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COMPREHENDING SMALLHOLDER MAIZE ENTERPRISES' PROFITABILITY WITH THE CURRENT MAIZE MARKETING SYSTEM IN ZIMBABWE: A CASE OF MAZOWE DISTRICT

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Abstract

Maize enterprise profitability is essential for sustainable maize production in smallholder farming. In Zimbabwe a lot of factors including several policy measures implemented in the past are believed to be influencing current maize profitability trends. Literature to confirm some of the crucial factors is limited especially in the smallholder farming sector. In this study we analyze profitability of smallholder maize farmers in Mazowe District of Zimbabwe. We estimate maize enterprise profitability using gross margin analysis, factors driving profitability using linear regression analysis and the influence of tobacco farming adoption on maize enterprise profitability using propensity score matching. We relied on both primary and secondary data from the study area. Results did not show robust outcomes on maize enterprises profitability. Maize profitability was found to be influenced positively by age of household head and selling produce to private buyers and negatively by fertilizer, chemical, and transport costs. Tobacco farming adoption was found to have a positive influence on maize profitability. Based on the results the study recommends the government through its various programs targeting agricultural development and food security to focus on smallholder maize production and marketing with the aim of improving its profitability.

1. INTRODUCTION

1.1. Background

Agriculture and farming is an integral part of Zimbabwe's social, economic and environmental well-being. In contributes significantly to overall economic growth, livelihoods, food, income and

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nutrition security (Juana & Mabugu, 2005). At the center of this well-being is the smallholder farmer (family farm). For the smallholder farmer, farming is more than just a business; it is also a way of life. For sustainable production, the market must allow the smallholder farmer to make profit or else we risk destroying our rural economy that produces most of the food. Weak and or non-remunerating markets and marketing systems will only make the family run farm hard to sustain. Remunerating markets and marketing systems will be important for the farm business as an enterprise since when farmers are profitable they re-invest their profits back into their businesses, benefiting more stakeholders in the economy. Most expected benefits will be job creation, improvement of food security, adding value to the rural society in general etc.

In Zimbabwe, maize is one important cereal crop grown. It is the staple cereal and it forms an important component of food security and livelihoods especially amongst smallholder farmers. Maize production is now dominated by smallholder farmers since the advent of the Fast Track Land Reform[1] (FTLR) of year 2000.The birth of the FTLR led to an increase in the number of smallholder farmers in Zimbabwe (Clifton, 2013; Moyo, 2011). This development improved significantly the role played by smallholder farmers in maize production in Zimbabwe.

Most of the smallholder farmers grow maize primarily for subsistence purposes (Mazvimavi *et al.,* 2012). With radical changes in the Zimbabwean agricultural sector since FTLR of year 2000, an estimated 70% of the population in Zimbabwe now lives in the smallholder farming areas (Mano, 2006). This has significant implications for food security, given the critical role of the smallholder sector in producing the staple maize crop. It therefore implies that any sort of challenges that affect smallholder farmers in production and or marketing might have serious consequences on incomes, food security and general livelihoods of the country's population.

However, the smallholder farming sector is constrained by several challenges that are affecting maize production and productivity. According to Mazvimavi *et al.* (2012) production of the main staple crop (maize) has been declining since the early 1990s significantly compromising household food security. A lot of factors have contributed to this decline but policy and institutional factors have played a major role (Rukuni *et al.,* 2006).

Some of the notable current challenges include the inconsistent maize marketing policy, lack of security of land tenure (offer letters and 99 year leases which discourage long term investment on land), lack of collateral to access credit, obsolete technologies, climate change, and lack of skills amongst other challenges. Of importance to this study is the government maize marketing policy that is currently affecting maize production and marketing. The government through the Grain Marketing Board (GMB) has failed to offer genuine support to maize farmers in Zimbabwe in terms of pricing and payment patterns.

The GMB is a wholly state owned enterprise with network depots. It is involved in commodity trading in cereals and oil seeds, the provision of logistic services to the agricultural industry as well as processing of products. The institution plays a pivotal role in maize marketing in Zimbabwe. However, the national institution has been dictating maize prices but without cash to pay the farmers. This alone has caused numerous problems in maize marketing in Zimbabwe. Recently, we have noticed the mushrooming of private companies (e.g. National Foods, Agrifoods, Feedmix, Fivet, Novatek, Profeeds, Staywell), millers, poultry and animal rearing companies (e.g. Irvines, Hubard, Chinyika, Lunar Chickens, Carswell and Koala meats) entering the maize market mix and pose competition to GMB. The problem with these companies is that they are taking advantage of poor payment terms and lack of funds of GMB to pay farmers and take farmers' maize produce at very low prices. The farmers are falling to the trap as they are left desperate because of the situation. They are finding it better to accept the low prices from private

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[1] Fast Track Land reform: A land redistribution exercise implemented in year 2000 that was meant to address imbalances in land ownership between blacks and whites post-independence in Zimbabwe.

buyers than to wait for the GMB lengthy payment periods despite them (GMB) paying a better price sometimes. Besides the poor and lengthy payment patterns, the GMB have been offering low prices that do not tally with high maize production costs characteristic to the smallholder farming sector. A good example is that of 2012/13 season in which the GMB gazetted price per tonne was US$390, which was far less than the cost to produce a tonne of maize that season which was at US$410 (ZimVAC, 2014). In that same season private buyers were offering prices as low as US$250 per tonne of maize. This scenario dis-incentivises maize production particularly among smallholder farmers who face many other challenges in their farming activities.

Considering that the new crop of smallholder farmers are resource poor, such kind of unfortunate circumstances may force farmers out of maize production or at least reduce focus on the crop. There has been a noticeable trend of most farmers increasing acreage grown under tobacco at the expense of maize production (ZimVAC, 2011). This has serious implications on food security to the Zimbabwean population. Maize production, productivity and profitability is declining in the agriculture sector mainly because of these challenges (ZimVAC, 2011).

Maize production and productivity is slowly declining in Zimbabwe because of a couple of problems in the sector. For example, per capita maize production is slowly declining because of a significant decline in yield per hectare over time. In the 1990s, the smallholder maize yield was around 1.5 tonnes/ha but after 2000 it dropped to about 0.7 tonnes per hectare (Agritex, 2015). The situation could be improved by improving maize marketing policies in Zimbabwe. This is most likely due to the confidence the farmers has on the national marketing institution. Improving maize output pricing and payment patterns is also most likely to attract more land towards maize farming than tobacco farming.

This study aims to unravel the effects of various elements in the current smallholder maize production and marketing sector. Precisely we ought to do the following:

  i. Analyse profitability in the current smallholder maize production system in Zimbabwe
 ii. Identify the factors influencing maize profitability and,
iii. Assess the impact of tobacco farming adoption on profitability of smallholder maize enterprises.

Results from such a study will be important in understanding significant factors influencing current smallholder maize profitability hence making it easy to offer sound policy recommendations that may improve profitability and hence benefits from farming e.g. income and food security. Results will confirm whether type of buyer dealt with by the smallholder farmer in selling his/her maize output is significantly related to profitability. This will go a long way in improving smallholder farmer incomes, food security and Zimbabwe's smallholder agriculture as a major source of livelihood. We explore the maize productivity trends in Zimbabwe since 1980 in the next section.

1.2. Maize productivity trends in Zimbabwe since 1980
Figure 1 shows national maize productivity trends from 1980 to 2014. Since 1980, maize productivity based on national statistics has been declining as shown by the downward trend in the graph. The linear trend line confirms the continuous decline in maize average output per hectare. In the early 80's, average maize productivity reached extremely high figures above 12 hectograms per hectare as shown on the graph. Productivity in maize production since then was high which to some extent explains why Zimbabwe was regarded the bread basket of southern Africa. However, due to various factors that has continuously hard hit Zimbabwean agriculture, such as climate change, macroeconomic challenges, disease and pest attacks, and government policy, maize productivity has been declining. From early 2000 to present, productivity continued to fluctuate within the range of 2 to 10 hectograms per hectare. Mostly blamed for the declining productivity

especially in the smallholder sector is the lack of productive resources by the new group of smallholder farmers. To add on, a lot of maize marketing policies have had an impact on the production and productivity of maize in Zimbabwe (Table 1). The maize sector is one sector that experienced a lot of policy changes since 1980.
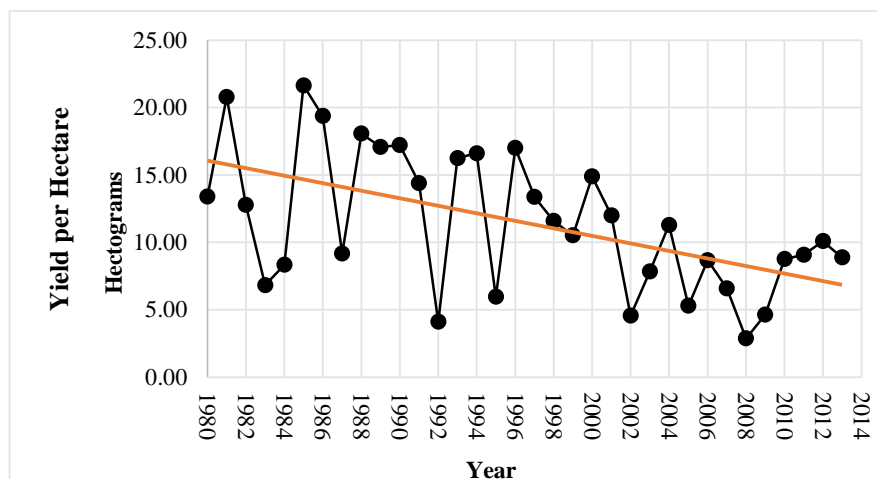

Figure 1: Maize productivity trend since 1980, Zimbabwe

Source: FAOSTAT (2015)

1.3. Maize policies in Zimbabwe in the past 40 years
In Table 1 we give a summary of some of the important policies targeted at improving maize productivity and profitability. When the country got its independence in 1980, the country was dominated by four main parastatals supervised under Agricultural Marketing Authority (AMA) formed in 1967. AMA acted as a conduit between the government and the farmers' interests. Producer and selling prices were fixed by the government through the ministry of agriculture in negotiations with the producers (Gwara, 2011). The main policy objective of the ministry during that time was to ensure self-sufficiency, retention of capital and expertise within the agricultural sector through incentive pricing and supply control through stabilization of prices and income.

Table 1: Main policies and programs targeted to maize in the past 40 years

Year	Policy/program	Main objective/s
1967	Formation of Agricultural Marketing Authority	Improve production and marketing
1980-1985	Doubling of maize producers prices, input support	Increase maize productivity, production and income
Early 1990s	The Structural Adjustment Programs (SAP)	Reduction of government control in markets and increasing market competition.
1994	Establishment of Zimbabwe Agricultural Commodity Exchange (ZIMACE). In 1996 Maize marketing was completely liberalized	Improve efficiency in maize marketing
2001	Grain Marketing Act	To retain the GMB to its monopoly status. Wipe competition in maize marketing
2001	Suspension of ZIMACE	Wipe away competition in maize marketing i.e. ensuring GMB was the sole buyer and seller of maize
2001	Release of statutory instrument (SI-235A)	To control maize grain, maize and wheat meal. One needed a permit to trade in the

		three commodities. Private trading was prohibited
2005	Operation Maguta	Increase productivity and production
2007	Agricultural Mechanization Program	Improve maize productivity as a reinforcement to land reform of year 2000
2007	Agricultural Sector Productivity Enhancement Facility (ASPEF)	Improve productivity in the agricultural sector through improving access to credit.
2008	Grain Mobilization Program	ensuring timely payments to maize producers for their grain
2009	Market liberalization reforms	Making GMB's main function as the buyer of last resort
-	Food aid policy	Ensure that food aid does not negatively affect maize pricing and productivity
-	GMO policy	Restriction of importation of GMO seed
2013	Zimbabwe Agenda for Sustainable and Social Economic Transformation (Zim ASSET)	Improve maize productivity amongst other crops to improve food security

In the period between 1980 and 1985 smallholder maize sales increased from 8 to 45%. This increase was attributed to doubling of the producer price of maize and input support programs (Gwara, 2011). The SAP program in Zimbabwe saw the dissolution of AMA and it formed an autonomous board of directors for marketing. However, the board experienced losses under the pretext of performing social and developmental obligations (Gwara, 2011). The SAP was also associated with conversion of the maize pricing policy from a system of producer and selling prices to a system of floor prices and also the deregulation of statutory marketing controls to encourage competition. The Economic Structural Adjustment Program (ESAP) also aimed to promote active participation of private players in the maize market.

ZIMACE was established in 1994 to improve efficiency in maize marketing by giving competition to the national marketing entity GMB. Maize marketing was thus within a relatively free market with ZIMACE (Rukuni *et al.,* 2006). Liberalization of the maize marketing system was not very successful, the structural adjustments failed to stabilize prices. The liberalization efforts failed as evidenced by food riots in 1998.

In 2001, the government made efforts to control maize trade and pricing. The GMB was made the sole player in maize trade and ZIMACE was suspended in the process. The statutory instrument (SI-235A) was released in the same period and it was aimed to tighten trade and exchange of maize grain, maize and wheat meal. One was to obtain a permit to effect movement of the three mentioned products. From 2001 to 2005 the GMB could not cope up with inflation and hence production fell, with private importation prohibited this saw the emergence of the parallel market.

A lot of other policies/programs meant to improve food security through improving both productivity and profitability of maize producers have been implemented. The main objectives of the policies have been generally the same. One such policy was named 'Operation Maguta'. Under this scheme, communal farmers were given inputs such as seed, fertilizer and herbicides in order for them to grow one hectare of wheat and or maize. Farmers were expected to pay back the inputs soon after harvest at an interest rate of 50%. According to Bird and Busse (2007) the input prices were heavily subsidized and were set way below market clearing prices.

In addition, the Agricultural Mechanization program was also conceived in 2007 as a long term measure that was to ensure consolidation of gains from the land redistribution exercise of the year 2000. The reform significantly transformed the equipment and productive landscape of the agricultural sector through mechanizing both communal and commercial farmers (Gwara, 2011).

In the same year (2007), the Agricultural Sector Productivity Enhancement Facility (ASPEF) was launched by the Zimbabwean government to support maize crop production amongst other commodities such as wheat and livestock. The policy was meant to improve productivity through improved credit access. However, lack of tittle deeds constrained the program as banks were reluctant to offer large sums of money to farmers with no collateral (Dawes *et al.,* 2009).

The Grain Mobilization Program of May 2008 is also another program meant to improve maize marketing and profitability. It set up a grain mobilizing committee comprised of officers from the ministry of agriculture, GMB and the Reserve Bank of Zimbabwe (RBZ). The main objective of the program was to ensure timely payments to farmers for their grain and to mitigate inflationary pressures. In addition, the intervention had the objective of ensuring urgent procurement of surplus produce from farmers in order to build the national stock of grain reserves. With liberalization reforms of 2009, the GMB was made the buyer of last resort. In this case it tried to maintain floor prices to promote domestic maize producers. This also saw the removal of duties and import restrictions on the maize commodity.

In addition, the Zimbabwe food aid policy has always been supportive of crop production. The Zimbabwean government always ensure that the food aid policy should not; destabilize the local market, act as a dis-incentive for producers, depress commodity prices (Mudzonga & Chigwada, 2009). In addition, the Zimbabwean government restrict importation of GMO seed. Esterhuizen and Kreamer (2011) pointed out that the ban on importation of GMO seed may reduce competitiveness and comparative advantage of maize production in Zimbabwe.

In 2013, the government introduced the Zimbabwe Agenda for Sustainable and Social Economic Transformation (Zim ASSET) which is an economic blueprint with a lot of themes/clusters, targeting to improve welfare in Zimbabwe. One main aim of the Zim ASSET has to do with improving food security and nutrition (Matutu, 2014). The policy is however very new and still at early stages of implementation. Maize is the main target commodity considering its importance in curbing food shortages in Zimbabwe.

In the end, the various policies addressed in this section give information on the importance of maize as a cereal staple crop in the country. In addition various socioeconomic indicators targeted by the various policies provide a good insight on the factors likely to influence maize productivity and profitability in Zimbabwe. Also, they show the importance of the commodity (maize) to the agricultural sector.

2. RESEARCH METHODS AND DATA COLLECTION

2.1. Description of the study area, sampling and data
We make use of primary and secondary household level based data for Mazowe district of Zimbabwe. Mazowe is the southernmost of seven districts of the Mashonaland central province in Zimbabwe. The large parts of the district lie in natural region 2. The rainfall ranges from 750 to 1000 mm/year. It is fairly reliable, falling from November to March/April. The region is suited to quite a number of crops that include maize, flue cured tobacco, cotton, wheat, soybeans, sorghum, groundnuts, seed maize and burley. The district is linked to Harare by a 35 km highway. The district location is shown in figure 2.
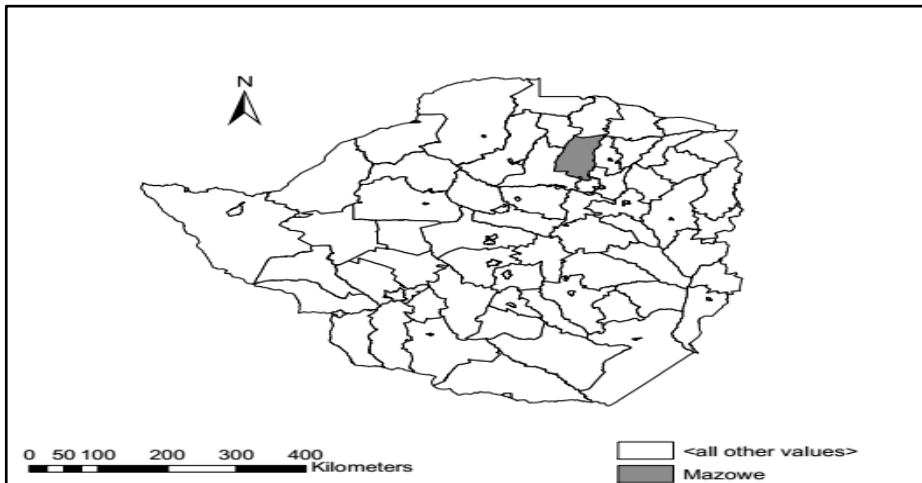
Figure 2: Map of Zimbabwe showing the Mazowe district

Secondary data pertaining to smallholder crop production and marketing statistics were obtained from the Ministry of Agriculture. Primary data was gathered in the form of a household survey using a structured questionnaire. The questionnaire was pre-tested, modified and then used to collect data. Specifically, information on maize production and marketing constituted the bulk of the questionnaire. However, farmer characteristics (resources' endowment and demographic characteristics etc.), costs and benefits incurred by farmers in the value chain, access to some institutional variables (such as credit, extension etc.) and some brief information relating maize and tobacco farming in the study area were also captured in the questionnaire. Face to face interviews were used to gather the data as the method was regarded as the one with a higher possibility of getting high rate of responses and to take less time than other interviewing methods.

A sample of 120 randomly selected smallholder farmers was gathered from Mazowe district of Zimbabwe. Local agricultural extension officers in the district assisted in providing list of smallholder farmers in the study area from which 120 farmers were randomly selected from 5 randomly selected villages.

2.2. Data analysis and processing
Quantitative data was processed and analyzed using Excel, STATA and SPSS. We relied on both descriptive and causality analysis to answer the study's research questions.

2.2.1. Evaluating private profitability
One prime objective was to assess the profitability of smallholder farmers in the district. To assess private profitability of smallholder maize producers we used value chain costs and benefits. Precisely, Gross Margin approach was used to assess private profitability in maize production. From the gross margin analysis the study reported cost benefit analysis ratios to assess profitability of the ith farmer. We applied the Benefit Cost Ratio (BCR) taking into account the time value of money. The benefit cost ratio as shown in equation 1 is calculated as the Net Present Value of benefits divided by the Net Present value of costs. We used the formula for BCR as follows:

$$BCR = \frac{\sum_{r=1}^{r} \frac{B_t}{\{1+r\}^t}}{\sum_{r=1}^{r} \frac{C_t}{\{1+r\}^t}} \qquad \text{.....................} \ (1)$$

Where B_t is benefit in time t and C_t is cost in time t. If the BCR exceeds one, then the maize enterprise is profitable. If the ratio is less than one, then maize production as an enterprise in

smallholder farming is not profitable. It is however important to note that we used value of all the farmers maize produce as the benefits and costs incurred in producing the same quantity of produce as costs discounted at an assumed 5% interest rate. We value all maize output from a specific season to avoid under or overestimation of profitability since most of the produce may not be sold but rather kept for household consumption.

2.2.2. Evaluating factors influencing maize profitability

We used multiple regression analysis techniques to examine the factors influencing smallholder maize profitability in the district. According to Barrow (2009), regression analysis is a more sophisticated way of examining the relationship between two (or more) variables. It is a generic term for all methods attempting to fit a model to observed data in order to quantify the relationship between two groups of variables. Multivariate regression takes into account several predictive variables simultaneously, thus modelling the property of interest with more accuracy. The study borrowed from a study by Olujenyo (2008) who selected various demographic, social, economic, institutional and environmental variables as factors into the regression model that affect profitability. We therefore apply multiple regression analysis to identify factors that significantly influence profitability. Maize enterprise Benefit Cost Ratio (BCR) was used as a dependent variable whilst a number of social, economic, cultural, and institutional and environmental factors were used as covariates explaining variation in profitability of smallholder maize producers. The multiple regression adopted took the following form:

$$Y = B_0 + B_1X_1 + B_2X_2 + \cdots \ldots \ldots .. + B_nX_n + \varepsilon \qquad \ldots\ldots\ldots\ldots\ldots\ldots (2)$$

Where, Y= is the dependent variable,
X_{1-n} are the independent variables
B_{0-n} are the coefficients to be estimated and
ε is the random error term.
Definition, description and measurement of variables used in regression analysis is shown in table 2.

2.2.3. Evaluating Impact of tobacco farming adoption on maize enterprise profitability

To assess the impact of tobacco farming on maize profitability the study adopted the potential outcomes framework following the work of Heckman and Vytlacil (2005). According to this framework impact (treatment effect) can be defined as outcome for exposure (adoption) minus outcome for non-exposure (non-adoption). In our specific case it will be the difference in maize enterprise gross margins for adopters and non-adopters of tobacco farming. In this study the Average Treatment Effect (ATE) was estimated using the Nearest Neighbor Matching Approach. This approach imputes the missing potential outcomes for the untreated group using average outcomes for individuals with similar observed characteristics, based on covariates X. STATA version 12 was used to do the analysis.

3. RESULTS AND DISCUSSION

3.1. Overview of smallholder Maize production and marketing in Mazowe

3.1.1. Maize productivity trends

Productivity trends in smallholder maize production can be positively related to profitability. Average maize productivity in the district has been fluctuating as shown in figure 3. Data collected in the past nine seasons reveal that productivity levels in the district have been fluctuating between 1.5 tons per hectare and 3 tons per hectare. Considering the high agricultural potential in the district the result is not surprising and an upward trend can be expected with improved maize production and marketing conditions.
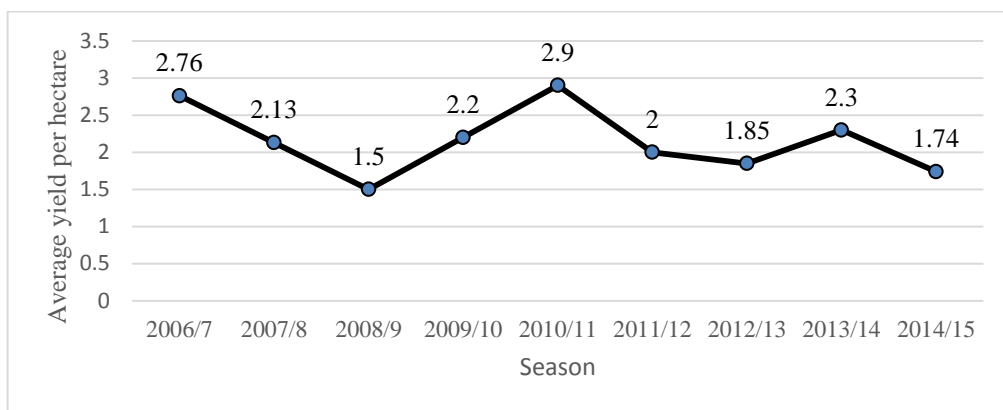
Figure 3: Maize productivity trends in Mazowe District in the past nine seasons

Source: Agritex (2015)

3.1.2. Major Market players in Mazowe

Maize marketing is very important if farmers are to fully benefit from their production. Marketing improves incomes for the farmer. This therefore justifies the need for reliable marketing players in the district. From statistics gathered by the Ministry of Agriculture, government through the GMB and private buyers have dominated as maize marketing players in the district. Other relevant players in the district were noted as private millers and some contractors. Some notable private buyers playing a big role in maize marketing in Mazowe are processors such as National Foods, poultry producers and beverage making companies e.g. Delta Beverages. The pie chart in Fig 4 shows the major market players in maize in Mazowe district.
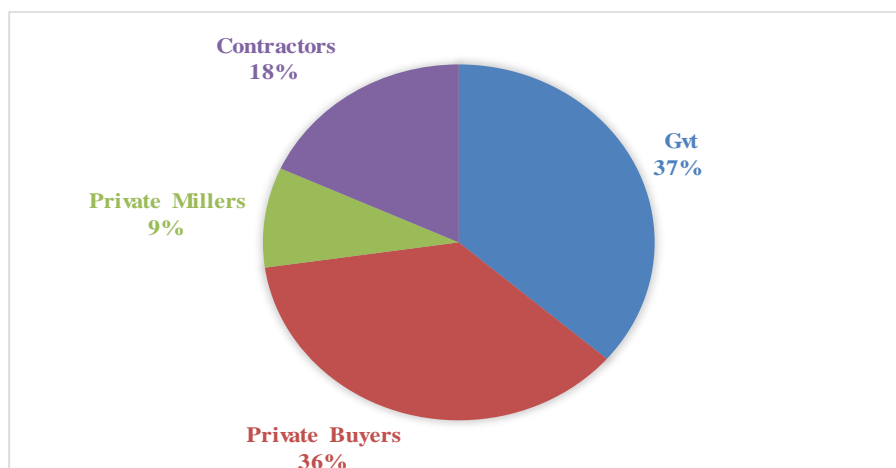

Figure 4: Major Maize Market players in Mazowe

Source: (Agritex, 2015).

3.1.3. Socioeconomic profiles of smallholder maize producers in Mazowe

Table 2 show characteristics of the sampled smallholder farmers from Mazowe district of Zimbabwe.

Table 2: Socioeconomic characteristics of the sample

Variable	Description and measurement	Mean/ Proportion
Age	Age of household head in years	49.1
Education	Number of years in formal education for the household head	9.8
Gender (%)	Sex of household head (1=male)	70.0
Dependency ratio	Household age dependency ratio	0.7
Farming experience	Farming experience of the household head in maize production and marketing in years	10.5
Land holding	Size of land holding that the household have access to in hectares (Ha)	5.9
Extension (%)	Access to extension advice (1=yes, 0=no)	87.0
Extn Freq	Number of times extension visit/advice was received	3.0
Dist Mkt	Distance to the nearest maize market in kms	11.0
SeedCost15	Average maize seed costs incurred per season (US$)	79.4
Fert Cost	Average maize inorganic fertilizer costs incurred per season (US$)	265.7
Chem Cost	Average maize chemical costs incurred per season (US$)	51.6
Labor Cost	Average maize labor costs incurred per season (US$)	28.6
Transpt Cost	Average maize transportation costs incurred per season (US$)	7.2
Maize buyer	Categorical variable indicating where the smallholder farmer sold his/her maize produce in 2014/15 season	
Farmgate (%)	Proportion sold to other farmers (farmgate)	7
Private Buyers (%)	Proportion sold to private buyers	86
GMB (%)	Proportion sold to GMB	7

Source: Own calculations

3.2. Demographic characteristics

Results of the descriptive characteristics 2 shows that smallholder maize producing households in Mazowe are mainly male headed (70%). Maize production is still mainly dominated by males probably because of the importance attached to the crop when it comes to household welfare. Results from the sample also show that maize producers in Mazowe are middle-aged with an average of 49 years. Age is very important in the studying of farming households as it is believed to have a bearing on many aspects of production and marketing i.e. risk preferences and experience. For example, old aged farmers are believed to be risk averse, a characteristic which may negatively implicate on adoption of maize marketing strategies and technologies. More importantly, results showed that on average smallholder farmers sampled had on average 9.8 years of formal education. The results show an average of 0.7 age dependency ratio meaning for every economically active household member there is about 1 person as a dependent (aged or too young). This is a rather fair result since high dependency is usually associated with poverty and low productivity especially in rural farming communities. Moreover, the group of farmers that constituted the sample was experienced with the maize crop both in production and marketing. Results show that the household head had on average about 10.5 years of experience in maize production and marketing in the area of study.

3.3. Landholding

Land holdings represent a key factor of production for agricultural enterprises in smallholder farming systems. The amount of land which a household allocates to a particular crop depends largely on the land holding which a household owns. In terms of landholding, results show that each household had an average of about 6 hectares of arable land owned.

3.4. Extension

In terms of institutional characteristics, results show that farmer have high access to agricultural advice and extension as shown by 87% access at the time of the survey. This was a good result considering the importance of agricultural advice in improving access to productive information that can improve maize and other crop's productivity and or profitability. On average, households received extension advice or visits by extension personnel at least 3 times per agricultural season.

3.5. Costs

Transaction cost is another challenge affecting mainly maize marketing in smallholder farming. Transaction costs are those costs associated with delivering produce to the market. They act as a barrier to market participation in most farming communities. In this study we used distance to the nearest main market as our proxy measure for marketing transaction costs. Results reveal that the distance to the nearest main market was about 11 km which indicates moderate to low transaction costs associated.

In terms of other physical costs, results show that on average, smallholder maize farmers spent much on fertilizer costs (US$ 265.7), followed by seed costs (US$79.4), then chemical costs (US$51.6), labor costs (US$28.6) and spent the least on transportation costs (US$7.2). The result shows that fertilizer, seed and chemical costs are the current three major cost areas farmers spent on in maize production. Fertilizers constitute the bigger chunk of the maize production costs because of the need by the farmers to raise productivity given the low fertility status of the soils. For seed it implies that farmers are trying to desist from using retained seed so as to aim for germ-plasm with desirable attributes that may improve on maize profitability. In addition, chemical costs are also one of the major costs mainly because of the prevalence of conservation farming which is encouraging use of herbicides in controlling maize weeds.

3.6. Buyer

In terms of the marketing channels smallholder maize producers are using, we found that currently most of them are selling their maize output to private traders (86%) and the remainder of the produce to either GMB (7%) or other farmers (7%). The results show that private traders currently dominate the maize market in the study area.

3.6.1. Maize enterprise Profitability with the current maize marketing system in Zimbabwe

The study also analyzed the gross margins of the smallholder farmer's maize enterprise. As elaborated under research methods, gross margins were calculated by subtracting variable costs specific to maize enterprise from gross income from maize. Table 3 shows the gross margin analysis statistics. Reported are gross margin and profitability ratio statistics for the past three seasons (2012/13, 2013/14 and 2014/15).

Table 3: Table Maize Gross Margins statistics and profitability ratios

Profit (US$)	Mean	Min	Max
Profit2013	416.48	-598	11495
Profit2014	983.55	-553	9051
Profit2015	378	-783	10945
Benefit Cost Ratio (BCR)			
BCR_2013	0.60	0.05	1.86
BCR_2014	0.85	0.06	3.741
BCR_2015	2.14	0.09	6.55

Source: Own calculations

Results show that, average profit per maize enterprise in all the three seasons was positive. From the average profits we can tell that the smallholder farmer maize enterprise is profitable. However, the results report negative minimum gross profit incurred in all the three seasons. This however

complicates making conclusions on profitability based entirely on the gross profits. The analysis went on to calculate a profitability ratios based on costs and benefits from the smallholder farmer's maize enterprise to ensure comparability of results and a more firm conclusion on profitability. From profitability ratios we could see that only season 2014/15 had a BCR greater than 1 whilst the two previous seasons 2012/13 and 2013/14 had average ratios less than 1. This gives a more reflective picture on profitability of smallholder maize enterprises in the district. The average BCR statistics shown in table 3, show that in 2014/15 season smallholder maize producer got on average US$2.14 for every dollar of costs spent, US$ 0.85 per dollar spent in 2013/14 season and US$ 0.6 per every dollar of costs spent in 2012/13 season. Overall, the results do not allow making a robust conclusion on smallholder maize profitability. Results in table 3 confirm the conclusion.

To further understand on the profitability the study went on to analyze the factors influencing maize profitability. Analysis of factors affecting profitability is based on causal analysis. Results are shown in table 4.

3.6.2. Factors influencing maize profitability in smallholder farming in Mazowe district of Zimbabwe

The study also analyzed the factors that affect maize profitability in smallholder farming. The regression model was highly significant as shown by the high significance of the model at 1% and R-squared value of 68% and adjusted R-squared of 60%. The chosen model variables both dependent and independent variables and the data had a good fit to the regression model as shown by the high values of R-squared and adjusted R-squared. Results revealed that, age of the household head, fertilizer costs, chemical costs, transport costs and selling maize to private buyers influenced profitability significantly. Precisely, results revealed that chemical costs, fertilizer cost and transport costs have a negative significant influence on maize profitability in smallholder farming, whilst age of the farmer and selling to private buyers have a positive significant influence on maize profitability.

Table 4: Factors influencing maize profitability

Profitability	Coef.	Std. Err.	t	P-vale
Age	0.044	0.0253	1.75	0.086*
Education	-0.076	0.0700	-1.09	0.282
Dependency Ratio	0.324	0.4790	0.68	0.502
Yrsfarming	-0.052	0.0608	-0.85	0.400
SeedCost15	-0.003	0.0070	-0.41	0.684
Fert Cost	-0.004	0.0011	4.07	0.000***
Chem Cost	-0.046	0.0150	-3.08	0.003***
Labor Cost	-0.001	0.0071	-0.07	0.945
Transpt Cost	-0.074	0.0380	-1.96	0.056*
Private Buyers	0.888	0.4721	1.88	0.066*
GMB	1.067	0.8246	1.29	0.202
Extn Freq	-0.025	0.0268	-0.92	0.360
_cons	1.120	1.2910	0.87	0.390
Prob >F =0.000***	R-squared= 0.68; Adjusted R-squared= 0.60			

***significant at 1%; **significant at 5%; *significant at 10%
Source: own calculations

Results in table 4 revealed that some of the main costs in maize production and marketing were significantly affecting maize profitability. Notably fertilizer costs, chemical costs and transport costs were found to have a negative significant influence on maize profitability. Fertilizer costs and chemical costs were highly significant in influencing maize profitability as shown by the p-values of the coefficients which are less than 0.01. Transport costs were however less significant

when compared to chemical and fertilizer costs as the p-value for variable coefficient was greater than 5% but less than 10%. The results could reflect on the cost of fertilizers and necessary chemicals in maize production in the Zimbabwean economy. Precisely, the result could imply that some prices of the necessary inputs in maize production are high which therefore impacts negatively on farmer's profitability. Considering that most smallholder farmers in Zimbabwe are resource constrained and the harsh economic environment that has worsened the economic situation in the past decade, this is not surprising as input dealers have adopted pricing models that are not close to efficient prices. Fertilizer prices in Zimbabwe for example are in the range of US$ 30 to US$ 40 for a 50 kilogram bag, which is way too high if we are to compare prices in the southern African region. When compared to South African prices, fertilizers in Zimbabwe are 15 to 20% more expensive which reflects also on protection of the fertilizer industry. Moreover, with the high promotion of climate smart agricultural technologies such as conservation agriculture in Zimbabwe, use of herbicides has been on the rise in place of frequent weeding. Moreover, the cost of spraying in case of disease and pest attack is also a significant factor increasing costs of chemicals. Adopting efficient chemical prices and ensuring maximum competition to local industries in the business of agrochemical is one way of improving on pricing of the chemicals.

Transport costs were also found to influence profitability though to a lesser extent when compared to fertilizer and chemical costs. This shows that, transaction costs in accessing maize markets is also another area affecting maize profitability. Considering the low prices received per ton of maize on average in the country, it is logical for any significant addition in costs along the value chain to influence profitability.

On the other hand, age of the smallholder farmer and type of buyer were the other variables found to have a significant influence on maize profitability. The two variables were found to have a positive significant influence on profitability. The age of the household head can be a proxy for farming experiences. This could mean that as the household head age increases, a household's knowledge in maize production and marketing issues can also improve which can therefore transform to profitability. Most studies have shown that as household head age increases, they acquire more farming experience, become risk averse and diversify their production (Olujenyo, 2008). As such, households headed by elderly heads are more likely to be profitable than households headed by younger heads.

Type of buyer that the smallholder farmer sold maize produce to was also an explanatory variable included in the linear regression. The explanatory variable was a categorical variable with the different type of buyers common in the study area. It was however, found that selling maize to private buyers had a positive significant influence on maize profitability. This could be because farmers have a role to play in the price discovery process and this have a strong bearing on profitability. When prices are set without letting market forces come to play, as with the case with GMB in Zimbabwe, there are high chances that the set prices are lower than market clearing prices and this would negatively affect farmers' profit.

3.6.3. Impact of tobacco farming on smallholder maize profitability

Competition between tobacco farming and maize production is also one interesting aspect believed to be negatively affecting maize profitability in Zimbabwe. The general belief is that smallholder farmers are investing much of their effort, income and resources towards tobacco farming at the expense of the maize production because of the lucrative tobacco market. In this study we tried to establish the impact of tobacco farming adoption on maize profitability in the study area. The paper as highlighted under research methods used propensity score matching techniques to estimate the impact. The results of the impact analysis are shown in table 5. Reported in the table is the Average Treatment effect on the Treated (ATT), the number of observations treated and control, standard errors and the test statistic. The radius matching

technique was applied to find ATT using data on gross margins from the three seasons 2014/15, 2013/14 and 2012/13 season. The instrumental variable was tobacco farming adoption.

Table 5: Impact of tobacco farming on maize profitability

Profitability indicator	n. treated	n. control	ATT	Std. Error	T
Gross Margin 2015	90	30	1322.8	458.2	2.9*
Gross Margin 2014	90	30	1286.7	486.8	2.6*
Gross Margin 2013	90	30	1922.4	681.7	2.8*

***significant at 1%; **significant at 5%; *significant at 10%
Source: own calculations

Results show that, tobacco farming adoption had a positive significant impact on maize profitability. A priori thinking of the researcher was proven opposite as results showed the strict opposite. The researcher thought that due to competition on land area and resources imposed by tobacco farming on other crops such as maize, adopting tobacco would negatively impact on maize profitability. Results imply that tobacco farming in smallholder farming is actually aiding maize production in Mazowe. Smallholder farmers could be using income from tobacco sale to boost their maize production by acquiring productive inputs hence improving maize profitability. he ATT figures confirm the positive impact, they report that in 2012/13 season tobacco farming adoption had an impact of about US$1922 on gross margins i.e. adopters will have US$ 1922 more gross margins than non-adopters. The same trend was found for the 2013/14 and 2014/15 season with US$1287 and US$1323 respectively. The impact was however estimated on the maize profitability for the whole enterprise and not per hectare grown maize.

3.6.4. Summary of the results

3.6.4.1. Profitability and factors affecting profitability
An analysis of the gross margins revealed maize farming enterprises to be profitable as shown by the positive average figures. However, an analysis of the benefit cost ratios (BCR) did not confirm the result. BCR for 2014/15 season was found to be 2.14, for 2013/14 it was 0.85 and 0.60 for 2012/13. We could say that smallholder farmers are profitable based on average positive maize enterprise profits. Based on the on both profitability ratios and average gross margins we could not make a robust conclusion though.

Maize profitability was found to be influenced positively by age of the household head and selling produce to private buyers. On the other hand, fertilizer costs, chemical costs and transport costs were found to have a negative significant influence on maize profitability.

3.6.4.2. Impact of tobacco farming on maize profitability
Tobacco farming was found to have a positive significant impact on maize profitability. Tobacco farmers were found to be more profitable in maize farming when compared to non-tobacco farmers. Results imply that tobacco farming could be aiding maize farming enterprises thereby contributing positively to maize profitability. Farmers may be using profits from tobacco farming enterprises to support their maize production activities.

4. CONCLUSIONS AND RECOMMENDATIONS

4.1. Conclusions
Based on the results we conclude that, maize enterprises in smallholder farming have high potential in improving the welfare of the farmer and that of Zimbabweans at large. Results showed modest profitability of smallholder farming enterprises which is a positive indicator for farmer income and food security of Zimbabwean inhabitants. Based on the result we also conclude that for smallholder farmers to be profitable in maize production with the current situation, they have

to sell their maize output to private buyers. Chemical costs of production, fertilizer costs and transport costs are the main factors negatively affecting maize enterprise profitability.

We also conclude that tobacco farming in smallholder maize farming is playing a supportive role as results showed tobacco farming to have a positive and significant impact on maize profitability. Farmers seem to be supporting maize farming from their income from tobacco sales.

4.2. Recommendations

Based on the results the study recommend the government of Zimbabwe through its various programs targeting agricultural development and food security to focus on smallholder maize production and marketing with the aim of improving its profitability. This is important for the smallholder farmer to sustain his/her maize production as well as in extending benefits of maize farming to the economy.

a) Specifically the study suggests the government to subsidize smallholder maize production in Zimbabwe either through input support or through allowing efficient pricing in input and output markets. Subsidizing is worthwhile considering that maize profitability will benefit both the nation and the farmer. Subsidizing will be key since chemical costs, fertilizer costs and transport costs were found to influence maize profitability negatively. Overall, it is through subsidizing maize (a staple cereal) that we can fight poverty and food insecurity that is disturbing a significant part of the Zimbabwean population.

b) Moreover, the government through the ministry of agriculture should continue promoting crop diversification as results show tobacco farming adoption to be playing a supportive role in maize farming. Adopting more than one crop is a key as income from one crop can be used to support production of the other.

c) Lastly the government should also consider less protection on inputs such as fertilizers as this can promote close to efficient pricing by the local input producers. Chemical input and fertilizer prices could be lowered significantly by less protection and this can improve maize productivity and hence profitability. Farmers and or other private players should be allowed to import some of the maize inputs without too much restriction as this may help lower domestic input costs through competition.

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