THE COMPETITIVENESS AND COMPARATIVE ADVANTAGE OF MAIZE AND WHEAT PRODUCTION IN ZAMBIA

A Research Report presented to the Department of Agricultural Economics and Extension Education of the University of Zambia.

BY

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In Partial Fulfillment of the Requirements for the Degree of Bachelor of Agricultural Sciences

ACKNOWLEDGEMENTS

First and foremost, I want to thank my Lord and Saviour Jesus Christ for making it possible for me to complete my studies.

I wish to express my sincere gratitude and appreciation to Mr. M. Likulunga my supervisor for his guidance and corrections in producing this report. I would also want to thank all the members of staff in the School of Agricultural Sciences and especially the Agricultural Economics and Extension Education Department of The University of Zambia for having assisted me in my academic endeavours.

I further wish to thank my Mum, Dad and the rest of my family and friends for their encouragement, moral and financial support.

Finally, I want to thank all of my friends and classmates for the help they offered me when I needed them and for making my stay on campus memorable.

Thank you all very much.

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LIST OF ABBREVIATIONS AND ACRONYMS

C.I.F	Cost, Insurance, and Freight
CEA	Comparative Economic Analysis
COMESA	Common Market for East and Southern Africa
CSO	Central Statistics Office
EU	European Union
F.O.B	Free on Board
FAO	Food and Agriculture Organization
GDP	Gross Domestic Product
MACO	Ministry of Agriculture and Cooperatives
PAM	Policy Analysis Matrix
SADC	Southern African Development Community
ZNFU	Zambia National Farmers' Union

ABSTRACT

The Competitiveness and Comparative advantage of Maize and Wheat Production in Zambia

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Given the long history of government involvement to varying degrees in the marketing and input supply sides of some agricultural commodities in Zambia, there is need to examine what the overall effects have been on the agricultural sector's growth and the current situation. This paper examines the trends in agriculture since 1990 and the impact of policy on sustainability, competitiveness and comparative advantage of maize and wheat production in Zambia.

To study the trends of agriculture, changes in two indicators of agricultural production were used; the percentage of total land used for agricultural purposes and the agricultural productivity measured as value added per worker. These two indicators were graphed to get an overview of yearly changes hence giving an insight into the general changes in agricultural production. The Policy Analysis Matrix (PAM) framework is an analytical framework commonly used to measure efficiency, competitiveness, and the comparative advantage of production under prevailing policy conditions. The PAM approach is in this study to get the competitiveness and comparative advantages of maize and wheat production in Zambia. It was also analyse the sustainability of local production.

The trend analysis showed that agricultural land in Zambia has been growing at an average annual rate of 0.5 percent from 1989. However, agricultural productivity had been constant ranging within 200 and 250 throughout the two decades with the exception of 1992 and 1994 when it fell below 200. The results from the PAM showed that domestic production of maize under the current policy environment was heavily subsidised, as tradable inputs were only about 50 percent of the world prices. The PAM for wheat however showed that wheat production was sustainable. The tradable inputs in wheat production were only about 8 percent cheaper on the domestic market than they were on the world market. From the two PAMs for maize and wheat, both commodities could be said to be competitively operating under the country's policy environment as both systems had Private Cost Ratios (PCRs) less than 1. It was also observed from the Domestic Resource Cost ratios (DRCR) calculated that both systems enjoyed a comparative advantage under the current policy environment. Both DRCRs calculated were below one indicting comparative advantage for both systems.

From an allocative efficiency point of view, it would be recommended that the subsidies on maize production be designed in the best way possible in order to achieve sustainable agricultural growth in the sector. Taxation on wheat output may also be reduced to give more incentive for farmers to produce wheat in the country.

CHAPTER ONE
INTRODUCTION

1.1. Background

The Zambian Government has constantly being searching for ways to make Zambia's agriculture more productive. If greater output could be produced with the country's land, labour, and other scarce resources, Zambia could grow more food and become a food basket in the Region. However, a number of factors have hindered this potential from being exploited; among those factors are the country's Government Policies.

Government policy tools can be categorised in several ways, one method relates to the type of policy instrument; that is Price Policy and Non Price Policy. Another commonly used distinction of policies is the policy's target; these include commodity specific policies, factor specific policies, and sector specific policies. Policies influencing the agricultural sector fall into one of three main categories – agricultural price policies, macro-economic policies, or public investment policies.

Agricultural price policies can be commodity specific or factor specific meaning each agricultural price policy instrument targets only one commodity or factor at a time. Other agricultural price policy instruments may however affect several other targets that may not be planned. This results in changes caused by implicit policy as opposed to explicit policy instruments. Unlike agricultural price policies, macro-economic policies are nation-wide in scope thus may have many commodities as a target simultaneously. Such policies include monetary and fiscal policy, exchange rate policy, and interest rate policy. The third type of policies affecting agriculture is public investment policies. These affect how capital expenditures from the public budget are allocated. They can affect various agricultural groups – producers, traders, and consumers – differently because they are specific to the areas where the investment occurs (Pearson et al., 2003).

All three categories of government policy may work through Price or Non-price policies. Price policy instruments include taxes, subsidies, exchanges rate policy, and choice of monetary or fiscal policy. These have a direct effect on price of commodities or factors of production. Non-price policies however, are not directly targeted at adjusting prices; they work through non-price systems. Examples of non-price policies include; international trade restrictions, capital-rationing policies, government investment in research and extension services, and improvement to markets and transportation infrastructure.

Further, all the three categories of government create net transfer effects either to or from the producers or consumers of the affected commodity and the government budget. The net transfers are a flow of resources between the government budget and the commodity systems, which includes the consumers and producers. The net transfer of the economy's resources may be from the commodity system to the government budget, indicating an implicit tax, or from the government budget to the consumers or producers, indicating an implicit subsidy. The net transfers therefore will affect profitability in the production of the affected commodity; this in turn affects potential investments in that agricultural sector.

A simple analytical tool used to measure the effects of the net transfers in an economy is the Policy Analysis Matrix (PAM). The Policy Analysis Matrix or PAM is a computational framework developed by Monke and Pearson in 1989, and later augmented by Masters and Winter-Nelson in 1995. It is used to measure input use efficiency in production, comparative advantage and competitiveness in production, and the degree of government intervention in the commodity system being studied. The PAM measures the effects of net transfers in a commodity system by disaggregating the economics of a commodity system into its sources of actual (private) profitability and social profitability; that is profitability of a commodity system under an efficiency pricing system without distortions resulting from policies. The PAM is thus a useful tool to identify sources of policy transfers, measure resource use efficiency, and measure the cumulative effects of policy on a commodity system.

1.2. Problem Statement

Zambia has a long history of policy vacillation in respect of agriculture and often policy making has rarely been evidence-based (Farrington and Saasa, 2002). Over the last two decades, the Zambian government has been trying to make agriculture more productive through various policy instruments including taxes, subsidies, and trade restrictions. Many policy changes with respect to taxation, subsidies, trade restriction, and price control policies have been proposed and some implemented to varying degrees. These policies may often be politically motivated and very often lack careful preparation and economic backing. Further, the long-term impacts on production of agricultural commodities of policies implemented have often been ignored. Government policies have sometimes undermined the free market operations, such as pan-territorial pricing by parastatal marketing boards (Farrington and Saasa, 2002). This leads to distortions in the market prices of commodities that sometimes may not be in the best interest of neither producers nor consumers in the long run. The PAM approach is therefore helpful in the analysis of efficiency, competitiveness and comparative advantages of commodity systems under the prevailing policy environment. The PAM shows the net effects of policy on profitability thus giving an indication of the current effects of policy as well as the long run effects of policy. Inference on sustainability of long-term production of a commodity system can also be made from the ratios calculated from the PAM.

1.3. Scope of the Study

The examination of the trends in agricultural production was done for the period 1989 to 2009 to get a two-decade period for the study. The 2009/2010 farming season budgets from the Ministry of Agriculture and Cooperatives (MACO) were used in the PAM analysis.

1.4. Study Objectives

1.4.1. General Objective

To understand the effect of agricultural price policy on the competitiveness and the comparative advantage of maize and wheat production in Zambia.

1.4.2. Specific Objectives

The Specific Research Objectives are;

a) To determine the trends in general agricultural production since 1990,
b) To examine the sustainability of local production of Maize and Wheat,
c) To find out the competitiveness of domestic production of Maize and Wheat using the PAM approach,

d) To calculate the comparative advantage of local production of Maize and Wheat using the PAM approach.

1.5. Rationale of the Study

Various studies that have been done have shown that countries can improve their national welfare by opening up their boarders to free trade. Furthermore, there is a worldwide move toward economic integration, the European Union being the most prominent example (Saasa et al., 1999). Zambia is no exception, with the country's move toward a free trade agreement under the Southern African Development Community (SADC) and Common Market for East and Southern Africa (COMESA). However, under such a framework of economic integration, countries can only reap the benefits by exploiting comparative advantages that exist within their own countries.

Zambia is one of seven countries in SADC that participated in a Research Program on Regional Agricultural Trade and Changing Comparative Advantage in Southern Africa. The comparative economic analysis (CEA) study in Zambia found that the country has comparative advantage in the production of all the crops that were analyzed, with the exception of rice production.

Despite this advantageous position, the country continues to lag behind and seems not to take advantage of its potential in the agricultural sector. Among the many factors, causing this has been a lack of careful planning and analysis of proposed changes in agricultural policy. For instance, the input supply side in agriculture has often been influenced persistently by political objectives. In an attempt to do something for their voters government has often supplied some fertiliser to small-scale maize growers every year since at least 1975 (Farrington and Saasa, 2002). This has often been done with little consideration for the adverse economic effects of such policy on the long-term agricultural sector's development and sustainability. Further, the maize production sector has long been highly politicised, with government, often regulating all aspects of maize production and marketing to ensure that the urban consumers are happy with mealie meal prices and to ensure that smallholder maize farmers have a guaranteed market. This re-entry of government into the agricultural sector may not be beneficial or sustainable for the country. With the ever changing demand and price fluctuations for minerals (especially copper), agriculture is seen by many as a potential solution for any developing economy with little or no mineral resources. According to the 2006 Living Conditions Monitoring Survey (LCMS), about 78% of the rural population in Zambia are living under the poverty line (Central Statistical Office, 2006). This therefore calls for proper policy planning and implementation that can help raise living standards for all.

This study intends therefore to give an understanding of the current situation with special attention on two important cereals, maize and wheat, using the PAM approach. It also gives an overview of the general trends in agricultural growth through the past two decades. This study might thus enable policy makers to see the impacts of the current policy environment on the two agricultural commodities studied and hence enable any potential fine-tuning of the current policy environment.

1.6. Organisation of the Report

This report opens with chapter one, which highlights the background information about the subject. It covers the problem statement, overall goal and objectives, the scope of the study, and the significance of the study. Chapter two reviews the existing literature and the conceptual framework concerning the study's methodological approach. The chapter highlights the definitions of various concepts and some terms used in the report. Chapter three presents the methodology actually used during the research; clearly explaining the various procedures that were carried out and the secondary data sources used to obtain the data used in the study. The fourth chapter presents and discusses the results from the data and the PAMs constructed. The last chapter is chapter five; it looks at the conclusions obtained from the research results and finishes with some recommendations based on the findings of the research report.

CHAPTER TWO
LITERATURE REVIEW

2.1. Introduction

This chapter discusses the logical framework used for this research report. It begins with an explanation of the conceptual approach used in the study of the agricultural trends in the country. The analytical framework of the PAM approach used in the research is then explained including other concepts used in the PAM methodology. It ends with an explanation of the various ratios derived from the PAM and their interpretation and relevance in policy analysis.

2.2. Conceptual Framework

For this study, policies are defined as government actions intended to change behaviour of producers and consumers. Analysis involves the evaluation of government decisions and actions taken to changing economic behaviour or environments. Agricultural refers to the production and consumption of commodities produced by cultivating crops or raising livestock. From these definitions, Agricultural policy analysis can therefore be defined as a logical system for analysing public policies affecting producers, marketers, and consumers of crops and livestock products (Pearson et al., 2003).

To describe trends in agricultural production over the decades, the World Bank's 'Little Green Book' looks at the percentage of land under agricultural use and also the productivity of the labour used in agriculture. Agricultural land refers to the share of land area that is arable, under permanent crops, and under permanent pastures. Arable land includes land defined by the FAO as land under temporary crops (double-cropped areas are counted once), temporary meadows for mowing or for pasture, land under market or kitchen gardens, and land temporarily fallow. Land abandoned because of shifting cultivation is excluded. Land under permanent crops is land cultivated with crops that occupy the land for long periods and need not be replanted after each harvest, such as cocoa, coffee, and rubber. This category includes land under flowering shrubs, fruit trees, nut trees, and vines, but excludes land under trees grown for wood or timber. Permanent pasture is land used for five or more years for forage, including natural and cultivated crops. Agriculture value added per worker is a measure of agricultural productivity. Value added in agriculture measures the output of the agricultural sector less the value of intermediate inputs. Agriculture comprises value added from forestry, hunting, and fishing as well as cultivation of crops and livestock production (The World Bank, 2009). The index uses World Bank Data that is in constant 2000 U.S. dollars.

For quantitative analysis of policy, the Policy Analysis Matrix (PAM), pioneered by Monke and Pearson (1989), is often used. The PAM embodies many insights from international trade theory and cost benefit analysis. The PAM is the representation of two basic identities. The first identity defines profitability as the difference between income and costs (rows), whereas the second measures the effects of the differences in incomes, costs and profits arising from distorting policies and market failures (columns). In this way, the matrix allows us to compute the effects of particular policy or the adoption of a new technology on income, costs and profits.

Table 1: Policy Analysis Matrix

	Revenues	**Costs**		**Profit**
		Tradable Inputs	Domestic Factors	
Private Prices	**A**	**B**	**C**	**D**
Social Prices	**E**	**F**	**G**	**H**
Divergences	**I**	**J**	**K**	**L**

In Table 1 above, private profitability from farming production is represented by ($D=A-B-C$) while social profitability by ($H=E-F-G$), and divergences between private and social valuations of revenue, costs and profits are in the last row of the PAM (*I, J, K, and L*). They represent a net balance from the application of a combination of policies that create economic distortions (trade protection, price control, taxes and subsidies), market failures, and correcting policies that aim to restore efficiency conditions. The columns of the matrix show income and profits, as well as a breakdown of costs into two components, tradable input costs and domestic production factor costs. The intermediate inputs, like fertilisers or pesticides, must also be decomposed into elements of their tradable inputs type and their domestic factors type.

The main purpose of constructing a PAM is to capture the differences between private and social profitability. Private profitability refers to observed revenues and costs reflecting actual market prices received or paid by farmers, traders, and processors in the agricultural commodity system studied. These private, or actual, market prices thus incorporate the underlying economic costs and valuation plus the effects of all policies and market failures. Social profitability refers to revenues and costs reflecting social prices. Social prices or valuations represent prices that would result in the best allocation of resources and thus the highest generation of income. Efficient outcomes are achieved when an economy's resources are used in activities that create the highest levels of output and income. Social profitability therefore, is to be strictly understood in conventional efficiency terms. For a developing nation like Zambia, adopting international prices as a benchmark in the social valuation of tradable goods gives a good estimate of social prices and valuations for tradable goods. International prices are used because they do not encompass other possible social objectives, such as the redistribution of income, food security or environmental protection, which may affect the actual prices or valuations of goods in a country through policies implemented by the Government, thereby leading to distortions.

Some conventions are adopted for pricing outputs and inputs in the PAM, in order to calculate social profitability. For those outputs and inputs that are internationally traded, world prices (c.i.f. for imports and f.o.b. for exports) set up appropriate social values, whereas the valuation of domestic factors corresponds to their opportunity cost (Martínez et al., 2008).

For this study, the PAM helped in evaluation of the effects of government policies on profitability of maize and wheat production in Zambia, thus enabling us to see the effects of policies on production in these two major crops. Since profitability affects production in agriculture, the PAM was used to see the divergences between profitability in the absence of policy and profitability with the current policy environment in place. These divergences are a good measure of the general effect of the policies.

To determine whether an agricultural system enjoys a comparative advantage in relation to the international economy, a number of ratios that explain these issues were calculated from the PAM, they helped determine; competitiveness of the commodity systems studied, the comparative advantage of production of the commodities in the country, and the efficiency and sustainability of prevailing agricultural price policy in relation to the commodities studied.

These ratios are explained further below;

2.2.1. Private Cost Ratio (PCR)

This is the quotient between the cost of the domestic factors, valued at private prices, and the value added, which is also calculated at private prices. The value added is the difference between the revenue and cost of the tradable inputs. The commodity system will be competitive if this quotient is lower than or equal to one. The ratio is calculated using the equation below, the letters represent the values obtained in the PAM table;

$$PCR = \frac{C}{(A - B)}$$ .... *Equation 1*

2.2.2. Domestic Resource Cost Ratio (DRCR)

This is the quotient between domestic factor costs valued at social prices and the value added, also computed at social prices. An agricultural system enjoys a comparative advantage if its *DRCR* ratio is less than one, indicating that the economy is saving foreign exchange by means of domestic production. The DRCR is obtained using the formula below;

$$DRCR = \frac{G}{(E - F)}$$ .... *Equation 2*

2.2.3. Policy Transfers

The third row of the PAM shows policy transfers, if market failures are unimportant, these transfers measure mainly the effects of distorting policy (Monke & Pearson, 1989). The main purpose for the policy transfers in the PAM is to show the general effects of policy on the production incentives for a specific commodity system. If policy has a negative effect on the production incentives for farmers, one of the ratios of policy transfers will be able to show us the effect of such policy on production of the commodity. Some of the effects that policy may have on production of a commodity include increased or reduced revenues from production, increased or reduced costs of inputs, and others. Policy transfers between two or more outputs from different systems can be compared using ratios that are calculated from the PAM results. These ratios are;

a) Nominal protection coefficient (NPC)

This ratio contrasts the private commodity price with the comparable world (social) price. It indicates the impact of policy (and of any market failures not corrected by efficient policy) that causes divergence between the social and private prices.

The NPC on tradable outputs (NPCO), defined as A/E, indicates the degree of output transfer; for example, an NPC of 1.10 shows that policies are increasing the market price to a level 10 percent higher than the world price. Similarly, the NPC on tradable inputs (NPCI), defined as B/F, shows the degree of tradable input transfer. An NPC on inputs of 0.80 shows that policies are reducing input costs; the average market prices for these inputs are only 80 percent of world prices (Monke and Pearson, 1989).

b) Effective protection coefficient (EPC)

This ratio is found by the ratio of value added in private prices (A - B) to the value added in world prices (E - F), so

$$EPC = \frac{(A - B)}{(E - F)} \qquad \textit{Equation 3}$$

This coefficient measures the degree of policy transfer from product market-output and tradable-input-policies. It however ignores the transfer effects of factor market policies therefore; it is not a complete indicator of incentives because of this.

2.2.4. Subsidy Ratio to Producers (SRP)

This ratio measures the net transfer to the farming system as a proportion of the total social income generated, allowing one to discover to what extent economic policy is subsidising the system. It is the final incentive indicator of policy transfer. The SRP permits comparisons of the extent to which all policy subsidises agricultural systems. A high *SRP* points to a lack of competitiveness, as the system's financial viability tends to depend on political decisions that affect policy. The SRP is calculated using the following equation;

$$SRP = \frac{L}{E} = \frac{(D - H)}{E} \quad \text{.......... } \textit{Equation 4}$$

CHAPTER THREE
METHODOLOGY

3.1. Introduction

This chapter outline the methods and procedures that were used in the research. It begins with an explanation of how the research's data were collected then explains the analysis procedures used to arrive at the set objectives for the research.

3.2. Data Sources and Analysis

To analyse the trends in agricultural production over the two-decade period, secondary data was used to see changes over the past twenty years in overall agricultural production. Although production is be affected by numerous other factors, agricultural price policy is also considered a huge factor in the production decisions of farmers since it may affect commodity prices, input prices and profitability. Each successive production year is representative of the effects of the policy environment of the preceding production year. Since the previous year's policy environment or situation has an effect on the following year's production decisions by farmers. To study agricultural growth trends, the percentage of total Zambian land under agricultural use and the agricultural productivity defined as value added per worker in constant 2000 U.S. dollars were used. Secondary data on the yearly changes in agricultural land as a percentage of total land in the country was collected from the World Bank's statistics database. This data was then graphed to give a graphical illustration of the changes that have occurred over the two decade period studied. Another indicator of agricultural productivity as recommended by the World Bank is the index of agricultural productivity measured as value added per worker in constant 2000 U.S. dollars. Yearly data on this index for Zambia were obtained from the World Bank's statistics database site and graphical illustrations for clearer interpretation were made.

In studying the maize and wheat production systems under the current policy environment, the PAM approach was employed. The Policy Analysis Matrix (PAM) is an analytical framework used to measure input use efficiency in production, competitiveness and the comparative advantage that a commodity system enjoys. The

PAM is designed to specially deal with measuring the impact of policy on the economics of production. It does this by disaggregating the economics of a commodity system into its sources of private and social profitability.

The first step that was carried out in the construction of the PAMs for maize and wheat was to obtain representative farm production budgets for the two commodities. For maize, the representative production budget used was for the average smallholder farmer this is because about 95 percent of the maize produced in the country is produced by this group of farmers (CSO Crop Forecast Survey, 2009). According to the 2009 Crop forecast survey, about 100 percent of the country's total wheat is produced by large-scale farmers, and hence the appropriate representative budget for wheat was the large-scale farmer's. The two representative budgets used were for the 2009/2010 farming season and were obtained from The Ministry of Agriculture and Cooperatives (MACO). From these, the inventory budget tables for the two commodity systems were constructed in private prices and these were then used to come up with input disaggregation tables. The input disaggregation tables allowed for the separation of the production inputs into tradable inputs and domestic factors of production. The tradable inputs were then disaggregated into there component values of tradable resources, domestic resources and transfer effect.

To estimate the social or efficiency prices for use in the PAM, world prices for the tradable inputs were obtained from the World Bank agricultural statistics website and the Food and Agricultural Organisation (FAO) statistics website. The world prices used were the fob prices at Gulf of Mexico, U.S.; these were for the period 2009/2010. To estimate social prices in Zambian Kwacha terms at farm gate, the world prices were adjusted to get the import parity prices as estimates of the social prices of each tradable input. The adjustments were done as recommended by the Zambia National Farmers' Union (ZNFU) standard procedures for import parity price calculations. According to this standard, the import parity prices were estimated as follows;

Import Parity Price at point of Import equals:

= fob price at point of export (world price of input) expressed in Zambian Kwacha equivalent at exchange rate of ZMK4, 500 per US$1.00

+ Duty charged at 15% of world price

+ Bagging, Handling, and Transport charges charged at US$13.00 per metric tonne (ZMK58, 500 per metric tonne)

+ Insurance charges charged at 1% of world price

+ Clearing charges charged at 1.5% of world price.

This procedure was followed to calculate the import parity prices for the tradable inputs and these social price estimates were used in the completion of the inventory budget tables for maize and wheat in social prices. The social prices were then entered into the input disaggregation tables for each commodity and separated into their component values of tradable resources and domestic factor resources. The transfer effect for social prices is zero since social prices represent efficiency pricing were it is assumed there are no distorting policies affecting pricing. For the domestic factor resource component, it was at 20 percent of the total social cost of the tradable input in question. PAM researchers use an arbitrary rule of thumb here to estimate the percentage of domestic factor cost component in tradable inputs; the experience of other developing and developed countries when they were at similar levels of development as the country in under study (Martínez et al., 2008). Past studies for countries such as Malaysia, Indonesia, Zimbabwe, and Malawi estimated this percentage value at 20 percent when they were at similar levels of development as Zambia. Hence 20 percent was used in this study as well.

For the domestic factor, land, it was assumed for this study that the private price for land could not be defined due to high levels of market fragmentation, the market for land has many different prices for land most of which are determined by forces other than market forces. The price of a hectare of land in Zambia can vary from 0 Kwacha to any price above that, thus the private price was taken to be zero as is often the case for developing countries at Zambia's level of development. The social opportunity cost of Zambian land was also taken to be zero as is often the case for developing economies according to Pearson, Gotsch, and Bahri (2003). This is due to a lack of proper market systems for land in many developing countries including Zambia. Most land in Zambia is mostly forestland that is undeveloped and would often remain undeveloped as an alternative use if it were not developed. Thus, the value of the next best alternative use for land in the Zambian case remains zero in the larger parts of the country. Therefore the social price for land is near zero.

Labour was treated as aggregated which is basically composed of unskilled and skilled labour (in which case the tractor operator would be considered skilled). The private price for labour was obtained as given in the farm budgets from MACO. For the social price of labour, shadow-pricing techniques were used to derive the social price estimate of aggregated labour cost. Due to abundant supply of labour on the Zambian market, the social opportunity cost of labour was found to be near zero since in its next best alternative use, the value of agricultural labour (most of which is unskilled labour) would still be relatively the same. Hence the social price for labour was taken to be zero.

For the social opportunity cost of capital, it was estimated that the social rates of interest for working capital would be similar as that of other developing countries at a similar level of development as Zambia currently is. In practice, to estimate the social rates of interest for working capital, PAM researchers again use an arbitrary rule of thumb – the experience of other developing and developed countries when they were at similar levels of development as the country in question (Martínez et al., 2008). For a country at Zambia's level of development, this estimate was taken to be 9% as was the case for Indonesia when it was at a similar level of development to Zambia's current development level.

These data on social prices were then used to complete the input disaggregation tables which were in turn used to come up with the system budgets. From the system budgets, the PAMs were constructed for both commodities being studied and the various ratios and analyses were carried out.

CHAPTER FOUR

STUDY RESULTS AND DISCUSSIONS

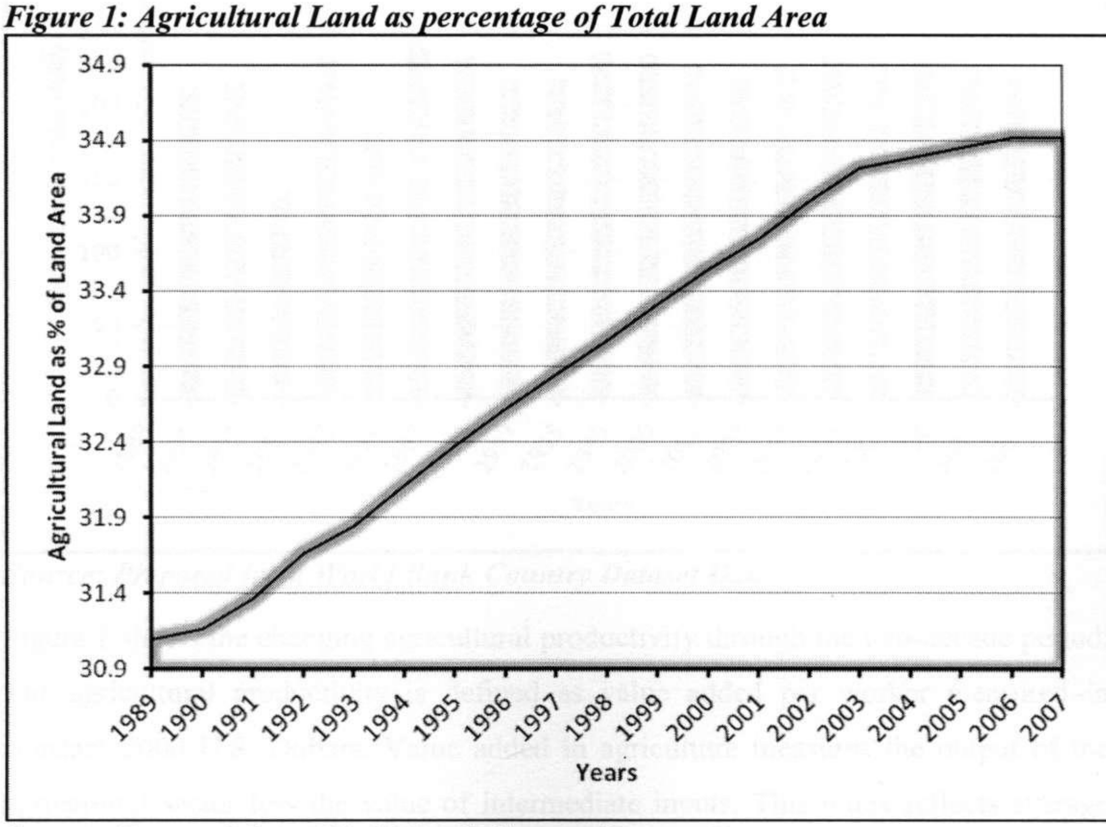
4.1. Introduction

This chapter presents results obtained for the research work that was carried out and discusses these results and their interpretations and inferences that can be drawn from the study results. It begins with a presentation of the charts showing trends in agriculture growth over the period studied and ends with the results obtained from the PAM tables and explains the various analysis calculations from the PAMs.

4.2. Trends in Agricultural Production

The trends in agricultural production for the two decades studied can be represented by the percentage of total land used for agricultural purposes and the agricultural productivity index, defined as the value added per worker in agricultural production. Figure 1 shows the graphical representation of the changes in the percentage of total land used for agricultural purposes since 1989 in Zambia.

Figure 1: Agricultural Land as percentage of Total Land Area

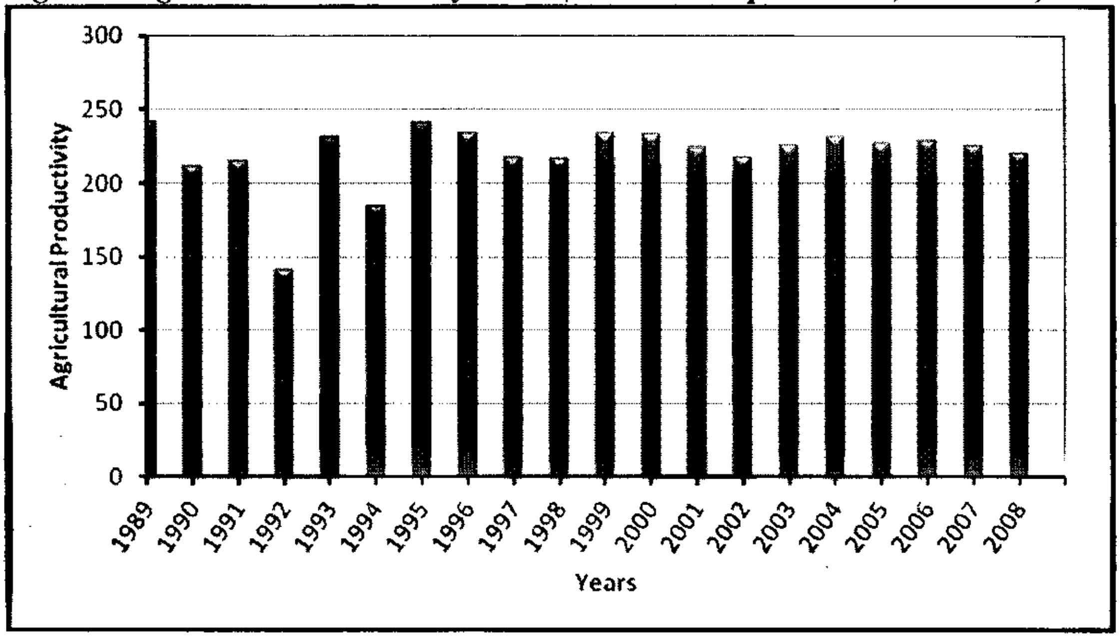


Source: Prepared from World Bank Country Dataset Data

Agricultural land here refers to the share of total land area that is arable, under permanent crops, and under permanent pastures. According to the FAO, arable land includes land under temporary crops, temporary meadows for mowing or for pasture, land under market or kitchen gardens, and land temporarily fallow. Land abandoned because of shifting cultivation is excluded under this indicator. Land under permanent crops is land cultivated with crops that occupy the land for long periods and need not be replanted after each harvest, such as cocoa, coffee, and rubber. This category includes land under flowering shrubs, fruit trees, nut trees, and vines, but excludes land under trees grown for wood or timber. Permanent pasture is land used for five or more years for forage, including natural and cultivated crops. All these comprise the total agricultural land in a country.

From Figure 1 it can be observed that the percentage of total Zambian land used for agriculture has grown from about 31 percent in 1990 to about 34 percent in 2007. This shows that there has been a 9.7 percent growth in land used for agricultural purposes over the past decade representing an average annual growth rate of 0.5 percent.

Figure 2: Agricultural Productivity Index (Value Added per worker, 2000 US$)



Source: Prepared from World Bank Country Dataset Data

Figure 2 shows the changing agricultural productivity through the two-decade period. The agricultural productivity is defined as value added per worker measured in constant 2000 U.S. Dollars. Value added in agriculture measures the output of the agricultural sector less the value of intermediate inputs. This index reflects average productivity and comprises the value added from activities such as forestry, hunting, and fishing as well as cultivation of crops and livestock production (The World Bank, 2009).

From Figure 2, it can be observed that the agricultural productivity index for Zambia has remained constant within the range of 200 and 250 over the two-decade period. Despite the increasing percentage of total land in the country being used for agricultural use, agricultural productivity has not been growing at the same pace. It can also be observed that in 1992 and 1994, the index fell well below 200 unlike in the other years. This could be attributed to the drought that the country experienced during that period. The value added per worker might have dropped during this period due to diminishing returns to labour.

4.3. PAM Tables for the Commodity Systems Studied

The following are the PAM tables obtained for the two commodities studied. The tables are based on 2009/2010 prices for private prices and social price estimates.

I. Maize Production

Table 2 shows the PAM for maize production;

Table 2: PAM for Maize

	Revenues (ZMK/ha)	Costs (ZMK/ha)		Profits (ZMK/ha)
		Tradable Inputs	Domestic Factors	
Private Prices	5850000	1567400	1375320	2907280
Social Prices	7920000	3170400	1063680	3685920
Effects of Divergence	-2070000	-1603000	311640	-778640

Source: Constructed from MACO 2009/2010 Production Budgets

The figures entered in the PAM table are obtained from the system budget for maize presented in Table E of the appendices. They are the sum totals of the Tradable inputs and the sum totals for the Domestic factors. The costs and revenues are all based on a per hectare basis of production.

The PAM shows that private pricing revenue was ZMK2, 070,000 less per hectare of maize production compared to social pricing revenue that stood at ZMK7, 920,000 per hectare of production. The tradable input costs under private pricing were ZMK1, 603,000 less than they would be under social pricing conditions, thus pointing an implicit subsidy on tradable production inputs for maize. Domestic factors under private pricing were ZMK311, 640 more per hectare than their social pricing value. The overall profit effect showed that profits were reduced by ZMK778, 640 per hectare of maize production under private pricing compared to what they would be under social pricing conditions. Total costs of inputs, both tradable and domestic were ZMK1, 291,360 less per hectare of maize production under private pricing conditions compared to what they would be under social pricing conditions, thus implying an implicit subsidy on production inputs for maize. Table 3 gives the calculation results for the ratios obtained from the PAM for maize production.

Table 3: Calculation Results from the PAM for Maize

Ratio	Formula	Result
PCR	C/(A - B)	0.321141363
DRCR	G/(E - F)	0.223951491
NPCI	B/F	0.494385566
NPCO	A/E	0.738636364
EPC	(A - B)/(E - F)	0.901675931
SRP	(D - H)/E = L/E	-0.098313131

Source: Calculated from the PAM Table for Maize

From Table 3, the following interpretations for the results can be inferred;

a) Private Cost Ratio (PCR)

The PCR was found to be 0.32 as shown in Table 3; this indicates competitiveness in the production system since the PCR is less than one. It therefore implies that the maize production system is competitively operating.

b) Domestic Resource Cost Ratio (DRC)

The DRCR was 0.22 from Table 3; this ratio indicates a comparative advantage, since cost of domestic resources used in the maize production is less than the cost of obtaining the maize commodity from outside the country. Therefore, foreign exchange is saved through domestic production of maize.

c) Nominal Protection Coefficient on Inputs (NPCI)

The NPCI of 0.49 was obtained from the calculations in Table 3, this shows that policies were reducing the tradable input costs; the average market prices for the inputs are only about 50 percent of world prices (social prices). This indicates an implicit subsidy on tradable inputs. The Fertiliser and Input Support Programme (FISP) implemented by the government to help the infant maize sector to grow can be said to be the major reason for the observations.

d) Nominal Protection Coefficient on Outputs (NPCO)

The NPCO of 0.74 shown in Table 3 indicates that policies were reducing the prices of output; the coefficient implies that the average market prices for output are only about 74 percent of the world prices for the same output.

e) Effective Protection Coefficient (EPC)

Table 3 gives an EPC of 0.90; This EPC is less than one, hence showing that the net effect of policies that alter prices in product markets was a reduction in private profits over social profits, but this is without considering the transfer effects of the factor market policies thus it is not a complete indicator of incentives in production.

f) Subsidy Ratio to Producers (SRP)

The SRP is a complete incentives indicator and the results from Table 3 showed that divergences have reduced the gross revenues by about 10 percent even though the financial viability of the system still is competitive. This is seen from the coefficient of 0.098 obtained from the calculations.

From the results presented above it can be seen that local production of maize is both competitive and has a comparative advantage in terms of domestic resource use. It does however depend on policy that reduces total tradable input costs to be only about 50 percent of what they would be under efficiency pricing, as observed from the NPCI of 0.49. This can be said to point to a lack of sustainability in local production since there is an implicit subsidy on domestic production of maize.

II. Wheat Production

Table 4 shows the PAM constructed for wheat production using data from the systems budget for wheat presented in Table F of the appendices.

Table 4: PAM for Wheat

	Revenues (ZMK/ha)	Costs (ZMK/ha)		Profits (ZMK/ha)
		Tradable Inputs	**Domestic Factors**	
Private Prices	8100000	1896200	4795200	1408600
Social Prices	8154000	2059760	1686240	4408000
Effects of Divergence	-54000	-163560	3108960	-2999400

Source: Constructed from MACO 2009/2010 Production Budgets

From the Table 4, it can be observed that the effects of divergence between private and social pricing revenue was - ZMK54, 000 per hectare of wheat production. This showed that private revenue was ZMK54, 000 less per hectare of wheat produced than it would be if efficiency-pricing conditions prevailed. Thus implying there was an implicit tax on domestic wheat production. For the tradable input costs, however, private pricing costs were ZMK163, 560 less than they would be under efficiency pricing per hectare of production. This indicates an implicit subsidy on tradable inputs equal to about ZMK163, 560 in total. The domestic factor costs stated in private prices were found to be ZMK3, 108,960 more than they would be under efficiency pricing per hectare of wheat production. This again implies an implicit tax on the production system for wheat. Overall profits for wheat production in private prices were found to be ZMK2, 999,400 less per hectare than they would be if efficiency pricing were followed. Table 5 gives the ratio calculation results from the PAM for wheat.

Table 5: Calculation Results from the PAM for Wheat

Ratio	Formula	Result
PCR	C/(A - B)	0.772945614
DRCR	G/(E - F)	0.276694059
NPCI	B/F	0.92059269
NPCO	A/E	0.993377483
EPC	(A - B)/(E - F)	1.017977631
SRP	(D - H)/E = L/E	-0.367844003

Source: Calculated from the PAM for Wheat

From Table 5, the following interpretations for the results were obtained;

a. Private Cost Ratio (PCR)

The PCR calculated was found to be 0.77 as shown in Table 5. This coefficient indicates competitiveness in wheat production since the PCR is less than one, implying that the system is competitively operating.

b. Domestic Resource Cost Ratio (DRC)

Table 5 shows a DRC ratio of 0.28. Like then maize production system, the DRCR obtained for wheat production indicates a comparative advantage, since domestic resources ratio is less than 1 but greater than 0. This means therefore that foreign exchange is saved through domestic production of wheat.

c. Nominal Protection Coefficient on Inputs (NPCI)

The NPCI was found to be 0.92 from Table 5. This shows that policies were reducing tradable input costs slightly as the average market prices for the tradable inputs are about 92 percent of world prices (social prices), thus they are about 8 percent cheaper than what they would be under efficiency pricing.

d. Nominal Protection Coefficient on Outputs (NPCO)

The NPC on outputs indicated that policies reduced output prices; the average market prices for output are about 1 percent cheaper than the world prices, therefore market prices are about 99 percent of world prices for output. This is shown by the NPCO calculated at 0.99 as shown in Table 5.

e. Effective Protection Coefficient (EPC)

Table 5 shows that the calculated EPC was 1.02. This EPC for wheat production was greater than one, showing that the net effect of policies that alter price in product markets was an increase in private profits over social profits, but this is without considering the transfer effects of factor market policies thus it is not a complete indicator of incentives. A more complete indicator is the Subsidy Ratio to Producers (SRP).

f. Subsidy Ratio to Producers (SRP)

The SRP calculated was found to be – 0.37. The SRP result implies that the overall effects of divergences was a reduction in the gross revenues by about 37 percent even though the financial viability of the production system was still is competitive.

The results obtained from the ratio analysis indicated both a comparative advantage and competitiveness in domestic wheat production. Despite the NPC on inputs being below 1 at 0.92 (implying an implicit subsidy on tradable inputs), local production of wheat can be said to be more sustainable compared to the maize production which relies heavily on policy with an NPC on inputs of 0.49 (indicating that tradable inputs were heavily subsidised)

CHAPTER FIVE
CONCLUSIONS AND RECOMMENDATIONS

5.1. Introduction

This Chapter presents the conclusions and recommendations obtained from the study's results and findings.

5.2. Conclusions

The trends in agricultural production for the past two decades studied were represented by the percentage of total land used for agricultural purposes and the agricultural productivity index, defined as the value added per worker. It was observed that while the percentage of total Zambian land used for agriculture has being growing from about 31 percent in 1990 to about 34 percent in 2007, the agricultural productivity index for Zambia has remained fairly constant within the range of 200 and 250 over the two decades with the exception of the two drought periods in 1992 and 1994. Overall, it was found that there has been a 9.7 percent growth in land used for agricultural purposes over the past two decades representing an average annual growth rate of 0.5 percent.

From the PAM for maize production, it was observed that the overall effect of policy on profit was a reduction in total profits. Local production of maize was found to be competitive and has a comparative advantage in terms of domestic resource use. It was however observed that maize production in the country heavily depended on policy that reduces total tradable input costs to be only about 50 percent of what they would be under efficiency pricing conditions. This was observed from the NPCI of 0.49 from the PAM for maize. This can be said to point to a lack of long run sustainability in local production since there is a large subsidy effect on the domestic production system for maize.

From the PAM for wheat production, it can be concluded that the private revenues of wheat production were reduced under the prevailing pricing policy conditions. This indicates that there is an implicit tax on domestic wheat production. The results obtained from the ratio analysis did however indicate both a comparative advantage and competitiveness in domestic wheat production. Further, despite showing some implicit subsidy on tradable inputs, local production of wheat can be said to be sustainable in the long run as it was found that the system was not heavily subsidised under the prevailing policy environment.

5.3. Recommendations

From the findings of the research, policy in the country may need to be directed towards reducing input subsidies on maize production if allocative efficiency is to be achieved in maize production. Therefore, it would be recommended that the FISP be structured in such a way that its subsidies on maize inputs are in a sustainable way for the future of the farmers involved. For wheat production, allocative efficiency may be achieved by a reduction of implicit taxation through policy on output. This would increase profitability in wheat production as it would increase revenues for wheat producers. However, it must be noted that the PAM cannot be used to identify exactly what the source of distortion is. Therefore, it is important that it be not assumed that policy is causing the distortions observed. Distortions may be coming from other sources such as market failure.

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APPENDICES

The following pages have the tables used in the construction of the PAMs for maize and wheat. Table A.1 shows the Inventory Budget for Maize production while Table A.2 gives the Inventory Budget for Wheat production. Both of these were constructed on a per hectare basis from MACO production budgets for the 2009/2010 farming season.

Tables A.3 and A.4 are the Input Disaggregation Tables for Maize and Wheat respectively. These contain the separated inputs from the Inventory Budgets for the two commodity systems. Tables A.5 and A.6 are the System Budget Tables for Maize and Wheat respectively. It is from these tables that the PAMs were finally constructed.

Table A.1: Inventory Budget for Maize Production

				Private Prices	Social Prices		Private Prices	Social Prices
I-O	*Quantities*	*Maize Crop*	*Quantities*	*Maize Crop*	*Maize Crop*	*Quantities*	*Maize Crop*	*Maize Crop*
Tradables	*Fertiliser(Packet/ha)*		*Fertiliser(Kwacha/Packet)*			*Fertiliser(Kwacha/ha)*		
	Basal (D-Compound)	4	Basal (D-Compound)	165000	373000	Basal (D-Compound)	660000	1492000
	Top Dressing (Urea)	4	Top Dressing (Urea)	145000	340000	Top Dressing (Urea)	580000	1360000
	Chemicals		*Chemicals*			*Chemicals*		
	Herbicide (Ltr/ha)	4	Herbicide (Kwacha/Ltr)	70000	76050	Herbicide (kwacha/ha)	280000	304200
	Insecticide (Ltr/ha)	0.3	Insecticide (Kwacha/Ltr)	150000	56000	Insecticide (Kwacha/ha)	45000	16800
	Seed (kg/ha)	20	*Seed (kwacha/Kg)*	8250	8000	*Seed (kwacha/ha)*	165000	160000
Factors	*Labor (man-days/ha)*		*Labor (Kwacha/man-day)*			*Labor (Kwacha/ha)*		
	Land Preparation	5	Land Preparation	13400	0	Land Preparation	67000	0
	Sowing	2	Sowing	13400	0	Sowing	26800	0
	Fertiliser Application	5	Fertiliser Application	13400	0	Fertiliser Application	67000	0
	Weeding	5	Weeding	13400	0	Weeding	67000	0
	Pest/Disease control	5	Pest/Disease control	13400	0	Pest/Disease control	67000	0
	Harvesting	5	Harvesting	13400	0	Harvesting	67000	0
	Threshing	3	Threshing	13400	0	Threshing	40200	0
	Drying	-	Drying	-	-	Drying	-	-
	Capital		*Capital*			*Capital*		
	Working Capital (Kwacha/ha)	3012000	Working Capital (%)	6%	9%	Working Capital (Kwacha/ha)	180720	271080
	Tractor Services (ha)	1	Tractor Services (Kwacha/ha)	250000	250000	Tractor Services (Kwacha/ha)	250000	250000
	Transport & packing (Bags/ha)	90	Transport & packing (Kwacha/Bag)	7000	7000	Transport & packing (Kwacha/ha)	630000	630000
	Land (ha)	1	*Land (Kwacha/ha)*	-	-	*Land (Kwacha/ha)*	-	-
Output	(50Kg)Bags/ha	90	Kwacha/Bag	65000	88000	Total Revenue (Kwacha/ha)	5850000	7920000
						Total Cost (excluding Land) (Kwacha/ha)	3192720	4484080
						Profit (excluding Land) (Kwacha/ha)	2657280	3435920

Source: Prepared from MACO Production Budgets 2009/2010 season

Table A.2: Inventory Budget for Wheat Production

				Private Prices	Social Prices		Private Prices	Social Prices
I-O	*Quantities*	*Wheat Crop*	*Quantities*	*Wheat Crop*	*Wheat Crop*	*Quantities*	*Wheat Crop*	*Wheat Crop*
Tradables	*Fertiliser(Packet/ha)*		*Fertiliser(Kwacha/Packet)*			*Fertiliser(Kwacha/ha)*		
	Basal (D-Compound)	8	Basal (D-Compound)	165000	373000	Basal (D-Compound)	1320000	2984000
	Top Dressing (Urea)	6	Top Dressing (Urea)	145000	340000	Top Dressing (Urea)	870000	2040000
	Chemicals		*Chemicals*			*Chemicals*		
	Herbicides (Ltr/ha)	4	Herbicides (Kwacha/Ltr)	35000	40000	Herbicides (Kwacha/ha)	140000	160000
	Pestcide monochrotophos (Ltr/ha)	3	Pestcide monochrotophos (Kwacha/Ltr)	30000	30000	Pestcide monochrotophos (Kwacha/ha)	90000	90000
	Seed (kg/ha)	90	*Seed (kwacha/Kg)*	2500	3000	*Seed (kwacha/ha)*	225000	270000
Factors	*Labor (man-days/ha)*		*Labor (Kwacha/man-day)*			*Labor (Kwacha/ha)*		
	Land Preparation	8	Land Preparation	13400	0	Land Preparation	107200	0
	Sowing	8	Sowing	13400	0	Sowing	107200	0
	Fertiliser Application	5	Fertiliser Application	13400	0	Fertiliser Application	67000	0
	Weeding	8	Weeding	13400	0	Weeding	107200	0
	Pest/Disease control	6	Pest/Disease control	13400	0	Pest/Disease control	80400	0
	Harvesting	5	Harvesting	13400	0	Harvesting	67000	0
	Drying	-	Drying	-	-	Drying	-	-
	Capital		*Capital*			*Capital*		
	Working Capital (Kwacha/ha)	5416000	Working Capital Interest (%)	6%	9%	Working Capital (Kwacha/ha)	324960	487440
	Irrigation water (MLtr/ha)	1	Irrigation water (Kwacha/MLtr)	105000	105000	Irrigation water (Kwacha/ha)	105000	105000
	Tractor Services (hr/ha)	8	Tractor Services (Kwacha/hr)	210000	210000	Tractor Services (Kwacha/ha)	1680000	1680000
	Transport & packing (Bags/ha)	90	Transport & packing (Kwacha/Bag)	5000	5000	Transport & packing (Kwacha/ha)	450000	450000
	Land (ha)	1	*Land (Kwacha/ha)*	-	-	*Land (Kwacha/ha)*	-	-
Output	(50Kg)Bags/ha	90	Kwacha/Bag	90000	90600	Total Revenue (Kwacha/ha)	8100000	8154000
						Total Cost (excluding Land) (Kwacha/ha)	5740960	8266440
						Profit (excluding Land) (Kwacha/ha)	2359040	-112440

Source: Prepared from MACO Production Budgets 2009/2010 season

Table A.3: Input Disaggregation Table for Maize[1]

	Private Prices (ZMK)	Social Prices (ZMK)
Fertiliser Total Cost	*1240000*	*2852000*
of which:		
tradables;	2281600	2281600
domestic resources;	570400	570400
transfers;	-1612000	0
Seed Total Cost	*165000*	*160000*
of which:		
tradables;	128000	128000
domestic resources;	32000	32000
transfers;	5000	0
Chemicals Total Cost	*325000*	*321000*
of which:		
tradables;	256800	256800
domestic resources;	64200	64200
transfers;	4000	0
Transport Total Cost	*630000*	*630000*
of which:		
tradables;	504000	504000
domestic resources;	126000	126000
transfers;	0	0
Domestic Resources		
Labour	402000	0
Capital	180720	271080
Land	0	0

Source: Prepared from MACO Production Budgets

Table A.4: Input Disaggregation Table for Wheat[2]

	Private Prices (ZMK)	Social Prices (ZMK)
Fertiliser Total Cost	*2190000*	*5024000*
of which:		
tradables;	4019200	4019200
domestic resources;	1004800	1004800
transfers;	-2834000	0
Seed Total Cost	*225000*	*270000*
of which:		
tradables;	216000	216000
domestic resources;	54000	54000
transfers;	-45000	0
Chemicals Total Cost	*230000*	*250000*
of which:		
tradables;	200000	200000
domestic resources;	50000	50000
transfers;	-20000	0
Transport Total Cost	*450000*	*450000*
of which:		
tradables;	360000	360000
domestic resources;	90000	90000
transfers;	0	0
Domestic Resources		
Labour	536000	0
Capital	324960	487440
Land	0	0

Source: Prepared from MACO Production Budgets

Table A.5: System Budget for Maize[3]

[1] A – Sign indicates a subsidy while a + sign indicates a tax.

[2] A – Sign indicates a subsidy while a + sign indicates a tax.

	Private Prices (ZMK)	Social Prices (ZMK)
Total Revenue	5850000	7920000
Tradable Costs/ Inputs:		
Fertiliser	2281600	2281600
	-1612000	0
Seed	128000	128000
	5000	0
Chemicals	256800	256800
	4000	0
Transport	504000	504000
	0	0
Domestic Resource Costs/ Inputs:		
in fertiliser	570400	570400
in seed	32000	32000
in chemicals	64200	64200
in transport	126000	126000
direct labour	402000	0
direct capital	180720	271080
direct land	0	0

Source: Prepared from MACO Production Budgets

[3] A – Sign indicates subsidies while a + sign indicates taxes.

Table A.6: System Budget for Wheat[4]

	Private Prices (ZMK)	Social Prices (ZMK)
Total Revenue	8100000	8154000
Tradable Costs/ Inputs:		
Fertiliser	4019200	4019200
	-2834000	0
Seed	216000	216000
	-45000	0
Chemicals	200000	200000
	-20000	0
Transport	360000	360000
	0	0
Domestic Resource Costs/ Inputs:		
in fertiliser	1004800	1004800
in seed	54000	54000
in chemicals	50000	50000
in transport	90000	90000
direct labour	536000	0
direct capital	324960	487440
direct land	0	0

Source: Prepared from MACO Production Budgets

[4] A – Sign indicates subsidies while a + sign indicates taxes.