FRESH PRODUCE RETAIL PRICE COMPARISONS IN TRINIDAD AND TOBAGO

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Abstract: *As the competitive landscape of the food and grocery retailing sector in Trinidad and Tobago is being transformed and consumers are separated from producers, shoppers are more reliant on price/quality cues in making their purchase decisions. The purpose of this study is to iden-tify the retail outlet with the lowest and or highest price for a selected number of fresh produce items, in an effort to direct shoppers to relatively cheap nutritious sources of fresh produce. ANOVA and the Games-Howell test were the analytical procedures used. The ANOVA results indicated that there is statistical difference for all the items at the different retail outlets – farmers' markets, roadside markets, public markets and super-markets. The Games-Howell results obtained indicated that the supermarket mean prices were the highest for all items. Shoppers who purchased pineapple at the farmer's market instead of the supermarket in 2016 could have potentially achieved the greatest savings of $6.52/kg.*

Introduction

Despite the overwhelming evidence in the diet/health literature of the numerous benefits from an adequate daily consumption level of fresh produce, in the Caribbean where there is supposed to be an abundant supply, many populations fail to achieve the recommended daily intake levels. As a direct result there has been increasing levels of Non-Communicable Diseases (NCDs) being experienced globally, including the Caribbean. In 2015 the Global Burden of Disease Study reported that the total deaths from NCDs reached 39.8 million. Table 1 illustrates the top five causes of death in Trinidad and Tobago (T&T) as reported by the World Health Organization (WHO) in 2014. As can be seen in this table cardiovascular diseases top the list, while injuries come in at number 5. Of the 13,000 deaths reported, 80% was attributed to NCDs. Root Crops and fruits and vegetables are rich sources of fibre, antioxidants, and phytochemicals that have beneficial health effects, such as aiding in the prevention of many chronic diseases, including type-2 diabetes when consumed. Increasing their consumption is one means of reducing the level of NCDs in many developing countries.

Table 1: Top five causes of death in T&T

diseases/injuries	Percent of total deaths
cardiovascular	32
cancers	16
other ncds	15
diabetes	14
injuries	11

Source: WHO Non-communicable Diseases Country Profiles, 2014

Traditionally, in the Caribbean, as was the case in most developing countries, fresh produce retailing was limited to public markets, roadside stands and at farm gate. However, in the last few decades consumers in developing countries in general, and Trinidad and Tobago specifically, have been offered increased options – supermarkets, public markets, roadside stands, farmers' markets and at farm gate – from which to purchase fresh produce. While supermarkets provide potential customers the benefits of "one stop" shopping and a pleasant shopping environment, in many developing countries price of goods is a major determinant of where one shops. The purpose of this study is to compare the retail prices for a selected number of fresh produce items in an attempt to identify the outlet with the highest or lowest price. The products selected for the study were from the Staples (Dasheen and Sweet Potato) and Fruits and Vegetables food groups (Pineapple, Watermelon, Cucumber and Pumpkin,) over the period January to December 2016 in Trinidad and Tobago.

Recently, several studies have suggested that healthier foods and diets are more expensive than less healthy options (Roa et al 2013, and Wiggins & Keats 2015). In a study titled "Obtaining Fruit and Vegetables for the Lowest Prices: Pricing Survey of Different Outlets and Geographical Analysis of Competition Effects" Pearson et.al (2014) state "Perhaps the most consistently noted barrier to adequate consumption of fruits and vegetables is cost". Appleton et.al (2016) focusing on just vegetables alone (i.e. not fruit and vegetables, just vegetable) suggest that besides individual preferences, higher vegetable consumption in adults is also related to increased availability and reduced cost, and low consumption is

largely associated with lower socio-economic status lower income, living in a more deprived area or lower income neighborhood (an indirect measure of socio-economic status) and lower education. Hence, being able to direct customers to cheap nutritious sources of fresh produce should therefore contribute to increased purchase and consumption levels. This study is an attempt to compare the prices of cucumber, pumpkin, pineapple, watermelon, dasheen and sweet potato at supermarkets, public markets, roadside vegetable/fruit stands and farmers' markets in T&T in an attempt to identify the retail outlet with the lowest and/or highest prices.

Minten and Reardon (2008) in a study titled "Food Prices, Quality, and Quality's Pricing in Supermarkets versus Traditional Markets in Developing Countries" looked at survey-based evidence from ten developing countries plus primary data from Madagascar. They concluded that there is a stable and predictable pattern in supermarket pricing and quality offerings versus traditional markets, as follows:

- In the early stages, supermarkets are better than traditional retailers by charging lower prices for processed products—taking advantage of procurement systems that allow economies of scale. The poor consumers take advantage of this to buy processed foods and semi-processed foods from supermarkets.

- In the early stages, supermarkets sell especially vegetables more expensive than do traditional retailers. Eventually, they do reduce their prices and compete on fruit and eventually vegetable prices.

- Supermarkets in the early stages tend to focus on packaged and high-quality products, but as time goes by, they extend their quality range to attract the mass market.

- Recognizing the data limitations, supermarkets tend to differentiate price based on quality. However, in the case of potatoes in Ecuador, they thought supermarkets provided better quality and lower prices.

They however suggested that these were early findings and should be verified at a later date adjusting price to take account of transaction costs. Since the "Supermarket Revolution" can be considered to be still in the early stages in the Caribbean, for purpose of this study we hypothesize that supermarket prices would be highest.

Several studies that compare prices at farmers' markets and supermarkets, Sommer et al (1980) and Swenson (2012) for example, suggest that fresh produce prices are lower at farmers' markets. Swenson (2012) compared the prices of sweet onions, broccoli, Romaine lettuce, butternut squash, vine ripened tomatoes and Navel oranges at farmers' markets and supermarkets in San Luis Obispo County, California over a five week period. She concluded, "The hypothesis that farmers' markets would have lower prices on average than their paired supermarkets was proven to be correct through intensive price analyses". Based on the six chosen

commodities, the average price at the farmers' markets was 25 cents lower than at the supermarkets.

As Valpiani et al. (2016) state "Whether direct farmer-to-consumer outlets compete with supermarkets on produce prices remains an empirical question". Consequently, the approach and analytical rigor applied will be very dependent on the researcher. Based on the review provided above, the problems that will be addressed in this study are as follows:

(1) To compute the average prices for cucumber, pumpkin, watermelon, pineapple, sweet potato and dasheen at the four retail outlets;

(2) To test if the mean prices are statistically different at the different retail outlets.

HO_1: The farmers' market, public market, roadside market and supermarket mean prices are equal;

HA_1: The farmers' market, public market, roadside market and supermarket prices are not equal,

(3) If the prices are not equal, to try and identify the outlet with the lowest and or highest price;

MATERIAL AND METHOD

Food price comparison studies are plagued with problems. Minten et al (2009) state "Three important issues in traditional food retail markets in India, as well as in a number of other developing countries, exist that might complicate the measurement of prices. They include bargaining, differential pricing, and cheating. First, prices are mostly not posted and bargaining might take place between the buyer and the seller before they settle on a price, especially for fresh produce". Further complicating things is the issue of similar quality, especially in the case of fresh produce, when comparisons are made between supermarkets and traditional outlets.

Being cognizant of the problems stated above this study utilized data collected by the National Agricultural Marketing and Development Corporation (NAMDEVCO), of Trinidad and Tobago. NAMDEVCO, a State Agency, manages the wholesale markets in T&T and is well positioned to collect the prices for a selected range of products in these markets regularly. To complement the data from the wholesale markets, their trained data enumerators also collect data at other selected retail outlets for agricultural products. This study uses monthly data (TT$/kg[1]) for the period January 2016 to December 2016 from the National Agricultural Marketing Information Systems (NAMIS), a part of NAMDEVCO.

The study uses the one-way analysis of variance (ANOVA) to see if there was a statistically significant difference between the mean prices of the fresh produce items at the different retail outlets.

The ANOVA is an analytical procedure that uses the variance to determine whether means are significantly different, by apportioning the variances between the groups of means versus the variance within the groups (the null hypothesis Ho: $\mu1 = \mu2 = \mu3 = ... = \mu k$, where k = the number of groups). There are a number of a posteriori or post hoc tests, run after a significant ANOVA, to determine which differences are significant. In the general case of multiple pairwise comparisons where we compare each of the pairs we make K(K-1)/2 comparisons (where K is the number of groups). As Field (2009), page 375 recommends, the Games–Howell test should be carried out when one is not sure that the homogeneity of variance assumption holds. Consequently, this was the a posteriori test used to identify the retail outlet with the lowest price and or highest price. The relevant data were analyzed using SPSS version 21.

RESULTS AND DISCUSSION

Figure 1 illustrates the average prices over the period January 2016 to December 2016 for the selected products at the various retail outlets. As is observed in the chart, the farmers' markets seem to have the lowest prices for the products except for pumpkin, where the lowest price is obtained in the public market. The supermarket appears to have the highest price for all of the products.

Figure 1: Average prices of the products at the retail outlets: January 2016 to December 2016
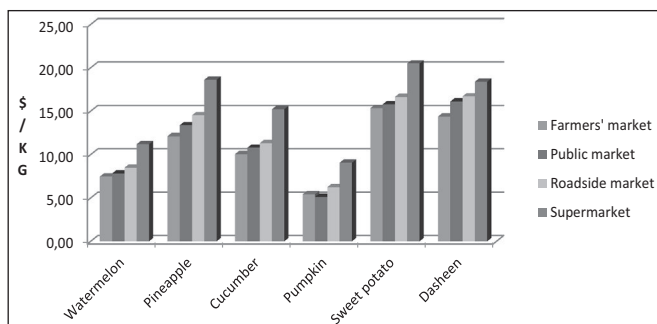

Table 2 illustrates the descriptive statistics of the various prices. As can be observed from this table, sweet potato at the supermarket had the highest mean price while public market for pumpkin the lowest mean price. The standard deviation is a measure that is used to quantify the amount of variation of a set of data values. A low standard deviation indicates that the data points tend to be close to the mean of the set, while a high standard deviation indicates that the data points are spread out over a wider range of values. It is worthy to note that the standard deviation of the public market mean price for watermelon was the lowest standard deviation, while the supermarket mean price for sweet potato had the highest standard deviation.

Table 2: Retail market prices for the period January to December 2016 descriptive statistics

Retail market prices	Mean	Std. Deviation	Std. Error
Watermelon			
Farmers' market	7.47	1.63	0.47
Public market	7.83	0.60	0.17
Roadside stand	8.49	0.85	0.25
Supermarket	11.21	0.78	0.23
Pineapple			
Farmers' market	12.11	1.56	0.43
Public market	13.38	0.61	0.18
Roadside stand	14.53	0.85	0.25
Supermarket	18.63	0.82	0.24
Cucumber			
Farmers' market	10.07	1.63	0.47
Public market	10.80	1.76	0.51
Roadside stand	11.32	2.19	0.63
Supermarket	15.23	2.32	0.67
Pumpkin			
Farmers' market	5.43	0.76	0.22
Public market	5.12	0.80	0.23
Roadside stand	6.25	0.71	0.21
Supermarket	9.07	1.25	0.36
Sweet Potato			
Farmers' market	15.35	2.37	0.68
Public market	15.79	2.32	0.67
Roadside stand	16.65	2.83	0.82
Supermarket	20.50	3.62	1.04
Dasheen			
Farmers' market	14.38	0.97	0.28
Public market	16.11	1.25	0.36
Roadside stand	16.71	1.42	0.41
Supermarket	18.40	1.84	0.53

An assumption of the ANOVA test is that each group of the independent variable has the same variance. Moderate deviations from this assumption of equal variance do not seriously affect the results in ANOVA, but we will normally check to see if the assumption holds. Table 3 shows the results of the Levene's Test for equality of variances. As is observed the p-value of the test statistic obtained was greater than 0.05 in all cases. As a result the null hypotheses cannot be rejected for pineapple, watermelon, cucumber, pumpkin, sweet potato and dasheen, so we can therefore proceed for the ANOVA test on the assumption of equality of variances.

Table 3:
Levene's Test for homogeneity of variances results for the products

Products	Levene Statistic	df1	df2	Sig
Watermelon	1.253	3	44	0.302
Pineapple	0.639	3	44	0.594
Cucumber	0.441	3	44	0.725
Pumpkin	0.858	3	44	0.470
Sweet Potato	0.943	3	44	0.428
Dasheen	1.737	3	44	0.173

Table 4 illustrates the ANOVA results for the six fresh produce items. The F-statistics obtained are statistically significant at the P<0.05 level. The null hypothesis that there is no significant difference between the average prices at the various outlets is therefore rejected. The data therefore suggest there is a statistically significant difference between the retail prices for the products at the different outlets.

The results of the ANOVA test do not inform us of the retail outlet with the lowest price. A cursory look at the mean prices as displayed in figure 1 suggests that the farmers' market prices are lowest and the supermarket prices are highest. The Games-Howell test is one of a number of a posteriori or post hoc tests, run after a significant ANOVA to help to identify which of the comparisons are lowest or highest. The Games-Howell test does not rely on equal variance and sample size and as a result was used here.

Table 4: ANOVA test results

Watermelon	Sum of squares	df	Mean Square	F	Sig.
Between Groups	103.155	3	34.385		
Within Groups	47.854	44	1.088	31.616	.000
Total	151.009	47			
Pineapple	Sum of squares	df	Mean Square	F	Sig.
Between Groups	286.689	3	95.563		
Within Groups	44.064	44	1.001	95.425	.000
Total	330.753	47			
Cucumber	Sum of squares	df	Mean Square	F	Sig.
Between Groups	191.650	3	63.883		
Within Groups	174.937	44	3.976	16.068	.000
Total	366.587	47			
Pumpkin	Sum of squares	df	Mean Square	F	Sig.
Between Groups	116.789	3	38.930		
Within Groups	36.143	44	0.821	47.392	.000
Total	152.932	47			
Sweet Potato	Sum of squares	df	Mean Square	F	Sig.
Between Groups	197.960	3	65.987		
Within Groups	353.011	44	8.023	8.225	.000
Total	550.971	47			
Dasheen	Sum of squares	df	Mean Square	F	Sig.
Between Groups	99.593	3	33.198		
Within Groups	87.069	44	1.979	16.776	.000
Total	186.662	47			

Table 5 illustrates a summary of the Games-Howell test results for the selected products. The results suggest that the farmers' market mean price and the supermarket price are significantly different for all of the fresh produce items. Similarly, the mean public market price and supermarket price are significantly different for all of the produce items with all p-values less than 0.05. Also, the results of the test in table 5 suggest there is no statistically significant difference between the farmers' market and public market mean prices except for dasheen. In the case of dasheen there is no statistical difference between the roadside market and supermarket mean price and public market and roadside market mean price, while there is statistically significant difference for all the other dasheen retail outlet price comparisons. For pineapple and pumpkin there is statistical difference between the public market and the roadside market mean prices. In the case of pineapple there is statistically significant difference between the farmers' market and roadside markets mean prices.

Table 5:
Summary of Games-Howell post hoc Multiple Comparisons test results

test	water-melon	pineapple	cucumber	pumpkin	sweet potato	dasheen
fm-pm						*
fm-rm		*				*
fm-sm	*	*	*	*	*	*
pm-rm		*		*		
pm-sm	*	*	*	*	*	*
rm-sm	*	*	*	*	*	

*The mean difference is significant at the 0.05 level
Where: FM = farmers' market; PM = public market; RM = roadside market; SM = supermarke

The results of the study do support the view that the mean supermarket price is highest. Hence, an examination of the difference between the supermarket mean price and the other outlet prices should provide an indication of potential savings for shoppers that purchased the items from the other outlets instead of the supermarket. Table 6 illustrates the differences of the mean supermarket price from the mean farmers' market price for the selected items in an attempt to illustrate the potential savings for shoppers that purchased the items at the farmers' market versus the supermarket in 2016. As is observed in this table the largest savings was for pineapple of $6.52/kg. An examination of the difference of the mean supermarket price from all the other mean market prices indicate that the smallest difference was for dasheen between the roadside market and supermarket – mean supermarket price minus mean roadside market price $1.69/kg. An examination of table 5 shows that the mean supermarket price was not statistically different from the mean roadside market price for dasheen.

Table 6: The differences of the mean supermarket price from the mean farmers' market price

Product	Supermarket – Farmers' market price	Potential savings ($/kg)
Watermelon	$11.21- $7.74	$3.74
Pineapple	$18.63 -$12.11	$6.52
Cucumber	$15.23 - $10.07	$5.16
Pumpkin	$9.07 - $5.43	$3.64
Sweet potato	$20.50 - $15.35	$5.15
Dasheen	$18.40 - $14.38	$4.02

Research suggests several reasons for low levels of fresh produce consumption ranging from taste, socioeconomic status and education, however, ability to buy is particularly important in many developing countries. As the food retailing landscape in these countries are transformed and shoppers are offered an expanded range of options, making decisions become more complex. Being able to identify cheap nutritious sources of fresh produce is a fundamental intervention needed in an effort to facilitate increased purchase and consumption.

The ANOVA results for this study suggest that there is statistical difference between the mean market prices of all the produce items analyzed at the different outlets. This study found that for the selected fresh produce items the price at the supermarket – modern retail – was higher than the other retail outlets. This result is opposite to that of Minten et al (2010). In the case of pineapple shoppers who purchased at the farmer's market instead of the supermarket in 2016 could have potentially achieved the greatest savings of $6.52/kg while shoppers of dasheen at roadside markets instead of supermarkets would have received the smallest potential savings of $1.69/kg. However, it is important to note that there was no statistically significant difference between the mean price at the farmers' market, roadside market and the public market for pumpkin, cucumber, sweet potato and watermelon. Also, in the case of dasheen while the farmer's market means price was statistically different (less) than the other outlets there was no statistical difference between the roadside market and public market mean prices. In the case of pineapple there was no statistical difference between the mean farmer's market price and the public market, while the roadside market was statistically different from all other markets.

These findings are significant to both marketers and consumers. From a theoretical perspective marketers are provided with an indication of the price differences that exist between the different outlets. This information could be useful to them, especially the small operators, in developing countries as they develop their marketing strategies. In T&T, like many other Caribbean countries, the pricing strategy of small operators for many agricultural products is not very scientific, but based more on "gut feelings" of what the market can bear. If this information promotes the use of more science based pricing methods, for example cost-plus pricing, which results in lower prices of the fresh produce, the study would have served a useful purpose. As Darian & Tucci (2013) point out the most important factors that would make it more likely that the respondent would eat more vegetables are "If vegetables cost less" and "If vegetables tasted better". Helping to identify where cost savings can be had when purchasing vegetables should therefore be useful information for shoppers.

For fresh produce that a barrier to consumption is financial cost, to achieve the desired goal of increased purchase and consumption, some consideration should be given to interventions that focus on lowering the cost. Various studies have looked at marketing and or pricing strategies on the choice of food in general and vegetables specifically in developed countries, for example Darian & Tucci (2013); Waterlander et. al. (2012), French (2003), French et al (1997), however to date to the best of our knowledge no such study has been done for T&T. Further research on the comparison of food prices between modern and traditional retail outlets is required in an endeavor to guide food policy development in T&T and the wider Caribbean.

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