

## SPATIAL AND TEMPORAL ARBITRAGE BY CITRUS FARMERS DEPENDING ON MARKET INFORMATION SYSTEM IN LATTAKIA REGION, R. A. SYRIA

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**Abstract.** The paper studies the impact of a market information system on the marketing decisions of citrus farmers in the Lattakia region. Agriculture there is focused largely on the production of citrus, which have for many years provided more substantial incomes for farmers than other crops. Prompt and accurate market information is one of the key elements in enhancing the incomes of citrus farmers, since it can help them negotiate with traders and move produce profitably from a surplus market to a deficit market. Two groups of 100 farmers were selected randomly in the pilot areas in the Lattakia region: in the Informed group farmers received information concerning the citrus price trends, supply and demand, market conditions and production management (actual and predicted) on a regular basis from the extension offices in the region in the course of 12 months, as opposed to the Non-Informed group, who did not receive any information. Farmers in each group were asked to fill in an application form during one citrus marketing season. The data obtained were subjected to statistical analysis using ANOVA, showing significant differences between the prices obtained by the two groups of farmers. Thus, our research has confirmed that receiving correct information leads to better commercial results. Our results suggest that most of the informed farmers – about 54 % – displayed a clear tendency to market their citrus fruits in the later sales period to obtain better prices by using temporal arbitrage in transaction volumes. This study was conducted in 2011-2013 before the situation in Lattakia worsened due to the decaying Syrian economy and the inflow of refugees from conflict areas.

**Keywords:** marketing information system, citrus, temporal arbitrage, Lattakia, Syria.

### Introduction

Citrus is an important crop in the Syrian Arab Republic. Citrus production provides an important source of income for more than 40 000 Syrian farm families located in the coastal governorships of Lattakia and Tartous [1]. Citrus prices in Lattakia have seasonal characteristics and further display fluctuations between months and markets [2]. This may suggest that farmers in the region cannot choose the right market at the right time to sell their citrus fruit, and it is clear that the risk of price fluctuation in the value of agricultural products has become one of the main risks faced by agricultural producers in developing countries [3].

The provision of efficient market information has positive benefits for farmers, traders, policymakers and governments [4]. There are a lot of studies confirming the role of marketing information systems in improving rural livelihoods, market participation and rural growth in the least developed countries [5-7]. Historical market information is a very important source material for research and policy making, for example, in price analysis and writing reports to determine seasonal market trends, forecasts for production and prices, and in evaluating the market in general, which can in turn help in planning production, storage and dealing with delays in the harvest; moreover, up-to-date information helps farmers and traders shift production from surplus to deficit markets, which helps mitigate against variations in prices between markets [5]. Thus, historical information is important in conducting temporal arbitrage, while current information is critical to spatial arbitrage [4].

Spatial arbitrage is defined as the movement process between markets in different regions with the objective of getting the advantage of where the price differential exceeds the transfer costs [8-10], and temporal arbitrage focuses on storing the product, when prices are expected to be higher in the future and the difference exceeds the cost of storing and transporting [8-10]. Market information arbitrage is the process of exchanging market information between actors to take advantage of price differences between the markets and seasons, when the costs of this information or transaction are relatively low [11].

When traders are well informed about the prices, they have an advantage over farmers who cannot access market information. Thus, providing market information to farmers should give them a better bargaining position to negotiate with traders and lead to receiving significantly higher prices [12]; in addition, market information helps reduce information asymmetry between actors in the supply

chain [13]. With an increased flow of market information through the value chain fair prices can be achieved for all actors, without extreme profit or loss, because all the actors are aware of the latest prices [14]. Market information helps make the market system both more efficient and competitive because it improves its mechanics by facilitating the organization of market processes with real data on the volume of supply, the volume of trade and pricing [15]. A market information system is the best way to supply farmers with this information, using communication technologies to provide information services to them and encouraging relations with extension offices, who provide the necessary training and help [16].

This paper presents the research, in which we tried to test the effect on the prices received of providing information on prices and market developments to citrus farmers in the Lattakia Region; this can be formulated as testing the following hypothesis: *The citrus producers, who receive market information, achieve higher prices than the producers, who bargain and take their decisions without such information.*

Confirmation of this hypothesis would justify our suggestion for the implementation of an agricultural market information system (AMIS) after the current war ends in Syria. We argue later in the paper that *small producers (households), who receive improved market information from an AMIS, are more likely to sell their citrus products in competitive crop markets instead of at the farm gate.*

The Lattakia region, which consists of four districts (Lattakia, Al-Qurdaha, Al-Haffi and Jablih), was selected as the target area, due to the local tradition of citrus fruit production, which amounts to some 920 thousand tons per year [1].

## Materials and methods

Testing of the functionality of the AMIS and testing of the above hypotheses were conducted by comparing the performance of two groups: Informed and Non-informed groups of farmers. The groups were selected randomly from the pilot areas, using the farmer records of the AMIS. Each group consisted of 100 farmers, selected randomly from 2 villages in each district (Chrisana, Borg al kasab, Babana, Al-Hamubshy, Acharashir, Al-hoyez, Ayn Al-Arus and BaniIssa villages for Lattakia, Al-Haffi, Jablih and Al-Qurdaha districts, respectively), whose citrus fruit production was marketed in one of the four markets studied.

We take into consideration that an AMIS can help farmers choose the right market at the right time to sell their fruit. In this way, farmers are supposed to obtain the maximum returns from their citrus orchards, as they sell fruit at the best prices. We served the “Informed” group of farmers with information in two ways:

1. Printed information (a sheet of paper) delivered directly to each member at the beginning of the new agricultural year (August, 2012),
  - A print-out of the predicted[or current]weekly citrus fruit prices at each of the wholesale markets in the Lattakia region;
  - A printed copy of information on sorting, grading and packaging of citrus fruit, as recommended by the Lattakia Agricultural Directorate.
2. Information sent by SMS (mobile phone) to the informed group, throughout the marketing season (February through the end of July 2013),
  - Averages of weekly empirical citrus fruit prices at each wholesale market in the Lattakia region.

The head of the households (farmers) in each group was asked to fill in a form relating to the sales procedure during one citrus season. The form contained the following items: social and economic characteristics (age, gender, education level, communication and mobility), cost of items produced per year, who decides the citrus fruit prices, form of marketing and main citrus buyers, date of citrus fruit sales; location (roadside, staple crop markets, farm gate, etc.), quantities sold and the prices received. The data obtained were subjected to statistical analysis for the mean, percentages, frequency, and analysis of variance (ANOVA) to show any significant differences between the prices received or quantities sold by the two groups of farmers (informed and non-informed), according to this formula:

$$Y_{ijk} = \mu + \beta_j + \gamma_i + \delta_k, \quad (1)$$

where  $Y$  – stands either for  $P$  – price or  $Q$  – quantity;  
 $\mu$  – intercept;  
 $\beta_j$  – coefficient for the markets;  
 $\gamma_i$  – coefficient for the information treatment;  
 $\delta_k$  – coefficient for the seasons;

Note, that season is to be treated as repeated observations, because the error terms are not necessarily independent.

## Results and discussion

To measure the effect of the AMIS on spatial and temporal arbitrage in the market for Valencia citrus fruit market, we considered four marketing periods: a) before marketing season (by contract), b) at the beginning of the marketing season (during February and March; at the farm gate and on wholesale markets), c) in the middle of the marketing season (April, May and June; at the farm gate and on wholesale markets), and d) at the end of the marketing season-late season- (during July; at the farm gate and on wholesale markets).

First, we verified that there were no significant differences between the two groups and thus that the effects on performance could be accounted for as mostly due to the provision of the new information. Table 1 shows that average Valencia citrus orchard areas were between 3.8 and 4.0 ha for the non-informed and informed group respectively and that this difference is not significant at  $\alpha = 0.05$ . Similarly, the differences between the two groups in terms of product volumes were not significant at  $\alpha = 0.05$ .

Table 1

Mean of total production and area for the two treatment groups

Group	Non-informed	Informed	ANOVA Test	
	Mean	Mean	<i>F</i>	Sig.
Area	0.4	0.38	0.334	0.564
Total production	14350.0	15807.0	1.319	0.252

Sources: Own calculations based on the questionnaire data

## Temporal and spatial arbitrage in transaction volumes

We encouraged farmers by giving them our information and knowledge of market trends both to sell their fruit directly to traders on the wholesale markets and at the late/end period of marketing, so as to get better prices as a result of decreased fruit supply, on one hand, and to eliminate mediator traders, on the other. The results drawn from our questionnaires are represented graphically in Fig. 1.

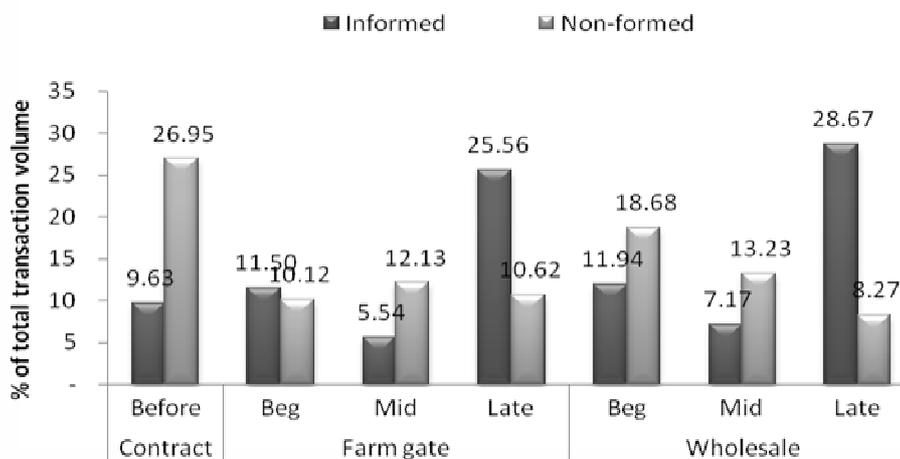


Fig. 1. Temporal and spatial arbitrage in transaction volumes

Fig. 1 shows that minimum and maximum percentages of total transaction volumes of Valencia citrus fruit ranged from 5.54 (at the farm gate in mid marketing season) to 28.67 % (on wholesale markets, in late marketing season), and from 8.27 (on wholesale market in late season) to 26.95 % (at the farm gate by contract before the marketing season) for the Informed and non-Informed groups, respectively.

- In the late of marketing period, at the farm gate, transaction volumes of Valencia citrus fruit increased from 10.62 % for the non-informed group to 25.56 % for the informed group;
- At the end of the marketing period, on the wholesale market, transaction volumes of Valencia citrus fruit increased from 8.27 % for the non-informed group to 28.67 % for the informed group.

Transaction volumes for the Informed group can be predicted by the formula  $y = 1.959x + 6.448$ , which indicates a positive trend in citrus farmers selling their fruit on the wholesale market at the late/end period, whereas the trend formula for the Non-informed group ( $y = -1.545x + 20.46$ ) has a negative trend.

These results suggest that most of the informed farmers group had a clear tendency to market their Valencia citrus fruit in the late/end period of marketing, on the wholesale market, as encouraged by the information received from the MIS, in order to obtain better prices by using both temporal and spatial arbitrage in transaction volumes –  $Q$  (Table 2).

Therefore, it can be said that the AMIS proposed is functional, resulting from temporal and spatial displacements of Valencia citrus fruit transaction volumes towards wholesale markets at the late/end period of the marketing season.

### MIS effects on average prices obtained per 1 kg of Valencia citrus fruit

Farmers sold their fruit in 1-6 transactions, with different volumes and prices, so we calculated the average price obtained by the farmers per 1 kg of Valencia citrus fruit, by the formula:

$$\text{Avg\_price\_per\_kg} = \frac{\text{Total\_gross\_income}}{\text{Total\_transactions\_volume}} \quad (2)$$

$$\text{Total gross income} = T_1 \cdot P_1 + T_2 \cdot P_2 + \dots + T_n \cdot P_n \quad (3)$$

where  $T$  – transaction;  
 $P$  – price.

Average price per 1 kg of Valencia citrus fruit obtained by Informed and Non-informed farmer groups.

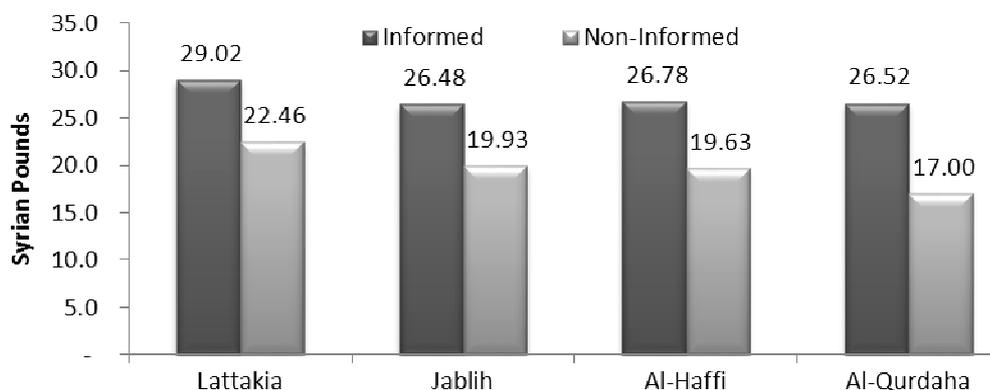


Fig. 2. Average prices per 1 kg obtained by farmers in each market

Fig. 2 shows that the farmers from the informed group obtained better prices than their peers in the non-informed group, due to their increased ability to select the right market at the right time. So minimum and maximum average prices obtained per 1 kg of Valencia citrus fruit ranged from 26.48 Syrian Pounds (on the Jablih market) to 29.02 Syrian Pounds (on the Lattakia market), and from

17.0 Syrian Pounds (on the Al-Qurdaha market) to 22.46 Syrian Pounds at (on the Lattakia market) for the Informed and Non-informed groups, respectively.

These results suggest that most of the informed farmers group from Al-Qurdaha, Jablih and Al-Haffi marketed some or all of their Valencia citrus fruit on the Lattakia market in order to obtain better prices, using spatial and temporal arbitrage when they sold their Valencia citrus fruit.

Table 2

**ANOVA test for marketed quantities of Valencia fruit and prices obtained by farmers from the two groups, in different marketing periods (SP)**

Test parameter	Df (price)	F (price)	Df (quant)	F (quant)	P > F (quant)
Model	6	207.911	6	5.515	0.000
Market	3	12.779	3	3.326	0.019
Inf	1	669.738	1	20.977	0.000
Season	2	269.694	2	4.841	0.008

Note; Residual degree of freedom: for price 2399, for sales (quant) 587.

Table 2 shows that the informed group obtained significantly higher prices per 1 kg of Valencia citrus fruit obtained at each place and time. It confirms the benefit of the marketing information in both terms: choosing the right time and going to the right place for selling Valencia citrus fruit produce.

The proposed AMIS caused spatial and temporal arbitrage in citrus fruit sales venues and improved the farmers' gross income from citrus fruit substantially. The information received was helpful in obtaining better prices per 1 kg of Valencia citrus fruit (8.7 Syrian Pound) "Table 3". These results are in line with [17], who reported that, when farmers got market information before selling their products, they had a chance to choose the right place and time to sell them and get higher prices, which also saved on the cost of multiple transportation and handling both by allowing more direct relations with traders and by using collective marketing. Therefore, market information can play a crucial role in the short and long term because farmers can benefit from this information to engage in better spatial and temporal arbitrage in addition to discovering new markets, which leads to reductions in price instability and provides more profit for the farmers [18]. However, we should take into account that the lack of competition in the markets and high transport costs on the national level have negative effects in making spatial and temporal arbitrage effective [19].

Table 3

**Estimated parameters**

Estimated parameters	Markets				Treatment group		Season			Cons
	Lattakia	Jablih	Al-haffi	Al-qurdaha	Non info	Info	Beg	Mid	Late	
Price	0.0	-2.5	-2.5	-1.4	0.0	8.7	0.0	-5.6	3.9	21.9
Quantity sold	0.0	566.9	411	525.6	0.0	743.6	0.0	-82.6	461.7	2726.9

Sources: Own calculations based on the questionnaire data

The more informed farmers were, the less middlemen were in the market chain. In this context [20] say that disintermediation may decrease the cost of servicing, which could lead to decreasing total costs by eliminating some actors in the value chain to increase the profit margin for the farmer, which is the main objective of our research. Other studies about the effect of information on groups of farmers with and without access to information have shown positive links between using public telephones and the amount of income received [21], other evidence from Uganda showed that households with access to a radio did deals for higher farm-gate prices than households without access to a radio [22]. We should therefore find the best ways and tools to disseminate timely, real and

accurate information to the farmers, which, in turn, can help them in the negotiation process and in making their decisions. For example, in our research we depended on mobile phones to send information, where 95 % of Lattakia farmers have mobile phones.

### Conclusions

It was confirmed that small producers (households), who receive improved market information, are more likely to sell their citrus products on competitive crop markets, where we found that most of the Informed group marketed their products on competitive markets, receiving higher prices, in contrast to most of the Non-informed farmers, who marketed their products “disadvantageously” by making contracts before the ripening period, receiving low prices. As opposed to this, the informed group showed a clear tendency towards selling their fruit on the Lattakia wholesale market. We also found that in all four regions the farmers, who received information, obtained higher prices for sales than farmers, who did not get this information. Information thus can be an important factor in the success of citrus producers and the implementation of an MIS is justified.

This view favors the implementation of an AMIS as a tool for the efficient dissemination of market information directly to producers on the basis of mobile phone use. The bonus of tools such as AMISs lies also in the building up of infrastructures that can be used later in other sectors, as well as in e-government, which could be one of the most interesting economic post-war-reconstruction-led reforms.

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