

PRICE SERIES CORRELATION AND MARKET INTEGRATION: SOME EVIDENCE FROM HAITI

**MATS LUNDAHL
ERLING PETERSSON ***

A commonly employed method for measuring the integration between agricultural markets in developing countries is that of correlating time series of price data for different market-places and products. This procedure builds on the rationale that if two markets are perfectly competitive and spatially well integrated, differences in prices between these markets will reflect transport and processing costs only and the bivariate correlation coefficient between a pair of such time series of prices will be equal to one. A lower correlation, according to this reasoning, will reflect bottlenecks arising e.g. from lack of market information, lack of product homogeneity, or monopoly power.

The studies that have been undertaken with this method have yielded very different results. Such studies have been made mainly in two areas: India and West Africa.¹ The «best» results have been obtained for India, with coefficients frequently exceeding 0.80², while the West African studies generally give much lower figures.³

¹ An overall evaluation of most of these studies is made in Harriss (1979).

² Ralph Cummings presents a modal correlation coefficient of 0.85 for 27 wheat markets in Northern India (1956-64) /Cummings (1967), pp. 88, 95/ and Uma Lele reports that all coefficients calculated for Delhi and five Punjab wheat markets lay above 0.90 (1955-65) /Lele (1971), p. 89/. R.C. Gupta gives the following modal coefficients for Uttar Pradesh markets: rice: 0.79, wheat: 0.71, jowar: 0.85, peanuts: 0.91 /Gupta (1973), pp. 118-25/. D.S. Thakur found that 71 percent of all correlations between seven Gujarat wheat markets exceeded 0.75 (1965-71) /Thakur (1974)/. Lower figures, have however, also been reported. Thus, Lele found the number of correlation coefficients for Tamil Nadu rice and paddy markets that exceeded 0.8 to be as low as three (out of 507) /Lele (1971), pp. 84-98, 245-46/.

³ William Jones in 1968 reported from Nigeria that out of 4,836 correlation coefficients computed for seven products only 19 reached the 0.90 level or more while 424 were zero or negative. The product showing the best correlation was gari, where more than one-third of the coefficients were 0.80 or higher. For cow-

The interpretation of correlation coefficients calculated in this manner, from raw price data, is not without problems, however. In some of the aforementioned studies, correlation was found to be highest between markets which had no physical contact or during periods when one should expect contacts to be less intense. Hence, criticism of the calculations has not been lacking. George Blyn⁴ has pointed out that there may be common, underlying trends in the series which bias the results upwards. Inflation or population growth, for example, may give rise to linear trends, and such trends show perfect correlation even if the markets in question are not at all integrated. Also seasonal variations may be synchronized, for example due to a common climatic pattern with planting and harvesting taking place at the same time near all the markets included in the sample. This would lead to high (spurious) correlation, even when there is no or little contact between markets. As a remedy Blyn suggests that the data should instead be grouped into twelve groups, one for each month, that a trend should be fitted to each of the thus obtained series and that the residuals within each group should thereafter be correlated. He has also undertaken to calculate monthly coefficients from Ralph Cummings' Indian data, showing that this produced an average which lay below the Cummings (modal) 0.85: 0.68.

The correlation method has also been criticized by Barbara Harriss on the grounds that a high correlation between two markets does not necessarily mean that these two markets are well integrated in the sense that a competitive network of traders exists which ensures that agricultural goods move between market-places in swift response to price differences that exceed transport costs.⁵ High correlation could just as easily indicate stable margins and monopolistic imperfections in the marketing system as competitive conditions and efficiency. Also, low correlation does not have to be an indication that markets are not well integrated. We will come back to this below.

The purpose of the present paper is to use price data from an economy where, on other grounds, an efficiently integrated marketing system for agricultural products is believed to exist, that of Haiti, to calculate monthly correlation coefficients between every pair of markets in the same manner as done by Blyn with Cummings' data, to show that coefficients of about the same size emerge, that a seasonal pattern which resembles the one found by Blyn is present and, finally, to discuss what these patterns may indicate with respect to the structure of the marketing network. Before

peas, some 30 percent were equal to 0.70 or more. No yam coefficient was as high as 0.80 and a maximum of 1 percent of the coefficients for the remaining products (rice, sorghum, millet and corn) reached this level /Jones (1968), pp. 110-11/. Alan Thodey reports better figures for cowpeas in Western Nigeria (almost all coefficients above 0.80) but equally low ones for rice and corn (almost all below 0.70) /Thodey (1968)/ and Elon Gilbert in Northern Nigeria found the modal coefficient for cowpeas to be 0.65, for rice 0.55, for sorghum 0.45, and for millet 0.36 /Gilbert (1969), p. 249/. H.M. Hays likewise reports that correlation coefficients for sorghum and millet in Northern Nigeria in only one percent of the cases exceed 0.80 /Hays (1975), p. 72/. D. Kohlers in a study of Nigeria for single years (1971, 1973 and 1975) mostly arrived at statistically insignificant coefficients during the first and last years but for 1973 found that most coefficients were significant and that half of them exceeded 0.80 /Kohlers (1977), pp. 35-44/. Elliot Berg for Upper Volta analyzed the three years 1962, 1963 and 1976. For the early years he only found that 20 percent of his coefficients were significant at the 0.05 level but for 1976 90 percent of the coefficients exceeded 0.90 and were significant /Berg (1977)/. Southworth, Jones and Pearson, finally, analyzed 16 markets in the Atebubu District of Ghana (1965-72) and found that in the case of corn 88 percent of all coefficients were 0.75 or higher but that for rice, yams and kokonte the figures were significantly lower: 31, 21 and 15 percent, respectively /Southworth, Jones & Pearson (1979) p. 189/.

⁴ Blyn (1973).

⁵ Harriss (1979), pp. 202-03.

we do that, however, we will give a brief overview of the Haitian marketing system and the indications for efficiency in this.

The Haitian Agricultural Marketing System

Between 1973 and 1975, the Interamerican Institute of Agricultural Sciences (IICA) carried out a major project entitled «Analysis and Diagnosis of the Internal Marketing System for Agricultural Produce in Haiti» in collaboration with the Canadian Embassy and a number of Haitian public agencies. The IICA project for 1975 identified a total of 519 market-places in Haiti with a presence of 50 persons or more on a normal market day.⁶ IICA classified all market-places in three different categories: urban, regional and semi-rural.

The urban market-places are those found in the largest ports and the Department capitals. Before the products reach these markets, they have passed through a chain of intermediaries. The market women who buy produce from the producers rarely themselves resell these goods to the consumers in urban markets but dispose of the goods to retail vendors. Thirty-four of the 519 markets covered by the IICA survey were classified as urban.

The regional market-places serve a large geographical area — in extreme cases almost the entire country. The sellers bring to these markets staples from different regions in order for them to be redistributed, partly to the cities and partly to local markets, i.e. many of the transactions taking place are transactions between intermediaries of various kinds. Consumers, however, frequently buy in the regional markets due to their large variety of goods. Fifty-nine of the markets of the IICA survey were of this kind.

Finally, we have the most common type of market: the semi-rural one. No less than 86 percent of the 519 IICA markets, i.e. 426 market-places, belonged to this category. These markets only touch the immediate area where they are located. Peasant women bring in the goods from the surrounding countryside and sell to traveling intermediaries who bulk the produce in order to bring it to regional or urban market-places. The same intermediaries dispose of goods of urban origin in these markets. In the semi-rural market-places, local producers also sell directly to local consumers.

This network of public market-places handles the marketing of all subsistence crops in Haiti, i.e. of all the crops grown in the country that are cultivated for the domestic market. In addition, it ensures that products that the peasants themselves do not manufacture — often imported goods — reach rural districts. It has to serve a large number of households. Haiti had a rural population of some 3.4 million in 1971, or 760,000 households,⁷ all of whom were dependent on this marketing system for disposing of farm products and for buying urban goods and agricultural commodities not grown on the farmstead.

The strategic person in the marketing system for agricultural products is *Madam Sara*,⁸ who is the Haitian counterpart to the West African «market mammy». She is the traveling intermediary who connects the countryside with towns and cities.

⁶ See LaGra, Fanfan & Charleston (1975).

⁷ Institut Haïtien de Statistique (1973), p. 1.

⁸ The name comes from that of a migratory bird that «flies from place to place and never fails to find its food wherever it might be» (Murray & Alvarez, 1973, p. 28), but the term also is somewhat derogatory, since this bird is known to pillage the peasants' crops.

Madam Sara as rule is a wholesale dealer who only carries retail trade as a side activity if she bothers at all with the latter type of transactions. In most cases she follows a regular geographic route and deals with customers with whom she has established close and reliable contacts. Often she carries a limited number of products only, where one crop is the main item and the others are carried as sidelines which she can fall back upon, should something exceptional happen to the demand or supply of her regular staple. She usually employs the services of truckers who regularly go back and forth between determined geographic points in the country.

The retail level of the marketing system is represented by another group of women, the *revendeuses*. These either obtain their stock from the *Madam Sara*, from the family farm, or from other peasants. It should be noted that the division between *revendeuses* and *Madam Sara* is not a rigid one. We have already seen that under certain (exceptional) circumstances, the *Madam Sara* may turn to retailing, but it also occurs that certain *revendeuses* go on trips in the countryside, in the same manner as the wholesale dealers do — only on a more infrequent and irregular basis. Often the ambition of the retailers is to become wholesalers (which requires more capital).⁹

The Efficiency of the Marketing System

The Haitian marketing system for agricultural products has been the subject of a fairly large number of studies since the late 1950s. The opinion as to whether the system is an efficiently functioning one in the sense that it enables goods to flow from producers to final consumers at minimum cost varies from author to author. Thus, Paul Moral, in his standard work on the Haitian peasant, contends that the «infinite number of small transactions» in the rural marketing system leaves the peasants with but «a miserable benefit», that the smallness and frequency of the transactions (with goods sometimes passing through many hands before they reach the consumer) increases the price of urban goods to the peasants, that the intermediaries subject the peasants to all kinds of petty frauds both when buying and when selling, and that the peasants as a rule are forced to sell their commodities at the most unfavorable moment in time — at the beginning of the harvest, when prices are low.¹⁰ In this view, the marketing system is characterized by imperfect competition, and the victim of these imperfections is the peasant.

Other observers, notably Sidney Mintz, who in the late fifties carried out a number of studies on the marketing system,¹¹ hold the opposite view and point to the economies involved in using large numbers of people with few alternative employment opportunities, investing human effort and time and economizing on scarce capital resources.¹² The system with this view is one which builds on stern competition between intermediaries at all levels and which does not contain any exploitative elements.

A detailed evaluation of the available information regarding the efficiency of the

⁹ For more details, see Lundahl (1979), pp. 145-49, and the literature cited there.

¹⁰ See Moral (1961), pp. 245-47. Cf. also Pierre-Charles (1965), pp. 154-55, and Brisson (1968), pp. 47-51.

¹¹ See Mintz (1960:1), (1960:2), (1960:3), (1961:1), (1961:2) and (1964).

¹² In addition to the Mintz works, see Métraux et al. (1951), p. 125, Underwood (1960), p. 32, and Rotberg & Clague (1971), p. 281.

marketing system for agricultural products has been made by Mats Lundahl,¹³ who concludes that the view which contends that the system is an efficient one and that exploitation of the peasants by the middlemen does not appear to take place is the one closest to the truth. Five types of evidence are discussed:

1. profit margins among intermediaries,
2. freedom of entry,
3. possibilities of making short-cuts in the marketing chain,
4. determination of prices, and
5. non-price competition.

The overall impression regarding profit margins is that these appear to be slim. It should be stated that no systematic evidence of the size of intermediary profits has been collected, but the available evidence shows that at the lowest levels of the trading hierarchy, the irregularly working *revendeuses*, the profits amassed only yield a small supplementary income to that generated by other livelihoods. Regular *revendeuses* appear to be a little better off, but not much. The evidence points to profit margins of perhaps 10-20 percent per *gourde*¹⁴ invested. The profit level of the *Madam Sara* seems to be in the same range. Even these figures are probably too high, however, since they presumably are not *net* figures, i.e. they do for example not take the value of the labor input into account. If a wage figure is imputed, the margins could be considerably lower.

There is enough freedom of entry in the marketing system to ensure that the system does not permit monopsony or oligopsony and hence inefficiency. Everybody cannot be a *Madam Sara*, since for this, a minimum capital is required, but the point to be noticed is that there are always enough *revendeuses* around who are prepared to enter wholesale trade, should the profit level there start to rise. In the same manner, *revendeuses* working on an irregular basis will start working full time if prospects in the retail sector look more promising than usual, and so on, all the way down the scale.

Ample opportunities exist for producers, intermediaries and consumers to make short-cuts at all steps in the commercialization chain. Consumers may buy both from intermediaries (at various levels) and from producers. The latter may sell both to the final consumers and to different types of intermediaries. The middlemen, finally, may sell either to other intermediaries (at many levels) or to the final consumers. This means that if middlemen, at any level in the system, attempt to fix prices to increase profits, they can be bypassed by simply avoiding that level, and proceeding to the next level instead.

The process whereby the price is set in a particular market-place bears a striking resemblance to the one described by economics textbooks when discussing free competition, i.e. it is set by the interaction of demand and supply. The existence of hundreds of different units of measurement which vary from place to place complicates the procedure, but haggling is always used for solving this problem. In any market, the equilibrium is established within a couple of hours and thereafter varies very little during the day.

The final means whereby competition and efficiency are ensured is that of non-price competition. Price competition is quite intense in the marketing system for agricultural goods, but it is not the only form of competition prevailing. In their

¹³ Lundahl (1979), Chapter 4.

¹⁴ The Haitian currency unit, the *gourde*, equals 20 US cents since 1919.

struggle to remain in business, the intermediaries attempt to form *pratik* relationships with the customers and sellers. Such relationships entail mutual concessions from the two parties entering the agreement, such as lower prices for a given quantity when selling or higher prices when buying. By doing so, the contracting parties attempt to neutralize extreme fluctuations in the market. The intermediary buys more than she would have done without *pratik* when there is a glut in the market, and in a situation when demand is high the seller does not sell scarce goods without first offering them to her *pratik*.

The *pratik* institution also saves some of the time normally involved in searching for goods. Finally, it should be mentioned that another form of non-price competition is that of trying to buy goods outside the market-places. Many *Madam Sara* employ agents who trace the produce among the peasants before it gets to the market to ensure that their employer is not without stock when leaving the market-place.

Thus, the conclusion to be drawn from this brief discussion is that the Haitian marketing system for agricultural goods appears to work smoothly and efficiently. Profit levels are not excessive. There is considerable freedom of entry. All parties involved have many opportunities to make short-cuts in the marketing chain. Prices are set by the forces of demand and supply. Non-price competition is used in addition to price competition.

Therefore, given the apparent efficiency of the Haitian marketing system, we should expect that the correlation analysis, as amended by Blyn, would apply throughout Haiti. However, the validity of these high correlation results is necessarily dependent upon the quality of the data. Let us then proceed with a discussion of the data base and its reliability.

The Data Base

During the course of the IICA marketing project, it was learned that four Haitian institutions, *Institut Haïtien de Statistique*, *Secrétairerie d'Etat du Commerce et de l'Industrie*, *Institut Haïtien de Promotion du Café et des Dénrées d'Exportation (IHPCADE)* and *Institut de Développement Agricole et Industriel (IDAI)*, were systematically collecting information regarding the prices of a number of agricultural products in a number of markets throughout the country.

The *Secrétairerie* did not start collecting data until 1974, and the data published by the *Institut Haïtien de Statistique* in its *Bulletin Trimestriel de Statistique* mostly turned out to be secondary data from IHPCADE, but the other two sets of prices series contained enough information to warrant further analysis and publication by IICA.¹⁵ Both IHPCADE and IDAI had collected daily data, the former since 1950 and the latter since 1965, and IHPCADE had in addition calculated weekly averages. With the aid of these series, IICA proceeded to calculate monthly averages by product and by market for the years 1965-74. This procedure yielded a total of 21 different crops and 49 different markets for which data were reasonably complete and where the units of measurement could be determined with some accuracy.¹⁶

James Johnson and Jerry LaGra point out that although time series exist for the entire 1965-74 period, these series are reasonably complete only for 1971-74.¹⁷ This

¹⁵ See LaGra, Charleston & Fanfan (1975), IICA (1975:1), (1975:2).

¹⁶ These crops and markets are listed in LaGra, Charleston & Fanfan (1975).

¹⁷ Johnson & LaGra (1975), p. 5.

is not quite true, however. For some products it is possible to go back to 1969. We will therefore presently use the 1969-74 period. Furthermore, reasonably complete data exist only for a limited number of products. We have selected five commodities — rice, grain millet, grain corn, ground corn and red beans. Rex Oro rice was available for seven markets only. We therefore added other, coarser, rice varieties as well. In this way, fourteen new series can be added to the original seven. This would, however, leave us with two overlaps, since for Cayes and Jacmel we have two series for each market. Since there are more non-Rex Oro series than Rex Oro series, we therefore dropped Rex Oro for these two markets. This procedure leaves a total of nineteen market for rice of different quality. Assuming that the different varieties are fairly close substitutes, the procedure may be defended.

A remedy had to be found for the missing monthly data in many of the time series. Here, one could either omit those months where data were missing or try to fill in the holes. The latter approach was chosen. We simply decided to follow Johnson and LaGra here:

«A decision had to be reached as to which missing data could be effectively estimated and what was the best estimation procedure. The prices for a number of products were plotted by month for each year that there was information and it was discovered that, in some cases, the patterns of price variation varied from year to year. A number of test estimates were performed on prices where the values were already known. These tests show that the estimates of prices based on the prices for the previous month and the following month in the same year were more accurate than estimates that included prices for the previous and following year for the same month. Thus, missing prices with adjacent prices for the same year were estimated by a simple average for the prices of the month preceding and the month following the missing price for that year.»¹⁸

The upper limit for the number of consecutive observations to be filled in was arbitrarily put at four. Thus, linear interpolation was used for filling in missing observations which were not the last month of the year.¹⁹ To obtain figures for those cases where the last or the last few (up to four) observations were missing, a different procedure was followed. We then used those observations for the remaining years which had *not* been filled in with the aid of linear interpolation, took the last month for which there was an observation in 1974 (the last year) and calculated the average price for the remaining (non-doctored) years. We repeated the procedure with the December observations, and thereafter assumed that the December value for 1974 followed this trend. (If September, October and November observations were also missing for 1974, these could subsequently be filled in with the aid of linear interpolation.) These two operations added 252 observations (out of a total of 5,256) to our data base.

Figure 1 shows the location of the markets included in the analysis, and Table 1 provides the key to the map. Altogether, series from 20 different markets could be used, although in only one case could use be made of all of them. The number used varied between 8 and 20: rice - 9, grain millet - 8, grain corn - 20, ground corn - 11, red beans - 15.

¹⁸ Ibid.

¹⁹ Even if the first observation in the series was missing, linear interpolation could be used, since in all cases data for December 1968 were available.

Figura 1

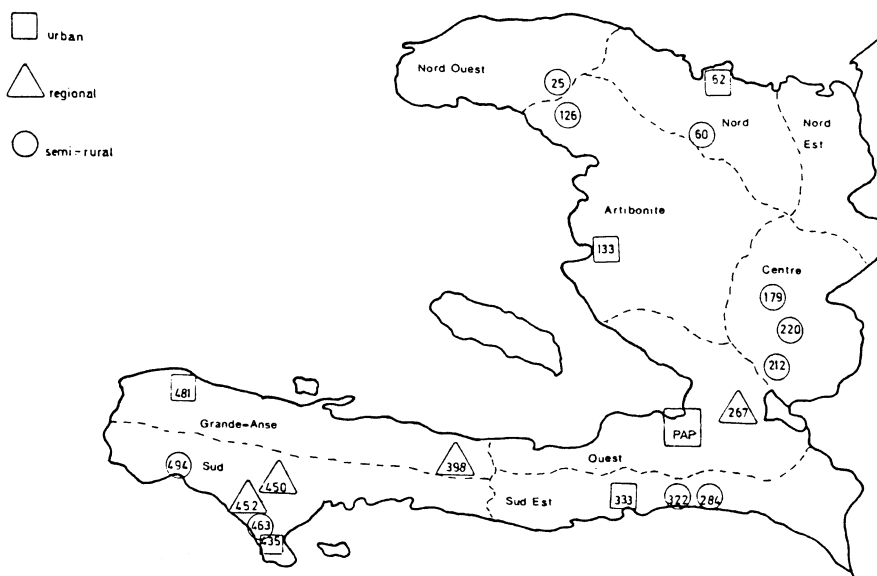


Table 1
Markes Used in the Analysis

IICA Number*	Market	Source of Data	Market Type
PAP	Port-au-Prince**	IHPCADE	Urban
25	Bassin Bleu	IDAI	Semi-rural
60	Grisson Garde	IDAI	Semi-rural
62	Cap-Haïtien	IHPCADE	Urban
126	Gros Morne	IDAI	Semi-rural
133	St-Marc	IHPCADE	Urban
179	Thomonde	IDAI	Semi-rural
212	Mirebalais	IDAI	Semi-rural
220	Lascahobas	IDAI	Semi-rural
267	Croix-des-Bouquets	IHPCADE	Regional
284	Marigot	IDAI	Semi-rural
322	Cayes-Jacmel	IDAI	Semi-rural
333	Jacmel	IDAI	Urban
398	St-Michel du Sud	IDAI	Regional
435	Les Cayes***	IHPCADE	Urban
450	Camp-Perrin	IDAI	Regional
452	Ducis	IDAI	Regional
463	Chantal	IDAI	Semi-rural
481	Jérémie	IHPCADE	Urban
494	Les Anglais	IDAI	Semi-rural

* According to the classification in LaGra, FanFan & Charleston (1975). This document also gives a description of each market-place.

** Not numbered in the IICA classification, since Port-au-Prince contains many markets, each of which has a separate number.

*** IDAI data for rice.

The Reliability of the Data

As we already are aware, our data are not perfect. Some observations were missing and had to be filled in. Other deficiencies in the data may also bias our results. One such source of errors has been encountered in the discussion of the rice series: different qualities of each product. In the case of rice, this source is presumably not a serious one, since we know what kind of quality that has been measured in each market. The problem, however, also arises for the other products, but when the IICA personnel started to analyze the IHPCADE and IDAI price data, they tried to minimize this type of error. In the first place, IHPCADE and IDAI data were comparable for all the products included in the present study (and in the one by Johnson and LaGra).²⁰ Secondly, care was taken to include price data for one variety only of each product. In the case of corn, two varieties are reported: grain and ground, but the price of the ground variety is consistently higher due to the cost of processing.

The reported data could also be distorted by the fact that in Haiti the basic units for measurement are volume and not weight measures. Thus, all our five products are measured in *gros-marmites* (*gro-mamit*), but the *gros-marmite* is not a fully standardized measure:²¹

«The size of the 'gro-mamit' is dependent upon the size of cans imported into Haiti or manufactured by Haiti Metal. These cans tend to be the standard N° 10 can. One exception is when the gro-mamit is manually produced for enterprising intermediaries in which cases the weight of a product may vary by 1/2 pound in either direction depending upon whether the 'marchande' is buying or selling.»²²

When people refer to the *gros-marmite*, they, however, often refer to a marmite of five, six, seven, eight or even ten, depending on the quantity equivalence in pounds. The latter of course differs from product to product. The IICA team collected *gros-marmite* measures from different regions of Haiti in an attempt to determine the average pound equivalent of a *gros-marmite* for a number of products. Their results are reproduced in Table 2. In no case did the *gros-marmite* measure for a particular product vary by more than 0.25 pound, and «... this variation was due to the fact that the mamit had had the bottom raised inside the can by an enterprising marchand (intermediary)»,²³ which means that basically, the *gros-marmite* measures used for the same product are the same throughout the country.

The practice of referring to marmite of seven, eight, etc, can instead be explained by the business practice prevailing:

«The fact that the 'gro-mamit' used throughout Haiti are of basically the same size leaves one with the questions: What is a mamit of 7, of 8, or of 10, etc...? The answer is that in times of abundance of a specific crop or perhaps in a particular market, the marchand (intermediary) may use the term mamit but instead of a true mamit (equivalent to approximately six one-pound cups) she may sell the purchaser 7, 8, 9 or 10 of the smaller units (gobelets). Thus it seems that while the basic measuring unit (*gro-mamit*) is approximately the same size

²⁰ LaGra, Charleston & Fanfan (1975), p. 29. These products are the only ones for which this is true.

²¹ For a list of 160 different volume and weight measures employed in Haiti, see Moral (1959), pp. 79-81. Cf. also Duplan (1975), pp. 8-17, Murray & Alvarez (1973), pp. 22-25, and Mintz (1961:2), pp. 25-31.

²² LaGra, Charleston & Fanfan (1975), note, p. 33.

²³ Ibid.

Table 2
Average Weight Equivalent in Pounds of One Gros-Marmite for Different Products

Product	Pound equivalent
Rice	6
Grain millet	5.75
Grain corn	5.75
Ground corn	5.25
Red beans	5.75

Source: LaGra, Charleston & Fanfan (1975), p. 32.

throughout Haiti, it is the terminology in reference to the 'mamit' which varies. When reference is made to a mamit of 8, one is referring to 8 gobelets (small tin cups).

Depending on the region, 8 'gobelets' may vary in weight between 5.5 and 8 pounds. Thus 8 'gobelets' may be equal to or exceed the average weight of a standard gro-mamit.²⁴

In the case of IDAI data, the pound equivalent of the *gros-marmites* were known, and for the IHPCADE data, *gros-marmite* prices were converted to pound prices with the aid of the conversion factors in Table 2.

A third weakness relates to the processing of the collected data. The collection itself appears to be fairly precise. Both IHPCADE and IDAI send agents to the market-places to interview the customers and to watch the transactions taking place, and this procedure according to the IICA team, who observed the collection in several instances, seems to be quite accurate.²⁵ It is when these data are processed at the respective regional offices or at the main IHPCADE office in the capital that errors may be introduced. In the calculation of the weekly averages, urban, regional, and semi-rural market-places in some instances — presumably the large urban concentrations — may be mixed. Moreover, the calculations are made by hand, which may be a source of further error. In the case of IDAI, no such errors should be present since the raw data are forwarded directly to the central office in Port-au-Prince and are filed there without having been processed.²⁶

To conclude, our price data are not perfect, but on the other hand we have not found any deficiencies which are of such magnitudes as to preclude their use for testing purposes. Most of the possible sources of error have been checked in one way or another.

Results

The average bivariate correlation coefficients for the «raw» series were lower than those obtained by Cummings and Lele for Indian wheat but more or less of the same magnitude as those reported by Gupta and Thakur for other agricultural products in India and higher than the figures obtained in most of the African studies; rice: 0.82, grain millet: 0.72, grain corn: 0.77, ground corn: 0.83 and red beans: 0.77. Already

²⁴ LaGra, Charleston & Fanfan (1975), pp. 33-34.

²⁵ Ibid., pp. 11-16.

²⁶ Ibid., pp. 39-40.

this is a strong indication of the low reliability of «raw» correlations. Provided that the Haitians marketing system is an efficient one, we would have expected higher figures.

The coefficients obtained after grouping and detrending data in the same manner as Blyn are shown in Table 3, where a comparison with Blyn's results is also made. It is immediately seen that the average coefficient for each of the products is approximately in the same range as the one calculated by Blyn for India. The supposedly well integrated Haitian market system does not give rise to higher correlation between the residuals after removal of the trend for each month.²⁷

Table 3
Average Correlation Coefficient for Given Months for Different Products.
All Pairs of Markets, Haiti, 1969-74, Punjab and Delhi, 1956-64

Month	Haiti					Nine Indian markets Wheat
	Rice	Grain millet	Grain corn	Ground corn	Red	
January	0.55	0.44	0.65	0.46	0.74	0.95
February	0.52	0.85	0.64	0.54	0.72	0.88
March	0.56	0.92	0.78	0.70	0.73	0.94
April	0.70	0.95	0.80	0.75	0.73	0.68
May	0.78	0.96	0.79	0.71	0.71	0.42
June	0.76	0.96	0.74	0.68	0.66	0.44
July	0.68	0.94	0.83	0.81	0.65	0.50
August	0.71	0.90	0.81	0.84	0.25	0.71
September	0.61	0.87	0.66	0.77	0.15	0.30
October	0.50	0.48	0.34	0.34	0.28	0.56
November	0.43	0.28	0.15	0.21	0.32	0.80
December	0.41	0.11	0.19	0.22	0.43	0.95
Average	0.60	0.72	0.62	0.59	0.53	0.68

Sources: Haitian figures computed by the authors, Indian data: Blyn (1973), p. 57.

²⁷ The coefficients in Table 3 come from a short time series of only six years, which means that for a coefficient to be significant at the five percent level it has to equal at least 0.81. The percentage of coefficients of 0.80 or more for each product and month is shown in Table 4, which reveals the same type of seasonal pattern as that shown in Table 3.

Table 4
Percentage of Correlation Coefficients of 0.80 or More. All Pairs of Markets

Month	Rice	Grain millet	Grain corn	Ground corn	Red beans
January	23	29	38	18	54
February	23	79	41	33	43
March	23	89	63	49	48
April	46	100	57	58	51
May	68	100	64	47	42
June	51	100	58	56	33
July	64	96	71	67	33
August	57	86	62	75	19
September	42	79	32	53	10
October	22	29	20	16	10
November	23	14	18	13	12
December	24	7	14	15	24

The Haitian data also corroborate the finding by Blyn that correlation appears to be lower during the harvest months when most of the deliveries are made. For all the food grains there is a tendency for correlation to fall towards the end of the year (a little earlier for red beans). This is not what one would expect *a priori*:

«Viewed as a whole, trading activity in Haiti's rural market-places reaches its peak about December, declines very sharply in the first months of the year, climbs to a spring climax around Easter, and then remains relatively stable (sometimes with a slight rise and fall in the late summer) until the November-December peak once more. This description is subject, of course, to variation and refinement, depending upon the region, the rainfall, the particular crops being considered, and so forth». ²⁸

The picture conveyed by the present correlation series, differs from the impression given by the quotation. One should *a priori* expect to find better correlation between market-places during periods of abundant supply of goods than when supply is scanty and erratic. In the former case, the itinerant traders should more easily be able to carry goods from one market-place to another so as to create a more uniform price picture, whereas when only smaller quantities are put on the market a split picture could arise. This is, however, not confirmed by the present findings. Neither can we explain the lower correlation during the winter months by the seasonal distribution of rain, since the winter is in general the period with *least* precipitation.

These findings are open to more than one interpretation. One explanation is that the Haitian internal marketing system for agricultural goods is not at all as efficient as commonly alleged. Other possibilities, however, appear to be more realistic. For correlation analysis to yield high coefficients when integration is high, trade must be uni-directional. Otherwise, the method breaks down. William Jones has constructed a «gold point» model of trade where two markets, A and B, both produce and consume a particular commodity. Thus, trade in both directions between A and B is possible, and the price in market A may exceed or fall short of the price in B with an amount equal to the transport costs between the two markets, i.e. the price in A can vary with as much as twice the transport costs *without* affecting the price in B. ²⁹ This is not accounted for in the correlation analysis which implicitly assumes that trade flows in only one direction between the two markets and that the range of possible price variation is limited to the transport costs between the two markets.

In Haiti, the situation appears even more complicated. The market system is basically vertical, i.e. a product does usually not travel between two markets at the same level in the market hierarchy. If it is to go from market C to market D in the same level, it usually does so only via market E on a higher or lower level. If then, in addition, there is (indirect) two-way trade between markets at the same level, the price in C may vary with twice the transport costs between C and E plus between E and D before affecting the price in D. In this situation, correlation coefficients do not provide any guidance as to the degree of interaction between markets on the same hierarchical level. A very detailed knowledge of the trading patterns is needed before anything regarding the integration of the system can be inferred from our price data. During the non-harvest season, on the other hand, trade is more likely to be uni-directional with goods flowing from areas where storage takes place to deficit areas.

²⁸ Mintz (1964), pp. 271-72.

²⁹ Jones (1968), pp. 116-17.

The reason for the mainly «vertical» trade pattern is to be found in the behavior of the *Madam Sara*. These generally specialize in traveling along a *given* route which takes them upwards and downwards in the hierarchy of market-places rather than in horizontal or circular directions. In this way they keep coming back to the same markets and can therefore more easily establish lasting reliable contacts with costumers and producers.³⁰

This finding puts us in a rather unfortunate position regarding the possibilities of extracting information regarding market integration and competition from price data. Unless we have sufficient knowledge both of transport costs between different markets, of the structure (direction) of trade and of the share of different markets in the supply in a given market-place, there is not much we can do, especially not with correlation analysis. The conclusion reached by Barbara Harriss, «until the technique is greatly refined, its diagnostic use should be abandoned»³¹, appears to be correct, not only as far as correlation of «raw» price data is concerned, but also when it comes to correlating residuals after removing trend elements and seasonal factors.

³⁰ Cf. Lundahl (1980), p. 147.

³¹ Harriss (1979), p. 203.

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