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**A STRUCTURE CONDUCT PERFORMANCE ANALYSIS OF THE
ZIMBABWE AGRICULTURAL COMMODITY EXCHANGE**

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Working Paper AEE 11/2000

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ABSTRACT

A STRUCTURE CONDUCT PERFORMANCE ANALYSIS OF THE ZIMBABWE AGRICULTURAL COMMODITY EXCHANGE

Farmers, agribusiness leaders and government policy makers in Sub-Saharan Africa are grappling with the difficult question of how to restructure their agricultural input and output marketing systems in order to expand the role of the private sector, focus public activities on core functions and improve access by smallholders. In Zimbabwe the concept of an agricultural commodity exchange came about with the government policy of structural adjustment and led commercial farmers to set up ZIMACE to provide a mechanism for price discovery and coordinating the exchange of agricultural commodities. Given the expanding volume of agricultural commodities traded through ZIMACE, ZIMACE is now a major player in domestic, regional and international markets. The most significant development is that smallholder farmers are now basing their prices on ZIMACE. A growing hypothesis is that if smallholders use ZIMACE as a price discovery mechanism then they will not be cheated into accepting low prices compared with if they bargain individually with traders. However, there is a lack of information on the efficiency and effectiveness of ZIMACE in carrying out marketing functions and the potential benefits to smallholders, especially in marginal areas. This study reviews literature on the mechanisms for discovering agricultural prices, mechanisms for coordinating exchange of agricultural commodities, and agricultural commodity exchanges in Africa. The study also reviews empirical methods for analysing agricultural commodity markets and develops a conceptual framework for analysing the structure, conduct and performance of ZIMACE. The conceptual framework is used to analyse basic conditions, contestability of the market and pricing efficiency.

The study found that ZIMACE is organised as an exchange. Although there is high market concentration, ZIMACE is a contestable market. Because of contestability participants engage in price and non-price competitive behaviour and because of market competition there is spatial pricing efficiency and correlation of the ZIMACE market with other markets. Granger causality tests indicate that ZIMACE is a price leader in terms of price discovery and performs well in the transmission of price information. The study recommends that the Government enact legislation to enforce grain handlers including GMB to submit price information which should be made public. In addition, grain commodity brokers are recommended to improve transparency in the price discovery process by not engaging in unethical business practices. Smallholder farmers are recommended to engage the services of brokers and consolidate their produce in different areas to obtain better access to ZIMACE. Finally it is recommended that ZIMACE supports the development of infrastructure facilities to effectively link production centres with market centres and improve market knowledge by providing accurate and timely public market information to all farming sectors.

1. INTRODUCTION

Farmers, agribusiness leaders and government policy makers in Sub-Saharan Africa are grappling with the difficult question of how to restructure their agricultural input and output marketing systems in order to expand the role of the private sector, focus public activities on core functions and improve access by smallholders. Thirty of the 48 countries in Sub-Saharan Africa are currently implementing International Monetary Fund - World Bank sponsored structural adjustment programs (World Bank Annual Report, 1998). The economic reforms are focusing on liberalisation and privatisation of agricultural input supply and farm output markets to get agriculture moving as an engine of economic growth. Zimbabwe has implemented an Economic Structural Adjustment Programme since 1991 to remove pervasive government ownership and control of the economy and transfer responsibilities for managing farm input supply and commodity marketing to the private organisations and market forces (Takavarasha, 1994). These reforms have focused on the dissolution of marketing boards, lifting of farm input and output price controls, and removal of foreign exchange allocation systems. To date, the Government has privatised the Dairy Marketing Board (DMB) and the Cotton Marketing Board (CMB), and it is now privatising the Cold Storage Commission (CSC). Although the Grain Marketing Board (GMB) has not been privatised, it is now required to operate on commercial lines.

The concept of an agricultural commodity exchange came about with the government policy of structural adjustment and led commercial farmers to set up the Zimbabwe Agricultural Commodity Exchange (ZIMACE), to provide a mechanism for price discovery and coordinating the exchange of agricultural commodities, making Zimbabwe the first country in Africa to have a commodity exchange. ZIMACE has taken off substantially since it was formed and the volume of trade has increased from a standstill position over the years. During the 1997/1998 agricultural marketing year, a total of 224531 tonnes of agricultural commodities were traded through the exchange compared with 107 thousand tonnes for the same period in 1996/1997. In terms of value about Z\$759 million of commodities in real terms were traded through ZIMACE during the period April to January 1999 compared to Z\$267 million for the same period in 1998, roughly three times as much as the next best year achieved by the exchange (The ZIMACE Trader, 1998).

Given the expanding volume of agricultural commodities traded through ZIMACE, ZIMACE is now a major player in domestic, regional and international markets. Although ZIMACE started as a holding company with a single broker providing a market for products, it has expanded over the years and now includes buyers and endusers. Farm leaders, agribusiness managers and policy makers are beginning to understand the details of the concept and how the organised exchange functions.

The most significant development is that smallholder farmers are now basing their prices on ZIMACE. A growing hypothesis is that if smallholders use ZIMACE as a price discovery mechanism then they will not be cheated into accepting low prices compared with if they bargain individually with traders. However, there is a lack of information on the efficiency and effectiveness of ZIMACE in carrying out marketing functions and the potential benefits to smallholders, especially in marginal areas. Smallholders face difficulties acquiring information on agricultural commodity prices, moving commodities from production to the urban market centres and obtaining cash to meet their immediate requirements. A major challenge for smallholder farmers is to appreciate that prices can fall as quickly as they can rise. ZIMACE has encouraged farmers to sell through the exchange and this is beginning to happen. However, farmers lack the ability to grow commodities and market them at an appropriate time. This study investigates the impact of ZIMACE on smallholder marketing and the potential benefits of smallholder farmers' participation especially in obtaining timely access to markets and influencing the rules of trading through the commodity exchange to their benefit. For example, although smallholder farmers can sell their produce using brokers through ZIMACE they can still be cheated in accepting low prices if they have a lack of information about prices and alternative buyers. Smallholders are cognisant of the need to be updated and are making enquiries by telephoning and visiting the ZIMACE.

ZIMACE disseminates price information through AGRITEX, through a DANIDA-funded Agricultural Price Marketing Information System project in the Ministry of Lands and Agriculture, and

through the Commercial Farmers Union (CFU) who also disseminate information to neighbouring smallholder farmers. The ZIMACE also disseminates information through the radio and television and its trade association journal, the ZIMACE Trader. In addition farmers are beginning to sell through forward contracts through the exchange. But forward contracts are still poorly understood by largescale and smallholder farmers because of the past history of a single channel of delivery.

This study carries out a structure, conduct, performance analysis of ZIMACE to obtain insights on how its operations may be broadened in order to expand benefits to smallholders. Recently leaders of smallholder farmers have expressed concern with ZIMACE and are exploring opportunities to establish an alternative agricultural commodity exchange for smallholders (Zhou, 1999). This raises the question of whether or not commodity exchanges offer benefits to smallholders, which exchanges are appropriate for smallholders, and what government policies need to be in place to underpin the establishment and management of beneficial commodity exchanges. The liberalisation of agricultural markets implies accepting potentially substantial variation in prices across time. This price variation is necessary if the private sector is to perform its marketing functions. The knowledge gained through the analysis of prices can help alleviate possible negative attitudes in the public sector towards markets and marketing processes in general. There is a need to provide solid and research based information to policymakers to help formulate informed decisions.

2. STUDY METHODS AND DATA SOURCES

The literature review has shown that analysis of agricultural commodity markets requires a broad and comprehensive conceptual framework that captures relationships between market organisation, behaviour of participants, performance and government policies. This developed a conceptual framework derived from the subsector approach for analysing agricultural markets. The conceptual framework is used to derive empirically testable hypotheses about the organisation and performance of ZIMACE and the maize subsector in Zimbabwe. An agricultural subsector refers to an interdependent array of organizations, resources, laws, and institutions involved in the production, processing, distribution and consumption of an agricultural input or commodity. The subsector framework used in this paper is based on the Structure-Conduct-Performance framework or the Industrial Organization theory of agricultural markets.

The Structure-Conduct-Performance framework posits that in an agricultural market subsector there are certain basic conditions that determine its structure. In turn, structure determines the behaviour of organizations engaged in agricultural commodity assembly, transport, storage, processing, wholesaling and retailing. Finally, the behaviour of market participants determines the performance of the industry. Government policies are ubiquitous and influence basic conditions, structure, conduct, and performance of the agricultural commodity market.

Basic conditions are classified on the supply and demand side. Basic conditions on the supply side include the legal and regulatory framework governing agricultural commodity marketing activities such as grades and standards, location of raw materials such as the processed farm grain, nature of technology, durability of the product, the value to weight ratio of the product, and time pattern of production. Basic conditions on the demand side include price and income elasticities of demand, availability of substitute products, rate of growth of demand, cyclical and seasonal demand variability, product marketing characteristics and purchase methods employed by buyers.

Market structure includes characteristics that influence the degree of competition in the market such as the number and size distribution of marketing firms, the degree of product differentiation among sellers' products, the presence or absence of barriers to entry of new firms, the degree to which firms are vertically integrated from assembly of raw grain to retail distribution, and the extent of firms' product line diversification and conglomerateness. Even where there are few firms in the market, the market can still be competitive if there is contestability.

Contestability attempts to specify the conditions under which oligopolies can be expected to have

pricing outcomes that approximate those for competitive markets. Therefore a contestable market is allocatively efficient without relying on the assumption of large numbers. The competitive result is realised because of the threat of entry (Kilmer and Ambruster, 1987). A perfectly contestable market is one in which entry and exit are absolutely costless. In such a market, competitive pressures supplied by the perpetual threat of entry, as well as by the presence of actual current rivals, can prevent monopoly behaviour. The theory of contestable markets suggests that even if there is only one seller, the seller may be forced to act as if there were many sellers and the market becomes a competitive industry.

Market conduct includes methods employed by market participants in determining prices and output, product line and advertising strategies, market channel activities, research and development commitments, legal tactics, lobbying, public relations, and conglomerate behaviour. Market performance refers to "how well the industry does the things" that society might reasonably expect it to do, including productive efficiency, pricing efficiency, progressiveness, employment and equity. Government policies include government programs on standards, product labelling, contract enforcement, infrastructure, price controls, licensing of traders and market regulations. Also government macroeconomic policies such as money supply and interest rates; fiscal policies such as public expenditure and taxation; trade policies such as tariffs and import and export controls; and foreign direct investments.

Market conduct defines the conditions which make possible exploitative relationships between buyers, sellers and brokers. The following guidelines will be used to analyse the elements of market conduct; available marketing channels, availability of price information and its impact on prevailing prices, buying and selling practices in place, distribution channels in place and the price setting behaviour. One can use information on structure and conduct and the nature of maize grain price transmission through the ZIMACE to infer about the pricing efficiency of the maize marketing system and the competitiveness of the markets.

The subsector approach broadens the structure-conduct-performance framework beyond the boundaries of the agricultural commodity marketing organisations and assesses structure and conduct vertically and horizontally at all functional levels from research and development through farm input supply, assembly of farm output, transportation, storage, processing, wholesaling and retailing. This is because structure and behavior at one level in the system influence those in other functional levels. The framework facilitates analysis of vertical coordination of the whole subsector, diagnosis of constraints on better performance, and identification of opportunities for and barriers to improved economic performance.

Although maize prices are discovered by the interaction of numerous market agents trading in several satellite markets dispersed all over the country, it is arbitrage in the principal ZIMACE market that will exert considerable influence in the local formation of maize price. The ZIMACE as a private market is expected to exert the most significant influence in discovering maize prices. In negotiating prices in forward contracts with farmers and larger traders at the ZIMACE, ZIMACE prices have been used as reference prices. It is thus hypothesised that the formation of local maize prices is centred around the ZIMACE meaning that the ZIMACE is expected to lead the local formation of maize prices and after some time lags, prices at the district level will be discovered. Since market integration is concerned about the behaviour of prices across spatially differentiated markets over time, the use of a time series model in the study is most pertinent. The structure and conduct of ZIMACE participants have a direct implication for the nature of maize grain price relationships between different markets.

This study uses econometric modelling to test the pricing efficiency of ZIMACE market integration with other maize markets and investigate price transmission. The first approach uses bivariate correlation. Price correlations measure the co-movements of prices that underlie the intuitive idea of market integration. Correlation of prices at different markets is related to the idea that integrated markets exhibit prices that move together. Parallel movements in prices can occur for several reasons other than the integration of markets for example due to inflation or seasonal influences. In order to eliminate some of these spurious

correlations, price differences instead of price levels are sometimes considered in computing correlation coefficients (Scott, 1995). The second approach uses seven price series to investigate the extent of market integration of the private maize grain markets with the Grain Marketing Board. Time series analysis of price data is conducted to tackle the issue of the relationship of prices in different markets.

The simplest tests of cointegration which use the Engle-Granger two-step procedure were applied in this study. If two markets are very far away from each other, the lack of cointegration may be due to transportation costs. Thus the ZIMACE market will be considered together with Mbare Musika and Chikwanha markets. The Chikukwa, Mhondoro and Guruve markets will also be considered as rural market separated from the urban markets by distance.

Furthermore causality of prices was investigated to give an insight on the price determination process and is a necessary step in investigating price transmission. To address this question the Granger Causality test is used. Testing causality in the Granger sense involves using F-tests to test whether lagged information on a variable Y provides any statistically significant information about a variable X in the presence of lagged X. If not, then "Y does not Granger cause X".

3. RESULTS

The literature review and conceptual framework have identified the institutional pre-conditions for an exchange as key variables that influence structure of markets, behaviour of markets and ultimate performance. Primary and secondary data sources were used to analyse the organisation of ZIMACE, focusing on basic conditions and market characteristics that influence the behaviour of its participants. The results included: interview responses to questions that collected trader perspectives about institutional characteristics of ZIMACE, barriers to entry, market structure and competitiveness.

3.1 Institutional Characteristics Of Zimace

The ZIMACE operates within an institutional environment consisting of a set of fundamental political, social and legal ground rules. These rules establish a basis for exchange, for example, standards, licensing rules, laws of contract and liability, company and cooperative laws and 'fair' trading conventions. Rules and conventions specifying entry conditions and boundaries on cooperative and competitive practices are also important in facilitating exchange and coordination of the ZIMACE activities.

3.2 Barriers To Entry

Traders were asked to rank main barriers to entry for new firms and threat of entry by new firms and threat of entry by regional and international firms. Table 4.2 shows that the major barriers to entry in decreasing order of listed importance are the cost of seat on ZIMACE for one to be a member broker followed by annual subscription fees.

Table 2: Barriers to Entry

Barriers to Entry	Frequency of Reporting by Brokers (%)
1. Cost of Seat on ZIMACE	100
2. Annual Subscription Fees	30

The major barrier to entry revealed in the study was the prohibitively high costs for a seat on ZIMACE for one to become a member. In addition to the joining fee (cost of seat) members are also required to pay an

annual subscription fee. This requirement presents a major barrier to direct participation by small traders and smallholders. A seat on the ZIMACE for one to become a broker is very expensive. Membership requires a joining fee of US\$10 000. In addition to the joining fee, members pay an annual subscription fee which is reviewed annually. In 1996 the fee was Z\$20 000, which was doubled in 1997. This requirement presents a major barrier to direct participation by small traders and farmers.

3.3 Structural Characteristics Of ZIMACE

Research results presented in Table 3 show a summary of the structural characteristics of ZIMACE.

3.3.1 Composition of ZIMACE Members

The exchange is composed of 18 members, 75 percent of which are broking members and the remaining 25 percent are non-broking members. Broking members exclusively deal on the ZIMACE. The non-broking members can buy and sell elsewhere other than the ZIMACE.

3.3.2 Firm Sizes and Conglomerateness

The research findings showed that ZIMACE broking members ranked as predominantly large business firms in relation to the other firms in their line of operation. The size distribution of numbers of buyers and sellers was measured by the volumes handled by each buyer or seller and revenue realised. The concentration ratio was computed as follows:

$$\text{Market share} = \frac{\text{Amount of maize handled by ZIMACE members}}{\text{National Grain Sales in one year}}$$

Table 3: General Characteristics of ZIMACE Members

Characteristic	Group		
	Broking ZIMACE member (Percent)	Non-broking ZIMACE member (Percent)	Total
Size			
small	12.5	0	12.5
medium	12.5	12.5	25
large	37.5	25	62.5
Year in operation			
less than 1	12.5	0	12.5
1 - 5	50	0	50
6 - 10	12.5	0	12.5
11 and above	0	25	25
Firm Legal Status			
Private Limited	50	12.5	62.5
Sole proprietor	-	-	-
Parastatal	-	12.5	12.5
Cooperative	12.5	-	12.5
Public Limited	-	12.5	12.5

Part of a group of Firms?			
Yes	25	12.5	37.5
No	37.5	25	62.5
Local Subsidiary of an Interna Parent?			
Yes	12.5	25	37.5
No	50	12.5	62.5
Activities of Firm in addition to trading			
Assembler			
Yes	12.5	25	37.5
No	50	12.5	62.5
Transporter			
Yes	25	12.5	37.5
No	37.5	25	62.5
Broker			
Yes	50	25	75
No	12.5	12.5	25
Exporter			
Yes	50	25	75
No	12.5	12.5	25
Processor			
Yes	25	37.5	62.5
No	37.5	0	37.5
Wholesaler			
Yes	-	-	-
No	-	-	-
Retailer			
Yes	0	25	25
No	62.5	12.5	75
Importer			
Yes	50	25	75
No	12.5	12.5	25

The results of market concentration analysis are shown in the Table 4 below. The results indicate that 40 percent of actively trading broking members control 70 percent of maize grain sales through the ZIMACE. Literature shows that about 10 percent of national maize grain sales go through the ZIMACE. Large quantities of grain are brought to the market by a few large scale commercial farmers. Thus there is a concentration of grain marketing by a few large market agents. Market concentration is a strong indication of non competitive pricing behaviour and of inefficient market performance. The presents of few large market agents within a defined market boundary suggests concentration of market power.

Table 4: ZIMACE Market Concentration

Firm	Concentration Ratio
A	0.3
B	0.2
C	0.1
D	0.1

However, concentration alone does not imply non-competitive behaviour, because there are other alternative marketing channels and ZIMACE only handles 10 percent of the total maize produced in the country.

3.3.3 Years of Operation of ZIMACE Members

Not surprisingly the majority (50 percent) fell in the 1994 to 1999 bracket, which coincides with the period when markets were liberalised. Nearly 70 percent of those who responded indicated that their businesses were growing, 10 percent reported their businesses as in the initial stages, whilst 30 percent characterised their business as mature.

3.3.4 Principal Maize Marketing Channels

Based on information gathered during the rapid appraisal as well as the data collected through the survey of marketing agents, a fairly accurate picture of the structure of the marketing system was developed. The main market participants were identified. Currently the ZIMACE marketing system is dominated by four major brokers.

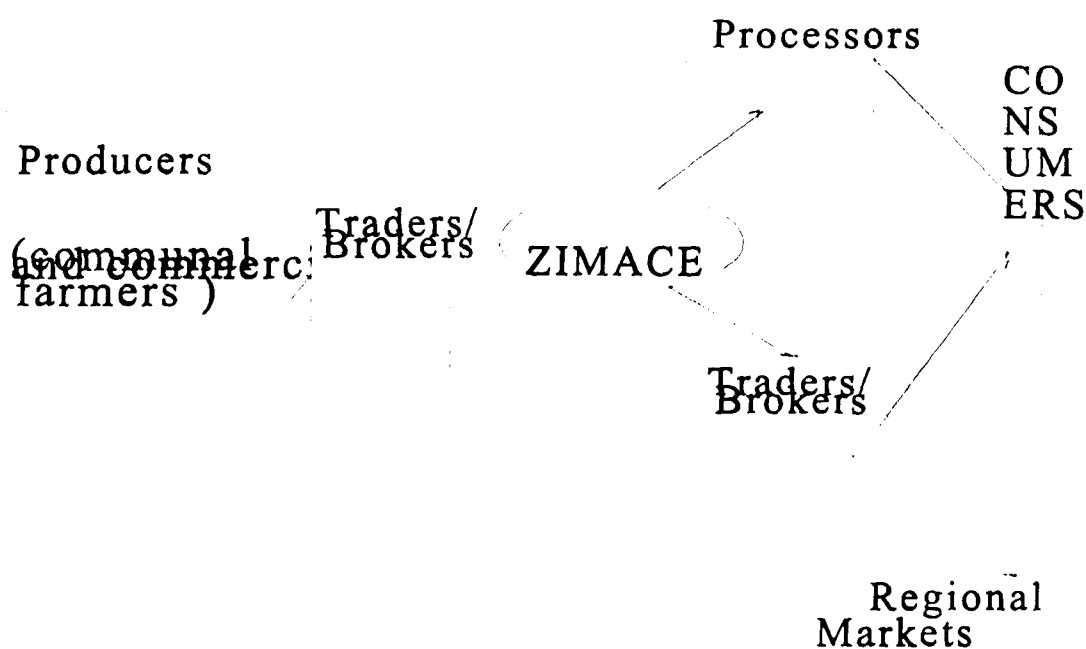


Figure 1. Principal Maize Marketing Channels for maize traded through ZIMACE

The communal or commercial maize grower is the first link in the marketing chain. The producers are linked to the ZIMACE by brokers who work for commission on the producers' behalf and the product is passed on directly to the processor or to the processor or regional market through other brokers or traders. The last link in the marketing chain is the consumer. The marketing chain for maize grain is shown in greater detail in Figure 2, which indicate that there are alternative maize marketing channels in the maize grain subsector that compete with the ZIMACE channel.

3.3.5 Competitiveness of Firms Operating through ZIMACE

An analysis of existing patterns of competition for actively trading companies can be illustrated in Table 5 below.

Table 5. Competitor Mapping for ZIMACE Members

Domestic Firms	1	2	3	4	5	6	7	8	9	10
1		*	*	*	*	*	*	*	*	*
2			*		*	*	*			*
3		*		*	*		*		*	*
4			*	*	*	*	*		*	*
5	*	*		*	*	*	*	*		*
6	*	*		*	*	*	*	*	*	*
7	*	*	*	*	*	*		*		*
8		*			*	*	*			*
9	*		*	*		*				*
10	*	*	*	*	*	*	*	*	*	
International Firms										
I	*									*
II	*	*	*							*
III										*
IV	*			*	*	*	*		*	*

Table 5 above on competitor mapping has shown that there is net competition amongst the ZIMACE brokers as shown by the density (60 percent) of firms in competition. The existing patterns of competition imply that the ZIMACE market is contestable since. Though there are only a few brokers on ZIMACE, there are many buyers and sellers of commodities traded on ZIMACE thus forcing the brokers to be contestable.

Taking contestability in the case of ZIMACE, buyers solicit bids from several brokers on the exchange and choose the lowest bidder. Competition amongst bidders ensures that the buyer will be served at the lowest possible price for a commodity, even though actually one broker will eventually sell the commodity to the buyer. There is intense rivalry among existing ZIMACE member brokers.

3.4 MAIZE SUBSECTOR

To further examine the contestability of ZIMACE, characteristics of alternative maize marketing channels in the maize subsector are analysed focusing on patterns of interaction, how the nature of commodity affects the organisation of the system and the rules associated with the system. The survey revealed the existence of a

complex and well developed marketing system for maize involving a large number of intermediaries and comprising many district marketing channels, millers, traders and processors. ZIMACE is also restrained to an extent by the number of residual controls in place, particularly in the country's maize market where maize farmers cannot enjoy the benefits of a free market because the Grain Marketing Board is still the main buyer and as such sets the floor prices and maintains a monopoly of imports and exports.

Communal Maize Grain

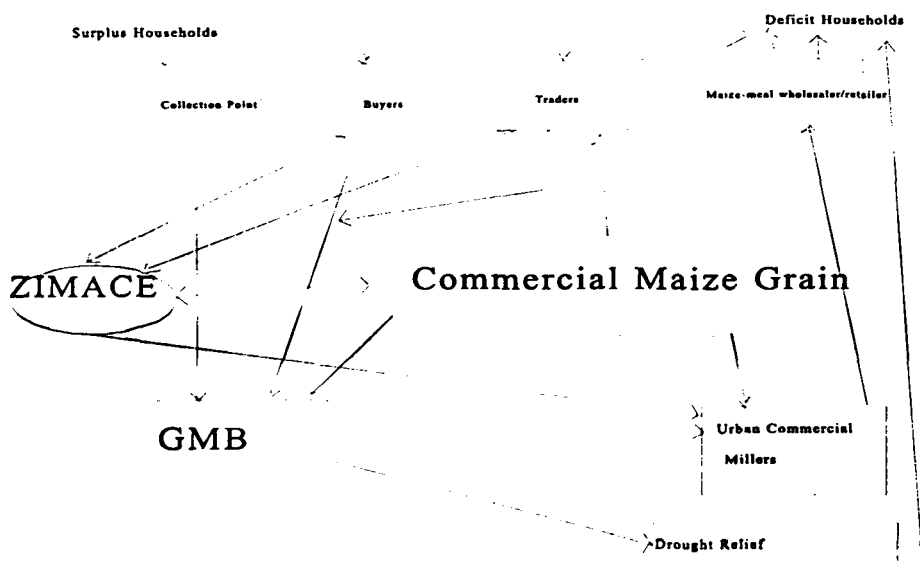


Figure 2: National Maize Distribution Channels

There are four major marketing channels: sales within villages either from farmer to farmer or from farmer through a trader / broker to another farmer; from farmer to collection point to GMB; from farmer to urban consumers; and from farmer through ZIMACE to either the commercial millers or other farmers.

3.5 Pricing Methods

Key informants interviewed in this study explained that price is determined on ZIMACE through interaction of brokers. Daily personal contact between buyers and sellers takes place at the ZIMACE. A board situated on the wall of the exchange reflects the highest bid (buying price), lowest offer (selling price), trade or strike prices and forward delivery. Prices are determined by the market. An open market like ZIMACE assures the industry that the price is set by the buyer most desperate to buy and thus bid the highest price while it gives the seller who needs to sell most urgently the opportunity to offer the product at a price that will move his/her product.

Government officials explained that the price range at which maize is traded is that which is between the GMB floor and ceiling prices. Wheat and soyabeans prices are determined by supply and demand (they are market related), the prices are perceived to move between import and export parity prices. The exchange rate is considered in price setting. The brokers outlined the factors considered in price setting as follows: supply; location; production costs; and alternative sources of supply. Internally in the country, heavy transport costs affect prices, internationally supply in other countries and the distance to and from these markets.

According to most respondents, buying prices, selling prices and transport costs are well known to all market participants and the ZIMACE plays a part in providing information. The brokers offer a variety of

services to their clients which include a sound marketing plan, frequent market updates, ensuring smooth and prompt payment systems and risk management services.

Some buyers prefer to give a higher price for higher tonnage. Some cooperatives in communal areas are starting to market commodities in bulk in order to obtain a good price. An open market like ZIMACE assures the industry that the price is set by the buyer most desperate to buy and thus bid the highest price while it gives the seller who needs to sell most urgently the opportunity to offer the product at a price that will move his/her product. The methods that are used to set prices as reported by the respondents are indicated in Table 7 below. Around 75 percent of the respondents reported the use of an organised commodity exchange (ZIMACE) as the most frequently used method. Confronted with increased competition from numerous traders, the brokers / traders are compelled to engage in contract sale involving forward contracting in order to secure their own market share. The ZIMACE allows all players in the market to judge likely future price movements based on historical prices, likely supply and demand assessments and current sentiments. Given the openness and transparency of the market, with no reason to conceal confidential deals and trading, the ZIMACE becomes a valuable source of market information.

Table 7: Methods of Price Setting Reported by ZIMACE Members

Method	Percent Reporting
Organised Commodity Exchange	75
Collective Bargaining	15
Private Treaty	10
Formula Pricing	0
Administered Pricing	0

There are also non-price factors that are considered by brokers in a bid to secure produce. The study was also able to reveal the factors affecting transmission of information across markets and thus trading opportunities. Observed unethical practices, lack of information, availability of marketing channels and transportation could impede rapid and full transmission of information across markets resulting in poorly integrated markets. In the smallholder farming sector transport availability was ranked high as important in affecting the potential for exchange of agricultural commodities as shown in Table 8. This has important implications as prices may be discounted to cater for transport costs and this may consequently result in an incomplete transmission of price changes across markets.

The benefits of these exchanges have occurred through the direct participation by farmers both small and large scale. Small scale farmers selling relatively small quantities have benefitted from the engagement of traders and cooperatives on the exchange. By locking in positions on the exchange, traders are able to pass along more secure price arrangements to farmers for example in forward contracting. By bulking up production from small scale farmers, traders and farmer cooperatives have been able to overcome the entry barriers to participation that are prohibitively expensive for individual farmers.

Table 8: Degree of Importance of factors that affect potential for business in the Smallholder Sector

Item	Order of Ranking ¹	Percent Rating ²			
		1	2	3	4
Transport Availability	1	71.4	28.6	0	0
Observed Unethical Practices	2	57.1	14.3	28.6	0
Lack of Information	3	57.1	42.9	0	0
Available Marketing Channels	4	42.9	14.2	42.9	0

Table 9 below indicates the ranking of the factors affecting the potential for business in the commercial sector. All the factors were rated as very important. The lack of information is indicated as the most impeding factor in affecting the potential for business followed by the available marketing channels and observed unethical practices respectively. Transport availability is not considered as a very important factor in affecting the potential for business in the communal sector. Sentiments about a trader's involvement in unfair pricing or other fraudulent practices is sufficient to discourage farmers from dealing with the broker. About 75 percent of the brokers reported that they provide transport for smallholders.

Table 9: Degree of Importance of factors that affect potential for business in the Commercial Sector

Item	Order of Ranking ³	Percent Rating ⁴			
		1	2	3	4
Lack of Information	1	100	0	0	0
Available Marketing Channels	2	85.7	14.3	0	0
Observed Unethical Practices	3	71.4	28.6	0	0
Transport Availability	4	57.1	28.6	14.3	0

The analysis has shown that ZIMACE provides an excellent opportunity to discover or test a price.

3.6 Market Channel Activities

The channels through which maize flows and the dynamics of the interaction among market participants in discovering maize as it moves through the markets are described.

¹The sources are ranked in order of importance with the source ranked 1 being the most important

²Rating number 1=Very important 2=Somewhat Important 3=Not Important 4=Not Applicable

³The sources are ranked in order of importance with the source ranked 1 being the most important

⁴Rating number 1=Very Important 2=Somewhat Important 3=Not Important 4=Not Applicable

Table 10: Sources of Maize Traded through ZIMACE

Source of Maize	Percent Reporting	
	Up to 50 percent	51 percent and above
Communal	71.6	28.4
Commercial	42.8	57.2

Generally the broking and non-broking members have access to three main sources of maize grain: communal, commercial and import. But imports are utilised to a limited extent by most participants except for the GMB. As high as 72 percent of the respondents reported obtaining less than 50 percent of the maize grain they handle from the smallholders. The remaining 28 percent obtain more than 50 percent of their traded maize from the smallholders. In contrast, less than 43 percent of traders obtain 50 percent or less of their maize grain from the commercial sector while roughly 57 percent source more than 51 percent of their maize supplies from commercial farmers. Without doubt the bulk of the maize traded on the ZIMACE is from commercial farmers. Respondents explained the low percentage of maize obtained from communal farmers by the fact that was that many communal area farmers find it difficult to meet the required tonnages.

3.7 Market Information And Research

Table 11 shows that 87.5 percent of respondents reported ZIMACE as a very important source of market news. The ZIMACE, communication with competitors and the direct communication with buyers and sellers ranked very high. The direct communication with buyers and sellers ZIMACE proved the most important source of finding out about trading opportunities given by 100 percent of respondents. The GMB was not ranked as an important criterion by most respondents.

Table 11 below lists the sources that the respondents considered to be most significant in finding out about possible trading opportunities.

Table 11: Sources of Finding out about Possible Trading Opportunities

Source	Order of ⁵ ranking	Percentage ⁶ Rating		
Direct communication with buyers and sellers	1	100	0	0
Communication with competitors	2	87.5	12.5	0
The ZIMACE	3	87.5	12.5	0
The Internet	4	75	25.0	0
Contacts in ministries or marketing boards	5	75	25.0	0
Contacts in the International business community	6	50.0	37.5	12.5
Word of mouth	7	37.5	62.5	0
Tenders for bids published in newspapers	8	25.0	62.5	12.5
GMB	9	12.5	87.5	0

Contacts are usually initiated by the buyers who look for sources of grain. When asked about the sources of

⁵The sources are ranked in order of importance with the source ranked 1 being the most important

⁶Ranking number 1= Very Important 2=Somewhat Important 3=Not Important

finding out about possible trading opportunities most respondents (100 percent) indicated that the most important source as being the direct communication with buyers and sellers. It is also noted that market information is transmitted across markets freely by word of mouth and 62 percent ranked word of mouth as a source of finding out about trading opportunities as somewhat important. So news on price changes is obtained from both informal and formal sources. Publicly available trading and market information as only about 25 percent of the respondents considered tenders for bids published in newspapers as a very important source of finding out about trading opportunities. There is also a significant percentage of respondents that use information from their competitors. It is evident that most market information utilised is that from ZIMACE and the direct communication with buyers and sellers and thus there is less exposure to price manipulation and exploitation. Several factors can be identified as contributing to limiting the possibility of price manipulation, namely, contracts and the callover process of the ZIMACE. The fact that ZIMACE members are frequently involved in trading it means that they are better able to read and interpret price signals.

In order of ranking by the respondents, Producer Organisations followed by ZIMACE ranked as very important sources for finding out about legal procedures for trading as indicated in Table 12 below.

Table 12: Sources of Finding out about Legal procedures for Trading

Source	Order of ⁷ Ranking	Percent Rating ⁸		
		1	2	3
Producer Organisations (ZFU, CFU, ICFU, AGRITEX etc)	1	100	0	0
The ZIMACE	2	75.0	12.5	12.5
Analysis done by own firm	3	71.4	14.3	14.3
Direct communication with buyers and sellers	4	50.0	25.0	25.0
Communication with competitors	5	42.9	14.3	42.9
Contacts in ministries or marketing boards	6	28.6	14.3	57.1
Contacts in the International business community	7	28.6	14.3	57.1
Tenders for bids published in newspapers	8	14.3	14.3	71.4

The results confirm that brokers on the ZIMACE link buyers with sellers. They do research on the markets and give advice to clients on how to handle the marketing of their crop. One broker is associated with a project of an association of farmers outside Gokwe who consolidate small lots of grain in order to achieve a higher price. Farmers normally approach the broker with their crop and discuss prices. Some manufacturers (mainly millers) utilise the ZIMACE as a parallel market to buy large quantities of commodities to their best advantage.

The heavy reliance on informal sources of information exposes farmers to possible price manipulation and exploitation. However, the access of farmers to multiple traders limits the possibility of price manipulation. Knowledge about the market through regular consultation with other sources also enables farmers and traders to validate price information they receive from another. The frequent and active involvement of brokers in trading also enables them to correctly read and interpret market signals and translate them into price expectations.

⁷The sources are ranked in order of importance with the source ranked 1 being the most important

⁸Ranking Number 1=Very Important 2=Somewhat Important 3=Not Important

3.8 Pricing Efficiency of ZIMACE

Results of the analysis of trends in maize grain prices, price correlations, cointegration and Granger-price causality are presented below.

3.8.1 Graphical Analysis Of Weekly Trends In Prices

Figure 3 shows real producer prices for maize grain in five different markets. The prices trend upward except that the GMB price which has declined since 1997/98 agricultural marketing season. An explanation for the declining GMB price is that the GMB prices are administered prices which have been held constant in nominal terms for the period under study. The ZIMACE, Mbare and Chikwanha and Chikukwa prices are closely following each other as they peak and fall. It is important to note that prices in Chikukwa, Mbare and Chikwanha are generally higher than ZIMACE prices with Chikukwa recording the highest prices. This is explained by the fact that prices per bucket charged in Chikukwa, Mbare and Chikwanha are reflective of the different players in the markets. The Chikukwa, Mhondoro, Guruve, Chikwanha and Mbare markets can be thought of as the farmers' retail markets; the ZIMACE is an organised commodity exchange and GMB is a terminal wholesale market. Following this argument it is clear that retail prices are generally higher than wholesale prices. The general trend in price movements is of rising real producer prices, shown in Figure 3. Figure 4 shows rising nominal producer prices in the ZIMACE, GMB, Mbare, Chikwanha and Chikukwa markets. An important factor to note is that both figures 3 and 4 show that prices are lowest around May to June which is soon after the harvest, and prices peak around December when there is a shortage in the market.

3.8.2 Correlation Analysis

Results of correlation analysis are presented in Tables 14 to 16 below.

Table 14: Nominal Price Correlation Analysis

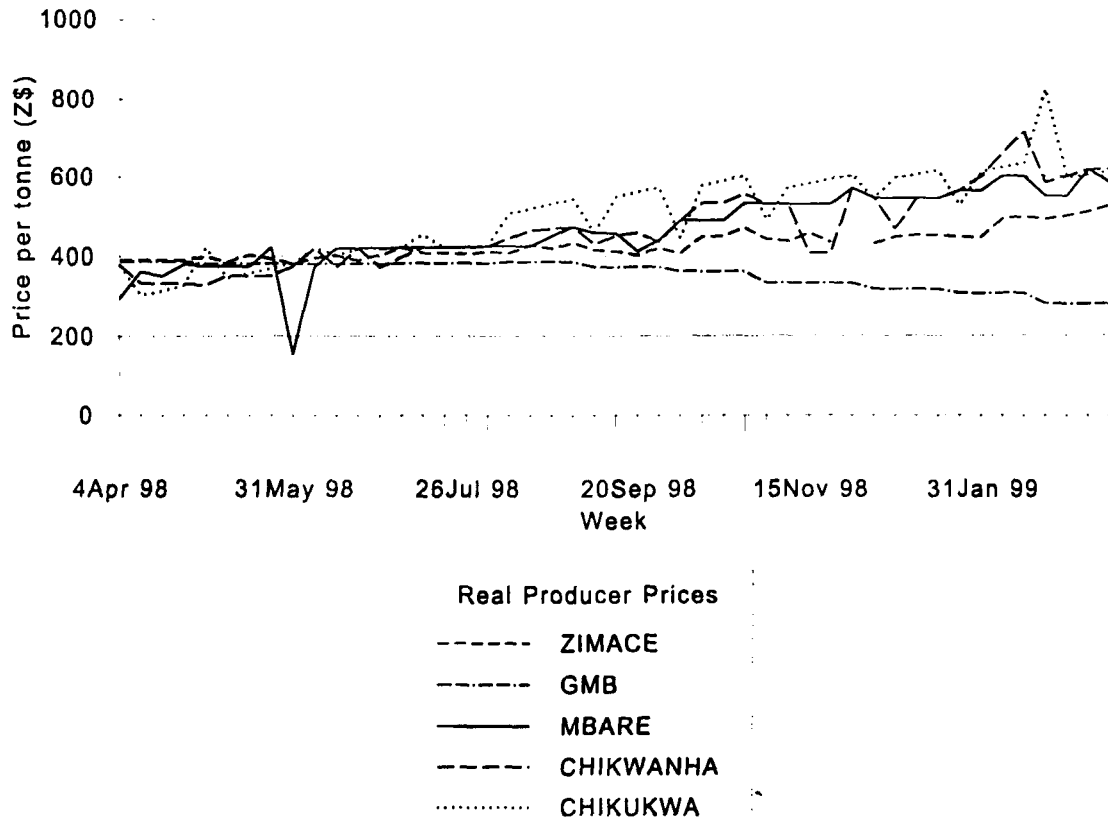
(ZIMACE, Mbare, Chikwanha, Chikukwa - Weekly Maize Grain Prices, April 1998 to February 1999)

Pairs of Markets	Correlation Coefficients
	Levels
ZIMACE - Mbare	0.943
ZIMACE - Chikwanha	0.948
ZIMACE - Chikukwa	0.916
Mbare Market - Chikwanha	0.929
Mbare - Chikukwa	0.898
Chikwanha - Chikukwa	0.903

Cross correlations are significant in all cases and, highly significant coefficients at around 0.9 for all pairs of four price series (ZIMACE, Mbare, Chikwanha and Chikukwa) as shown in Table 14, suggesting an instantaneous relationship between the five series at the 0.01 significance level. This can be attributed to availability of current price information which influences all markets at the same time. A very close relationship exists between ZIMACE and Mbare retail market; ZIMACE and Chikwanha urban market; and Mbare and Chikwanha urban market prices. All correlation coefficients were significant at the 1% level. The highest correlation coefficient was recorded between ZIMACE and Chikwanha retail market. This indicates that the ZIMACE is an important indicator of price not only at the producer levels, but also as maize moves

towards the consumer in the marketing system.

Fig 3. Maize Grain Real Producer Prices
(Weekly Price - Apr 1998 to Feb 1999)



The results indicate that price correlation coefficients for three markets: ZIMACE, Chikwanha and Mbare with Chikukwa market are lower than the rest of the pairs. This can be explained by the fact that the Chikukwa market is separated from the other markets by distance, hence the correlation coefficient would be expected to be lower than that for the other market pairs. Information takes a little longer to be incorporated into the Chikukwa market from the rest of the markets.

Table 15: Nominal Price Correlation Analysis
(GMB, ZIMACE, Guruve, Mhondoro - Monthly Maize Grain Prices, April 1994 to February 1999)

Pairs of Markets	Correlation Coefficients
	Levels
ZIMACE - GMB	0.805
ZIMACE - Guruve	0.885
ZIMACE - Mhondoro	0.933
GMB - Guruve	0.906
GMB - Mhondoro	0.910
Guruve - Mhondoro	0.975

Table 15 above presents results of nominal maize grain price correlation analysis using monthly price observations for ZIMACE, GMB, Mhondoro and Guruve markets. Firstly, there is a high positive correlation between the GMB and ZIMACE price in nominal terms. The results again indicate high price correlations close to +0.9 for all pairs of the four price series. The correlation coefficient for the ZIMACE-Mhondoro market pair is higher than for the GMB-Mhondoro market pair. This is consistent with expectations as smallholders farmers are now increasingly making use of ZIMACE marketing information. Furthermore, the correlation coefficient for the ZIMACE-Guruve market pair is lower than that of the ZIMACE-Mhondoro pair. This is expected given the proximity of the Mhondoro market to the ZIMACE when compared with Guruve.

Tables 16 and 17 below show price correlations in real terms.

Table 16: Real Price Correlation Analysis
(ZIMACE, Mbare, Chikwanha, Chikukwa - Weekly Maize Grain Prices, April 1998 to February 1999)

Pairs of Markets	Correlation Coefficients
	Levels
GMB - Mbare	-0.815
GMB - Chikwanha	-0.817
GMB - Chikukwa	-0.761
ZIMACE - Mbare	0.841
ZIMACE - Chikwanha	0.818
ZIMACE - Chikukwa	0.875
Mbare - Chikwanha	0.825
Mbare - Chikukwa	0.783
Chikwanha - Chikukwa	0.816

The correlation coefficients for maize grain prices between ZIMACE and the urban markets were around +0.8 compared to the correlation coefficients between GMB and urban markets which were around -0.8. The negative correlation coefficients imply that an increase in maize grain prices in Chikwanha and Mbare markets is associated with a decrease in the GMB price. The positive correlation coefficient is higher for the ZIMACE-Chikwanha pair than the ZIMACE-Mbare pair. Reasons for this may be attributed to the fact that Mbare is not as organised a market like the Chikwanha market in that smallholder bring their produce to Mbare which is the nearest market to where smallholder farmers obtain transport. In most cases smallholder farmers are in desperate need for cash such that they sell immediately even if they know that the ZIMACE and Chikwanha prices are higher.

The negative correlations indicate a negative association between the prices. Because real price correlation coefficients are being considered, the elements of inflation have been removed and one can safely

conclude that the GMB price is not the right price. The ZIMACE also recorded a high correlation coefficient with the rural market (Chikukwa). So an increase in ZIMACE prices is associated with an increase in Chikukwa prices. Furthermore the lowest negative correlation coefficient of -0.76 was recorded between GMB and Chikukwa.

Table 17: Real Price Correlation Analysis
(GMB, ZIMACE, Guruve, Mhondoro - Monthly Maize Grain Prices, April 1994 to February 1999)

Pairs of Markets	Correlation Coefficients
	Levels
GMB - Guruve	0.681
GMB - Mhondoro	0.691
ZIMACE - GMB	0.357
ZIMACE - Guruve	0.583
ZIMACE - Mhondoro	0.756
Guruve - Mhondoro	0.847

A low positive correlation was recorded between the ZIMACE - GMB market pair. The major reason for the low correlation coefficient stems from the fact the GMB price is an administered price and therefore it is expected that it does not move closely in relation to free market prices. Comparing results in Table 16 and 17, it is clear that the correlation of prices is higher for ZIMACE with urban markets than it is with the rural markets. The reason is that information is readily available to the urban markets than to the rural markets. The ZIMACE disseminates information through the Standard Chartered financial highlights on television and this information is not readily available to the rural markets.

3.8.3 Cointegration Tests

The null hypothesis of non-cointegration, was tested against the alternative hypothesis of cointegration, by estimating cointegrating regressions for the different market pairs using the Ordinary Least Squares method. In the second stage the Augmented Dickey Fuller (ADF) testing procedure was conducted on the error terms obtained from each of the regression equations of the pairs of markets being investigated. Results of cointegration tests of maize grain producer prices changes between the market pairs are shown in Table 18 below.

Table 18: Results of Cointegration Tests

Market Pair	Number of Lags	t-statistic	Augmented Dickey Fuller Test	R-square	Durbin Watson Statistic
ZIMACE - Mbare	1	-3.18	-3.04	0.842	0.89
ZIMACE - Chikwanha	2	-3.61	-3.50	0.897	0.97
ZIMACE - Mhondoro	2	-3.54	-3.04	0.603	0.88
Mbare - Chikwanha	1	-3.76	-3.50	0.889	1.56
Mbare - Chikukwa	2	-3.53	-3.50	0.870	1.98
Chikwanha - Chikukwa	3	-3.05	-3.04	0.881	1.19
ZIMACE - Guruve	1	-2.48	-3.04	0.784	0.83
ZIMACE - GMB	4	-2.40	-3.04	0.6541	0.68
ZIMACE - Chikukwa	5	-1.18	-3.04	0.873	1.29
GMB - Guruve	0	-2.50	-3.04	0.821	0.56
GMB - Mhondoro	0	-2.61	-3.04	0.828	0.52
Mhondoro - Guruve	0	-2.80	-3.04	0.950	0.53

Therefore the results of cointegration analysis suggests that the ZIMACE, Mhondoro, Chikwanha and Mbare markets are integrated by arbitrage establishing long term relationships. So this implies that all information is instantaneously exploited by arbitrage and is reflected by independent identically distributed changes in prices. This implies spatial efficiency of the markets pointing out to the convergence of prices in the separated markets to one price, thus suggesting that any deviations from the long-run equilibrium observed between the markets are only transitory. These findings are important given the confirmed cointegration of the markets and so one series may be used to predict the other even if the series is unpredictable on the basis of its past.

The last six pairs of markets in Table 18 show no evidence of cointegration. The most important finding here is that the ZIMACE and GMB markets are not integrated. Furthermore, ZIMACE is not integrated with the Guruve and Chikukwa markets. Whilst the GMB is not integrated with any of the rural markets, the results have shown that ZIMACE is integrated with the Mhondoro market. This finding is also supported by the correlation analysis which has shown high correlations between Mhondoro and ZIMACE markets. The transmission of information between ZIMACE and Mhondoro is more efficient than with the other district markets given that Mhondoro is nearer to Harare and thus nearer to ZIMACE than the other rural markets considered.

3.8.9 Effects Of Zimace Prices On Market Prices

The cointegration tests suggest there are long run relationships between markets, short run relationships may also exist. Bivariate Granger causality tests were performed to investigate the lead-lag relationships between the different market pairs. Findings of Granger Causality tests are summarised in Table 19 below, which shows in the first column the direction of causation being tested.

3.8.9.1 ZIMACE To Mbare Market Price Causality

The results on Granger causality between ZIMACE and Mbare prices presented in Table 19 indicate a statistically significant F-statistic for the null hypothesis that the ZIMACE price does not Granger cause the Mbare price, but the F-statistic is not significant in the reverse. The null hypothesis that the ZIMACE price does not Granger cause the Mbare price is rejected whilst the null hypothesis that Mbare price does not Granger cause the ZIMACE price is accepted. It is therefore concluded that ZIMACE prices cause Mbare price at a test size of 1 percent significance. The leader follower relationship is confirmed in the findings, ZIMACE lead the Mbare market in maize grain pricing as revealed by the statistically significant unidirectional Granger causality. A significantly transmission of information happens between the two markets.

3.8.9.1 ZIMACE to Chikwanha Market Price Causality

The results on Granger causality between ZIMACE and Chikwanha prices indicate a statistically significant F-statistic in both directions of causation. The null hypotheses that the ZIMACE price does not Granger cause the Chikwanha price and that the Chikwanha price does not Granger cause the ZIMACE price are both rejected at a decision rule of 5 percent. This indicates a feedback relationship between the ZIMACE and Chikwanha markets, meaning that shocks originating from the postulated central market (ZIMACE) influence pricing in Chikwanha and that shocks coming from the Chikwanha market also affect the ZIMACE market. Thus this feedback relationship indicates that prices are discovered simultaneously at a lag of one week.

Table 19: Granger Causality Test (Weekly Maize Grain Prices April 1998 to February 1999)

Hypothesised Direction of Causation	F-Statistic	P-value	Decision	Confirmed Direction of Causation
ZIMACE--> Mbare				
<i>Null Hypothesis:</i>				
ZIMACE price does not Granger cause Mbare price	23.174	0.0000	Reject	ZIMACE Prices Granger cause Mbare Prices
Mbare price does not Granger cause ZIMACE price	0.004	0.9507	Accept	
ZIMACE--> Chikwanha				
<i>Null Hypothesis:</i>				
ZIMACE price does not Granger cause Chikwanha price	5.929	0.0191	Reject	There is bidirectional causality between the two price series
Chikwanha price does not Granger cause ZIMACE price	18.578	0.0001	Reject	
ZIMACE--> Mhondoro				
<i>Null Hypothesis:</i>				
ZIMACE price does not Granger cause Mhondoro price	5.822	0.0202	Reject	ZIMACE Prices Granger cause Mhondoro Prices
Mhondoro price does not Granger cause ZIMACE price	0.544	0.4649	Accept	
Mbare--> Chikwanha				
<i>Null Hypothesis:</i>				
Mbare price does not Granger cause Chikwanha price	1.044	0.3126	Accept	Chikwanha Prices Granger cause Mbare Prices
Chikwanha price does not Granger cause Mbare price	26.602	0.0000	Reject	
Mbare--> Mhondoro				
<i>Null Hypothesis:</i>				
Mbare price does not Granger cause Mhondoro price	5.865	0.0197	Reject	There is bidirectional causality between the two price series
Mhondoro price does not Granger cause Mbare price	21.91	0.0000	Reject	
Chikwanha--> Mhondoro				
<i>Null Hypothesis:</i>				
Chikwanha price does not Granger cause Mhondoro price	18.218	0.0001	Reject	There is bidirectional causality between the two price series
Mhondoro price does not Granger cause Chikwanha price	6.746	0.0128	Reject	

3.8.9.2 ZIMACE to Mhondoro Market Price Causality

Using a decision rule of 0.05, the null hypothesis that the ZIMACE price does not Granger cause the Chikukwa price is rejected and the null hypothesis that the Mhondoro price does not Granger cause the Mhondoro price is accepted. This indicates a unidirectional Granger causality and suggest market leadership by ZIMACE. Prices are first discovered in ZIMACE (lead market) and then in the Mhondoro market. This result is supported by the market structure and behaviour of ZIMACE participants and the market information systems now available to smallholder farmers. The ZIMACE argument that smallholder farmers are now using information provided by ZIMACE to come up with their own prices is supported by these findings.

3.8.9.3 Mbare to Chikwanha Market Price Causality

The hypothesis that the Mbare price does not Granger cause the Chikwanha price is accepted at the 1 percent significance level whilst the hypothesis that the Chikwanha price does not Granger cause the Mbare price is rejected at the same significance level. Therefore unidirectional causality is inferred from Chikwanha to Mbare. These results are consistent with the correlation analysis which has shown higher correlation coefficients between ZIMACE and Chikwanha than the ZIMACE and Mbare market pairs, as concluded in section 6.2 that the Chikwanha market is more organised than the Mbare market.

3.8.9.4 Mbare to Mhondoro Market Price Causality

At a test significance of 5 percent it is concluded that there is bidirectional causality between Mbare and Mhondoro. The null hypotheses that the Mbare price does not cause the Mhondoro price and that the Mhondoro price does not cause the Mbare price are both rejected since a significant F-statistic is calculated. Given the probabilities for the F-statistics in Table 19, it may be inferred that at lower significance the Mhondoro prices are likely to have a greater cause effect on Mbare prices.

3.9.8.5 Chikwanha to Mhondoro Market Price causality

At the significance level of 1 percent both hypotheses are rejected as shown in Table 19 since the F-statistic is significant. It is thus concluded that Chikwanha prices cause Mhondoro prices and the reverse is also true. Bidirectional causality is inferred.

3.9.9 Price Movements Across The Markets

Econometric tests of symmetric price relationships between the markets having a causal relationship was conducted. The model used for estimating the asymmetry hypothesis is given below:

$$\Delta M_{bt} = \varphi_1 T_1 + \alpha_1 \sum_{i=0}^k CIZ_{t-1i} + \beta_1 \sum_{i=0}^k CDZ_{t-1i} + \varepsilon_{1t} \dots \dots \dots \text{equation 5}$$

$$\Delta C_{ht} = \varphi_2 T_2 + \alpha_2 \sum_{i=0}^k CIZ_{t-2i} + \beta_2 \sum_{i=0}^k CDZ_{t-2i} + \varepsilon_{2t} \dots \dots \dots \text{equation 6}$$

$$\Delta M_{ht} = \varphi_3 T_3 + \alpha_3 \sum_{i=0}^k CIZ_{t-3i} + \beta_3 \sum_{i=0}^k CDZ_{t-3i} + \varepsilon_{3t} \dots \dots \dots \text{equation 7}$$

ΔM_{bt} = change in the mbare maize grain retail price at time t

ΔC_{ht} = change in the chikwanha maize grain retail price at time t

ΔM_{ht} = change in the Mhondoro maize grain retail price at time t

CIZ_t = cumulative increase in ZIMACE maize grain producer prices up to the time period t

CDZ_t = cumulative decrease in ZIMACE maize grain producer prices up to the time period t

φ = coefficient on trend variable T

α_i = coefficient on the current lagged values of CIZ_t

β_i = coefficient on the current and lagged values of CDZ_t

et = error term

k = denotes the lag length on cumulative upward and downward changes in ZIMACE, Chikwanha and Mbare market prices

The equations above were estimated using Ordinary Least Squares procedures. The symmetric price relationships in the ZIMACE, Chikwanha, Mhondoro and Mbare markets were investigated by testing the following hypotheses:

Null Hypothesis One: The effects of upward and downward ZIMACE price movements on Mbare prices are equal

Null Hypothesis Two: The effects of upward and downward ZIMACE price movements on Chikwanha prices are equal

Null Hypothesis Three: The effects of upward and downward ZIMACE price movements on Mhondoro prices are equal

The test of price symmetry was based on the equality of the coefficients on upward and downward price movements using Wald coefficient restriction tests. The results are presented in Table 20.

Table 20: Price Transmission in Maize Grain Prices between ZIMACE, Mbare, Chikwanha and Mhondoro markets (April 1998 to February 1999 Prices)

Price Transmission	Coefficient	Std Error	t-value	t-prob
ZIMACE to Mbare				
Constant	80.866	127.40	0.635	0.5290
Cumulative Increase in ZIMACE Price	0.070062	0.15607	0.449	0.6558
Cumulative Decrease in ZIMACE Price	0.17302	0.48107	0.360	0.7209
<i>R-squared</i>	0.00488377			
<i>F-statistic</i>	0.10552 (0.90)			
<i>DW Statistic</i>	2.85			
<i>Wald Test Statistic</i>	0.21103 (0.90)			
ZIMACE to Chikwanha				
Constant				
Cumulative Increase in ZIMACE Price	-78.103	107.87	-0.724	0.4730
Cumulative Decrease in ZIMACE Price	-0.12890	0.13214	-0.975	0.3348
<i>R-squared</i>	0.0505305			
<i>F-statistic</i>	1.1442 (0.33)			
<i>DW Statistic</i>	2.29			
<i>Wald Test Statistic</i>	2.2884 (0.32)			
ZIMACE to Mhondoro				
Constant				
Cumulative Increase in ZIMACE Price				
Cumulative Decrease in ZIMACE Price	15.864	186.10	0.085	0.9325
<i>R-squared</i>	0.00192985			
<i>F-statistic</i>	0.041572 (0.96)			
<i>DW Statistic</i>	2.96			
<i>Wald Test Statistic</i>	0.083144 (0.96)			

The regression results show that \$0.07 of a \$1.00 increase in the ZIMACE price is immediately transmitted to Mbare whilst \$0.17 of a \$1.00 decrease in the ZIMACE price is transmitted to Mbare. Therefore price transmission from ZIMACE to Mbare is symmetric. The fact that price transmission is symmetric from ZIMACE to the Mbare market then it indicates some level of pricing efficiency. ZIMACE price information is being transmitted efficiently leading to market efficiency. The results also show that there is symmetry in price transmission from ZIMACE to Chikwanha at 10 percent significance level. About \$0.13 of a \$1.00 increase in the ZIMACE price is passed on to the Chikwanha market whilst \$0.56 of a price decrease in the ZIMACE price is transmitted to Chikwanha. Upward and downward price movements in ZIMACE are equally passed on to the Mhondoro market. The results from the regression analysis presented in Table 16 show that \$0.01 of a \$1.00 increase in price in ZIMACE is immediately transmitted to Mhondoro whilst \$0.13 of a \$1.00 decrease in the ZIMACE price is immediately transmitted to Mhondoro.

4. CONCLUSIONS FROM THE STUDY

Three major conclusions can be drawn from this study. The first conclusion is that ZIMACE is a contestable market. Competitor mapping reveals that there is competition among ZIMACE member brokers and between ZIMACE and other maize marketing channels. Although there is a small number of participants of the ZIMACE market and significant barriers to entry for few firms, the price discovery process results in prices that reflect the underlying demand and supply conditions and prices which would have prevailed even if there were a large number of buyers and sellers on ZIMACE. Given that prices are discovered at competitive levels, consumers will receive the benefits of competition even though there may be fewer brokers participating in ZIMACE. Brokers in ZIMACE thus strive to discover competitive prices otherwise they will be overtaken by rivals in the market.

The major barrier to entry is the cost of seat on the exchange. However, this is necessitated by the exchange needing to generate finance from internal sources to pay operational expenses as the exchange is non-profit making. Furthermore an increasing number of people are beginning to find security in ZIMACE and they are confident in the knowledge that the deals they strike are transacted at the correct market price. The ZIMACE provides a valuable source of transparent market information which the farmer can use to track the markets. The information can be used to ascertain future price movements and likely supply and demand assessments.

The second conclusion is that ZIMACE market participants engage in price and non-price competitive behaviour. Given that ZIMACE member brokers compete for clients they are forced to be competitive since the markets for agricultural commodities have now been liberalised and producers look for the best price. Most significant has been the changes that have affected marketing which has significantly influenced the conduct of participants in the maize grain subsector. Increasingly large volumes of maize grain are now traded outside the GMB, with large quantities being traded in private markets. The effective and efficient communication of maize grain price signals in the various markets is an important characteristic describing the overall operation of the market. Price is the primary mechanism by which various markets are linked.

Third, it can be concluded that the ZIMACE performs well as a marketing institution and transmits the benefits of its transparent demand and supply-based price discovery and exchange process through the maize subsector. High price correlation coefficients obtained indicate relatively low costs and strong transmission of information within the marketing system. Cointegration and Granger-Causality results further confirm that ZIMACE drives the price discovery process in other markets. These results are a reliable indicator of the existence of healthy competition in the markets for maize grain.

5. RECOMMENDATIONS AND POLICY IMPLICATIONS

Several implications can be drawn from the study results. The implications apply to Government, brokers and smallholder farmers.

5.1 Implications for the Government

The implementation of ESAP in 1992 has led to the acceptance of the principle of free marketing thus the decontrol of marketing through the GMB. This has necessitated a mechanism and infrastructure like the ZIMACE to market crops that had previously been handled by GMB. In this regard, the knowledge of the extent of spatial integration of markets and the nature of price transmission is important in making decisions regarding prices and markets to stabilise. The study has indicated the integration of the ZIMACE market with the private urban markets as well as with some rural markets. This implies that the Government can influence market outcomes including price by using market-based instruments such as dissemination of market information especially to outlying rural markets rather than through direct non-market instruments such as price controls. This study recommends that Government enact legislation to enforce grain handlers including GMB to submit price information to the Agricultural Price Marketing Information system in the Ministry of Lands and Agriculture and that this information should be made public.

5.2 Implications for grain commodity brokers

There has been several changes in the agricultural commodity markets due to deregulation. The deregulated market is perceived to bring with it suspicion, uncertainty resulting from entry by "fly-by-night" grain traders, lack of information, and volatile prices. A commodity exchange like ZIMACE has the capacity to contribute to the improved performance in the agricultural commodity markets by providing a framework within which traders can operate. This study recommends that brokers improve the transparency in price discovery by not engaging in unethical business practices.

5.3 Implications for smallholders

The results of the study have indicated ZIMACE as a leader in the process of price discovery. There exist substantial opportunities for smallholders to benefit through the ZIMACE process of price discovery. Given that the smallholders only have small volumes to market making them vulnerable to receive low prices, this study recommends that the smallholders engage the services of brokers and consolidate their produce in different areas to obtain better access to ZIMACE. The study also recommends that the Zimbabwe Farmers Union provide leadership to organise smallholders so that they can use ZIMACE to market their produce.

5.4 Implications for ZIMACE

The process of market reform involves a lengthy transition process from a state-run to a private sector based distribution system. The findings of the study show that maize grain markets are imperfectly integrated. ZIMACE with its transparent pricing fulfils the crucial role in information provision. The study recommends that ZIMACE supports development of infrastructure facilities to effectively link production centres with market centres and improve market knowledge by providing more relevant, accurate and timely public market information. In addition it is recommended that ZIMACE improves the methods of disseminating market information to result in more transparent prices to all market agents including smallholder farmers. Timely introduction of infrastructure is important as a tool to stimulate improvement in market channel performance. Volatile prices can be taken care of by engaging in forward contracting.

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