

# Assessing the Impact of Retail and Wholesale Market Prices on Farmer Decision Making Behavior on the Cultivation of Up-Country Vegetables in Sri Lanka

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## ABSTRACT

This study examines the seasonal price behavior and wholesale retail price spread of a number of vegetables cultivate in the Up country in Sri Lanka, including Tomato, Potato, Bean and Beetroot on farmer decision making behavior using the time series data from 1990 to 2002. Based on the twelve-month Moving Average method, the Seasonal Price Index of each vegetable was estimated to examine the impact of seasonality on the retail prices of these vegetables in the Colombo market. The results suggest that the retail prices reached to the maximum ("peak phase") in the month of June/July and in December/January and to the minimum ("depressed phase") in February to April and in August to October.

A Relative Price Spread model was used to identify the factors that effect on Market Margin and the Wholesale Retail Price Spread of the vegetables. The results revealed that the retail price acts as the crucial factor for farmer decision-making on the cultivation of these vegetables, since it has positive and statistically significant effect on the Market Margin. Further, the correlation analysis showed that the decision making on crop selection for cultivation is done based on the current retail prices of those vegetables prevailing in the market, and farmers, in general, select the vegetable which has the higher retail price at the point of their decision making.

**KEY WORDS:** Correlation, Market margin, Relative Price Spread Model, Seasonal price Index.

## INTRODUCTION

Next to rice, the vegetable sub-sector is the most important in the agricultural sector. As with rice, vegetables are grown throughout the country and a large number of farmers are engaged in it. Most of the farmers in the hill country derive their primary income from vegetable farming. Vegetable industries in Sri Lanka is characterized by high dependency on weather, small scale production, perishability of the product, high use of family labor and is more concentrated in remote areas where transport, electricity, communication and water facilities are lacking. This results in severe price fluctuations, high post-harvest losses and high cost of business activities.

Vegetables are not only important for the farming community, but also for the consumers as well. An average consumer spends nearly 6 percent of his expenditure on vegetables (Consumer Finance Survey, Central Bank of Sri Lanka, 1986/1987). Prices of vegetables affect the cost of living of people. Vegetable consumption contributes to an increase in the nutritional level of the people, especially the poor, because vegetables are the cheapest source out of many of the elements required for human nutrition. The annual vegetable production is about 500, 000 metric tons, with an extent of 70, 000 hectare, but availability is less than the requirement. Trend in production of major up country vegetables is shown in Figure 1. It shows that higher production was recorded for potato compared to other vegetables and it was fluctuated through out the year. Lower and somewhat stable production has recorded for beetroot, whereas bean and tomato had similar trend in production.

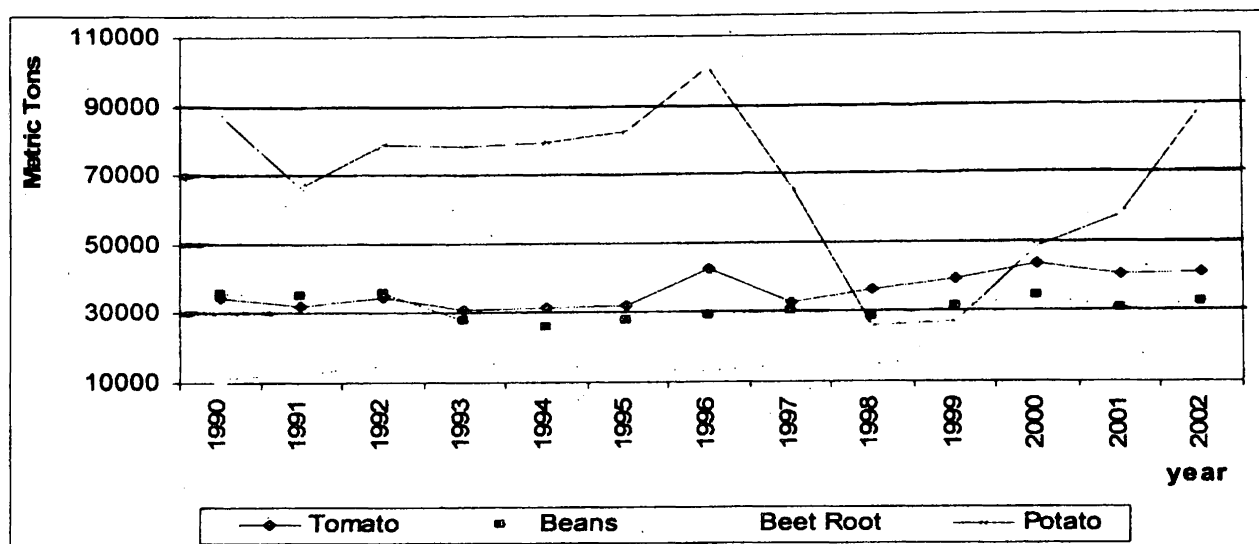
The study of price behavior is an essential request of any sound price policy. In economic theory price is formed by demand and supply. In the case of

vegetable industry price is mainly determined by supply, since the consumption of vegetables does not vary in the short run. Assurance of a profitable price to the farmer will be essential for encouraging investment in agriculture and for the adoption of modern technology. Farmers in general always respond to the current market price but not to the future price ("Cobweb Theorem"). It reveals that the attitude in crop selection indicated that farmers are less market oriented, which means they look for market after production. Instability in the prices of farm products has far reaching consequences. Price fluctuations play an important role in guiding the farmers in decision making on production.

Middlemen offer an important marketing service of getting farm produce from the farm gate to the retail market and they are allowed to charge a premium to cover the cost of marketing services. A widening of the marketing margin for a crop could discourage farmers from production. Marketing Margin (MM) analysis is also an important aspect of agricultural marketing and useful in determining unfair pricing practices. Market Margin can be defined "as the percentage share of the final price that is taken by the marketing functions". By determining the factors that significantly influence marketing margin, policy instruments could be put in place to facilitate a more efficient marketing of farm produce.

Purpose of this paper was to identify the determinants of the margin earned by the retailer (Wholesale Retail Price Spread) for Tomato, Potato, Bean and Beetroot and to determine the impact of each factor on retailer margin. Also the paper examines the Seasonal Behavior of Retail Prices of these selected vegetables in Colombo market.

Figure 1 - Trend in production of selected Up-Country vegetables in Sri Lanka:



**METHODS**

This section presents the methods used to analyze Marketing Margin (retailer margin) and ways and means of data collection and analysis.

**Analytical Framework**

In this section Relative Price Spread Model was used to examine the impact of different factors on retailer margin. The Relative Price Spread (RPS) Model of Wohlgenant and Mullen (1987) have widely applied in marketing margin analysis. Breaster and Music (1995) applied the RPS model to study the effect of market concentration on lamb marketing margin. The RPS model assumes profit maximization, implying that firms will offer marketing services to the point at which the marginal value of the services (equivalent to the marketing margin) is equal to the marginal cost.

The model is represented by:

$$M = K(Q, C), \tag{1}$$

Where  $M$  is the marketing margin or retail wholesale price spread,  $K$  is the marginal cost of services,  $Q$  is the quantity of output and  $C$  is the vector of prices of marketing inputs. As indicated in equation (1), the marginal cost of marketing services depends on the output quantity and the prices of marketing inputs. Wohlgenant and Mullen showed that equation (1) is equivalent to (2) below:

$$M = P_m K(Q, C/P_m), \tag{2}$$

Where,  $P_m$  is the market price.

**Empirical Model**

Using the RPS model as a basis, the empirical model for analyzing the marketing margin is stated as:

$$MM_{kt} = \beta_1 P_{m,kt} + \beta_2 P_m Q_{kt} + \beta_3 MC_{kt} + \epsilon_{kt} \tag{3}$$

Where  $MM$  is the real marketing margin (Retailer margin) as the difference between the real retail price and real wholesale price,  $P_m$  is the real retail price,  $Q$  is the quantity output,  $MC$  is an index of the cost of marketing services and  $\epsilon$  is an independent identically distributed error term. The  $\beta$ 's are model parameters and the indices  $k$  and  $t$  represent particular vegetable type and time period respectively. For the analysis of marketing margin model (3) was used.

**Data Collection and Analysis**

Production and price data (Wholesale and Retail prices) for potato, tomato, bean and beetroot from year 1990 to 2002 were used for the analysis of Marketing Margin. All nominal prices were converted to real prices using the price deflators and the real prices were used for the analysis. Greater Colombo Consumer Price Index for transport and communication (GCCPI) was used as a proxy for Marketing Cost (MC) in the empirical model of MM. Annual average vegetable production was converted to quarterly production using the mean retail price index for each quarters, with the assumption of price is inversely related to the production.

All necessary price and production data were collected from the Marketing and Food Policy division of Hector Kobbekaduwa Agrarian Research and Training Institute, Colombo. GCCPI for transport and communication was collected from Central Bank Report of Sri Lanka from year 1990 to 2002.

**Marketing margin analysis:** Both Linear and Log Linear form of the empirical model (model 3) were estimated using Ordinary Least Square (OLS) method for relevant vegetables. In order to find the possible effects of seasonal changes, dummy variables were created for each quarter (as Quarter1 for January to April, Quarter2 for May to August and Quarter3 for September to December) and included in the empirical model. Linear model was best fitted than log linear model and linear model was used for the MM analysis.

**Analysis of seasonality:** Seasonality in average monthly retail prices in Colombo market for above selected vegetables was analyzed using the time series data from 1993 to 2002. Price Indices were used to study the seasonal price behavior of agricultural products within a year. Ten year average retail prices for each month in Colombo market were calculated (1993-2002). Twelve month moving averages for relevant crops were computed. Then the ratios of the average monthly retail prices to the corresponding average were formed to arrive at a seasonal price index for each month. These ratios measure the monthly deviations from the average. Index has been formulated by taking the average price index for a particular year is equal to 100.

**Correlation Analysis:** Time series data of monthly retail prices in Colombo market for above selected vegetables from 1985 to 2003 were used to find the association among the retail prices at current month and at three-month lag. The aim of this analysis was to find the impact of retail prices on farmer decision-making on cultivation of Up-Country vegetables.

## RESULTS AND DISCUSSION

### Descriptive Statistics

Descriptive statistics on retail and wholesale prices and retailer margins are presented in Table 1. It shows that retailers obtain half of the market price as margin for tomato and beetroot whereas very low margin for potato. Retail margins of each vegetable during 1990 to 2002 are presented in Figure 2. Retailer margin for tomato is very high compared to other three vegetables and it has decreasing trend over the year (Figure 2). Retailer margin of tomato was followed by beetroot, bean and potato. Higher margin was recorded for tomato in 1<sup>st</sup> quarter of 1994 and in 2<sup>nd</sup> quarter of 1995 as 8.25 Rs/Kg.

Table 1 – Descriptive statistics of variables used in the empirical model of marketing margin:

Variable (Rs/Kg)	Mean	Std. Dev	Min	Max
<b>Tomato</b>				
Real marketing margin	5.42	1.23	1.98	8.25
Real wholesale price	6.19	1.85	3.57	10.31
Real retail price	11.60	2.68	7.36	18.56
<b>Potato</b>				
Real marketing margin	2.55	0.58	1.47	3.91
Real wholesale price	10.45	3.23	5.62	18.62
Real retail price	12.99	3.62	7.81	21.92
<b>Bean</b>				
Real marketing margin	3.45	0.53	2.56	4.64
Real wholesale price	5.84	0.99	4.14	8.22
Real retail price	9.29	1.20	7.25	12.42
<b>Beetroot</b>				
Real marketing margin	4.65	0.66	3.67	6.23
Real wholesale price	4.94	1.15	2.96	8.1
Real retail price	9.58	1.66	6.66	13.87

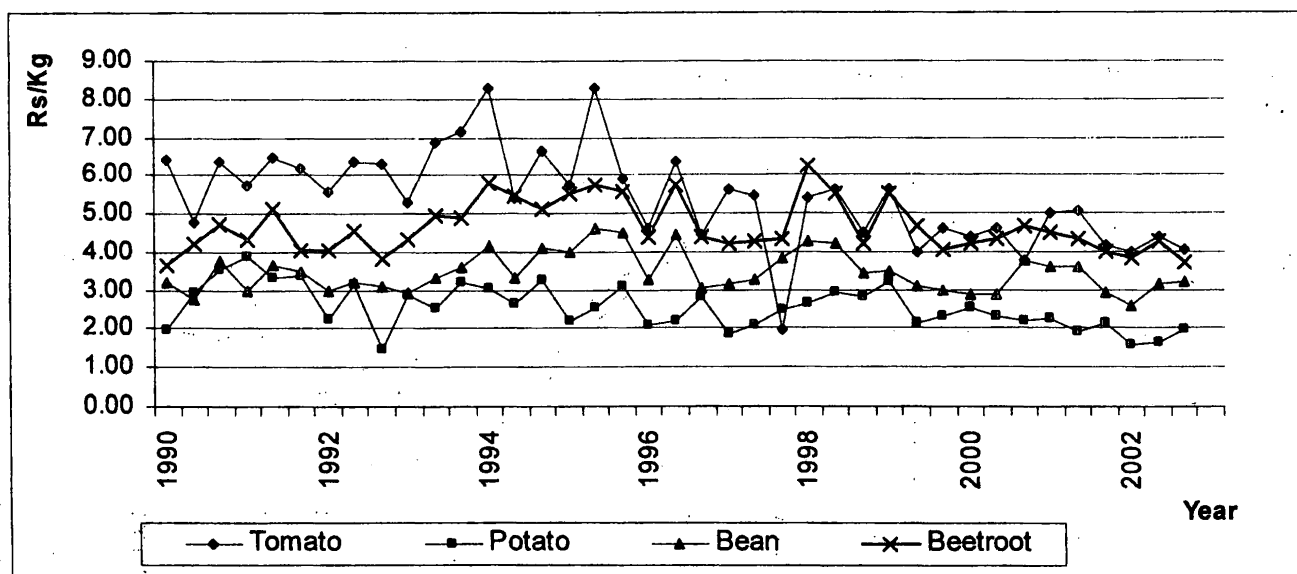
Source: Author

### Marketing Margin Analysis

The results of multiple linear regression model on MM analysis are presented in Table 2.  $R^2$  represents the portion of variability in retailer margin explained by explanatory variables, such as  $P_m$ ,  $P_mQ$ ,  $MC$ .

The results suggest (Table 2) that the market price (retail price) has positive and statistically significant effect on retailer margin (wholesale retail price spread) for tomato, bean and beetroot and it is statistically insignificant for potato. The coefficient of the real market price and quantity interaction term (income) has negative sign for tomato, potato and beetroot and positive sign for bean and it has no significant effect on retailer margin. The coefficient of the cost of marketing services has negative sign for potato, bean and beetroot but positive for tomato.

Figure 2 - Trend in real retailer margins of Up-Country vegetables in Sri Lanka:



**Table 2 – Parameter estimates of the empirical model of marketing margin for selected Up-Country vegetables:**

Variable	Estimated Coefficient	Std. Deviation	Elasticity Estimate
<b>TOMATO</b>			
<i>Pm</i>	0.501**	0.077	1.10
<i>PmQ</i>	-0.159E <sup>-4</sup>	0.093E <sup>-4</sup>	
<i>MC</i>	0.334	0.175	
Quarter1	0.092	0.217	
Quarter2	0.123	0.071	
Constant	1.129	0.683	
R <sup>2</sup> = 0.9615			
<b>POTATO</b>			
<i>Pm</i>	0.135	0.065	0.68
<i>PmQ</i>	-0.012E <sup>-4</sup>	0.014E <sup>-4</sup>	
<i>MC</i>	-0.124	0.279	
Quarter1	-0.389	0.291	
Quarter2	-0.007	0.269	
Constant	1.249	0.576	
R <sup>2</sup> = 0.5082			
<b>BEAN</b>			
<i>Pm</i>	0.323**	0.084	0.86
<i>PmQ</i>	0.023E <sup>-4</sup>	0.075E <sup>-4</sup>	
<i>MC</i>	-0.329**	0.153	
Quarter1	-0.421	0.205	
Quarter2	0.449**	0.152	
Constant	-1.088	0.81	
R <sup>2</sup> = 0.8163			
<b>BETROOT</b>			
<i>Pm</i>	0.308**	0.079	0.63
<i>PmQ</i>	-0.003E <sup>-4</sup>	0.143E <sup>-4</sup>	
<i>MC</i>	-0.333	0.203	
Quarter1	0.051	0.209	
Quarter2	0.244	0.149	
Constant	0.63	0.632	
R <sup>2</sup> = 0.8485			

Note: \*\*denotes statistically Significance at 5 percent level.  
Abbreviations: *Pm*, retail price; *Q*, output; *MC*, marketing cost

MC has statistically significant and negative effect on retailer margin only for bean and margin decreases with the increase of MC. Seasonal differences have positive coefficient for tomato and beetroot and negative for potato. Seasonal difference in MM is statistically significant and positive only for bean in 2<sup>nd</sup> quarter, in 2<sup>nd</sup> quarter MM increase by 0.449 Rs/Kg and in 3<sup>rd</sup> quarter MM fall below the level than in 2<sup>nd</sup> quarter.

The elasticity estimates, calculated at the means, indicate that Retailer Margin for tomato is elastic and potato, bean and beetroot are inelastic with respect to the retail price (Table 2).

**Seasonality in Retail Prices**

Calculated seasonal price indices for each vegetable are presented in Figure 3. The seasonal price behavior shows a high seasonality in monthly average retail prices. Seasonal retail price index is low in February to April and August to October for tomato, potato, bean and beetroot, where price index is below 100, i.e. there is an excess supply than market demand. The peak seasonal price index occurs for all above vegetables in June/July and December/January, where price index is above 100, i.e. supply is inadequate to meet the market demand (Figure 3). If there is a good market price, numbers of farmers go for the same crop and cultivate more; ultimately price will go down during harvesting season. Fluctuation of prices affects the certainty of the farmer income. This indicates that the farmers unable to enjoy better prices with surplus supply and shortage in supply cause problems to consumers.

**Correlation Analysis**

Result of the correlation analysis is presented in the Table-3. All above correlation coefficients were statistically significant at 1 percent probability level. Correlations among retail prices revealed that the current month prices and three-month lag prices were highly correlated (Table 3). Current month prices of potato and bean were highly correlated with the three month lag prices of potato and bean respectively, but changes in current month.

**Figure 3 - Seasonal Retail Price Index of selected Up-Country vegetables in Sri Lanka:**

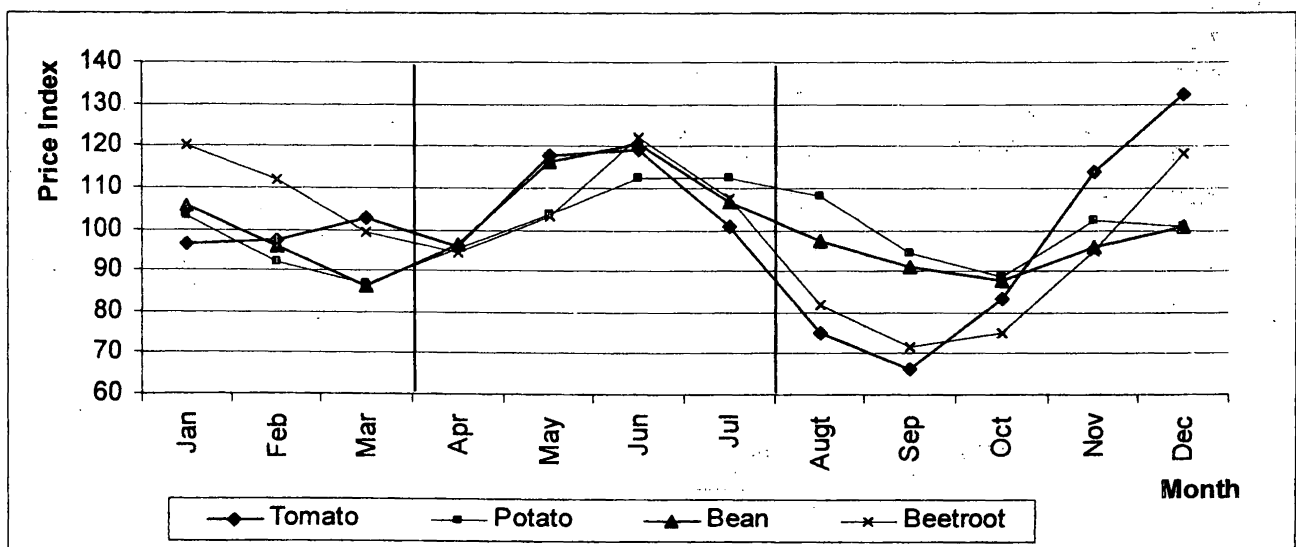


Table 3 - Correlation coefficients among retail prices of selected vegetables (1985-2003):

Current Month Retail Price	Retail Price at Three Month Lag		
	Tomato	Potato	Bean
Tomato	0.495	0.579	0.587
Potato	0.630	0.796	0.752
Bean	0.666	0.684	0.793

tomato prices were adjusted mostly by the three month lag prices of other two vegetables (Potato and Bean). The results suggest that current price is influenced by three month lag prices for above vegetables. It is obvious that when market price is high farmers tend to produce more in order to earn more as a result; price will go down when it is harvested. Because of that there is a severe price fluctuation at every three month. This indicates that farmers make production decision based on the prevailing market price.

### CONCLUSIONS

This study suggests that retail price is the important factor that determines the retailer margin for Up-Country vegetables in the Colombo market. It also suggests that retail price as a policy instrument. If policy makers put in place to make sure that farmer get more proportionate share of increases in retail price, it is expected that farmers will respond by increasing production, as to earn more profit from increased output.

The study of price behavior and correlation analysis revealed that farmers in general, select the vegetables for cultivation, which have higher retail price at the point of their decision making. Therefore extension services should be conducted to farmers on seasonal price behavior to overcome severe price fluctuation. Also by limiting the excess supply during

the peak production period (February/April and August/October) farmers can have reasonable prices for their produce. So have to take relevant actions to supply vegetables during the period when prices reach to higher and lower level. Policy makers also should pay attention to purchase vegetables from farmers when there is an excess supply and improve the storage facilities to maintain a continuous supply.

In future further studies can be done on farm gate-retail price spread of these vegetables if proper information's are available (Farm gate prices, Cost of marketing services).

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