regional differences in the margin of potatoes were found in South Africa. Variables performed differently well within each market. The only variable that consistently explained the potato price margin significantly, was the producer price in each region. Regional differences, were therefore once again detected. The producer prices, the predicted and true margins of potatoes in Johannesburg, Durban, and Bloemfontein was highly correlated. This confirms that margins for the potato industry was mainly determined by the producer price, indicating high marketing-efficiency of Bloemfontein, Johannesburg and Durban. It may be said that the margins in the potato industry were justified. Other variables contributed to explain the margins, i.e.influence of the margin of tomatoes in Cape Town, Bloemfontein and Durban. A complementary relationship, however, existed between potatoes and tomatoes.

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