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# **An Analysis of Farm-Retail Price Spread for Jamaican Fresh Fruits**

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## **Abstract**

This paper uses the relative price spread model to analyze the farm-retail spread for pineapple, pawpaw and watermelon in Jamaica. Our findings suggest that price increase in the retail market is not being passed down to pineapple and pawpaw farmers and only marginally to watermelon farmers.

## **Introduction**

Jamaica is popular for its exotic fruits and juices. Apart from the production of bananas for the export market, fresh fruits are also supplied to the domestic market in large quantities. Over the last decade, however, the fruit industry, like most other agricultural sub-sectors in the island, have recorded drastic fall in output. Not only did the production of bananas for the export market halved between 1995 and 2000, the production of pawpaw declined from 21,063 tons in 1993 to 9333 tons in 2002 while the production of watermelon fell from 9584 to 8068 tons within the same time period, representing a decline of about 56% and 16%, respectively. On a positive note, the all-island production of pineapple increased from 14,532 tons in 1993 to 20,571 tons in 2002, representing an increase of about 42% in output. The mixed trends in domestic production of these fruits are depicted in Figure 1. Regardless of these trends, prices have generally been on the increase. For instance, while there has been an upward trend in pineapple production, a downward trend in pawpaw production and a somewhat stable trend in watermelon production between 1993 and 2002, price data have shown steady increases in retail prices for these fruits. During this period, the real retail price (in 1988 dollars) of pineapple increased from J\$3.77 per kilogram (kg) in the first quarter of 1993 to J\$5.13 per kg in the fourth quarter of 2002. Similarly, the real retail price for pawpaw and watermelon rose from J\$2.86 per

kg and J\$3.73 per kg, respectively, in the first quarter of 1993 to J\$5.51 per kg and J\$4.31 per kg, respectively, in the fourth quarter of 2002.

Ordinarily, an increase in retail price, *ceteris paribus*, should induce increased production of a commodity. Despite the general increase in real retail prices, domestic production of fresh fruits in Jamaica has indeed declined considerably in some cases. This situation suggests that either price is not enough an incentive for production or that the middle-men do not pass on increased retail prices to the farmers. A closer look at real farm gate prices and the marketing margins for these fruits should provide a rough indication of market mechanism for these farm products. Figures 2 to 4 show trends in real market price, real farm gate price and real marketing margin for pawpaw, pineapple, and watermelon, respectively. As seen in Figures 2 and 3, the real market margins for pineapple and pawpaw have increased steadily over the years while their real farm gate prices have been fairly stable. In contrast, Figure 4 indicates that the real marketing margin for watermelon has been fairly stable while the real farm gate price has been increasing modestly.

In order to solve the puzzle on whether or not real increases in retail price are reaching the farmers, a determination of the effect of retail price on marketing margin is crucial. Our objectives in this paper are therefore to identify factors that influence marketing margins for pineapple, pawpaw and watermelon in Jamaica and to determine the impact of each factor on the marketing margins for these fruits. It is hypothesized that middle-men absorb significant portion of increases in market prices and hence leave the farmers with no price incentives to increase or even maintain production. 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.

## **Marketing Margin Analysis**

Marketing margin analysis is an important aspect of agricultural marketing because of the policy implications of such studies. Concerns about market concentration, monopoly pricing, etc., have warranted marketing margin analyses for various industries (Brester and Musick; Capps, Jr., Byrne, and Williams; Holloway; Schroeter and Azzam). In subsistent farming, marketing margin analysis is useful in determining unfair pricing practices or receipt of economic profits by dominant merchants who normally have the bargaining power against the peasants. Middle-men or commodity merchants offer an important marketing service of getting farm produce from the farm gate to the retail market and are entitled to charge a premium over the farm gate price paid to farmers to cover the costs of rendering this service. When costs of marketing services increase, the middle-man has three options: he could pass on this cost to end consumers in terms of higher retail prices, to the farmers in terms of lower prices paid at the farm gate, or absorb the cost in terms of reduced profits to himself. The corollary of this also holds in theory when the cost of marketing services decline. An interesting issue arises when, in the case of an increase in the cost of marketing services, the middle-man charges a premium over and above the increase in costs, resulting in the consumers paying significantly more while the farmers get no increase in the farm gate price received for their products, or even at times get paid less. Such scenario is common practice and happens more often in subsistent agriculture.

A widening of the marketing margin for a crop could potentially discourage farmers from producing and causes genuine concern for policy makers. Any program aimed at inducing increased farm output must pay due attention to the market for the farm products as well. An

analysis of the marketing margin for fresh fruits in Jamaica is, hence, seen as a necessary step toward addressing the fall in domestic output for these crops.

### **Analytical Model**

The Relative Price Spread (RPS) Model of Wohlgenant and Mullen has been widely applied in marketing margin analyses. Brester and Musick applied the RPS model to study the effect of market concentration on lamb marketing margins. Capps, Jr. *et al.* also used the RPS model in their analysis of marketing margins in the U.S. lamb industry. 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. Formally stated, the model is represented by:

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

where  $M$  is the marketing margin or price spread,  $K$  is the marginal cost of marketing services,  $Q$  is 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.

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

$$MM_{kt} = \beta_1 P_{m,kt} + \beta_2 P_{m,kt} Q_{kt} + \beta_3 MC_{kt} + \varepsilon_{kt}, \quad (3)$$

where  $MM$  is the real marketing margin for fresh fruits defined as the difference between the real market price and the real farm gate price,  $P_m$  is real market price,  $Q$  is the output quantity,  $MC$  is an index of the cost of marketing services, and  $\varepsilon$  is an independently and identically distributed error term. The  $\beta$ 's are model parameters, and the indices  $k$  and  $t$  represent particular fruit type and time period, respectively.

Estimation of the empirical model (3) will provide us with values for the model parameters. These parameter estimates are in turn used to compute the marketing margin elasticities for the explanatory variables. These elasticity estimates denote, respectively, the effect on the marketing margin of a percentage change in the real market price and the cost of marketing services.

### **Data and Estimation**

Quarterly production and price data for pineapple, pawpaw and watermelon from 1993 to 2002 were collected from the Data Bank and Evaluation Division of the Ministry of Agriculture in Kingston, Jamaica. Data on consumer price indices was collected from several issues of *Statistical Digest*, a monthly publication of the Bank of Jamaica. All nominal variables were converted to real variables (in 1988 dollars) using the implicit price deflators. The real variables were in turn used for estimation purposes. Due to lack of data on the actual costs of marketing

services, the consumer price index for transportation was used as a proxy for *MC* in the empirical estimation. Quarterly marketing margins were calculated as the difference between the market price and the farm gate price at the end of the quarter. The descriptive statistics of the variables used in the model are given in Table 1.

Both linear and log-linear forms of the empirical model were estimated using ordinary least squares (OLS) method for each of pineapple, pawpaw and watermelon. The three equations were also estimated as a system using the seemingly unrelated regression (SUR) procedure to take advantage of the gain in efficiency from possible contemporaneous correlation of the error terms of the individual equations. The SUR estimates were observed to be generally better and hence the SUR model was selected as the preferred one. In order to capture the possible effects of seasonal changes, dummy variables were created for quarters and included in the SUR regression equations.

## **Results**

The results of the SUR estimation are presented in Table 2. They indicate that real market price has a positive and statistically significant effect on marketing margin for pineapple, pawpaw and watermelon. The coefficient of the real market price and quantity interaction term has a negative sign for pineapple and pawpaw but a positive sign for watermelon. It is also only statistically significant for pineapple. The coefficient of the cost of marketing services is negative and statistically insignificant for pawpaw and watermelon but positive and statistically significant for pineapple. Seasonal differences in marketing margin are only statistically significant for pineapple, with the marketing margin falling in the fourth quarter below the levels for the other three quarters.



The elasticity estimates, calculated at the means, indicate that marketing margins for pawpaw and pineapple are elastic with respect to retail price and inelastic with respect to cost of marketing services. As for watermelon, the estimate for the marketing margin suggests unitary elasticity with respect to the retail price but inelastic response with respect to the cost of marketing services.

Our findings show that retail price is an important factor in determining the level of marketing margin for pawpaw, pineapple, and watermelon in Jamaica. The findings further suggest that the cost of marketing services, e.g. transportation cost, only impacts significantly on the marketing margin for pineapple and not for pawpaw or watermelon. The deductions from the elasticity estimates are that the middle-men pass on a disproportionately less amount of increases in market price for pawpaw and pineapple to the farmers but pass on a proportionate increase in the retail price for watermelon to farmers. Interestingly for pineapple, our model suggests that the middle-men would not only pass on all increases in the cost of marketing services to the farmers, they actually would charge an additional premium.

In summary, the findings of this paper indicate that market price is an important factor in determining marketing margin for fresh fruits in Jamaica and that due to the elastic nature of marketing margins, middle-men gain disproportionately when compared to farmers as a result of increases in the market price for fresh fruits.

## **Conclusions**

This study has established an empirical relationship between marketing margin for fresh fruits in Jamaica and their market prices and cost of marketing services. Results of the marketing margin analysis indicate that marketing margin is positively related to market price. Marketing margin

in also observed to be elastic to changes in market price for pawpaw and pineapple, but neither elastic nor inelastic to changes in market price for watermelon. Since price is a good indication of future profits and an incentive for production, this paper has established that a high market price for fresh fruits does not translate to a high farm gate price. This finding may partly offer a solution to the puzzle raised earlier in this paper. Since farmers do not received appreciable share of increases in retail prices for their products, other incentives apart from price must induce them to increase output. This offers a possible explanation for why production of pawpaw may be falling in the face of real increases in retail prices.

As an important step in reversing the declining trend of fresh fruit production in Jamaica, this paper has identified market price as a policy instrument. If institutions are put in place to ensure that farmers gets a more proportionate share of increases in market price, it is expected that farmers, being economic agents, will respond by increasing production so as to earn more profits from increased output. Institutions that take farmers closer to the market or that bring the market closer to the farmers will serve important functions in this regard. Such provision will induce efficiency in the marketing of farm produce by improving price information and eliminating economic profits for middle-men.

In as much as this study has identified important factors that determine price spread for fresh fruits in Jamaica, the study has some limitations. The lack of actual data for the costs of marketing services necessitated the use of a proxy for this variable. While the use of this proxy is justified, it may not reflect an accurate cost structure for fresh fruits marketing services and hence may have biased the result one way or the other.

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**Table 1: Descriptive Statistics of Variables in the Empirical Model of Marketing Margin for Fresh Fruits in Jamaica**

Variable	Mean	Std. Deviation	Minimum	Maximum
Pawpaw				
Real marketing margin (\$/kg)	1.84	0.638	0.44	3.47
Real farm gate price (\$/kg)	2.04	0.303	1.15	2.79
Real market price (\$/kg)	3.88	0.779	2.73	5.84
Output ('000 tonne)	3.37	1.328	1.721	7.355
Pineapple				
Real marketing margin (\$/kg)	1.89	0.564	0.63	2.82
Real farm gate price (\$/kg)	2.58	0.432	1.89	3.60
Real market price (\$/kg)	4.48	0.480	3.60	5.33
Output ('000 tonne)	4.60	3.237	0.61	9.69
Watermelon				
Real marketing margin (\$/kg)	1.96	0.421	1.08	3.08
Real farm gate price (\$/kg)	2.12	0.465	1.23	3.25
Real market price (\$/kg)	4.08	0.434	3.10	4.70
Output ('000 tonne)	3.30	1.402	1.13	7.11
Transportation CPI	944.76	367.04	330	1556.1

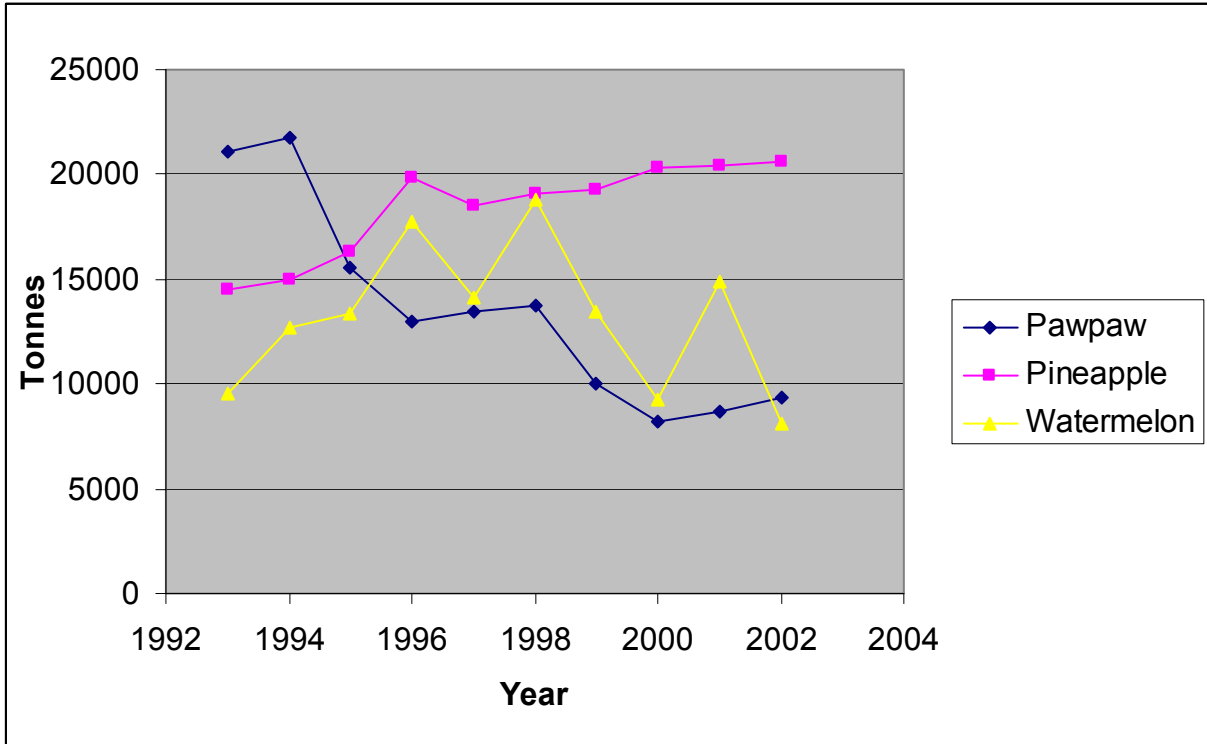
**Table 2: Parameter Estimates of the Empirical Model of Marketing Margin for Fresh fruits in Jamaica**

Variable	Estimated Coefficient	Standard Error	Elasticity Estimate
<i>Pawpaw</i>			
$P_m$	0.830***	0.129	1.645
$P_mQ$	-0.015	0.014	
$MC$	-0.0003	0.0003	-0.138
Quarter 1	0.059		
Quarter2	-0.173		
Quarter 3	0.445		
Constant	-2.920***		
$R^2 = 0.8679$			
Log-Likelihood Function = -11.7846			
<i>Pineapple</i>			
$P_m$	0.945	0.176	1.820
$P_mQ$	-0.039	0.018	
$MC$	0.0006	0.0002	0.311
Quarter 1	0.492	3.419	
Quarter2	1.966	0.607	
Quarter 3	1.324	0.414	
Constant	-3.094	0.720	
$R^2 = 0.7371$			
Log-Likelihood Function = -11.7846			

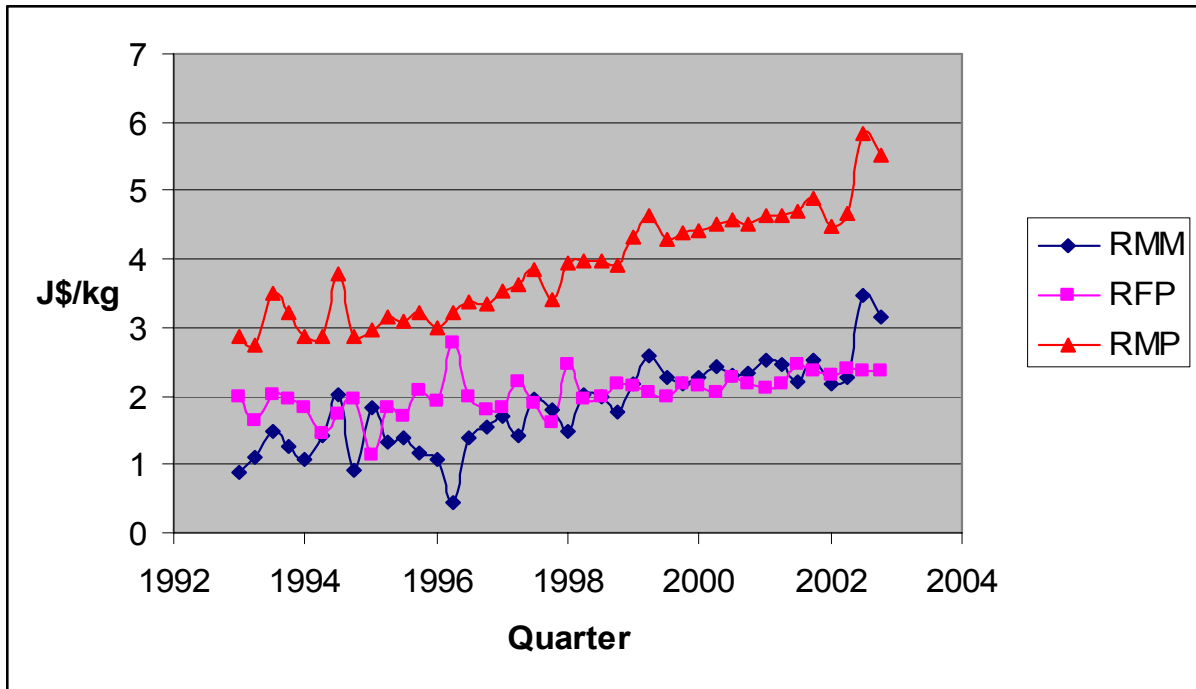
**Table 2 (Continued): Parameter Estimates of the Empirical Model of Marketing Margin for Fresh fruits in Jamaica**

Variable	Estimated Coefficient	Standard Error	Elasticity Estimate
<i>Watermelon</i>			
$P_m$	0.457	0.161	1.04
$P_mQ$	0.012	0.010	
$MC$	-0.0003	0.0002	-0.129
Quarter 1	-0.315	0.161	
Quarter2	0.167	0.161	
Quarter 3	0.125	0.161	
Constant	0.252	0.595	
$R^2 = 0.4066$			
Log-Likelihood Function = -11.7846			

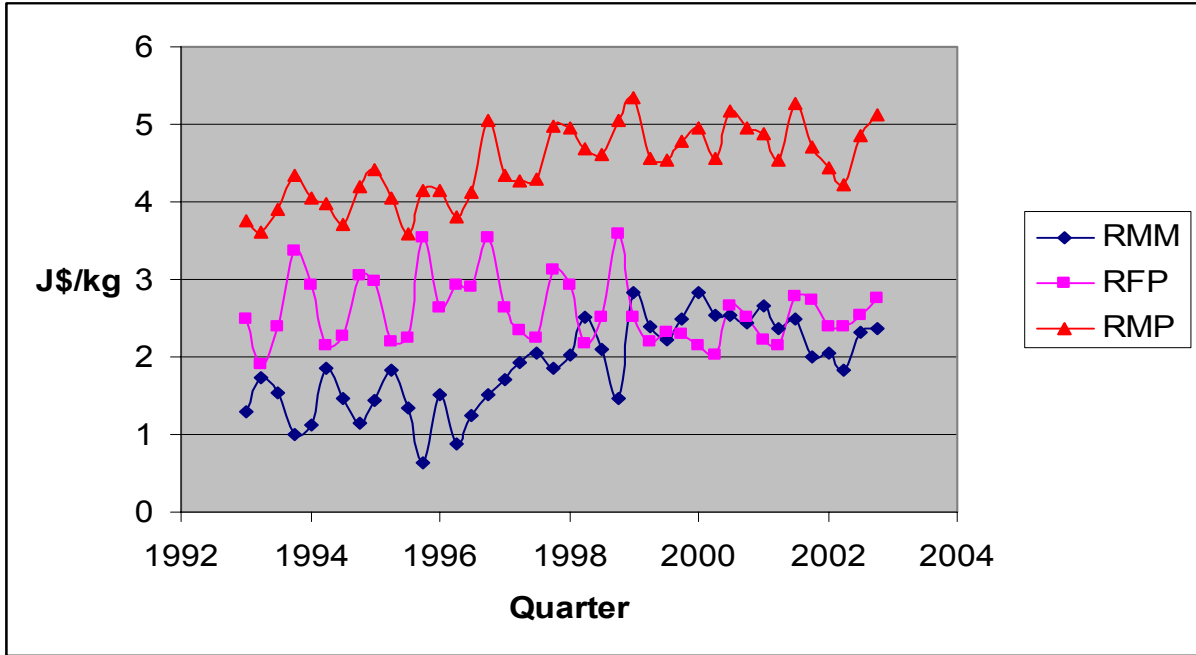
Note: \*\*\* denotes statistical significance at the 1% level.



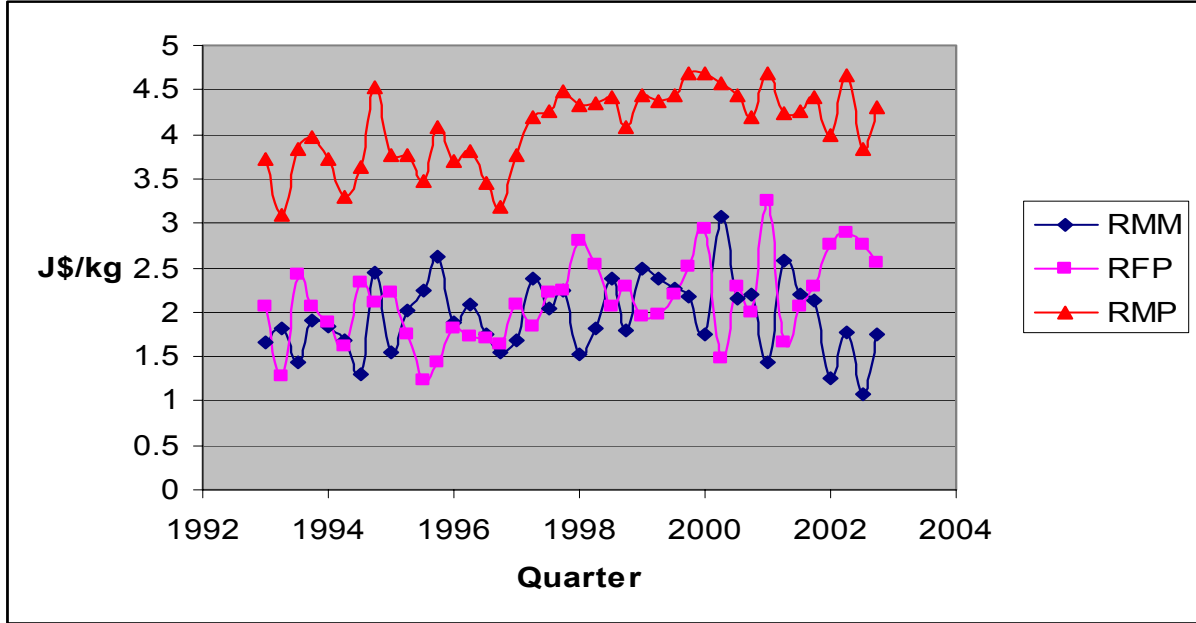
**Figure1: Trend in Production of Major Fruits in Jamaica**



**Figure 2: Trend in Prices and Marketing Margin for Pawpaw in Jamaica**



**Figure 3: Trend in Prices and Marketing Margin for Pineapple in Jamaica**



**Figure 4: Trend in Prices and Marketing Margin for Watermelon in Jamaica**

Legend: RMM is real marketing margin, RFP is real farm price and RMP is real market price.