Analyzing Marketing Margins and the Direction of Price Flow in the Tomato Value Chain of Limpopo Province, South Africa

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Abstract— *The Limpopo Province is home to South Africa's tomato farming giants, some of whom also occupy the position of the largest producers of the commodity in the Southern Hemisphere. Regardless of its importance in the tomato industry of the country, there are few studies analysing the mechanism through which prices of tomatoes are determined and transmitted from the farm gate in Limpopo to the various provincial, local and international markets. This study attempts to fill the knowledge gap on the performance of Limpopo Province's tomato markets by examining the marketing margins and the direction of price flow amongst the successive tomato marketing levels. By means of the Concurrent Marketing Margin Analysis approach, it was established that the farmers' portion of the consumer's Rand is low. About 85.1% of the consumer's Rand goes to pay for marketing margins. Granger causality tests show that both the wholesale and retail prices are caused by farm gate prices. The farm level is therefore key to tomato price determination in Limpopo Province of South Africa and pertinent policies that improve the commodity's primary sector may potentially enhance the other sectors in value chain that depend on tomato production.*

Keywords— Limpopo Province, market dominance, marketing margins, price flow, tomato markets, vertical price linkage.

I. INTRODUCTION

Agricultural productivity has improved throughout history because of economic progression, innovation, specialization, research and development (Fuglie et al., 2007; Fuglie and Nin-Pratt, 2012; Nin-Pratt, 2013). This has increased the productive capacities of farmers who in time have been able to produce in excess of what is needed for home consumption and subsistence. Such developments augmented the significance and complexity of marketing and have seen the establishment of arenas to facilitate the exchange of marketable surplus between producers and consumers.

In the context of the tomato industry of South Africa, it is highlighted in Department of Agriculture, Forestry and Fisheries (DAFF) (2011) that production of tomato occurs in all the nine provinces of South Africa by both commercial and emerging farmers. However, different provinces produce varied volumes due to environmental disparities amongst other factors. The Limpopo Province with its warmer climate plays the most vital role in the country's tomato production. According to DAFF (2011) the province contributes about 3 590 ha to the country's total area planted to tomatoes. Limpopo Tourism and Parks Board (2011), suggests that almost 60% of the country's tomatoes are produced in Limpopo Province which is responsible for about 45% of the Johannesburg Fresh Produce Market's annual turnover. However, the Limpopo Province's tomato producing industry's concentration is high which in economics sense means that a large share of total production is dominated by a few large producers. Limpopo Tourism and Parks Board (2011), indicates that only one farming company is responsible for about 40% of the province's 60% contribution to South Africa's total tomato production.

Even though the majority of tomato is produced in the Limpopo Province, the commodity is consumed in all parts of the country and is also exported thus; there is some degree of spatial separation between production and consumption. Such spatial distribution calls for the need for an efficient and effective marketing system to facilitate the movement of tomatoes from the point of production to the end user. Bringing the agricultural product from the agricultural enterprise to the consumer according to Saccomandi (1998), involves a series of functions and productive activities that interconnect. The process also depends on the current state of technology, the organization of productive activities and the spatial distribution of production and consumption.

II. PROBLEM STATEMENT

There is high industry concentration in the tomato producing industry of the Limpopo Province. Such a situation where the industry is dominated by a few large firms paves way to major producers potentially using their market power to influence pricing strategies from time to time. As to which of the participants in the chain will consequently suffer or benefit from

impending price shocks depends on the degree to which market players adjust to price signals. It also depends on the timing in response and the extent to which their adjustment to price shocks is asymmetric as shown in Vavra and Goodwin (2005).

Particular aspects of participants' response to price movements may also have important implications on marketing margins of several players in the marketing chain of tomato in Limpopo Province. While farmers may view their proportion of the consumer's Rand as low, tomato consumers on the other hand experience continual rising prices of this commodity. It may be questioned therefore, as to whom in the marketing chain sits at point(s) of price determination. It may also be of interest to determine the direction of price causality along the marketing chain for tomato in Limpopo Province so as to guide any pricing policy in the respective food market.

III. AIM AND OBJECTIVES

This study seeks to analyze marketing margins and the direction of price flow in the tomato value chain of Limpopo Province South Africa so as to determine the performance of tomato markets in the region. It's is imperative to estimate the point(s) of price determination and direction of causality along the marketing chain for tomato in Limpopo Province so as to guide food marketing and pricing policies.

IV. RESEARCH HYPOTHESES

1. Price and direction of causality along the marketing chain for tomato in Limpopo Province are determined beyond the farm gate.
2. The proportion of the consumer's dollar that goes to pay for marketing margins is uncertain.

V. LITERATURE REVIEW

According to FAO (2002), the percentage share of the final price, which is taken up by the marketing functions, is what is known as the marketing margin. Guvheya et al. (1998) treated the concept of marketing margins as differences between prices at different levels in the marketing channel which capture the proportion of the final selling price that a particular agent in the marketing chain adds. Elitzak (1996) characterize marketing margins or the farm-to-retail price spread as the difference between the farm value and retail price that represents payments for all assembling, processing, transporting and retailing charges added to farm products. Cox (2009) noted that producers often wonder about the large difference between the prices that consumers pay for food and the prices that farmers receive. However, high marketing margins can be justified by costs involved in distributing the product from point of production to the final consumer. It can be argued though, that too high a percentage reflects some exploitation of either farmers or consumers. Wohlgenant (2001) investigated marketing margins and identified some of the questions that are frequently asked about the issue. These questions, which have attracted considerable interest across literature and amongst researchers and policy makers, include; Are marketing margins too large? What is the incidence of marketing costs on retail prices and farm prices? How quickly are farm prices transmitted to the retail level and how quickly are retail price changes transmitted to farmers? In order to have a thorough and exact investigation, Mojtaba et al. (2010) recommended that the marketing margin be divided into two smaller portions namely Retailer Margin (RM) and Wholesaler Margin (WM). RM refers to the difference between the price paid by consumers and the price that retailers pay to the wholesalers. WM refers to the difference between the price at which wholesalers sell their product and the price that they pay to the farmers.

While price represents the equilibrium point where demand and supply meet in the market place, Schnepf (2006) emphasizes that the general price level of an agricultural commodity, at any stage, is influenced by a variety of market forces that can alter the current or expected balance between supply and demand. According to Holland (1998) price determination for many consumer products is in most cases a function of the cost of production and a desired level of mark-up. Price determination by this desired level of mark-up is what is referred to as cost-plus pricing, mark-up pricing or full-cost pricing which in Salvatore (1993) is related to three rules of thumb. The first is termed; mark-up percent, which is the proportion of profit to total cost. The second is the gross margin percent, which is the proportion of profit to the selling price, and lastly, profit margin, which is the difference in selling price and total cost.

VI. STUDY AREA, DATA COLLECTION AND SAMPLING TECHNIQUE

This study is based mainly on the Limpopo Province which is the northernmost province of South Africa covering a total surface area of 123,910 km2 making it the fifth largest province amongst the country's nine provinces. Limpopo Province can be described as the garden of South Africa due to its rich fruit and vegetable production. Apart from being South Africa's

main tomato producer Limpopo Province is responsible for about 75% of the country's mangoes, 65% of its papayas, 36% of its tea, 25% of its citrus, bananas, and litchis, 60% of its avocados, 285 000 tons of potatoes, and 35% of its oranges. Most of tomato production in the province is done by a private corporation, who is also the largest tomato farmer in South Africa. The province is also involved in the production of coffee, nuts, guavas, sisal, cotton, tobacco, sunflower, maize, wheat, grapes and timber. Livestock production and game ranching is also prominent particularly in most of the higher-lying areas (vanNiekerk, 2012; Limpopo Tourism and Parks Board, 2011).

This study used both primary and secondary data of time series in nature. Daily tomato prices were collected synchronously at farm gate, wholesale and retail levels for mixed grades of cooking tomatoes to achieve a sample size of 50 observations. Semi structured interviews and desk studies were also conducted to explore the procurement and marketing procedures followed by various participants in tomato marketing in the Limpopo Province.

VII. MARKETING MARGIN ANALYSIS

In analysing the marketing margins, the Concurrent Margin Method was used. As described by Singh (1998) the method is a static analysis of the distributive margin usually adopted to calculate the price spread in one market town by considering differences between prices prevailing at successive stages of marketing at a given point of time.

The model is defined as thus;

$$M_t = P_{t,L} - P_{t,L-1} \text{ where;} \quad (1)$$

M_t= Marketing margin between market level (L) and its preceding level (L-1) at time (t)

$P_{t,L}$ = Price at market level (L) at time (t)

$P_{t,L-1}$ = Price at market level (L-1) at time (t)

Where marketing margins at different levels of the marketing chain are compared, Guvheya et al. (1998) emphasizes the use of consumer price as the common denominator for all margins.

The two indices that were used in this study are Total Gross Marketing Margin (TGMM) and Producers' Gross Marketing Margin (GMMp) as given in Scott (1995) where Gross Marketing Margin is the difference between consumer's price and farmer's price. TGMM and GMMp were calculated as;

$$\text{TGMM} = \frac{Consumer\ Price - Farmer's\ Price}{Consumer\ Price} \text{ x } 100, \quad (2)$$

and

$$\text{GMMp} = \frac{Price\ paid\ by\ the\ consumer - Gross\ Marketing\ Margin}{Price\ paid\ by\ the\ Consumer} \text{ x } 100 \quad (3)$$

VIII. TESTING FOR UNIT ROOT NON-STATIONARITY

The Augmented Dickey Fuller test was performed on each of the logarithmic series of farm prices (FP), wholesale prices (WP) and retail prices (RP) to formally ascertain whether they contained a unit root.

IX. PRICE DETERMINATION AND DIRECTION OF CAUSALITY

In assessing the points of price determination and the direction of causality along the major marketing channels for tomato in Limpopo Province, Granger causality tests (Granger, 1969) were performed.

Three sets of Vector Autoregressive (VAR) models were formulated and estimated;

(a) Testing causality between farm gate and wholesale levels:

$$ln\text{FP}_t = \alpha_1 + \sum_{i=1}^{n} a_i ln\text{WP}_{t-i} + \sum_{i=1}^{n} b_i ln\text{FP}_{t-i} + U_{1t}$$

$$ln\text{WP}_t = \alpha_2 + \sum_{i=1}^{n} c_i ln\text{WP}_{t-i} + \sum_{i=1}^{n} d_i ln\text{FP}_{t-i} + U_{2t} \quad (5)$$

(b) Testing causality between wholesale and retail levels:

$$lnWP_t = \alpha_1 + \sum_{i=1}^{n} a_i lnRP_{t-i} + \sum_{i=1}^{n} b_i lnWP_{t-i} + U_{1t}$$

$$lnRP_t = \alpha_2 + \sum_{i=1}^{n} c_i lnRP_{t-i} + \sum_{i=1}^{n} d_i lnWP_{t-i} + U_{2t} \quad (6)$$

(c) Testing causality between farm and retail levels:

$$lnFP_t = \alpha_1 + \sum_{i=1}^{n} a_i lnRP_{t-i} + \sum_{i=1}^{n} b_i lnFP_{t-i} + U_{1t}$$

$$lnRP_t = \alpha_2 + \sum_{i=1}^{n} c_i lnRP_{t-i} + \sum_{i=1}^{n} d_i lnFP_{t-i} + U_{2t} \quad (7)$$

**where*; *ln* is the natural logarithm of each respective price series

FP_t is the farm price at time (t)

WP_t is the wholesale price at time (t)

RP_t is the retail price at time (t)

FP_{t-i} is lagged farm gate price

WP_{t-i} is lagged wholesale price

RP_{t-i} is lagged retail price

n is the upper limit set at the optimal lag length

a_i, b_i, ci, and d_i are coefficients to be estimated using the ordinary Least squares method and α_1 and α_2 are intercepts

U_{1t} and U_{2t} are error terms that are assumed uncorrelated and white noise

The inference in the first mathematical statement of equation 5 is that current farm prices are dependent on past farm prices and past and present wholesale prices.

Likewise, the second mathematical statement postulates that current wholesale prices are dependent on past farm prices and past and present wholesale prices.

The inference in the first mathematical statement of equation 6 is that current wholesale prices are dependent on past wholesale prices and past and present retail prices.

Likewise, the second mathematical statement postulates that current retail prices are dependent on past wholesale prices and past and present retail prices.

The inference in the first mathematical statement of equation 7 is that current farm gate prices are dependent on past farm prices and past and present retail prices.

Likewise, the second mathematical statement postulates that current retail prices are dependent on past farm gate prices and past and present retail prices.

In each of the cases (a), (b) and (c), four causality relationships were tested by placing the appropriate restrictions on each model. P-values and F-tests were used to confirm statistical significance of the causality relationships.

For instance, in case (a) the following were the causality relationships tested between farm gate and wholesale prices;

(i) A unidirectional causality from wholesale to farm gate levels would be concluded if;

$\sum_{i=1}^{n} a_i \neq 0$ and $\sum_{i=1}^{n} d_i = 0$

(ii) A unidirectional causality from farm gate to wholesale levels would be concluded if,

$\sum_{i=1}^{n} a_i = 0$ and $\sum_{i=1}^{n} d_i \neq 0$

(iii) An absence of a causal relationship between the variables that is independence would be concluded if both

$\sum_{i=1}^{n} a_i = 0$ and $\sum_{i=1}^{n} d_i = 0$

This would imply that both sets of the lagged exogenous variables were not statistically different from zero.

(iv) a bilateral causality or feedback would exist if both

$\sum_{i=1}^{n} a_i \neq 0$ and $\sum_{i=1}^{n} d_i \neq 0$

This would imply that both sets of the lagged exogenous variables were, as a group, statistically significantly different from zero.

In formulating the above sets of VAR models, the VAR Lag Order Selection Criteria (VLOSC) was used to determine the optimal lag length.

X. RESULTS OF THE STUDY

10.1 Marketing Margin Analysis

Prices of the tomatoes varied across the marketing chain over time. For the ten week period the highest weekly average farm gate price was ZAR1.85/kg, while the lowest was ZAR1/kg and the average farm gate price for the whole period was ZAR1.37/kg. The highest wholesale price was ZAR5.45/kg; while the lowest was ZAR3.10/kg and the whole period average was ZAR4.73/kg. The highest retail price was ZAR9.60/kg, while the lowest was ZAR8.79/kg and the average was ZAR9.20/kg.

Table 1 shows the marketing margin structure of Limpopo Province's tomato marketing chain on five day weekly basis for the period of study.

TABLE 1
FIVE DAY WEEKLY MARKETING MARGINS FOR LIMPOPO PROVINCE'S TOMATO MARKET CHAIN

	South African Rands (ZAR)/ kg						%	
Week	FP	WP	RP	F-to-W GMM	W-to-R GMM	F-to-R GMM	Total GMM	Producer GMM
1	1.33	4.17	8.79	2.84	4.61	7.45	84.84	15.16
2	1.34	4.93	9.28	3.60	4.34	7.94	85.58	14.42
3	1.85	4.80	9.37	2.95	4.57	7.52	80.27	19.73
4	1.76	5.23	8.95	3.48	3.71	7.19	80.36	19.64
5	1.14	4.42	9.08	3.28	4.66	7.94	87.44	12.56
6	1.00	3.10	9.60	2.10	6.50	8.60	89.58	10.42
7	1.46	5.45	9.49	3.98	4.04	8.03	84.56	15.44
8	1.29	5.19	9.15	3.90	3.97	7.86	85.94	14.06
9	1.18	4.98	9.09	3.81	4.11	7.92	87.07	12.93
10	1.36	5.02	9.20	3.66	4.18	7.83	85.19	14.81
Average	1.37	4.73	9.20	3.36	4.47	7.83	85.08	14.92

The average farm-to-wholesale gross marketing margin (FWGMM) of R3.36 and the average wholesale-to-retail gross marketing margin (WRGMM) of R4.47 in sum give us the average farm-to-retail gross marketing margin (FRGMM) of R7.83. With the average retail price of R9.20, it follows that consumers typically had to part with R9.20 for every kilogram of tomato they purchased from retailers. However, comparing the FRGMM of R7.83 with the average retail price we can conclude that the total gross marketing margins constituted about 85.1% of the consumer's Rand. With such a high marketing margin, the common hypothesis that the farmers' portion of the consumer's Rand is low holds true. During the period of analysis, tomato farmers were getting only 14.9% from every Rand spent by consumers on tomatoes at retail level.

10.2 Unit Root Tests

The information on margins, given in the previous section, prompts the need to undertake further explorations on vertical price linkages amongst different levels in the marketing chain of tomatoes in Limpopo Province. The statistical properties of the price series are analysed before carrying out causality tests. Table 2 presents an abstract of results of the unit root tests performed on lnFP, lnWP, and lnRP according to the Augmented Dickey-Fuller (ADF) criteria.

TABLE 2
AUGMENTED DICKEY FULLER TEST RESULTS ON lnFP, lnWP, lnRP IN LEVELS

Null Hypotheses: each of lnFP, lnWP, and lnRP contain a unit root			
lnFP	ADF test statistic Test Critical Values	t-Statistic Prob. -2.083252 0.5419 1% level -4.156734 5% level -3.504330 10% level -3.181826	Lag Length: 0 (Automatic - based on SIC, maxlag=5) DW stat: 1.799676
lnWP	ADF test statistic Test Critical Values	t-Statistic Prob -0.073823 0.6531 1% level -2.614029 5% level -1.947816 10% level -1.612492	Lag length: 1 (Automatic - based on SIC, maxlag=5) DW stat: 2.089489
lnRP	ADF test statistic Test Critical Values	t-Statistic Prob 0.126524 0.7180 1% level -2.613010 5% level -1.947665 10% level -1.612573	Lag length: 0 (Automatic - based on SIC, maxlag=5) DW stat: 2.548604

The results in Table 2 shows that ADF test-statistic values of the three price series are greater than the MacKinnon critical values for rejecting the hypotheses of a unit root. As a result, we cannot reject the null hypothesis of a unit root at 1%, 5% and 10% levels of significance. This regression result can be trusted since the Durbin-Watson statistics are all significant enough to reject the presence of serial correlation in each of the three series. With the statistical evidence generated, we can therefore conclude that the farm gate, wholesale and retail price series of Limpopo produced tomatoes for the period of analysis is non-stationary.

Vavra and Goodwin (2005) noted that most economic time series being non-stationary in nature need some transformation through differencing or de-trending, otherwise the regression will be spurious. Spurious regressions occur when the mean, variance and covariance of a time series vary with time. The classic results of a usual regression cannot be legitimate if non-stationary series of data is used for analysis.

As such, first differences were taken on each of the three series lnFP, lnWP, lnRP to come up with a differenced set of data, DlnFP, DlnWP, and DlnRP that is unit root free. The summary of the ADF test on the first differenced series are shown in Table 3.

TABLE 3
AUGMENTED DICKEY FULLER TEST ON DlnFP, DlnWP, and DlnRP (FIRST DIFFERENCES)

Null Hypotheses: each of DlnFP, DlnWP and DlnRP contain a unit root			
DlnFP	ADF test statistic Test Critical Values	t-Statistic Prob -6.644587 0.0000 1% level -4.161144 5% level -3.506374 10% level -3.183002	Lag length: 0 (Automatic - based on SIC, maxlag=3) DW stat: 2.004682
DlnWP	ADF test statistic Test Critical Values	t-Statistic Prob -11.33005 0.0000 1% level -4.161144 5% level -3.506374 10% level -3.183002	Lag length: 0 (Automatic - based on SIC, maxlag=5) DW stat: 2.097217
DlnRP	ADF test statistic Test Critical Values	t-Statistic Prob -9.150489 0.0000 1% level -2.614029 5% level -1.947816 10% level -1.612492	Lag length: : 0 (Automatic - based on SIC, maxlag=5) DW stat: 2.030275

Table 3 shows that ADF test-statistic values of the three differenced price series are less than the MacKinnon critical values for rejecting the hypotheses of a unit root. As a result, the null hypothesis of a unit root in first differences of lnFP, lnWP and lnRP can be rejected at 1%, 5% and 10% levels of significance. Again, the regression result can be trusted since it passed the Durbin-Watson test. It can therefore be concluded with 99% confidence that the DFP, DWP and DRP series of Limpopo produced tomatoes for the period of analysis are stationary since there is enough statistical evidence to support this. The implication of the ADF tests results is that the series generating the three price variables are all integrated of order one, that is, I(1).

10.3 Lag Order Selection Criteria

The next step was to carry out the lag-order-selection criteria for correct specification of the VAR model to use in Granger Causality tests. Results showing the optimal lag lengths to use in the causality tests are summarized in Table 4. For the sample with 50 observations, lnFP and lnRP were the endogenous variables, while the constant C was the only exogenous variable.

TABLE 4
VECTOR AUTO REGRESSIVE LAG ORDER SELECTION CRITERIA (lnFP and lnRP)

Lag	LR	FPE	AIC	SC	HQ
0	NA	6.40e-05	-3.980930	-3.900634	-3.950997
1	70.25371	1.44e-05	-5.475860	-5.234972*	-5.386059*
2	6.503296	1.46e-05	-5.460664	-5.059184	-5.310997
3	4.282047	1.56e-05	-5.395572	-4.833499	-5.186037
4	9.614758*	1.44e-05	-5.484871	-4.762206	-5.215469
5	7.539553	1.39e-05*	-5.528845*	-4.645588	-5.199575

In Table 4, the asterisk (*) indicates lag order selected by each criterion, LR is the sequential modified LR test statistic (each tested at 5% level), FPE is Final Prediction Error, AIC is the Akaike Information Criterion, SC is the Schwarz Information Criterion and HQ stands for Hannan-Quinn Information Criterion. The VAR lag order selection criteria results summarized in Table 4 show that AIC and FPE chose 5 lags, SC and HQ 1 lag and only LR chose 4 lags. However, retailers indicated that they in most cases alter their tomato prices on weekly basis. It is therefore reasonable to accept the AIC and FPE choices given the available knowledge of the tomato retail markets in Limpopo Province. As a result, five lags were used as the optimal lag length for testing Granger Causality and cointegration relationships between farm gate prices and retail prices.

A similar procedure was done to determine the optimal lag length between farm gate and wholesale prices and results are shown in Table 5. For the sample with 50 observations, lnFP and lnWP were the endogenous variables, while the constant C was the only exogenous variable.

TABLE 5
VECTOR AUTO REGRESSIVE LAG ORDER SELECTION CRITERIA (lnFP and lnWP)

Lag	LR	FPE	AIC	SC	HQ
0	NA	0.001598	-0.763229	-0.682933	-0.733296
1	59.44108*	0.000464*	-2.000715*	-1.759827*	-1.910915*
2	3.811524	0.000504	-1.918226	-1.516745	-1.768558
3	2.279414	0.000569	-1.800433	-1.238360	-1.590898
4	7.039860	0.000563	-1.818206	-1.095541	-1.548804
5	4.482782	0.000594	-1.772275	-0.889018	-1.443006

Table 5 shows that the optimal lag length between the farm and wholesale is one. In the same way the VAR Lag Order Selection Criteria results for wholesale and retail prices are shown in Table 6.

TABLE 6
VECTOR AUTO REGRESSIVE LAG ORDER SELECTION CRITERIA (lnWP and lnRP)

Lag	LR	FPE	AIC	SC	HQ
0	NA	3.93e-05	-4.467427	-4.387131	-4.437494
1	26.85320*	2.48e-05*	-4.929011*	-4.688123*	-4.839211*
2	7.009408	2.49e-05	-4.926469	-4.524988	-4.776801
3	2.730931	2.78e-05	-4.820558	-4.258485	-4.611023
4	3.816023	3.00e-05	-4.748781	-4.026116	-4.479378
5	7.354435	2.92e-05	-4.787310	-3.904052	-4.458040

Table 6 shows that the optimal lag length between the wholesale and retail is one. lnWP and lnRP were the endogenous variables.

10.4 Granger Causality Tests

The results for the pair wise Granger causality test on the series lnFP, lnWP and lnRP are presented in Table 7.

TABLE 7
RESULTS OF PAIR WISE GRANGER CAUSALITY TESTS FOR lnFP, lnWP, and lnRP

Null Hypothesis	Lags	Obs.	F-stat.	Prob.	Decision
lnWP does not Granger Cause lnFP	1	49	9.1E-06	0.9976	Do not reject
lnFP does not Granger Cause lnWP			8.19633	0.0063	Reject
lnWP does not Granger Cause lnRP	1	49	0.77784	0.3824	Do not reject
lnRP does not Granger Cause lnWP			0.28772	0.5943	Do not reject
lnFP does not Granger Cause lnRP	5	45	3.93156	0.0064	Reject
lnRP does not Granger Cause lnFP			1.12593	0.3654	Do not reject

10.5 Price Causality between Farm and Wholesale

Table 7 shows that the p-value (0.0063) is significant at 1% level. As a result the hypothesis that lnFP does not cause lnWP can be rejected. In support of this assertion, the p-value (0.9976) on the other hand is insignificant which means we cannot reject the hypothesis that lnWP does not cause lnFP. With such statistical evidence, it can be concluded that there exists a unidirectional causality from the farm level to the wholesale level. This implies that farm prices cause wholesale prices. A high industry concentration that is present at the farm level can be the reason for the direction of price flow from the farm gate (who has market power) to the wholesale (who use the commission system based on the prices set by farmers).

10.6 Price Causality between Wholesale and Retail

Table 7 also shows that both p- values (0.3824 and 0.5943) are insignificant at 5% level, as such we do not reject the null hypotheses of lnWP not Granger causing lnRP and lnRP not Granger causing lnWP. However, the F-statistic probabilities indicate a slight possibility of the hypothesis of lnWP not causing lnRP more likely to be rejected at a higher significance level. In this sense, it is more likely that wholesale prices may perhaps cause the retail prices than the opposite even though the chances are trivial. This weak causal relationship is represented by the dotted line in Figure 1. The empirical evidence available at 5% level even so, still suggests that there is no extrapolative power between wholesale prices and retail prices. It therefore follows that an independent causal relationship exists between the wholesale and the retail levels. Possible explanations for such a causal relationship is the growing outsourcing behaviour of, and direct purchasing from the farms by some tomato retailers in the Limpopo Province. For instance during the exploratory phase of this study, it was established that some retailers consider the National Fresh Produce Markets as a competitor than a supplier.

10.7 Price Causality between Farm and Retail

The p-value (0.0064) is significant at 1% level while p-value (0.3654) is insignificant at 1%, 5% and 10% levels. The hypothesis that lnFP does not cause lnRP can therefore be rejected while the one for lnRP not causing lnFP cannot. It can be concluded that prices stream unidirectional from the farm level to the retail level. In other words, farm gate prices have a predictive power on retail prices. The market structure of the tomato industry in Limpopo Province suggests a high concentration at the farm level than at the retail. Such can be the reason for the direction of price flow from the farm (who has more market power) to the retail level.

The causality relationships that exist amongst the three series are demonstrated in Figure 1. Arrows represent the direction of price flow, where solid and dotted lines symbolize a strong and a weak causal relationship respectively.

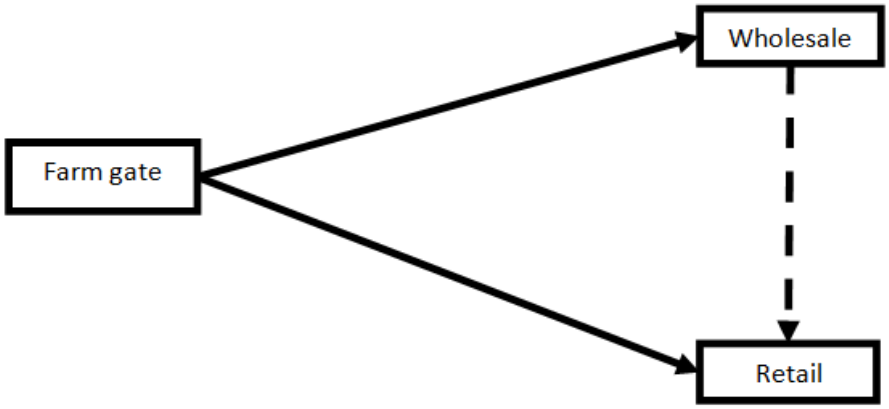

FIGURE 1: POINTS OF PRICE DETERMINATION AND DIRECTION OF PRICE CAUSALITY

As shown in Figure 1, the farm gate plays a major role in the price formation process of tomato markets in Limpopo Province. Therefore, the farm gate's current and past price information is useful in improving the forecasts of both the wholesale and retail prices it causes. Figure 1 also indicates that there is a weak causal relationship between the wholesale and retail level prices. The weak dependence of Limpopo retail prices on wholesale prices can be attributed to the proximity of retailers to tomato farms than they are to the National Fresh Produce Markets. As a result it is sensible that Johannesburg wholesale prices may be seldom useful in predicting tomato retail prices in Polokwane considering the increasing direct sourcing by Limpopo retailers from farmers.

XI. SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

The study attempted to fill the knowledge gap on the performance of Limpopo Province's tomato markets by examining prices at successive marketing levels. The gross marketing margins constitute about 85.1% of the consumer's South African Rand. There exists a large gap between what consumers pay for each unit of tomatoes purchased from retailers, and the amount farmers receive for the same quantity from retailers in Limpopo Province. It therefore follows that the producers' portion of the consumers' purchasing power is low since according to the findings, a major part of tomato retail prices is taken up by the marketing functions.

The VAR lag order selection criteria showed that the optimal lag lengths between the levels; farm gate and wholesale, farm gate and retail, wholesale and retail are 1, 5 and 1 respectively. Since the reaction to a price change at the point of determination does not reflect instantaneously at the other levels in a marketing chain, these optimal lag lengths indicate that wholesale prices are faster in adjusting to farm gate price changes than do retail prices.

The results of the pair-wise Granger Causality tests suggested a unidirectional causality from farm to wholesale and also from farm to retail. However, a weak causal relationship was found between wholesale and retail levels. It therefore follows that tomato prices are determined at the farm gate in Limpopo Province. This finding may be consistent with the expectation that whenever an industry is highly concentrated, the most dominant participant may also act as the price leader as is the case in the tomato producing industry of Limpopo Province, South Africa.

An important conclusion drawn from the causal relationships between the farm gate, wholesale and retail prices is that the farm level is key to tomato price determination in Limpopo Province. It therefore means that current and past information on farm gate prices is useful in improving estimations of both wholesale and retail prices it causes. According to Guvheya et al. (1998), information on causality shows the direction of price flow between levels and thus helps in the identification of points of price determination along the marketing chain. In the light of this assertion, it can be concluded that tomato prices in Limpopo Province are determined at the farm level. With the farm level being key to tomato price determination in Limpopo Province of South Africa, pertinent policies that improve the commodity's primary sector may by the ripple effect, potentially benefit the other sectors in the value chain who are also dependent on tomato production.

This this study has shown the importance of the farm level at deciding the market price for food. Governments in the developing economies such as South Africa are encouraged to intensify small scale farmers support programs so as to reduce industry concentrations as well as encourage fairer competition in the food producing sectors of their respective economies. This will ensure that agricultural produce prices will not be determined by a few major producers. A scenario where only one producer dominates a market potentially leads to situation where all price movements are influenced by this single player while the other farmers are simply price takers regardless of their cost structures.

XII. AREAS FOR FURTHER STUDY

The study established that the gross marketing margins of tomato in Limpopo Province are high. However the source of such huge marketing margins has not been ascertained between marketing costs and retailers' profits. This study only managed to alert on the existence of high marketing margins that constitute the major portion of the consumer's Rand. It is therefore recommended that further research be undertaken to establish whether the retailers' profits are unfairly high or peradventure whether the marketing margins are as a result of high marketing costs. Such a complementary study will assist in identifying the actual basis of the high marketing margins so that corrective policy measures can be directed appropriately and more specifically.

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