

Full Length Research

Price risk management strategies in corn marketing in rural Mozambique

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This study aims at analysing the hedging strategy in the marketing of maize grain in the rural areas of Mozambique. The farmers living in the rural areas of Mozambique that engaged in the business of cultivation, production and marketing of corn as their main rural activity and a means of ensuring subsistence were identified as the target group. The surveyed communities are located in three provinces of Mozambique, they are: Maputo, Gaza and Manica. Questionnaires with key questions relating to the central objective of the work were designed and distributed for data collection to farmers totalling 107 in number, cutting across the three provinces of consideration. A qualitative and quantitative approach that is both exploratory and descriptive in nature was used in the research. In addition to the primary data obtained through the questionnaires, secondary sources of information such as thesis, dissertations, and scientific articles relating to the focus of this study were harnessed. Results from the research showed that marketing plays a leading role in the social life and welfare of the Mozambicans. Majority of the producers claimed to use no risk management strategy in marketing due to lack of information and thus, becoming vulnerable to prices from the buyers. While a small number gave credence to long term experience in the production and marketing business, and have adopted certain strategies for managing price risk, such as the use of fixed-term contracts, most of them being informal agreements and sometimes not compensatory to price risk in the management context. Among other socioeconomic variables that had statistically significant effect on influencing the choice and use of hedging strategy to manage price risk in the marketing of corn, are: schooling, production time, membership in a cooperative and satisfaction financial return.

Key words: Corn marketing, hedging strategies, and farmers. **JEL Codes:** D40, D47, O13.

INTRODUCTION

In Mozambique, maize cultivation ranks first in the production of cereals; being produced on a small, medium and large scale by farmers, majorly for consumption as food and as a source of livelihood for rural families. Because of the green revolution, an increase in the production and demand for this commodity took place over the years. In 2010/11, the production reached 1.9 million tons. However, according

to studies done in Mozambique, the productivity levels measured in tonnes per hectare are still very low, as stated by the Agriculture Promotion Centre of Mozambique (MINAG, 2013).

According to MINAG (2013), corn production in 2015 will increase by 12.5% and consumption will grow by 29%. According to the Agency for Information Mozambique-AIM (2011), an agency of the government, it forecasted that consumption will increase as a result of growth in population and the increase in its use in the feeding of livestock, particularly, in poultry production.

Mozambique is essentially an agricultural country and

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maize cultivation being an economic activity is associated with risks and uncertainties, as a result, proper planning of activities focusing on social and economic development of the country is very essential. Thus, this plan should begin from the family farm which is the core of the Mozambican agriculture.

Marketing can be referred to as the physical transfer process of a product and cash flow for the various links along a production chain within the agricultural planning process. The process of marketing of the agricultural products starts from the production unit to the market demand. In this context, agricultural marketing is an important activity in the socioeconomic development of Mozambique, because much of the food consumed in the urban areas comes from the family farm. Nevertheless, due to the country's characteristic small farming output, there exist sharp fluctuations in the prices; this is partly explained by the asymmetry of information during the harvest season and thus implies the price risk faced by producers during the product marketing period.

Faced with the risk of prices, several management and risk reduction strategies are employed at the time of transaction, one of which is the hedge that is defined by Hull (2007) as a strategy used to reduce the risk of prices through futures markets (contracts term and future), which also include operations that aims at neutralizing the risks involved in price fluctuations in the market spot. This operation usually comes down to the buying or selling of future contract value similar to that of the given business, so that a possible loss due to fluctuation in prices is offset by a gain on the futures market.

Thus, this study aims at analysing the marketing strategies of corn in rural areas in three provinces of Mozambique, and to be acquainted with the tools used by the farmers in the trading price of corn with respect to risk management. It is also expected to serve as a reference in generating information for decision-making regarding the choice of the hedging strategies for farmers, particularly those who grow corn, focusing mainly on the reduction in the volatility of price risks.

Research problem and justification

The agricultural activity basically involves two types of risks: production and prices. Production risks involve losses due to drought, pests and diseases, which can be minimized by proper use of technology and by agricultural insurance. Since price risks are more difficult to be avoided as they vary according to the behavior of supply and demand of commodities in domestic and foreign markets (Oliveira, 2007).

According to Schneider (1990 cited by Ponciano et al., 2003) one of the main difficulties of small and medium rural producers, is suitable commercialization of their production, that is, improving the economic and financial returns of the activity. By analyzing the data on

marketing, the author found out that small farmers have less information, thus, they are dependent on market agents to market their products.

According to the National Statistics Institute of Mozambique - INE (2008), the percentage of Mozambique's population involved in agricultural production between rural and urban areas is as follows: in rural areas, 94% of the population are involved in agriculture while 6% are into non-agricultural activities and in urban areas 56% are involved in agricultural activities, while 44% are into non-agricultural businesses. These data show the importance of agriculture for subsistence and household income.

According to the PGM (2011), in Mozambique there was an increase in agricultural production specifically in cereals (for example, corn) which simultaneously resulted in the growth in agricultural marketing that reached an average of 400,000 tons per year, this was due to the implementation of the plan of action for food production, but also, in response to this call the government needs to complement the small farmers by ensuring proper storage so that the marketing of surplus (surplus production) are not lost due to lack of proper storage conditions.

Therefore, the lack of infrastructure such as suitable storage structures, insufficient enforcement of product quality standards, lack of access to credit for marketing, poor availability of information on markets and prices, lack of extension services for marketing and the absence of strong associations of small farmers, inhibit the establishment of a closer and equitable link between the farmers and markets and the effective functioning of market input and agricultural products, which are essential components to poverty reduction in rural areas (MINAG, 2010).

The points referenced in the previous paragraph that still exist in the value chain of agricultural products validates the need to continue with the adoption of a set of mechanisms and measures for the continued development of the competitiveness of agricultural production and marketing (MIC, 2013).

In Mozambique, maize is mainly produced by small producers and is initially purchased by intermediaries, when approaching the harvest time, proliferates in the rural areas to meet the producers, particularly those in the most remote areas to buy their products. At this level, the intermediaries who have greater control of information on prices in other markets tend to manipulate the producers to sell their products at low prices using addicted scales in most cases (Sitole and Mudema, 2012).

TIA (2008) showed that only 34% of producer households have access to information on agricultural markets, which somehow contributes to the lack of transparency and it encourages speculation on high marketing because, in Mozambique the control system of agricultural prices is still deficient and incurs constant

fluctuations.

In this context, the use of hedge as a management strategy and risk protection in the marketing of agricultural products, prices surge acts as an important instrument both for the producer and the buyer, contributing to the elimination of economic losses and gains in trading.

According to the TIA (2005), the agricultural component of Mozambique consists of small, medium and large scale farmers, with larger percentage belonging to the small and then average. During the marketing process few producers can sell their products, that is, sales prices have not been satisfactory due to excess production which consequently generates imbalance in supply and demand and causes a reduction of the consumer price ratio. Therefore, the selling price is not always efficient in covering production costs, which in addition to this factor, generally does not have adequate conditions for storage and prefers to sell at a low price to avoid incurring costs or losses.

THEORETICAL FRAMEWORK

Markets and agricultural prices in Mozambique

According to Mosca (2008), Mozambique is part of the rural market in Africa with distortions that do not always allow verification of reports from the economics textbooks, assuming the absence of interventions from outside and a competitive structure. The difficulties in communications and the limited means of transport, by different types of producers and consumers, generate specific markets that are rather delimited spatially and socially.

Indigenous agricultural products that are mainly consumed in urban centers are mostly from family farms through the existing commercial network, as public agencies or private market agents that buy the goods from the small producers and then use them as food, as well as for raw material in the processing industry (for example, in the production of flour and feed).

The prices in rural and urban areas are evidence of the functions of economic policies. Market forms are connected with the productive sector, resulting from the configuration of agrarian and economic structures from the colonial period. Physical joints, functional and economic and social interests between the formal and informal markets are known, to be mutually reinforcing (Mosca, 2008).

Agricultural prices are controlled in some way by the Government. For this purpose, they used different instruments such as: various allowances to producers and consumption taxes, trade barriers, food banks, establishment of official prices, production quotas, food stock management to stabilize markets, among others (Mosca, 2008).

The direct and indirect forms of price control (by the government), always influence the markets, the competitiveness of producers, the efficient use of resources and public accounts. On the other hand, it can also stimulate consumption, increase access to food by low-income social groups, thus, contributing to poverty reduction (Mosca, 2008).

Many of the informal economic agents such as (small producers, small informal traders, retailers), has no knowledge, tradition and ability to invest in commercial infrastructure and the formalization of activities. This phenomenon exacerbates the growth of cities without the infrastructure or economies that support the population concentration in social stability and sustainable development of the environment.

According to Mosca (2008), agricultural prices may have great variability in the short term, mainly for the following reasons: instability and fluctuations in supply, due to the specific risks in agricultural production such as organic, natural (climate), political (conflicts and constant changes in agricultural policies); the seasonality of harvest; the uncertainty of the arrival of goods as food aid and other aspects.

Marketing

Agricultural marketing is a "continuous and organized process of the delivery of agricultural products through a marketing channel, in which the product undergoes transformation, differentiation and added value" (Mendes and Padilla, 2007: 8). These authors associate the marketing concept to the existing coordination between production and consumption of agricultural products, including the transfer of property rights, product manipulation and institutional arrangements that contribute to consumer satisfaction.

Agricultural market functions

The sale involves a series of activities or functions through which goods and services are transferred from producers to consumers as it appears in the current settings. These activities result in the transformation of the goods by the use of productive resources - capital and labor - who work on agricultural raw material and it is, therefore, a production process and as such, can be analyzed by making use of the instruments provided by economic theory (Barros, 2007).

The marketing functions are as follows: exchange functions, physical and auxiliary functions. The following appears to define each of them: Exchange functions: Related possession of agricultural products, involving the formation of prices from the relationship between the purchasing and sales functions; Physical functions (logistics): those related to generation of utility (facility) for

agricultural products, with respect to time (storage) to the place (transport) and form (processing); Auxiliary functions: They are those that facilitate or complement the process of commercialization of agricultural products such as standardization, financing, insurance, information and market research.

Marketing channels

According to Waquil et al. (2010), a marketing channel or distribution, is the sequence of steps which the agricultural product passes through, until it gets to the final consumer, setting the organization of intermediates; each performing one or more marketing functions, and the institutional arrangement that enables the market relations in Agro industrial production chains. Examples of the agents that make up the marketing channels, such as trading companies, wholesalers, retailers, central purchasing and distribution of food services, carriers, stores and Agro- processing industries (Waquil et al., 2010).

Marketing strategies

According to Mendes and Padilha (2007), marketing strategy is understood as a procedure, mechanism, method or option that the producer uses to sell his/her product or influence the terms of the sale.

Strategies in marketing have emerged and evolved due to the increased physical ability of the marketing system (mainly related to storage) and also due to the growing trend in the reduction of government's intervention in agricultural markets.

Agriculture by nature is known as an activity of risks and uncertainties. The risks refer to the probability of occurrence of events during the production process and marketing. The uncertainty in the absolute reflected by the lack or the probability of occurrences of certain events' decision maker (Mendes and Padilha, 2007).

The uncertainty of a good price generates a continuous effect and chain along the marketing system and agribusiness. Due to problems in the variability (volatility) of agricultural prices (market risk), it is necessary to search for better marketing alternatives, so that we can find an answer in relation to the economic classic problem: when and how to sell the production (Mendes & Padilla Jr, 2007).

According to Mendes and Padilha (2007), the strategies used in marketing belong to four main groups to indicate: 1) selling at harvest or sale view at harvest; 2) production contracts before harvest or an anticipated production sale (term); 3) storage of the product for speculation and 4) futures strategies and agricultural derivatives (future market).

Market types

According to Marques et al. (2006), the markets can be classified into four basic types:

a) Physical or available market: one in which the products are traded with cash payment or in instalments, through immediate delivery of merchandise or other markets, where products are traded in exchange for receiving money.

b) The term market: one in which they negotiate contracts, specifying the sale or advance purchase of production at a previously agreed price between the parties, which may or may not occur as resource advance on the future delivery of promised merchandise at a given location. The contracts are not standardized, are not transferable and may only be paid on the date agreed and with the delivery of the product.

c) Futures: one in which they negotiate contracts, which are commitments for the purchase and sale of a particular product at a particular price in the future. Futures contracts evolved out of term contracts and, therefore, have some similar conditions.

d) Options market: markets where option contracts are negotiated, setting up agreements where one party, to pay an amount (premium), acquires the right (option) to buy or sell at a future date, a commodity at a price traded on the stock market.

Agricultural marketing in Mozambique

The Mozambican market for agricultural products consists mainly of rural stores, authorized dealers and non-accredited (tents, stalls and street vendors), wholesalers, importers and exporters. Most traders perform various types of trade (wholesale and retail). In rural areas, marketing of agricultural products is done by street vendors (MIC, 2013).

The Mozambican domestic market is characterized generally by low purchasing power, with high rates of absolute poverty (more than half the population lives below the poverty line); most of the population lives in the countryside and produces the basics for their food with a low level use of money. The population of towns and cities with formal employment generally have a higher purchasing power and often keep the connection with rural areas, through family members who produce and provide food to relatives living in urban areas (MIC, 2013).

According to the MIC of Mozambique (2013), agricultural marketing is one of the main sources of income of the population in rural areas, where it mostly depends on agriculture. This activity is a factor of links between small farmers and the market. In order to improve the marketing, the government approved the following policies, they had: Agricultural Marketing Fund;

Agricultural Marketing Strategy 2000/04 (Phase I); Agricultural Marketing Strategy 2006/09 (Phase II). It follows the process of completion of Agricultural Marketing, Integrated Strategy (EICA 2013 -2020).

Mozambique agriculture exports to America, and Asia are (almond and cashew nuts, sesame, and so on), to Europe (cotton) and to neighboring countries, formally and informally, various agricultural products (corn, rice, beans and peanuts).

METHODOLOGY

Sampling

The research was exploratory and descriptive in nature, using primary and secondary data in order to provide greater familiarity with the problem through literature search, and description of the characteristics of the phenomenon, as well as relationships between the variables. The empirical study allowed the use of literature, in search of information interpreted in various stages of the work. Interviews with 107 maize producing farmers were done in the two provinces of southern and one in central Mozambique: Maputo Province (districts of Boane and Manhiça), Gaza Province (district of Chibuto) and Manica Province (districts of Gondola, Manica and post town of Vanduzi).

The choice of study area and its sample was done due to the fact that corn is a traditionally produced item in the region. The criteria for choosing these provinces for research was based on the number of producers with experience in marketing, rural poverty rate and characteristics of producers in production and marketing. Manica, Tete, Sofala, Zambezia and Niassa have the same poverty rate, which is between 32 and 50.1% of rural poverty; Gaza has an index between 50.1 to 67% of rural poverty and Maputo between 67.1 to 85%, respectively.

The sample used was not probable, by convenience and intentional. For convenience, because it selected only a group of producers (elements) who were easily accessible and intentional, because it is one population subgroup, selected based on the information available from the past that involved the production system and commercialization of corn, and it was considered representative of the entire population.

We also maximized the use of information from secondary sources; as articles and scientific papers address issues related to hedge use in marketing, term markets, futures and option markets for agricultural commodities and agricultural products.

It is a qualitative research, in which questions were raised relating to the productive system of individual farmers, associations, cooperatives and the relationship between the market and the processed products. There were technical visits to the headquarters of the farmer cooperatives, where it was also possible to access

certain data and documents to supplement the search.

To obtain primary data, questionnaires were supplied to the farmers, farmers' associations and agricultural cooperatives that produce and sell corn. We tried to formulate objective questions by standardized and systematic stimuli, so that the responses or lack thereof, constituted a sum of evidence that would allow the development of logical reasoning, leading to a diagnosis and certainly a correct conclusion.

The questionnaires were divided into four parts: 1) producer information; 2) farm information; 3) information on agricultural marketing; and 4) hedging strategy analysis. Upon completion of the interviews the quantitative and qualitative data, tests and analysis were performed using the SPSS (Statistical Package for Social Sciences) to a 5% significance level.

Since the study was done in Mozambique, the currency used is the Metical, and was used at the conversion rate of the currency at the Bank of Mozambique (2014) to an exchange: 1 US Dollar for 42 Mozambican Metical. The values that appear in the current text of this work have been converted from Mozambican Metical into US Dollar, using the exchange rate.

Multinomial logit econometric model

The Logit is a statistical technique used to describe the behavior of a binary dependent variable and metric and non-metric independent variables. That is, it is intended to investigate the effect of the variables by which individuals are exposed to, on the probability of occurrence of a particular event of interest (Fávero et al., 2009).

The logit as well as many other statistical classification techniques are used to set up a linear predictor function that builds a score from a set of weights that are linearly combined with the explanatory variables (characteristics) of a particular observation.

According Agresti (2007), logistic regression assigns each predictor of the independent variable a β coefficient, measuring its independent contribution of variation in the dependent variable. The dependent variable can only assume one of two values: 0 or 1. What we want to predict from a knowledge of relevant independent variables and coefficients is, therefore, a numerical value of a dependent variable in the regression, but the probability (p) which is one less than 0 (belonging to a group, rather than the other).

According Wooldridge (2011), if Logit (p) is the log (to base e), the odds ratio or probability ratio that the dependent variable is 1, then the equation is given by:

$$\text{Logit}(P_i) = \ln\left(\frac{p_i}{1-p_i}\right) = \beta_0 + \beta_1 X_{1,i} + \dots + \beta_k X_{k,i} \quad (1)$$

Where P_i is the expected probability, β_0 is the intercept,

β_1 is the estimated coefficient of variable X_k is the independent variable.

Multinomial logistic regression deal with responses that are polynomic, or dependent variable with more than two categories of responses, that is, if Y is the dependent categorical variable with three responses: $Y = 0, Y = 1, Y = 2$ or more.

According Hosmer et al. (2013), as it is assumed that the dependent discrete variable in the model assumes more than two answers. Then, the equation is then given by:

$$g1 = \ln\left[\frac{\Pr(Y=1|X)}{\Pr(Y=0|X)}\right] = \beta_{10} + \beta_{11}X_1 + \beta_{12}X_2 + \dots + \beta_{1p}X_p \tag{2}$$

$$g1 = \ln\left[\frac{\Pr(Y=2|X)}{\Pr(Y=0|X)}\right] = \beta_{20} + \beta_{21}X_1 + \beta_{22}X_2 + \dots + \beta_{2p}X_p \tag{3}$$

Therefore, the conditional probability for each categorical variable is given by the following equations:

$$\Pr(y = 0|x) = \frac{1}{(1+e^{g1x}+e^{g2x})} \tag{4}$$

$$\Pr(y = 1|x) = \frac{e^{g1x}}{(1+e^{g1x}+e^{g2x})} \tag{5}$$

$$\Pr(y = 2|x) = \frac{e^{g2x}}{(1+e^{g1x}+e^{g2x})} \tag{6}$$

The model of the general equation for the conditional probabilities of the three categories will be:

$$\pi_j(X) = \Pr(Y = j|X) = \frac{e^{g_j(X)}}{\sum_{k=0}^2 e^{g_k(X)}} \tag{7}$$

Where $\beta_0 = 0$ and $G_0(X) = 0$

The maximum likelihood in logistic regression is a method that maximizes the probability of classifying the observed data to the appropriate category, given to the regression coefficients. The method also allows to estimate the function of least squares on the linear regression model when the error term follows a normal distribution. In general, this method seeks values of unknown parameters in a data set that maximizes the probability and the simultaneous estimators are calculated values that maximize function (Fávero et al., 2009).

For assume that the observations are independent, the likelihood function which is obtained as a product of terms are given in the following equation:

$$l(\beta) = \prod [\pi_0(x_i)^{y_{0i}} \pi_1(x_i)^{y_{1i}} \pi_2(x_i)^{y_{2i}}] \tag{8}$$

Assuming the log and the fact that $\sum y_{ji} = 1$ for each i , the likelihood log function will be:

$$L(\beta) = \sum_{k=1}^n \{y_{1i}g_1(X_i) + y_{2i}g_2(X_i) - \ln(1 + e^{g_1(X_i)} + e^{g_2(X_i)})\} \tag{9}$$

Where: L is the logarithm of likelihood.

To find the value of β that maximises L(β) it calculates the differential of L(β) in relation to β_0 and β_1 . Which equals zero, and this equation is known as the likelihood equation and is represented as follows:

$$dL(\beta)/d\beta_{ji} = \sum x_{ki} (y_{ji} - \pi_{ji}) = 0 \tag{10}$$

For $j = 1, 2$ and $k = 0, 1, 2, \dots, p$, with $x_{01} = 1$ for individuals.

According to Wooldridge (2011) the calculation of the marginal effect uses the following equation:

$$EM = \left[\frac{e^{\beta x}}{1+e^{\beta x}} \left(1 - \frac{e^{\beta x}}{1+e^{\beta x}} \right) \right] \beta \tag{11}$$

Where: EM = marginal effect; X is an explanatory variable; β is the estimated coefficient; e is the neperian coefficient ($e = 2.72$).

In order to establish the relationship between multiple nominal categories of interest and set of explanatory factors, we used to the multinomial logit model because the dependent variable admitted three possible answers, being so a categorical trichotomous dependent variable that settled three responses.

The three possible responses grouped for term markets and the future were not aware of futures markets ($Y = 0$); knowledge and do not use futures markets ($Y = 1$); knowledge and use futures markets ($Y = 2$). Thus, became the same for the term markets and are not aware of term markets ($Y = 0$); knowledge and do not use term markets ($Y = 1$); knowledge and use term markets ($Y = 2$).

In both cases, a dummy variable with value equal to 1 was applied if, the farmer knows and uses such contracts and 0 otherwise. The survey also included yes or no answers, as well as Likert scale answers, ranging from 1 (complete disagreement) to 5 (complete agreement).

The independent variables were: age of farmer (Ida), education (Esc), membership at a cooperative (Ass_coop), source of income (Prov_Ren), gross income (Ren_bru), Satisfaction with economic return (Sat_Retor_Financeiro), time of production (T_Produção), preference for other tools of price risk management (Pre_ger_ris), propensity to take risk (Pro_ris), absence of risk perception (Fal_per_ris), market monitoring (Acom_merc), over-reliance on farm

management (Exc_Con_gpro), farm size (Tam_prop), participation in any segment of the corn chain (Part_seg), number of bags sold per year (Quant_sacos_comerc), yield of production (Rend_prod).

The multinomial logit model was used to establish the relationship between multiple nominal categories of interest and a set of explanatory factors. The estimation strategy consisted in combining two models of binary logistic regression, which adjusted simultaneously, using the following equation:

$$\log \left[\frac{\Pr(Y=j|X)}{\Pr(Y=0|X)} \right] = \beta_1 + \beta_2 I_{da} + \beta_3 Esc + \beta_4 Ass_{coop} + \beta_5 Prov_{Ren} + \beta_6 T_{Producao} + \beta_7 Pre_{ger_ris} + \beta_8 Pro_{ris} + \beta_9 Fal_{per_ris} + \beta_{10} Acom_{merc} + \beta_{11} Exc_{con_gpro} + \beta_{12} Tam_{prop} + \beta_{13} Part_{seg} + \beta_{14} Ren_{bru} + \beta_{15} Quant_{sacos_comerc} + \beta_{16} Rend_{producao} + \mu_i \quad (12)$$

Where: $j = 0, 1$ and 2 ; Not aware of futures and term markets ($Y = 0$); Be aware of but without the use of future and term markets ($Y = 1$); Be aware of and uses futures and term markets ($Y = 2$).

RESULTS AND DISCUSSION

Farmers and farms

The Mozambican agriculture is practiced by people of all ages in this form as the only source of livelihood in the rural community and a part of the urban. The young people have the practice of agriculture as a complementary activity as the older people have it as their source of income. The survey shows that 44.7% of the producers were within the age range of 40 to 58 years, followed by 30.3% in a range 22-40 years, 20% between 58-76 years and only 5% was within the age group of 76 to 94 years.

The level of education of farmers is a crucial factor in terms of the understanding of certain aspects, such as those related to the adoption of technology to increase yields as well as all post-harvest process and the use or not of risk management strategies in marketing. The survey shows that 40.2% is made up of producers without schooling, 25.2% had primary school education, 23.4% secondary school, and only 11.2% had completed high school.

Asked about the number of years that they produce corn, 58% of respondents indicated that they have been dedicated to this crop between 2-23 years, 24% between 23-44 years, 14% between 44-65 years and 4% between 65-86 years. The survey results suggest that the older community has only 4% and the highest percentage of 58% belong to a range between 2-23 years as producers. This is explained by the fact that most of the production done by families, is characterized by parents to transfer to their children. Most producers in the range dedicated to corn production between 2-23 years are new and incoming young people in agriculture and most of these

are children of farmers.

Asked about the production on the farm, 51.4% answered that they engaged in production of corn as the main crop, followed by 41.1%, who grows corn and vegetables, and 7.5% who produce corn, vegetables and livestock.

Most producers (about 96.3%) reported agriculture as a major source of income generation, while only for 3.7%, it is not the primary source. The superiority of agriculture as the main source of income is explained largely by the fact that, Mozambique is a country where this activity is the main activity in recent economic development and contributes to the advancement of social welfare. This corroborates the result of the study by the INE (2008), which pointed out that about, 94% of the population lived on agriculture and only 6% had another activity as a source of income.

About 85% of farmers considered that maize production is the main source of family income generation and only 15% said no. Maize production in areas where the research was done is considered a tradition and even if some are dissatisfied with the financial return, they do not stop producing because it helps them acquire monetary resources to cover major family expenses, such as education and housing. The remaining 15% considered the production of corn as not being the main source of income, because they have formal work as the main activity in the generation of income, or even other businesses and therefore, have maize production as a complementary activity.

Information on marketing

Farming alone is considered as a field of uncertainties and risks generated by its peculiarities, including dependence on weather and natural disasters, such as periods of heavy rainfall and other drought as well as, increased susceptibility to pests or diseases. During the research, producers were asked about the biggest risk factors in the production of corn, 31.8% replied that they were weather conditions and the price received by producers, 23.4% that they were the weather conditions, raw material prices and prices received for corn, 19.6% showed only the price of agricultural inputs, 12.1% said it was the weather, the price of raw materials, the prices received for corn in addition to pests and diseases, and others 9.3% said it was the weather and the prices of inputs.

Regarding the financial return on corn activity, farmers showed up in divergent answers, 45.8% reported not being satisfied and 54.2% were satisfied with the return. As for satisfaction or no financial return, there are several factors to consider among which we highlight: input prices and selling often do not cover production costs, bringing about economic deficits to the activity.

For most of the producers who have good financial returns, the bottom line is the effective negotiation of the

sale price and the use of risk management strategy in marketing.

About the sale of production, 55.1% answered that they sell their output to individuals, 18.7% to processing plants, mills and individuals, 8.4% processing factories and mills, 7.5% for persons physical, companies and /or government, and only 6.5% sell to processing plants, mills, individuals and non-governmental organization.

Questions relating to marketing the property are made or not by contract, 59.8% said no and 40.2 said yes. The agreements entered into by producers are mostly informal. These informal agreements, mostly characterized by the choice of producers by enterprises, between institutions and producers, as it was found that there is a lot to be improved on this aspect. These contracts are based primarily on experience and production capacity.

Regarding the contract feature made by producers in the sale of corn, 88.8% said it was a contract where the price is set on principle without suffering any variation, overtime, the contract was 8.4% variable selling price and 2.8% the contract, whose settlement price was based on the price seen in certain market.

Hedge strategy analysis

Risk management in marketing is a subject that should be taken into account in all activities because, it plays an important role in a country's economy, providing a major source of income for rural populations, a liaison mechanism of production and of the market, between the countryside and urban (MIC, 2012). In the survey, 54.2% of farmers said they did not use any hedging strategy in marketing and 45.8% said they used.

Regarding the adoption of risk management mechanisms, through the knowledge and use of futures markets, 96.3% of farmers do not have knowledge of future markets and 3.7% have knowledge and do not use futures markets.

In this survey, 46.7% of farmers said they had knowledge and were using the term markets, 36.4% did not have term market knowledge and 16.8% did not know nor did they use the term of markets.

Econometric analysis

All variables in the general model were not statistically significant. This fact may be related to multi-collinearity problems (Appendix 1) as put forth by Gujarati (2011), which undermines the significance of the coefficients of the variables, in studies, this is because the variance and covariance takes higher values (inflates) and confidence intervals tend to be larger, leading to immediate acceptance of the null hypothesis equal to zero of no significance.

When there are multi-collinearity problems, one solution for this is the withdrawal of collinear variables, making the use of a more parsimonious model. In the new model, twelve variables were removed, leaving only four, which are as follows: education, production time, the cooperative membership and enjoyment of financial returns that are in Tables 1, 2 and 3. In this new model, all the independent variables had statistically significant coefficients for term market and no significance for future markets.

Considering the level of significance at 1, 5 and 10%, the result of the analysis of the variables, using the model shown in Table 1, was not statistically significant. So, one could say no to its influences, the choice and use of futures markets. Most producers showed no knowledge nor use these markets, because in Mozambique, the commodity exchange that would make them is still in the implementation phase. These results are supported by the fact that about 96.3% of the producers claiming that they had no knowledge about the functioning of future markets and simultaneously, when asked about the knowledge classification on the same, 94.4% also said they had a low level of education.

Based on Table 2, the explanatory variable coefficients are not significant at 5%, when compared to producers who do not forward market knowledge ($y = 0$) with those who have knowledge and use of market forward ($y = 2$); and the coefficients were statistically significant when compared to producers with knowledge and does not use the forward markets ($y = 1$) with those who possess knowledge and use of markets to term ($y = 2$). Significant variables were: education, the time of production, the cooperative membership and satisfaction of financial return.

Level of education had positive sign and was statistically significant at 10%, and it can be understood that the level of education plays an important role in the life of the producer for the interpretation of certain facts inherent in production and marketing. Except, with an increase in the greater school level, it would be possible for the producer to acquire better information in general, to make the use of the term markets, which aim to reduce the risk of the activity. A similar result agrees with the study done in Brazil by Lima Dias (1997), Cruz Junior et al. (2011), Aguiar and Marques (2004).

The time of production was one of the variables which also has a positive and statistically significant correlation, which can be explained as follows: The longer the time of production, gives the largest producer experience and makes the search for further information, in order to obtain greater success in marketing of the product. Therefore, with increasing years of production, it would be more likely to opt for the use of farmers' markets forward as an alternative to reduce risks. A similar result was found in Brazil by Lima Dias (1997) in his research, where he used the econometric Logit model to conclude that the experience of horticultural producers had a

Table 1. Results of estimation multinomial logit model for the awareness of future markets.

Multinomial logit model (not aware of future markets)	Coefficient	Significance
Intercept	2.022	0.294
Education	0.341	0.580
Time of production	0.064	0.196
[Assoc_coop=0]	20.514	b
[Assoc_coop =1]	20.514	b
[Sat_Retor_Financeiro=0]	-2.098	0.103
[Sat_Retor_Financeiro=1]	-2.098	0.103
Pseudo R ²	Cox and Snell	0.076 ^{ns}
	Nagelkerke	0.276 ^{ns}
	Mcfadden	0.246 ^{ns}

Source: Research results. Note: (a) The reference category is: awareness and not use futures markets; (***) Statistically significant at 1%; (**) Statistically significant at the 5% level; (*) Statistically significant at 10%; (ns) statistically not significant; b standard error equal to zero indeterminate t and p value as well.

Table 2. Results of estimation multinomial logit model for awareness of term markets.

Multinomial logit model (Not aware of term markets)	Coefficient	Significance
Intercept	-0.51	0.5
Education	-0.113	0.638
Time of production	0.011	0.457
[Assoc_coop=0]	0.276	0.593
[Assoc_coop =1]	0.276	0.593
[Sat_Retor_Financeiro=0]	0.158	0.752
[Sat_Retor_Financeiro=1]	0.158	0.752
Multinomial logit model (Aware of and no use of term markets)	Coefficient	Significance
Intercept	-3.739	0.002***
Education	0.581	0.092*
Time of production	0.051	0.007***
[Assoc_coop=0]	-2.68	0.004***
[Assoc_coop =1]	-2.68	0.004***
[Sat_Retor_Financeiro=0]	1.609	0.012**
Pseudo R ²	Cox and Snell	0.205
	Nagelkerke	0.234
	Mcfadden	0.11

Source: Research results. Note: (a) The reference category is: awareness and not use term markets; (***) Statistically significant at 1%; (**) Statistically significant at the 5% level; (*) Statistically significant at 10%; (ns) statistically not significant; b standard error equal to zero indeterminate t and p value as well.

positive relationship, and they hold more information than the necessary markets in marketing.

The variable satisfaction in terms of financial returns showed a positive and statistically significant relationship in the regression model. So, the greater the satisfaction of the largest financial returns, the greater the ability of producers to make use of the forward markets as a way of managing price risks in trading. This is precisely due to the greater chance of financial return for the operation.

This result corroborates those presented in Marques and Aguiar (2004), who found that the higher the gross income obtained by soybean producers, the higher the probability that farmers choose ways to ensure better performance return / risk ratio in marketing the product.

Calculation of the marginal effect of each variable: $EM = \beta Pi (1-Pi)$ as $Pi = \frac{e^{\beta X}}{1+e^{\beta X}}$

Table 3. Calculation of marginal effects of significant variables.

Variables	Coefficient β	Average point	Marginal effect
Education	0.581	2.1	0.102
Time of Production	0.051	25.4	0.0086
Satisfaction with economic return	1.609	1	0.223
Membership at a cooperative	-2.680	0.692	-0.3134

Source: Research results.

Then:

$$EM = \left[\frac{e^{\beta x}}{1+e^{\beta x}} \left(1 - \frac{e^{\beta x}}{1+e^{\beta x}} \right) \right] \beta \quad (13)$$

FINAL CONSIDERATIONS

Agricultural marketing in Mozambique is practiced by people of all ages. The absence of clear policies was noted in order to address the protection of the producer, so that they are not vulnerable to buyers. The number of years of farmers' involvement in agricultural production, made them more experienced in marketing and was a driving force in the adoption of price risk management strategy. Many of maize producers do not make use of risk management pricing strategy in the market due to lack of information and the way the process of choosing each strategy is made. Most of the time, the goal was to sell all the production at once, to avoid storage which could be attacked by pest, resulting to a reduction in the quality of the grains, this is due to the fact that the producer does not have ideal conditions to store the product for subsequent sale.

Another way to manage price risks was to create bonds of friendship with certain buyers through mutual trust generated over time in the marketing process, such as the delivery of production in the form of credit and subsequent receipt of the sale amount.

The main marketing channel was the informal physical market, agricultural fairs and formal market. The climate, price received for maize and high cost of inputs in the market constituted major risks associated with production that somehow raise the total cost of production which is not compensated with the selling price in the final consumer markets. The climatic factors such as; floods are the greatest obstacle in the production process, since, it is quite difficult in the process of production of crops in the field, but also in the preservation process of the product and as a result, one obtains a low-quality product that is sold at low prices.

Another aspect that is an issue in marketing is the issue of flow of logistics of products due to poor access roads (degraded roads) caused by frequent floods that in turn, hinder buyers' mobility from urban to rural areas, where the producers are settled.

In the econometric analysis, twelve socioeconomic variables had no impact on the choice and use of

markets to the future and forward. However, it was expected that they all have a contribution that was statistically significant, but, due to multi-collinearity problems between independent variables, the results became unfeasible and non-significant.

Little is known about the use of future contracts as a risk management pricing strategy in marketing which also was not done. The term market was the only strategy used by producers in marketing as a means of managing price risks, some contracts were with feed production companies and mill in the production of corn flour, with a few clear skies on informal contracts.

The variables that have an impact and were instrumental to the use of the term markets, as a way of price risk management were: education, production time, membership in a cooperative and satisfaction of financial return. The increased likelihood of producers, making the use of term markets as a way of price risk management in trading was influenced by some variables like schooling, production time and satisfaction of financial return.

REFERENCES

- Agresti, A. (2007). *An Introduction to Categorical Data Analysis*. 2nd edn. Department of Statistics, University of Florida, Gainesville, Florida, USA.
- Barros, GCH. (2007). *Economics of Agricultural Marketing*. Luiz de Queiroz College of Agriculture - ESALQ, Department of Economics, Management and Sociology - LES, Advanced Studies Center in Applied Economics - CEPEA, University of São Paulo, Piracicaba - SP, Brazil.
- Cruz Junior, J.C., Silveira, L.F., Maia, A.G., and Saes, M.S.M. (2014). Influence of behavioral aspects in the decision to hedge the coffee futures market. *Agricultural Economics and the Environment*, São Paulo-SP, Brazil.
- FAO. (2012). Faostat database. from <http://faostat.fao.org>. Accessed 23 March 2014.
- Favero, L.P., Belfiore, P., Da Silva, F.L., and Chan, B.L. (2009). *Data analysis: multivariate modeling for decision making*. Elsevier, Rio de Janeiro-RJ, Brazil.
- Gonçalves, R.M.L., and Braga, M.J. (2008). Liquidity Risk Determinants of Credit Unions: An Approach from the Multinomial Logit Model. *Contemporary Administration*

- Review 12(4): 1019-41.
- Gujarati, D.N., and Porter, D.C. (2011). *Econometria Básica*. 5th edn. AMGH editora Ltda, Porto Alegre, Brazil.
- Hosmer Jr, D.W., Lemeshow, S., and Sturdivant, R.X. (2013). *Applied Logistic Regression*. Wiley Series in Probability and Statistics, 3rd edn. John Wiley & Sons, USA.
- Hull, J.C. (2005). *Fundamentals of futures and options markets*. 4th edn. Commodities and Futures Exchange, São Paulo-SP, Brazil.
- Information Agency of Mozambique, AIM. (2012). *News of Mozambique*. Maputo, Mozambique.
- juice-of-corn-rises more-than-a-production. Accessed 17 October 2013.
- Kupfer, D. (2002). *Industrial Economics; technical and practical foundations in Brazil*. Campus, Rio de Janeiro, RJ, Brazil.
- Lima Dias, R. (1997). *The market information role in the marketing of horticulture in the Federal District*. PhD Thesis, Federal University of Viçosa, Viçosa, MG, Brazil.
- Mabota, A., Arlindo, P., Paul, A., and Donovan, C. (2004). *Key lessons of the seminar on Prospects for agricultural and food security in Mozambique marketing for the business year*. Results of investigations of the SIMA-Dest and the Department of Analysis of MADER-Directorate for Economic Policies, Maputo, Mozambique.
- Marques, P.V., Mello, P.C., and Martinez, J.G. (2006). *Futures Markets and Agricultural Options*. Educational Series No. D-129. Department of Economics, Management and Sociology of ESALQ / USP, Piracicaba-SP, Brazil.
- Marques, R.H.S., and Aguiar, D.R.D. (2004). *Determinants of the use of futures markets for soybean producers in Cascavel*. *J. Econ. Agribusiness.*, 2(2): 209-34.
- Mendes, J.T.G., Padilla Jr, J.B. (2007). *Agribusiness: an economic approach*. Pearson Prentice Hall, São Paulo-SP, Brazil.
- Ministry of Agriculture, MA. (2010). *Strategic Plan for the Development of the Agricultural Sector*. PEDSA 2010-2019. Ministry of Agriculture, Maputo, Mozambique.
- Ministry of Agriculture, MA. (2013). *Agriculture Promotion Centre (CEPAGRI)*. Ministry of Agriculture, Maputo, Mozambique.
- Ministry of Industry and Trade, MIT. (2013). *Action to improve access to markets and food security*. Presentation Annual Meeting Purchasing Program Consultation for Progress (CFP), Rome & Rio de Janeiro.
- Ministry of Industry and Trade, MIT. (2014). *Plan of agricultural marketing 2011 and 2012*. http://www.sima.minag.org.mz/mic_apresent_plano_comercializacao_agricola_18_8_11_sima.pdf. Accessed June 3.
- Mosca, J. (2008). *Agriculture and Development in Africa*. Publisher Piaget, Lisbon, Portugal.
- National Agricultural Survey, NAS. (2005). *Republic of Mozambique*, Maputo, Mozambique.
- National Agricultural Survey, NAS. (2008). *Republic of Mozambique*, Maputo, Mozambique.
- National Statistics Institute, NSI (2009). *National Household Survey on Family Budget 2008/09*. Final report. Maputo, Mozambique.
- National Statistics Institute, NSI. (2005). *Statistics of Mozambique*. Maputo, Mozambique.
- National Statistics Institute, NSI. (2008). *Agricultural Census: Final results*. Maputo, Mozambique.
- Oliveira, V. (2007). *Agricultural market. Information, strategies and decision making*. Toledo-PR, Brazil. www.fag.edu.br/graduacao/agronomia/arquivos/mercado_agricola.pdf. Accessed 28 April 2014.
- Pinto, A.M. (2013). *Commercialization of agricultural products from Mozambique grow there is still room for improvement*. <http://nandiwe.blogspot.com.br/2013/01/comercializacao-de-produtos-agricola.html>. Accessed 3 June 2014.
- Ponciano, N.J., De Souza, P.M., and Rezende, A.M. (2003). *Commercialization of barriers will competitiveness of Brazilian corn*. *Magazine Paranaense Development*, 104(1): 23- 40.
- Portal of the Government of Mozambique, PGM. (2011). *Corn consumption increases more than production*. <http://www.portaldogoverno.gov.mz/noticias/agricultura/marco-de-2011/con>
- Systole, R.F., and Mudema, J. A. (2012). *Analysis of food prices fluctuation in Mozambique and its impact on consumers; Organizations Network for Food Sovereignty (ROSA)*, Maputo, Mozambique.
- Triola, M.F. (2005). *Introduction to Statistics*. Ltc, Rio de Janeiro-RJ, Brazil.
- Vugt, A. (2002). *Agrarian sociology (Agrarian sociology notes)*. Faculty of Agronomy and Engineering Florestal-FAEF- PPV- communication section and agrarian sociology. Eduardo Mondlane University (UEM), Maputo, Mozambique.
- Waquil, P.D, Miele, M., and Schultz, G. (2010). *Markets and marketing of agricultural products*. UFRGS, Porto Alegre-RS, Brazil.
- Wooldridge, J. A (2011). *Introduction to econometrics: a modern approach*. Translation of the 4th edition North - American. Cengage Learning Editions Ltda, São Paulo-SP, Brazil.

Appendix 1. Matrix of correlations of explanatory variables.

	Idade	Escol	coop	Prov_ren	Ren_Pro	Pref_inst-ges_risco	Pro_risc	Fal_per_ris	Acomp_merca	Ges_prop	Sat_ret_fin	Tam_Prop	Part_segm_	Ren_bru	Sacas_comer	Tem_prod
Idade	1	-0.4928	0.2223	-0.0762	0.4009	0.2021	0.1746	0.0554	0.1848	0.1225	0.0255	0.2972	-0.1518	0.3536	0.3565	0.6749
Escol	-0.4928	1	-0.0637	0.0283	-0.3123	-0.0413	-0.0337	-0.1391	-0.0273	-0.0218	0.0755	-0.2601	0.0291	-0.2684	-0.4257	-0.4257
coop	0.2223	-0.0637	1	-0.1232	0.0222	-0.1134	-0.1302	-0.0591	-0.1056	0.0168	0.361	0.0005	-0.098	0.1171	-0.0743	-0.0743
Prov_ren	-0.0762	0.0283	-0.1232	1	0.0469	-0.0645	-0.0756	0.0982	-0.0613	-0.0935	-0.1708	0.0494	0.2949	0.0357	0.0376	0.0376
Ren_Pro	0.4009	-0.3123	0.0222	0.0469	1	0.1459	0.0767	0.1202	0.1396	0.0897	-0.1552	0.7734	0.1331	0.8922	0.4557	0.4557
Pref_inst-ges_risco	0.2021	-0.0413	-0.1134	-0.0645	0.1459	1	0.8618	-0.2196	0.9413	0.6967	-0.1561	0.0583	0.1339	0.1416	0.1352	0.1097
Pro_risc	0.1746	-0.0337	-0.1302	-0.0756	0.0767	0.8618	1	-0.1774	0.8112	0.8085	-0.0807	0.0683	0.052	0.084	0.0873	0.1321
Fal_per_ris	0.0554	-0.1391	-0.0591	0.0982	0.1202	-0.2196	-0.1774	1	-0.1439	-0.1237	-0.0373	0.0291	0.2639	0.1357	0.1404	0.0275
Acomp_merca	0.1848	-0.0273	-0.1056	-0.0613	0.1396	0.9413	0.8112	0.8112	1	0.6558	-0.1461	0.0554	0.1251	0.1378	0.1288	0.089
Ges_prop	0.1225	-0.0218	0.0168	-0.0935	0.0897	0.6967	0.8085	-0.1237	0.6558	1	0.0232	0.0845	0.1065	0.1154	0.0965	-0.0053
Sat_ret_fin	0.0255	0.0755	0.361	-0.1708	-0.1552	-0.1561	-0.0807	-0.0373	-0.1461	0.0232	1	-0.1084	0.0685	0.0106	-0.0488	-0.1584
Tam_Prop	0.2972	-0.2601	0.0005	0.0494	0.7734	0.0583	0.0683	0.0291	0.0554	0.0845	-0.1084	1	-0.0533	0.64	-0.0488	0.4094
Part_segm_	-0.1518	0.0291	-0.098	0.2949	0.1331	0.1339	0.052	0.2639	0.1251	0.1065	0.0685	-0.0533	1	0.2038	0.1988	-0.1532
Ren_bru	0.3536	-0.2684	0.1171	0.0357	0.8922	0.1416	0.084	0.1357	0.1378	0.1154	0.0106	0.64	0.2038	1	0.8893	0.2204
Sacas_comer	0.3565	-0.2527	-0.0369	0.0899	0.9395	0.1352	0.0873	0.1404	0.1288	0.0965	-0.0488	0.7325	0.1988	0.8893	1	0.3776
Tem_prod	0.6749	-0.4257	-0.0743	0.0376	0.4557	0.1097	0.1321	0.0275	0.089	-0.0053	-0.1584	0.4094	-0.1532	0.2204	0.3776	1