ESTIMATION OF HYBRID MAIZE SEED DEMAND IN ZAMBIA

BY

BRIAN L. CHISENGA

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ESTIMATION OF HYBRID MAIZE SEED DEMAND IN ZAMBIA

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BY

BRIAN L. CHISENGA

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<tr>
<td>CSO</td>
<td>Central Statistical Office</td>
</tr>
<tr>
<td>FSP</td>
<td>Food Security Program</td>
</tr>
<tr>
<td>GDP</td>
<td>Gross Domestic Product</td>
</tr>
<tr>
<td>GRZ</td>
<td>Government Republic of Zambia</td>
</tr>
<tr>
<td>NARS</td>
<td>National Agricultural Research System</td>
</tr>
<tr>
<td>NGO</td>
<td>Non-governmental Organization</td>
</tr>
<tr>
<td>OPVs</td>
<td>Open Pollinated Varieties</td>
</tr>
<tr>
<td>SADC</td>
<td>Southern African Development Community</td>
</tr>
<tr>
<td>SPSS</td>
<td>Statistical Package for Social Scientists</td>
</tr>
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<td>Zamseed</td>
<td>Zambia Seed Company</td>
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ABSTRACT

ESTIMATION OF HYBRID MAIZE SEED DEMAND IN ZAMBIA

Brian L. Chisenga
University of Zambia, 2005

The purpose of this study was to estimate farmer responsiveness to changes in the price of hybrid maize seed as well as to changes in the seed price of alternative crops. In determining this responsiveness, it was hoped that some light would be shed on the best way to improve maize production as part of achieving food security and increasing rural incomes. Given the food security concerns that have arisen in the recent past and the changes in the agricultural arena, it is necessary to gain an understanding into the way farmers are likely to behave given changes in their environment. Because seed plays a major role in increasing farmer productivity, the achievement of these goals implies that there needs to be in place a seed supply system that delivers more seed, higher yielding seed, and better storing seed. The question that a policy maker might ask, and one that this research hoped to shed some light on is, what is the best way that this can be done?

The demand for Hybrid maize seed was estimated econometrically using a linear regression model. The explanatory variables were own price of hybrid maize seed, and the seed prices of related crops namely soybeans, millet and sorghum. Seed prices for the different crops were collected from Zamseed. The maize seed price data used were the data for MM 604. It was not possible to obtain actual maize seed sales data and therefore crop production figures were used as proxies.

It was found that maize seed demand is not responsive to changes in price or changes in the price of alternative crops. Possible reasons for this are that maize is a staple food and that the majority of farmers that grow maize do not do so because of the profit motive. Rather, they grow maize for survival reasons or because it is what they have grown accustomed to.

The implication of this is that government policy interventions that reduce seed price will not result in increased demand and would only prove wasteful. It is therefore recommended that government interventions should not include policies that control prices but focus more on helping the private sector in the marketing of seed. Changes in seed price that might come about because of costs incurred by the seed companies in research and marketing would not reduce demand.
CHAPTER 1
INTRODUCTION

1.1 Introduction

This chapter presents a short background to maize production in the country and where maize stands on the government agenda and how that cause was championed in the past. It also looks at how seed is a key consideration in any attempt to increase maize production.

The position of government since independence has been to increase food production and farmer incomes. It has sought to achieve this in various ways as shall be presented here. Although the government’s position on this has not changed, the ways in which it is pursued has. Maize is the main staple food grain grown in Zambia (FAO/WFP, 2005). It is a tropical grass plant having its origins in South America. At its introduction in Zambia, it gained popularity and displaced most of its predecessors (sorghum and millet). This popularity was helped by government in the 1980s through programs that subsidized inputs to small-scale farmers in the rural areas and areas off the line of rail. Maize seed was one such input. Seed as an input is important in improving maize output as it determines the upper limit of yield. To increase the country’s productivity, resources were invested in breeding programs, resulting in the release of many varieties1. During the 1970s and the 1980s foreign aid projects, experts and equipment were brought in to help improve government seed agencies (Rusike et al, 2003). Although the aims of government after at the time were to increase maize production as well as reduce reliance on European farmers, what resulted was a redistribution of production from commercial farmers to small-scale farmers. The subsidization programs had became unsustainable and were done away with in 1991 (Howard and Mungomba, 1996).

---

1 Since 1965, Zambia’s national agricultural research system (NARS) has produced 18 maize hybrids
Not only did government involve itself in the development and production of hybrid maize seed, but in it’s marketing as well. As such, Zamseed was set up. From around 1979 to about 1991 Zamseed was the sole producer and marketer of seed in the country when the economy was liberalized. Then only hybrid maize seed was produced, but now improved maize seed varieties can also be found on the seed market. Small-scale farmers, large and international firms now do maize seed production in Zambia. The latter dual dominate the supply of hybrid maize seed, while international research centres, NGOs, informal farmer groups and commodity traders control the supply of open pollinated varieties.

Despite government aims, there have been changes in the policy environment that affect farmer incomes. Liberalisation of the economy saw the removal of floor prices for maize during the early 1990s resulting in a lack of expected prices resulting in fluctuations in national maize production. In addition to policy changes, the country has experienced adverse weather conditions resulting in a fall in national maize production, in some years falling short of typical consumption requirements. Food security for all the people through agricultural production was threatened. In order to address this, government, advocated for the production of drought tolerant crops alongside maize.

As stated earlier, there have been changes in agricultural policy. When the economy was liberalised, one thing that government did was to stop setting floor prices and subsidising input production and marketing. In the recent past however, farmers have received assistance in the form of fertiliser and seed subsidies as well as guaranteed maize prices. This simply means that the role of the public and private sector in increasing agricultural production is yet to be defined. Increased food production remains one of the government’s policy aims- that and increased farmer (rural) incomes. It has been stated for the SADC region that food security can be stated in terms of maize (Phiri, undated). The same holds true for Zambia- increased food production implies increased maize production. This means that increased in national output will not increase if production of maize were to fall.
1.2 Problem Statement

Following the discussion above, it can be seen that policy position has changed over time and we can assume that it will continue to. Because maize as a staple food holds such a central part in Zambia, its production cannot be compromised without having adverse effects on the urban poor and people in the rural areas. Policy makers are faced with the problem of deciding the best course of action in achieving higher maize production nationwide. Given commercial production will shift from year to year e.g. from maize to high value crops, and towards more drought tolerant crops by small-scale farmers due to uncertainty about the weather, farmer preference for maize has to be examined. Questions that can be raised are:

- How keen are large-scale and emergent farmers for hybrid maize seed given the alternatives of soya beans?
- How keen are small-scale farmers on hybrid maize seed given the alternatives sorghum and millet?

It is unknown how farmers would respond to changes in the relative price of maize seed.

1.3 Objectives

The general objective of the study was to determine the nature of hybrid maize seed demand in the nation given the prevailing market conditions. This is in order to contribute to defining an appropriate context for policy interventions with respect seed as part of the bigger picture of increasing maize production. The specific objective for the study was to determine farmer response to changes in the price of hybrid maize seed.

It was assumed that the demand for hybrid maize seed would be inelastic. A change in the price of maize seed would make little difference in the quantity demanded.
1.4 Relevance of the Study

The study was relevant because the policy formulation process, with regard to maize production would benefit from an understanding of how farmers are likely to respond to changes in factors that influence production decisions, particularly changes in the relative price of seed (as a key input). The elasticity of a commodity has implications on what kind of policy interventions can be applied to, hence the need for information on elasticity. Indiscriminate application of policy can lead to wastage of scarce national resources and failure to attain desired outcomes.

1.5 Organization of the Thesis

The thesis has five chapters. In chapter 1 the background to the study is given by presenting a short background to maize production in the country. Past government policy to do with agricultural production and maize in particular is reviewed building up to the problem statement and the study objectives. The relevance of the study is also shown.

Chapter 2 reviews literature that is relevant to the study. It first gives an overview of maize production and marketing in the country. In both cases the discussion tries to point out why seed is an important consideration if maize output is to increase. The increase in maize output logically implies partial achievement of food security. It outlines relationships between maize and other food crops as well as how the demand for maize affects the demand for seed. The chapter also touches on what has been done under seed marketing in the country and opinions on how seed supply can be improved. Beyond that, literature is reviewed to justify why the research was done as well as to build expectations for the results. The last section of the chapter presents the theoretical basis for the model.
Chapter 3 presents the methodology used in the study. The methods and procedures used in carrying out the research are outlined in this as well as the problems encountered.

In chapter 4 the results of the study are presented and discussed systematically. They are interpreted based on theory and what they imply is also discussed. Finally in chapter 5 conclusions are drawn and outlined based on the study findings. Based on these conclusions, recommendations are made as to appropriate policy interventions.
CHAPTER 2
LITERATURE REVIEW

2.1 Introduction

This chapter reviews literature that is relevant to the study. It first gives an overview of maize production and marketing in the country. In both cases the discussion tries to point out why seed is an important consideration if maize output is to increase. The chapter also touches on what has been done under seed marketing in the country and opinions on how seed supply can be improved. Literature to justify why the research was done and to build expectations for the results is also reviewed. Finally, demand theory is reviewed briefly from which the model guiding this study is derived. The concept of Elasticity is also briefly reviewed in general terms. This is in order to justify the model used. The chapter closes with a section on what the study findings will be.

2.2 Overview of Maize Production and Marketing

Both large and small-scale farmers do maize production in Zambia. Small-scale production accounts for around 75% maize production. (Rusike et al, 2003). Cassava, millet and sorghum are grown as alternative crops to maize. These are traditional staple food crops in Zambia. Different groups of people subsist one more than the other depending on the area/province. Since they are more drought tolerant than maize, they have been promoted in crop diversification strategies (World Bank, 1994).

It is recognized that without increased agricultural production, food security, poverty reduction, and increased incomes goals cannot be achieved (Phiri, undated). A country therefore has to put in place policy to improve food production. Privatization of the agricultural sector sought to achieve efficiency in agricultural marketing. Instead of subsidies on maize production, it was hoped that the market would allocate prices. Relative price changes would create
incentives for growing alternative crops and in this way promote food security through a diversity of production among the poor (World Bank, 1994). When the SADC region alone is considered, limited access to agricultural inputs such as improved seed and inorganic fertilizer are also considered to be major factors destabilizing maize production, income and food security. These factors can be influenced by the policy pursued by government. This study however focuses on seed because of all the inputs used in agriculture; none has the ability to affect productivity as much as seed. Through its genetic properties, seed places the upper limit on yield potential and influences the productivity of other inputs.

2.2.2 Seed Distribution in Zambia

Various players are involved in seed distribution in the country namely, donor agencies, NGOs, private companies and government agencies. The motives of each player differ however i.e. relief efforts, profit or the pursuit of policy objectives.

It should be pointed out here that the relative roles of the public and private sectors in increasing maize production are not rigidly defined so far and therefore keep on being redefined. This includes the distribution of agricultural inputs. There is consensus however on the need to improve seed sector performance. It has been proposed that this can be improved in the following ways:

- Discontinuation of the direct distribution of relief seed for commodities that are available commercially
- Build public-private sector partnerships in marketing certified seed to farmers. These are generally more effective than either government seed companies or entirely private ventures.
- Improve NGO involvement.
2.3 Relevant Research on Production and Marketing of Maize Seed

A lot of research has been carried out on the development and production of improved maize seed, but not much of it has been devoted specifically to its demand nationwide. The literature reviewed for this study has tended toward other aspects of the seed industry among them being:

- Historical and descriptive information about the evolution of the maize seed markets in the country and the region (Muliokela, 1997.).
- Policy and its influence/effect on the seed industry.
- Adoption. Studies have been carried out at the regional and national levels, but these focus on assessing farmers' utilizations of improved seed, customer perception, seed buying behavior, etc. Most studies focus on both OPVs and hybrid maize seed, rarely on hybrid maize seed alone (Phiri, undated).

Other studies have focused on open pollinated varieties (OPVs) altogether. The drive behind this is the focus of governments and donors to improve small-scale farmer productivity as well as to assure food security in the region.

2.4 Concepts Underlying Product Demand and Elasticity

2.4.1 Product Demand

The demand for a product is a function of own-price, income, population and the prices of related goods. Depending on the type of product being considered, a negative relationship is expected to exist between changes in the price of a complementary good and the quantity demanded and positive relationship between a change in the price of a substitute and the quantity demanded. Technically the demand function can be stated as:

\[ Q_i = f(P_i, Y, P, P_j) \]
Where $Q_i$ denotes the total demand for product $i$, $P_i$ is the product's own price, $Y$ is defined as per capita income, $P$ is the market population and $P_j$ is the price vector of related products i.e. substitutes and complements (Ahuja, 2004)

### 2.4.2 Elasticity

Elasticity of demand can be defined as the measure of responsiveness of demand to changing prices. (Ahuja, 2004). Generally, elasticity expresses the strength of linear association between two variables. An understanding of the way farmers are likely to respond to changes in the independent variables is our main concern here. Elasticity can be expressed as:

\[ E = \text{Proportionate change in quantity demanded} \]

\[ \text{Proportionate change in independent variable} \]

Thus we can estimate elasticity coefficients for price and income using the following model:

\[ E_p = \frac{\delta Q.P}{\delta P \cdot Q} \]

But from econometrics it is known that:

\[ \beta_1 = \frac{\delta Q}{\delta P} \text{ i.e., } \frac{\delta Y}{\delta X} \]

Therefore price elasticity can be expressed as:

\[ E_p = \beta_1 \cdot \frac{P}{Q} \]

But elasticity changes along a given demand curve, therefore average price and quantities are used. We thus arrive at:

\[ E_p = \beta \cdot \frac{P}{Q} \]
2.5 Expected Findings

It is unlikely that maize seed demand would be elastic because food security in the region is defined in relation to the availability of maize, the main staple in these countries (Phiri, undated). This assertion is strengthened further by research findings on alfalfa and hemp seed. It was found in both cases that own-price demand was inelastic. Therefore, despite changes that might occur in the relative price of maize seed with respect to that of alternative crops, the quantity of maize seed demanded would not change significantly. This however is not to suggest that the price of seed can be adjusted upward indefinitely. The demand for a commodity is inelastic up to a certain point after which it becomes elastic (Dewett, 2004). Inelastic maize seed demand simply means that government interventions to increase hybrid maize seed usage need not involve distorting its price. There needs instead, to be a concerted effort to improve access to markets and lower transaction costs associated with agricultural marketing. This effort should be designed to promote competition in the provision of services to geographically isolated areas (World Bank, 1994).
CHAPTER 3
METHODOLOGY

3.1 Introduction

In this chapter the procedure used in carrying out the study is presented. It first outlines the model used in the study and then describes data collection as well as data type sources sources. This is followed by an account of the problems encountered during the research and specification analysis.

3.2 Model Specification

Based on demand theory (See Chapter 2) the ideal empirical model should be one in which demand is influenced by changes in own price of hybrid maize seed, income of the farmers that grow maize, related crops like soybeans, wheat, millet and sorghum. The econometric model should be as follows:

\[ Y = \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \beta_5X_5 + E_i \]

Where:

\( Y \) = amount of hybrid maize seed demanded in a given period of time.
\( X_1 \) = hybrid maize seed price.
\( -X_1 \) = Soya bean seed price.
\( X_3 \) = Hybrid sorghum seed price.
\( X_4 \) = Farmers’ income
\( X_5 \) = Millet seed price
\( \beta_0 \) = Constant
\( \beta_1, \beta_2, \beta_3, \beta_4, \text{ and } \beta_5 \) are regression coefficients and
\( E_i \) = unknown influences. This is assumed to be the net impact of all the variables not specified.
The quantity demanded is thus affected by the above factors and we therefore refer in this case to Y as the dependent variable (hybrid maize seed demanded) and the other factors as independent variables. Due to lack of data and also as a result of specification analysis, the actual demand equation used was as follows:

\[ Y = \beta_0 + \beta_1 \chi_1 + \beta_2 \chi_2 + \beta_3 \chi_3 + \beta_5 \chi_5 + \epsilon_i \]

It cannot be said that price changes alone affect seed demand because agricultural production decisions are based on many factors. The choice of what to grow will be determined in part by the farmer's expectations about the weather (Kay, 1986). Output price expectations also affect the current level of production. Given a good price the previous year, say for maize, the following year's production will be higher for the same crop. The reverse is also true.

3.2 Data Collection and Analysis

The main sources of data were Zamseed and Ministry of Agriculture and Co-operatives' Food Security Program. Other sources of data were Central Statistical Office, FAOSTats and UNStats databases. Seed prices for the different crops were collected from Zamseed. GDP figures were obtained from the UNStats database while the population figures were obtained from the FAOSTats Database. Data on production were collected from CSO.

The decision to use Zamseed prices was arrived at because it is the oldest seed supply company in the country. It was assumed that it would provide the longest time series data for all of the crops. Further there are only five companies supplying seed in the country namely Zamseed, Pannar, Seed Co, MRI and Afgri, which makes it a fairly oligopolistic market. Prices are not expected to be very different from one company to another. The data used were MM 604 data. This variety was deemed representative in that it is planted in all agro ecological zones. Further, its price tended to fall within average Zamseed price ranges.
It was not possible to obtain actual maize seed sales data. Instead taking total hectarage planted and dividing that by 15kg (commercial farmer seed application rate is about 20kg/ha, but this is not always adhered to, and not all farmers use hybrid seed) an approximate was obtained. It must be mentioned here that seed production has been inconsistent over the years. Neither crop nor seed production figures make good proxies for seed used, but crop production figures have the advantage that it accommodates both locally produced seed and imports in the analysis. Production figures were obtained from FSP. Neither was it possible to obtain farmer incomes. Instead, GDP per capita, adjusted for the farming population was used (i.e. GDP multiplied by the ratio of farming population to total population).

The data obtained was analyzed using SPSS – a statistical computer package. A linear regression was run using the quantity of maize seed bought as the dependent variable the results of which are presented in a later section. Some problems were encountered in the course of the study and as such, a number of compromises had to be made.

For the first regression, constant 1990 Kwacha values were used, but the regression obtained was insignificant. A second regression was then run using current Kwacha, the results from which were used in this report. Despite the fact that the estimate of the constant may not be reliable, the elasticity is still captured as relative changes among the independent variables are still captured over time.

3.2.1 Specification Analysis

The model used was chosen arbitrarily based on economic theory. The variables to be retained in the equation were determined by running different regressions on the data and performing basic diagnostic checks such as the signs of the coefficients based on expectations from theory. Regressions with the most appropriate results were chosen. Basically, specification analysis was done by
examining the regression results obtained from different models specifically by looking at the $R^2$, probability of the t-statistics obtained and coefficient signs in relation to a priori expectations. The functional forms that were tested were a linear model and a log-linear model. The linear model performed better
CHAPTER 4
RESULTS

4.1 Introduction

This section presents the results of the regression equation and what the figures obtained mean. The focus of this chapter is to lay a foundation on which the conclusions and recommendations presented in the next chapter are based. To achieve this, this chapter attempts to marry the theoretical implications of these findings to reality

4.2. Estimation of the Demand Model

A simple linear regression was run to derive the demand function for seed and the following results were obtained:

Table 1: Regression Results

<table>
<thead>
<tr>
<th>Explanatory variable</th>
<th>Variable identity</th>
<th>Coefficient</th>
<th>Standard error</th>
<th>p-value</th>
<th>Elasticity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>$\chi_0$</td>
<td>31520.555</td>
<td>3261.435</td>
<td>0.002**</td>
<td></td>
</tr>
<tr>
<td>Maize seed price</td>
<td>$\chi_1$</td>
<td>0.300</td>
<td>0.072</td>
<td>0.025**</td>
<td>0.0884</td>
</tr>
<tr>
<td>Soya Beans seed price</td>
<td>$\chi_2$</td>
<td>0.00412</td>
<td>0.016</td>
<td>0.087*</td>
<td>0.0012</td>
</tr>
<tr>
<td>Sorghum seed price</td>
<td>$\chi_3$</td>
<td>-2.961</td>
<td>0.556</td>
<td>0.013**</td>
<td>-0.2506</td>
</tr>
<tr>
<td>Millet seed Price</td>
<td>$\chi_5$</td>
<td>0.500</td>
<td>0.185</td>
<td>0.073*</td>
<td>0.3139</td>
</tr>
</tbody>
</table>

$R^2 = 0.825$  Durbin-Watson = 2.073

Where p = the p-value of getting the t-statistic computed for each estimate. Significance at the 5% confidence interval is indicated by **, at the 10% confidence interval, by *
4.3 Significance of the Model

The significance of the entire regression was determined using the p-value of the overall F-statistic. Given that significance is being tested at the $\alpha=0.05$ level, the regression is significant if p-value < 0.05. The p-value that was obtained for the regression was 0.049. This means that the overall regression for seed demand was significant at the 95% interval.

4.4 Significance of the Estimates

The significance of the estimates was determined by considering the p-values of the t-statistics that were obtained. The same criterion for significance was applied for the estimates as was done for the overall regression and it can be seen that the coefficients for soya beans and millet are statistically insignificant meaning that changes in seed demand are influenced only by changes in the prices of maize and sorghum seed. It can be seen that all the estimates are significant at the 10% confidence interval. The positive sign of the own price coefficient however runs directly against theoretical expectations as to suggest a positive relationship between price and quantity demanded. It is a rather irrational result and can only be explained in that maize production really is determined by many factors than seed price. In the very recent past, as was seen in the media, inputs such as seed and fertilizer were subsidized for small scale farmers. Given such a scenario, an increase in the price of maize will result in more seed being offloaded on the market by the seed companies. Increased uptake by the farmers however is not a direct response to changes in the price of seed but to the subsidy offered. It can be seen therefore that the input subsidy increases both seed output onto the market as well as uptake by farmers, but they are not sustainable or without a great cost to the nation.
4.5 Discussion of the Regression Results

The adjusted coefficient of determination, $R^2$ equals 0.825 ($R^2 = 0.925$), which means that 82.5% of the variation in the quantity of maize seed demanded is explained by changes in the seed prices of maize, sorghum, Soya beans and millet. At first glance the model can be said to fit very well except for the unexpected signs of the maize and sorghum coefficients. One would immediately suspect a misspecification error, but it should be mentioned here that the removal of the GDP variable actually improved the fit right down to more correct coefficient signs with respect to demand theory.

It must be admitted however that bias in the estimates is expected owing to the fact that the wheat seed variable had to be removed for lack of data. Neither could all alternative crop seed prices e.g. rice, sunflower, etc. be built into the model.

The Durbin-Watson statistic shows that there is no autocorrelation among the explanatory variables because the statistic found (2.073) is close to 2, which means near zero autocorrelation. Its significance at $\alpha=0.05$ however could not be tested because there are no entries in the tables for the upper and lower limits for 8 observations and 4 explanatory variables. Taking the upper and lower limits for $n=8$, $k =3$ and $n=9$, $k=4$, the calculated $d$ (1.927) falls within the critical interval both cases [(dL=0.368, dU=2.287) and (dL=0.296, dU=2.588) respectively]. It can therefore be safely concluded that whatever autocorrelation there was, it was insignificant.

The coefficient of sorghum seed price shows a negative relationship between the price of sorghum seed and maize seed demanded. This is contrary to economic theory because the two crops are supposed to be substitutes and not complements. Similarly, the maize price coefficient depicts a positive relationship between seed price and quantity demanded. This is difficult to explain except that
the elasticities are also low, which means that demand for seed really depends on other factors instead of price.

4.6 Price Elasticity

The price elasticity value shows that the quantity of maize seed is not responsive to changes in the price of maize seed. The same applies for millet and the other types of seed. The price elasticity of demand of maize hybrid maize seed is inelastic. This simply means that, given a K1 increase in the price of maize seed or any of its complements, the quantity demanded will most likely not change. This in itself can be explained in two ways: Firstly, maize is the staple food for the majority of Zambians. It has seen a lot of promotion and is imbedded in the Zambian way of living. Once this has happened, it is not easy to change the inclinations that people have without having got to rewrite their culture. Being a staple food, its demand may not be expected to be elastic by virtue of its mere importance.

Although sorghum and millet can be seen as consumption alternatives, they are only consumed on a large scale by some tribal groupings whereas maize has penetrated most rural areas in the country and is and more established in the urban areas. If one considers industrial usage (except by millers), it is found that the three crops can be used together. This however was not the concern for this research, but it does serve to explain in part why the coefficient for sorghum is inconsistent with expectations. Form this argument therefore it can be said that sorghum and millet cannot exert much influence on the demand for maize nor that of maize seed.

Secondly, when one looks at other crops (sorghum, millet and soya beans) as production alternatives it is found that most farmers growing maize fall into the small-scale and emergent farmer brackets. Poorer people are often confronted with the fact that they have fewer survival choices and subsequently less ability to
take risk. It follows then that they often carry on in same fashion and do not have courage to change. Profit maximization is not often the driving force behind their choice of crop enterprises but survival and/or tradition and therefore the influence exerted on the demand for maize seed is reduced (Todaro, 1989) These farmers constitute about 70% of the farming population (CSO Agric Census, 2002/3). The former produce primarily for own consumption and sell the excess. They are resource poor and will not change their farming practices easily. The latter produce with the thought of selling their produce in mind as well as for home consumption. In both cases however, maize is produced primarily for human consumption and its demand does not change according to changes in price. It can be concluded that the demand for hybrid maize seed will be consistent with past trends.
CHAPTER 5
CONCLUSION

5.1 Introduction

Having looked at the results of the regression, this chapter now presents the author’s thoughts on the nature of maize seed demand and how it is affected by changes in price. Immediately thereafter, policy alternatives for improving maize production by providing more seed are presented.

5.2 Conclusions

Considering the negative price elasticity and the closeness to zero of the positive elasticities, it can be concluded that changes in the quantity of maize seed demanded are not influenced by changes in price of maize seed itself or by changes in price of other crops mentioned in this study. This suggests that:

1. The price of maize seed is still low enough on the demand curve to be raised before the farmers start to respond significantly to changes in the price of maize seed or any of the alternative crops specified. This however is not to say that price can be raised indefinitely as there still is .

2. Policy interventions that seek to increase maize production by interfering, or more specifically, reducing the price of hybrid maize seed will only prove to be wasteful as they will not induce increased usage of maize seed.

5.3 Recommendations

Some of the results that the current agricultural policy is expected to achieve by 2015 are:

- The achievement of food security and
- Increase in agricultural incomes.
As far as maize is concerned, both results hinge upon increased output and marketing. The achievement of increased output entails an efficient maize seed supply system requires further research and investment by the seed companies. This may entail higher seed costs. Given the inelastic nature of maize seed demand, it would be most beneficial to the country if efforts of the private sector to produce and market maize seed were supported through the provision of better infrastructure by the public sector. Needless to say that institutional framework should be in place to ensure that the farmers are not exploited by seed suppliers. In so doing, the seed producers can increase their output as they are pushed to a higher point on the supply curve. It must be mentioned however that there is no guarantee that the seed companies would specifically reinvest the earnings into maize seed research, but it is a start.

5.4 Further Research

This study focused only on seed demand elasticity in order to shed some light on one consideration of policy decision-making. It remains therefore that other areas require further research to build a clearer picture. Future research may be directed towards determining the price elasticities of the other crops mentioned in this research to determine whether the recommendations for increasing maize production may be applied to them as well. If we take a holistic look at increasing food production, other areas for further research would include the determination of elasticities of supply as well.
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APPENDIX 1: NOMINAL VALUES FOR ALL VARIABLES (1993-2005)

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<th>YEAR</th>
<th>GDP (K'Million)</th>
<th>QTY (MT)</th>
<th>MAISE (K)</th>
<th>SOYA BEANS (K)</th>
<th>WHEAT (K)</th>
<th>SORGHUM (K)</th>
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