AN ECONOMIC ANALYSIS OF SUNFLOWER PRODUCTION IN ZAMBIA: THE CASE OF KALOMO DISTRICT

by

Kezia Mbita Katyamba

A Thesis submitted to the University of Nairobi in partial fulfilment of the requirements of the Master of Science in Agricultural Economics, 1994.

DECLARATION

This thesis is my original work and has not been submitted for a degree in any other university.

Sign _____ Date 14/03/94

Kezia M. Katyamba

This thesis has been submitted with our approval as university supervisors.

University Supervisors:

Sign _____ Date 16/3/1994

DR. W.A. Oluoch-Kosura

Sign _____ Date March 17, 1994

PROF. O.L.E. Mbatia

TABLE OF CONTENTS

		PAGE
ABBREVIATIONS		(i)
ACKNOWLEDGEMENTS		(ii)
ABSTRACT		(iii)
CHAPTER 1.	.....	1
1.	INTRODUCTION AND BACKGROUND INFORMATION ..	1
1.1.	The Marketing Policy and the Evolution of the Marketing Institutions	6
1.1.1.	Sunflower Marketing	9
1.1.2.	Maize Marketing	11
1.1.3.	Input Marketing	12
1.2.	Agricultural Pricing Policies	15
1.2.1.	Sunflower Pricing	15
1.2.1.	Maize Pricing	16
1.2.3.	Input Pricing	17
1.3.	The Exchange Rate Policy	19
1.4.	Problem Statement	19
1.5.	Objectives	30
1.6.	Hypotheses	31
CHAPTER 2.	.....	33
2.	LITERATURE REVIEW	33
CHAPTER 3.	.....	42
3.	METHODOLOGY.....	42
3.1.	Theoretical Foundation of the Policy Analysis Matrix	42

3.2. Data Requirements 47
3.3. Data Sources and Collection 48
3.4. Theoretical Analysis 49
3.5. Sensitivity Analysis 56
CHAPTER 4. 57
4. EMPIRICAL ANALYSIS 57
4.1. Social Valuation 58
4.1.1. The Shadow Exchange Rate 58
4.1.2. Determination of the Social Price of Sunflower 61
4.1.3. Determination of the Social Price of Maize 69
4.1.4. Determination of the Social Cost of Seed Sunflower 72
4.1.5. Determination of the Social Cost of Seed Maize 73
4.1.6. Determination of the Social Costs of Fertilisers 74
4.1.7. Determination of the Social Cost of Lubricating Oil 20W/40 75
4.1.8. Determination of the Social Cost of Jute Bags 77
4.1.9. Social Values of Domestic Factors 79
CHAPTER 5. 82
5. EMPIRICAL RESULTS AND DISCUSSIONS 82
5.1. The Template and PAM for Small-Scale Sunflower Production 82

5.2. The PAM for Small-Scale Sunflower Production 85
5.3. The Template and PAM for Small-Scale Maize Production 87
5.4. The PAM for Small-Scale Maize Production 89
5.5. The Template and PAM for Medium-Scale Sunflower Production 91
5.6. The PAM for Medium-Scale Sunflower Production 93
5.7. The Template and PAM for Medium-Scale Maize Production 95
5.8. The PAM for Medium-Scale Maize Production 97
5.9. Comparison of Incentives for Sunflower to those for Maize 98
5.10. Effect of Seed Sunflower and Sunflower Producer Price Liberalisation on Sunflower Production 102
5.11. Effect of Devaluation on Sunflower Production 106
CHAPTER 6. 107
6. CONCLUSIONS AND POLICY IMPLICATIONS 107
6.1. Profitability of Sunflower 107
6.2. Comparison of Incentives for Sunflower to those for Maize 108

6.3. Efficiency of Sunflower Production in Zambia 109
6.4. Effect of Seed Sunflower and Sunflower Producer Price Liberalisation on Sunflower Production 109
6.5. The Effect of Devaluation on Sunflower Production 110
6.6. Policy Implications 111
REFERENCES 113
ANNEXES 119

LIST OF TABLES

1.1. Oil Content and Contribution of Each of Zambia's 4 Major Oilseeds to the National Oil Requirement 5

1.2. Trends in Sunflower Production and Price: 1981-90 21

1.3. Trends in Maize Production and Price: 1981-90 26

3.1. The Schematic Framework of the Policy Analysis Matrix . 43

4.1 Consumer Price Indexes and Inflation Rates for Zambia and the United States 59

4.2. FOB South Africa Sunflower Price Series 62

4.3. FOB South Africa Maize Price Series 69

5.1. The Template for Small-Scale Sunflower Production 84

5.2. The PAM for Small-Scale Sunflower Production 85

5.3. The Template for Small-Scale Maize Production 88

5.4. The PAM for Small-Scale Maize Production 89

5.5. The Template for Medium-Scale Sunflower Production 92

5.6. The PAM for Medium-Scale Sunflower Production 93

5.7. The Template for Medium-Scale Maize Production 96

5.8. The PAM for Medium-Scale Maize Production..... 97

5.9. Measures of Incentives for the 4 Categories of Production 99

5.10. Simulation of Producer Price Liberalisation into the Small-Scale Sunflower PAM 102

5.11. Simulation of Producer Price Liberalisation into the Medium-Scale Sunflower PAM 103

5.12. Simulation of Producer and Seed Price Liberalisation into the Small-Scale Sunflower PAM 104

5.13. Simulation of Producer and Seed Price Liberalisation into the Medium-Scale Sunflower PAM 105
5.14. Effect of Devaluation on Sunflower Profitability 106

LIST OF FIGURES

1.1. Location of Kalomo 3

1.2. Trend in Sunflower Production 22

1.3. Trends in Sunflower Producer Prices 23

1.4. Trend in Maize Production 27

1.5. Trends in Maize Producer Prices 28

4.1. Trend in the FOB South Africa Sunflower Price Series 63

DEDICATION

To my parents Fides and Leonard Mbita who have shown me the virtues of patience, perseverance and determination.

ABBREVIATIONS

ARMB	Agricultural Rural Marketing Board
CIF	Cost Insurance and Freight
CPIs	Consumer Price Indexes
DCUs	District Cooperative Unions
DRCR	Domestic Resource Cost Ratio
FAO	Food and Agriculture Organisation of the United Nations
GMA	Gross Margin Analysis
GMB	Grain Marketing Board
LDCs	Less Developed Countries
NAMBOARD	National Agricultural Marketing Board
NCZ	Nitrogen Chemicals of Zambia
NPCI	Nominal Protection Coefficient on Inputs
NPCO	Nominal Protection Coefficient on Output
PAM	Policy Analysis Matrix
PCUs	Provincial Cooperative Unions
POI	Premium Oil Industries
ROP	Refined Oil Products
SAP	Structural Adjustment Programme
SER	Shadow Exchange Rate
SRP	Subsidy Ratio to Producers
US$	United States dollar
ZAMSEED	Zambia Seed Company
ZCF	Zambia Cooperative Federation
ZK	Zambian Kwacha

ACKNOWLEDGEMENTS

I am indebted to my supervisors Dr. W.A. Oluoch-Kosura and Prof. O.L.E. Mbatia who tirelessly read my work and offered invaluable advice. The British Council deserves to be thanked for giving me the scholarship which covered my expenses in Kenya. Special thanks go to Dr. K. Munyinda of Department of Agriculture (HQs) who sourced funds for me when it was impossible to continue with the research due to lack of funds.

I am thankful to Julius Shawa for the comments he made on my work and the useful information he provided. The staff of the Agricultural District Office in Kalomo are thanked for their assistance during data verification. The assistance with analysis that was given by the staff of the Egerton University Research and Training in Agricultural Policy Analysis Project is greatly appreciated.

My sincere gratitude goes to my patient and inspiring husband Buumba, whose support kept me motivated to go through with the programme. I am grateful to my brothers and sisters, and friends too for their indirect contribution to the completion of this work.

Finally my gratitude goes to all the institutions and individuals who in their different ways assisted with data and information for this study. Space limitation does not allow me to list them all.

ABSTRACT

The government of Zambia has intervened in sunflower production to stimulate its production and achieve self-sufficiency. A number of interventions including the pricing and marketing policies have been used to stimulate production. However, self sufficiency has not been attained. About 62% of the country's vegetable oil requirements are still met by imports.

Existing literature highlights that there is a link between policies and low agricultural production in the developing countries. The interventions create disincentives for production. This study was undertaken to determine the incentive effects of policies on sunflower production. The other objectives were to determine the efficiency of sunflower production in Zambia and estimate the likely effects of further devaluation and of price liberalisation on sunflower production.

Using the Policy Analysis Matrix (PAM) methodology the study found that the interventions had not been conducive to attainment of self-sufficiency. Only a few agricultural marketing institutions had emerged, prices had been depressed while the provision of inputs and payment of farmers for their produce had left much to be desired. The policies had ultimately caused distortions and induced market failures creating disincentives for farmers. The study found that the sunflower producer price was depressed by 87% relative to its world market equivalent. This translated into the depression of production by 59% given the sunflower producer price elasticity of 0.68.

As compared to maize it was found that the disincentives for sunflower were greater. Not only revenue was depressed for sunflower (97% for sunflower and 92% for maize) but input provision was also worse for it. Sunflower was at an added disadvantage because maize is a staple food besides being a cash crop. Thus even if it was unprofitable maize would still be grown for food needs.

The social profitabilities for the 2 categories of sunflower production were greater than zero. They were found to be ZK20,530/HA for small-scale and ZK37,600/HA for medium-scale. This indicated that producing sunflower in Zambia was an efficient undertaking. It was therefore recommended that sunflower production should be encouraged in Zambia .

In relation to devaluation of the Kwacha and liberalisation of input and output prices, the study found that these measures were likely to induce increased sunflower production. These measures would move sunflower production from being unprofitable to profitable in private prices. It was further noted that if these changes were accompanied by better marketing services such as improved input (particularly improved seed and fertiliser) provision, sunflower production was likely to rise even more.

The study concluded that sunflower production was an efficient enterprise. However, the interventions had created disincentives for sunflower production and consequently depressed its production.

CHAPTER 1

1. INTRODUCTION AND BACKGROUND INFORMATION

For a long time in Zambia copper exports have been the major source of foreign exchange. However, the copper industry has not performed well since the mid 1970s. The export earnings have deteriorated as a result of declining real prices and demand on the world market (Shawa, 1990). Consequently the government has increasingly been placing emphasis on diversification of the export base besides attaining self sufficiency in production of major food crops and substitution of agricultural imports.

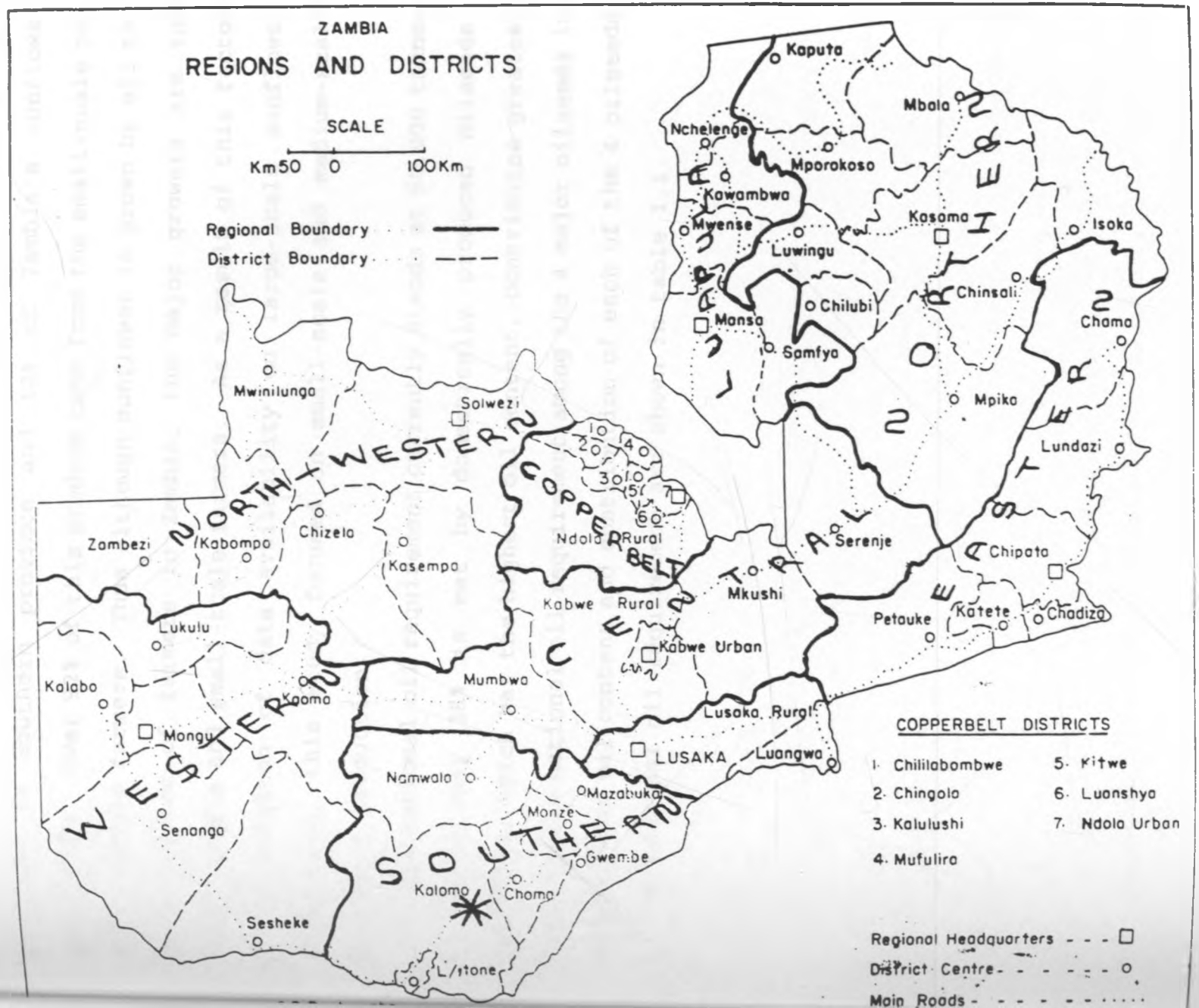
Agriculture has been identified as having the potential to contribute to these needs. Zambia has about 68 million hectares of potentially arable land but only 14 million hectares (21%) are currently cropped. The country has one rain season which starts around November and ends around April. The annual rainfall ranges from 1,270mm in the north to 760mm in the centre and less than 760mm in the south.

Oilseeds are among the major crops for which the government has had the objective of increasing production in order to achieve self-sufficiency in vegetable oil production (National Commission for Development Planning, 1989). There are 4 major oilseeds in Zambia of which sunflower is the most important. The other 3 oilseeds are soyabeans, cottonseed and groundnuts. Sunflower is grown by all the 3 categories of farmers in Zambia namely large-scale, medium-scale and small-scale. Large-scale farmers crop 20

or more hectares each, are highly mechanised and specialised, use a high level of technology and management, improved inputs and rely heavily on permanent and casual labour. Medium-scale farmers are engaged in partially mechanised mixed farming, and employ medium levels of improved inputs. Medium-scale farmers typically crop between 5 and 20 hectares. Small-scale farmers crop 5 or less hectares and are engaged in extensive draught power use. They are predominantly mixed farmers who employ low levels of improved inputs. They are those who do not qualify for the large-scale or medium-scale category (Ministry of Agriculture, 1991). Sunflower is mostly grown in the medium rainfall high potential area. This area is near the consuming centres and the railway line, has better organised extension and research facilities and farmers with more experience with animal draught power. With a population density of eleven per square kilometre, the medium rainfall area still has substantial unutilized arable land available for development (FAO, 1991).

In terms of provinces, the major sunflower growing provinces are Southern, Central and Eastern provinces. Of these provinces, Southern is the largest sunflower producer. Southern province accounted for 40% of total sunflower production while Central and Eastern province produced 30% and 23% respectively in 1990. Kalomo district in Southern province, is the largest sunflower producing district in Zambia. The location of Kalomo is shown in figure 1.1.

FIG 1.1 LOCATION OF KALOMO



There are 55 districts in the country 7 of which are in Southern province. In 1990, Kalomo accounted for 46% of the sunflower produced in Southern province and 12% of Zambia's sunflower production. Over 92% of this produce came from the small-scale and medium-scale farmers. Thus although sunflower is grown by all the 3 categories of farmers in Zambia, the major growers are the medium-scale and small-scale farmers. As a result of this factor and limitation of data availability on large-scale sunflower production, this study focused on small-scale and medium-scale sunflower production.

The national oil requirement currently stands at 50,000 tonnes of which only 38% is met by domestically produced oilseeds. Sunflower, which has the highest oil content, contributes greatest (18%) to the national oil requirement among the 4 major oilseeds in Zambia. The oil content and contribution of each of the 4 oilseeds to the national oil requirement are shown in table 1.1.

TABLE 1.1: Oil Content and Contribution of Each of Zambia's 4 Major Oilseeds to the National Oil Requirement.

Seed	Oil Content (%)	Contribution to National Oil Requirement (%)
Sunflower	40	18
Soyabean	18	16
Cotton	20	4
Groundnuts	38	-
Total		38
Shortfall		62

_ Insignificant

Source: Lubozhya and Chacko, 1991.
Data collected from Mt. Makulu Research Station, Chilanga, Zambia.

The government has used policies in an effort to stimulate oilseed production and achieve self-sufficiency. Policies change the environment within which production takes place (Ellis, 1992). They influence input and output prices, and the development and operation of marketing institutions. Policies also affect the

generation of new technologies. For example, due to the government's intervention in research, increased oil content seed sunflower has been developed. The oil content has increased from 25% in 1976 to the current level of 40% (Lubozhya and Chacko, 1991).

Government expectations from agriculture have increased since the 1970s. Agricultural production has been expected to increase and contribute to the reduction of demand for foreign exchange for imports as well as to contribute to foreign exchange earnings. However, while there has been an increase in the government expectations from agriculture since the 1970s, there have not been major changes in the policies affecting agriculture until very recently. These policies include the exchange rate, the agricultural marketing, and the pricing policy. These policies are discussed in detail in the subsections that follow.

1.1. The Marketing Policy and Evolution of Marketing Institutions

The basis of agricultural marketing policy in Zambia has been to increase production and ensure there is a market for all produce. This has resulted in government involvement in input and produce marketing. Agricultural marketing has been government controlled since the pre-independence days. The Grain Marketing Board (GMB) then purchased maize, soyabeans, sunflower and cotton. The GMB offered floor prices for these commodities. In 1964, after independence, the Agricultural Rural Marketing Board (ARMB) was set

up to serve the remote areas where the GMB could not cover the marketing costs with the revenue from sale of produce. GMB and ARMB were merged in 1969 to form the National Agricultural Marketing Board (NAMBOARD). NAMBOARD was given the monopoly of buying produce including maize, soyabeans, sunflower, cotton, fruits and vegetables. NAMBOARD also had the sole responsibility for the procurement and distribution of crop production inputs such as fertilisers, agricultural chemicals, seeds, packing materials and small implements. NAMBOARD used its rural depots to collect the produce from the farmers and the same depots were used to supply the inputs. This went on until the early 1980s when the retailing functions of NAMBOARD were transferred to the Provincial Cooperative Unions (PCUs). This led to the establishment of the PCUs in all the provinces except in Southern and Eastern provinces where they were already established. The Zambia Cooperative Federation (ZCF) was also put in place to provide administrative and technical support to the PCUs. The PCUs worked as agents for NAMBOARD. During the same period the seed supply responsibility was moved to the Zambia Seed Company (ZAMSEED), a parastatal. In 1989, NAMBOARD was dissolved and its functions were taken over by ZCF. The District Cooperative Unions (DCUs) were also created to take over marketing functions in the respective districts from the PCUs. In 1990, fertiliser importation and distribution to the provincial centres was transferred to Nitrogen Chemicals of Zambia (NCZ) another parastatal which also produces fertiliser. ZCF has been serving as an overseer of the PCUs, DCUs and the primary

cooperative societies that have developed since the advent of the cooperative scheme.

The affiliates of ZCF, that is, the cooperatives have been buying the produce and moving it to safe storage. The safe storage is made up of concrete and wooden stands, storage sheds and silos. From the storage facilities, the produce is moved to the processing points. The purchasing of most produce, including maize and sunflower has been done without grading. Farmers have been receiving the same price for any quality. Crop purchases have in some cases been financed by loans from the commercial banks while in others farmers have had to wait until the PCUs sell the produce to the processors. When loans have been obtained late or the PCUs have not been paid promptly by the processors, the farmers have received their payments late.

Marketing has been characterised by the creation of new institutions and the transfer of marketing functions from one institution to another. This has been done in an effort to make marketing more efficient. Marketing in Zambia has been characterised by inefficiencies some of which are late payments, late delivery of inputs and in some cases delivery of wrong inputs.

Currently the government is in the process of liberalising agricultural marketing as part of the Structural Adjustment Programme (SAP). The marketing of sunflower and soyabeans was partially liberalised in 1982. Marketing of all produce except maize was further liberalised in 1986. The cooperatives' role in marketing was then limited to buyer of last resort offering the

government set floor prices. The government is in the process of registering buyers of produce and a number of institutions are now engaged in fertiliser marketing. The private sector has taken up agro-chemical marketing. Companies such as Shell Chemicals, Wellcome, ICI, Growell and Chempro Zambia Limited procure and supply agro-chemicals to farmers. However, their area coverage is not as wide spread as that of the cooperative unions. In most cases farmers have to get their chemicals from the agro-chemical companies' outlets in Lusaka. Generally, there is still great involvement by the government in agricultural marketing. Many farmers especially the small-scale and medium-scale ones still depend on the cooperative unions for provision of inputs and sale of their produce.

A notable feature of agricultural marketing in Zambia is that it has tended to be biased towards maize. Maize has for example been given priority in input provision. Seed maize and the respective fertilisers have been more readily available. Loan facilities for maize inputs have also been easily available.

1.1.1 Sunflower Marketing

As stated in section 1.1, marketing of sunflower was the sole responsibility of the cooperatives until 1982 when it was partially liberalised. Other institutions were allowed to go into sunflower marketing. However, no other institutions were willing to go into sunflower marketing because the prices were still controlled.

After prices were decontrolled in 1986, Refined Oil Products (ROP) which has now been divided into ROP and Premium Oil Industries (POI) introduced a premium grade price for seed which exceeded 35% oil content. However, as Sichinga (1992) points out, these prices can only be enjoyed by farmers in Central, Copperbelt and Lusaka provinces who can deliver to these plants. Most farmers including those in Kalomo cannot deliver to POI and ROP due to logistical reasons. Additionally, although premium grade prices were based on oil content POI has been grading seed on the basis of moisture content.

Most farmers still sell their sunflower to the PCUs and DCUs at government set prices irrespective of quality. The only criteria used to determine price is the weight. As regards payment for produce the trend is that the PCUs get the sunflower from the farmers on credit. Farmers have to wait until the PCUs sell the sunflower to the processors before they can be paid. This contributes to late payment of farmers for their produce. Apart from POI and ROP which also buy sunflower directly from farmers, the other notable buyers of sunflower are the stockfeed manufacturers and small cooking oil processors. Among these are the National Milling Company and the Zambia Trading Company.

1.1.2 Maize Marketing

Maize is an important crop in Zambia. It is the country's staple food and accounts for about 60% of marketed crop output. Maize has dominated Zambia's agricultural policy, as Muwamba (1990) has noted.

Maize marketing has been further liberalised but there is still great government involvement in it. The DCUs and PCUs have been buying maize through the primary societies or directly from the farmers and moving the produce to safe storage. Crop purchases have been financed through loans obtained by the PCUs from the commercial banks. These government guaranteed loans are due before the next marketing season which starts in August. The unions repay the loans after selling the produce to the processors and getting the marketing cost reimbursement from the government. In some years, the unions have received the reimbursement late which has made them unable to repay their loans. In other years this problem has been compounded by the PCUs having carry-over stocks. This has contributed to the depletion of the unions' credit worth, delayed their acquisition of fresh loans for the subsequent seasons and resulted in late payment to farmers.

With the partial liberalisation of maize marketing in 1989, farmers were allowed to sell their maize to any buyers at a price equal or above the floor price. Those who produced more than 10,000 90kg bags were allowed to export the excess. The cooperatives became buyers of last resort even for maize. The

government started meeting only part of the cooperatives' marketing costs and passing the other part to the consumer unlike in the past when all the maize marketing costs were borne by the government. From 1991 there has been an effort by the government to get as many private institutions as possible engaged in maize marketing and completely remove the maize marketing subsidy.

Purchasing of maize by the cooperatives is done without grading. Weight is the only criteria used to determine the price.

1.1.3 Input Marketing

Availability of appropriate improved inputs is very important in production improvement. For better yields these inputs should be available in the right quantities at the right time. Fertiliser and improved seeds are some of these crucial inputs.

(a) Fertiliser

Like in most produce marketing in Zambia there has been great government involvement in fertiliser marketing. There are 2 sources of fertiliser in the country; NCZ and imports. Before 1989, when NAMBOARD was responsible for fertiliser procurement and distribution to the provincial centres, and through its agents (PCUs and DCUs) to farmers, the government paid for all the fertiliser marketing costs up to the rural depots. Between 1989 and 1991, the responsibility of fertiliser importation was

transferred to ZCF and then to NCZ. The government only paid for marketing costs up to the provincial centres then. For the intra-provincial costs it was working out an average margin which the PCUs got per bag of fertiliser. This margin was the same across the country. As expected, since this margin was a national average, it was sufficient to cover the cost of distributing fertiliser to rural depots in some provinces and inadequate for others.

Fertiliser marketing has been characterised by a number of problems which include late arrival and arrival of wrong types. Late arrival of fertilisers can partly be attributed to the logistics of importation which sometimes result in late arrival of fertilisers in the country. For the same reason, top dressing fertiliser may for example arrive earlier than basal dressing. Such problems consequently lead to farmers getting fertilisers late or/and getting the wrong fertilisers at the wrong time. Another reason why fertilisers get to the farmers late is the existence of inadequate storage facilities at the rural depots. As a result of inadequate storage facilities, fertilisers can not be delivered to the rural depots on time even when they are available in the province. The problem is aggravated with the onset of rains when many rural roads become impassable.

Fertiliser importation was liberalised in 1990 and domestic marketing is also being liberalised. While almost all the small-scale and medium-scale farmers still get their fertiliser through the cooperatives, some large-scale farmers get it directly

from NCZ while others import. There are also other non-farming individuals and institutions now engaged in fertiliser marketing as middlemen.

(b) Seed

As stated in section 1.1, ZAMSEED has been the sole supplier of seed in Zambia since the early 1980s. The parastatal company is responsible for production, processing, storage and distribution of high quality seed. Where there are shortfalls ZAMSEED imports the seed. Most of the seed is marketed through the PCUs. In the case of maize about 70% of the seed is handled by the PCUs while 20% is sold through its other agents and 10% through its retail outlet in Lusaka. ZAMSEED appoints the seed dealers. Seed sunflower is also supposed to be marketed through the same channels but its supply is erratic.

There is not much government involvement in seed marketing. The government has only been approving the ZAMSEED prices and working out the margins the PCUs should get per bag of seed.

Seed supply has not been immune to the problems of agricultural marketing. While in some cases seed has not been available altogether, there have been other problems with seed supply in Zambia. These have included limited availability of the right varieties, late arrival of seed to the rural depots and inadequate storage facilities.

1.2. Agricultural Pricing Policies

The objective of agricultural pricing policy in Zambia has been attainment of self-sufficiency in production of a number of commodities, equity among different producers and provision of affordable food to consumers. Agricultural prices have been regulated by government since independence. Before 1974, the country had a regional pricing system. However, as from 1974, uniform producer pricing has been in place for most crops. The government liberalised prices of all agricultural commodities except maize in 1986. The government continued to set prices but these prices were now acting as minimum prices. The prices set by government have been based on the weighted average total production cost for the 3 categories of farmers. The maize producer price was liberalised in 1991. Prices of agricultural inputs like fertiliser, seed and packing materials have also been regulated by government until recently.

1.2.1. Sunflower Pricing

Before 1986, when the sunflower price was still government determined, its into-mill price was the same as its farm-gate price. The prices were pan-seasonal as well as pan-territorial. The handling, transport and storage costs were met by government. The government was in this way subsidising sunflower marketing. Uniform pricing was applied to the final product (vegetable oil) as

well. This pricing system hindered the development of alternative marketing channels other than those established by the government. In 1986, the sunflower price was partially liberalised. When selling to buyers other than the PCUs the farmers were free to negotiate for prices higher than those offered by the cooperatives. The cooperatives started operating the floor prices. However, despite the possibility of getting higher prices when they sell to alternative buyers, most farmers still get the floor prices because few other buyers exist.

1.2.2 Maize Pricing

While producer prices for all crops were deregulated in 1986, the maize farm-gate and into-mill price remained equal until 1989. This discouraged other institutions from entering into maize marketing and restricted the farmers to marketing their produce through the cooperative unions. In 1989, due to the country's continued economic decline and the re-adoption of the SAP, maize pricing was partially liberalised. The government-set maize into-mill price started differing from the farm-gate price. Farmers were allowed to negotiate for prices between the farm-gate and into-mill prices when selling to buyers other than the cooperatives. Like in the case of sunflower, the cooperatives then started offering the floor prices for maize. They bought the maize at the minimum price and sold it at the government set into-mill price.

The maize producer prices have been pan-seasonal and pan-territorial. This pricing has resulted in production of maize in all the Zambian provinces and discouraged on-farm storage (Republic of Zambia, 1990).

1.2.3. Input Pricing

Input prices particularly those of seed and fertiliser have been regulated. This has been done to reduce their effect on the price of the produce on one hand and to stimulate production on the other.

(a) Fertiliser

It can be said that the fertiliser prices have been essentially controlled to keep maize prices low as 70% of Zambia's fertiliser requirements are used on maize. Zambia's annual fertiliser requirements are estimated at 250,000 metric tonnes (Republic of Zambia, 1990).

Fertiliser has been supplied to all farmers at the same price. This has been made possible by the government meeting the marketing costs and setting the marketing margin as discussed in section 1.1.3(a).

Fertiliser pricing which is incorporated in fertiliser marketing has now been liberalised. As from early 1992 fertiliser prices are no longer pan-seasonal and pan-territorial.

(b) Seed

From the time of its establishment it was the policy of ZAMSEED to make at least 8% profit. The company was set up as a commercial enterprise. However like in the other agricultural prices in Zambia, the government has had a hand in seed pricing. The government was approving the prices at which ZAMSEED, the sole seed supplier in the country until 1991, was supplying the seed. The government was also determining the retail margin seed retailers such as the PCUs should get for distributing seed in their respective provinces. Seed prices were thus pan-territorial until 1991. These prices were also pan-seasonal. For some provinces the government set retail margin was not enough to cover the handling and transportation costs and contribute to the seed dealers' profits. This may explain why some seeds were not supplied to primary societies in some districts. They may have been unprofitable to deal in. With liberalisation of the seed market since 1991, seed prices now differ with place and dealer. ZAMSEED now comes up with a recommended seed retail price which the dealers are at liberty to adopt or sell at other appropriate prices. The dealers can now recover all their marketing costs because they are allowed to add any margin to the wholesale price. The wholesale price of seed is still the same at all ZAMSEED depots. ZAMSEED has 5 depots. These are located at Lusaka, Mazabuka, Chipata, Mkushi and Kapiri Mposhi. It is likely that seed availability will improve with price liberalisation.

1.3. The Exchange Rate Policy

Zambia had a relatively strong currency until the 1970s when the terms of trade started turning against it. The country then maintained a fixed exchange rate. In the early 1980s when the country adopted a restructuring program due to the financial and economic problems, it started devaluing its currency gradually through a crawling peg. Due to the continued economic decline, the country in 1985 adopted a foreign exchange auctioning system. This went on until 1987. During the auction period foreign exchange was allocated and its price was determined through auctioning. When auctioning was abandoned, the government again started fixing the exchange rate. A two-window system was established where one window sold foreign exchange at what was called the official rate and the other window sold at the market rate. This system has since been abandoned. The exchange rate is now market determined. Unlike in the past when the official exchange rate was sometimes half the black market rate, the difference between the 2 rates is now small. Additionally, foreign exchange is easily obtainable as long as it is less than US$2000.

1.4. Problem Statement

Despite the government's objective to stimulate oilseed production, oilseed production has remained low and that of sunflower has been declining. Consequently, Zambia has remained an

importer of crude vegetable oil and oilseeds. The country requires about 16 million United States Dollars per year for vegetable oil imports to meet the short-fall (Lubozhya and Chacko, 1991). The decline in sunflower production has been occurring inspite of the high potential of the major sunflower growing area, the development of high yielding varieties through research, extension efforts made by the government and the setting of input and output (producer) prices. Sunflower production in Zambia has been declining since 1984 as exemplified by table 1.2 and figure 1.2.

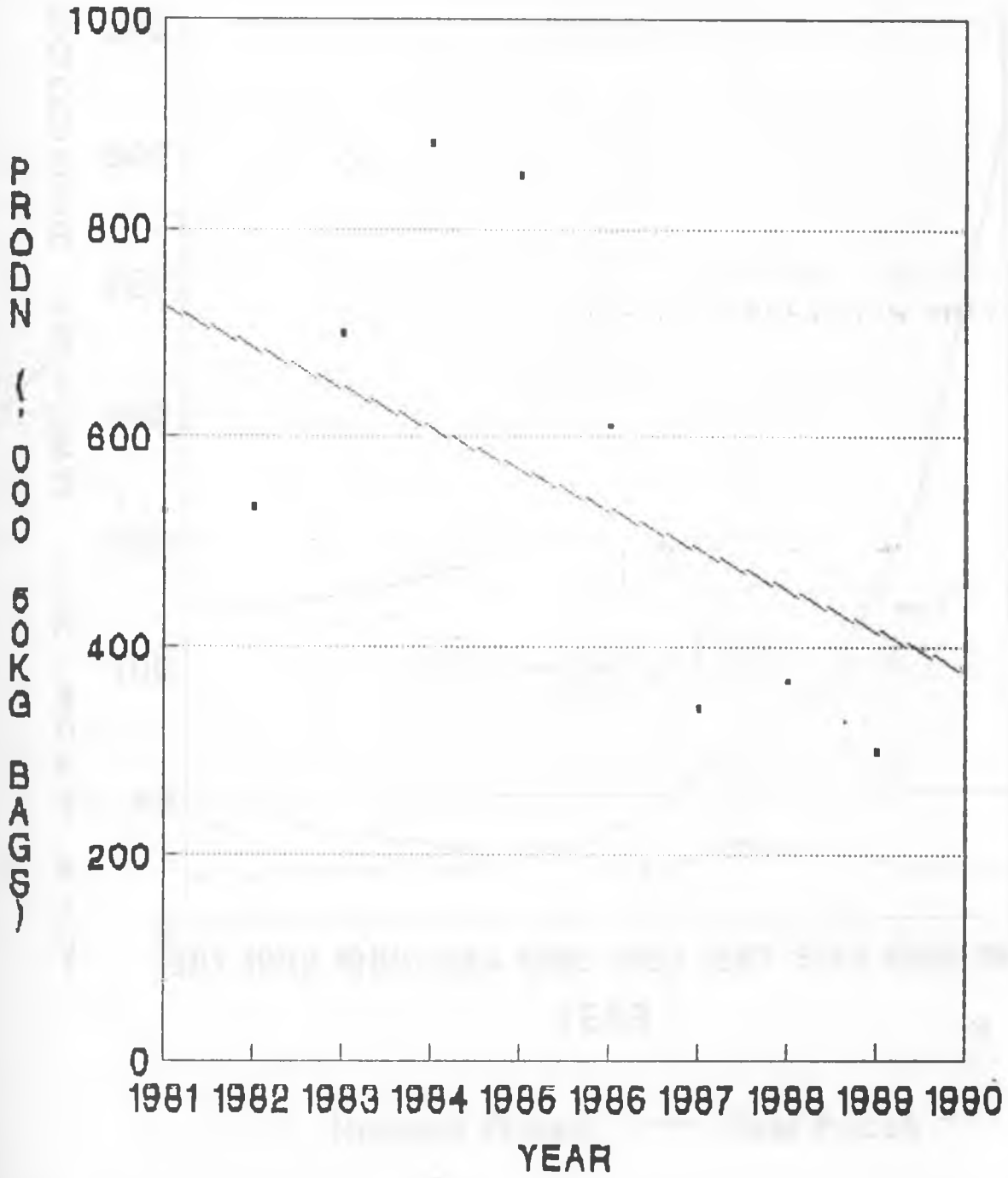
Table 1.2: Trends in Sunflower Production and Price 1981-90

YEAR	PRODUCTION (50kg bags)	CHANGE (%)	NOMINAL PRICE (Kwacha/bag)	CHANGE (%)	REAL PRICE[a/] (Kwacha/Bag)
1981	529,397	-	17.60	-	39.02
1982	534,620	0.9	20.75	17.9	40.93
1983	698,609	30.7	21.50	3.6	35.47
1984	860,167	23.1	21.50	0	29.53
1985	848,474	-1.4	27.88	29.7	27.88
1986	611,533	-27.9	41.95	50.5	18.01
1987	340,018	-44.4	70.00	66.9	30.76
1988	368,085	8.2	90.00	28.6	25.67
1989	300,663	-18.3	162.00	80.0	20.24
1990	399,313	32.8	311.00	92.0	18.54

Source: Compiled from various Statistics Bulletins and data collected from the Ministry of Agriculture, Zambia.

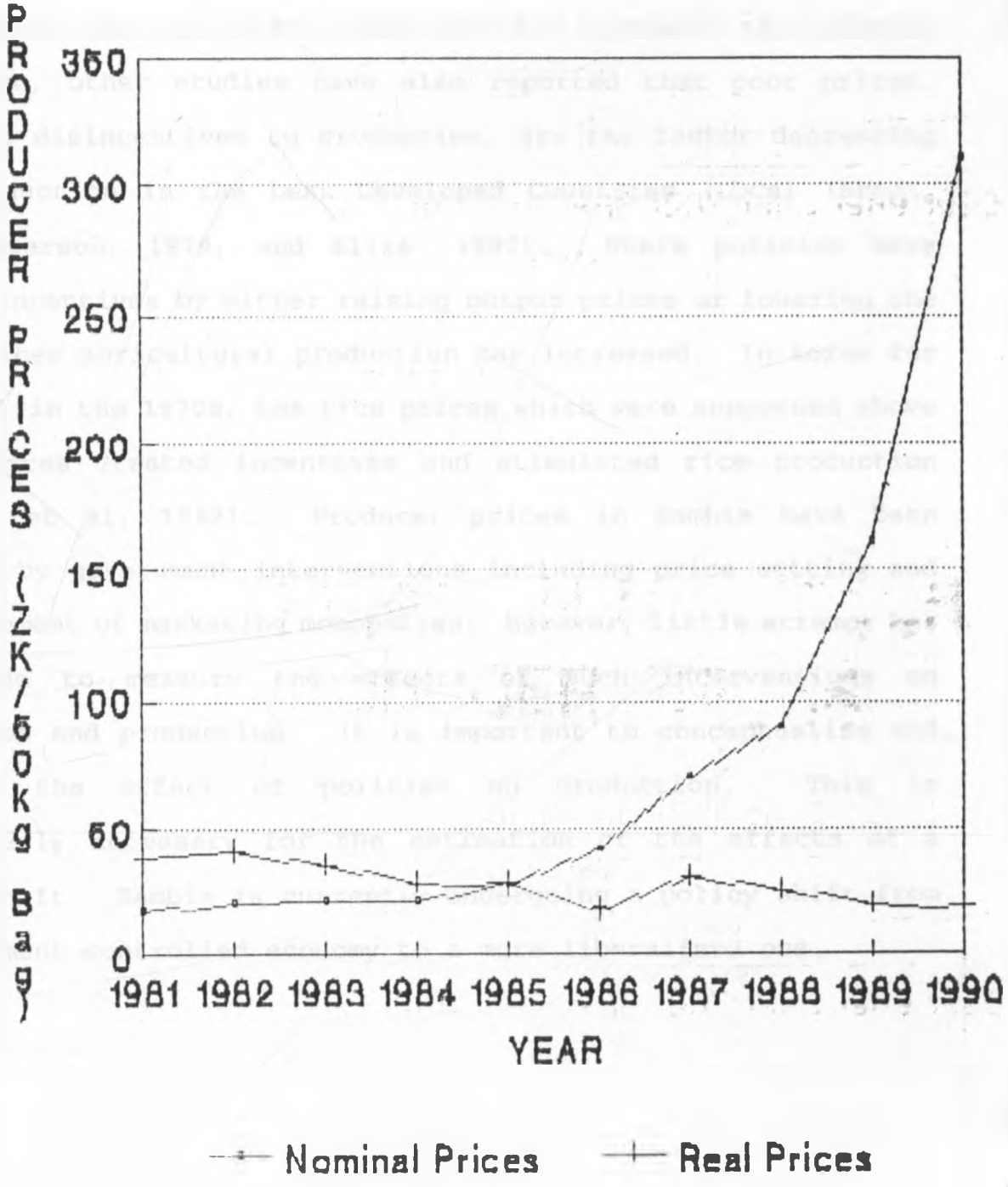
[a/] CPIs (1985 = 100) used to deflate the nominal prices.

FIG. 1.2: TREND IN SUNFLOWER PRODUCTION



SOURCE: DRAWN FROM TABLE 1.2

FIG. 1.3: TRENDS IN S/FLOWER PRODUCER PRICES



SOURCE: DRAWN FROM TABLE 1.2.

It has declined from 860,167, 50kg bags in 1984 to 399,313 bags in 1990, a decline of about 54%. The decline in sunflower production has partly been attributed to poor producer prices (Sichinga, 1992). The sunflower real producer price has been declining as shown in table 1.2 and figure 1.3. It has declined from ZK40.93 in 1982 to ZK18.54 in 1990. Although remunerative prices are necessary but not sufficient conditions for increased agricultural production, other studies have also reported that poor prices, which are disincentives to production, are the factor depressing crop production in the Less Developed Countries (LDCs) (Brown, 1978, Peterson, 1979, and Ellis, 1992). Where policies have created incentives by either raising output prices or lowering the input prices agricultural production has increased. In Korea for instance, in the 1970s, the rice prices which were supported above world prices created incentives and stimulated rice production (Tolley, et al, 1982). Producer prices in Zambia have been effected by government interventions including price setting and establishment of marketing monopolies. However, little attempt has been made to measure the effects of such interventions on incentives and production. It is important to conceptualise and quantify the effect of policies on production. This is particularly necessary for the estimation of the effects of a policy shift. Zambia is currently undergoing a policy shift from a government controlled economy to a more liberalised one.

Sunflower competes with maize for production resources. The price and production trends of maize over the same period (1981-90) are shown in Table 1.3. Figures 1.4 and 1.5 also show the trends in maize production and maize producer prices respectively. As tables 1.2 and 1.3 show, while maize production increased by 9.6% in 1986 production of sunflower declined in the same year by 27.8%. In 1988, after a drought year of 1987, sunflower production increased by only 8.2% while maize production increased by 83.1%. In 1990, sunflower production increased by 32% but maize production declined by 41%.

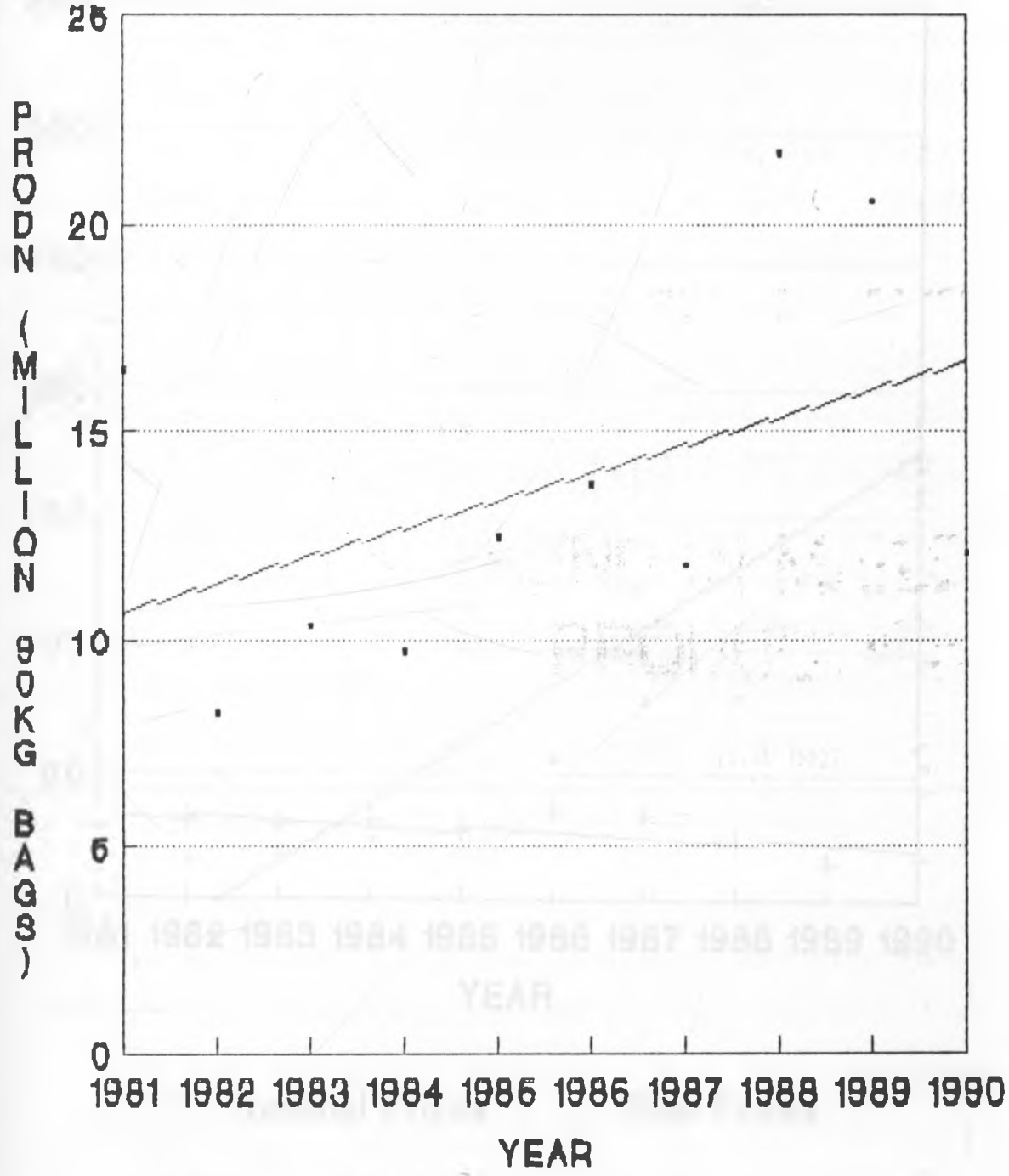
Table 1.3: Trends in Maize Production and Price 1981-1990

YEAR	PRODUCTION (Million 90kg bags)	CHANGE (%)	NOMINAL PRICE (Kwacha/bag)	CHANGE (%)	REAL PRICE[b/] (Kwacha/bag)
1981	16.5	-	13.50	-	29.93
1982	8.2	-50.3	16.00	18.5	31.56
1983	10.4	26.8	18.30	14.4	30.20
1984	9.7	-6.7	24.50	33.9	33.65
1985	12.5	28.9	28.32	15.6	28.32
1986	13.7	9.6	55.00	94.2	35.53
1987	11.8	-13.9	78.00	41.8	34.27
1988	21.6	83.1	80.00	2.6	22.82
1989	20.5	-5.1	125.00	56.2	15.62
1990	12.1	-41.0	295.20	136.2	17.60

Source: Compiled from various Agricultural Statistics Bulletins of the Ministry of Agriculture, Zambia.

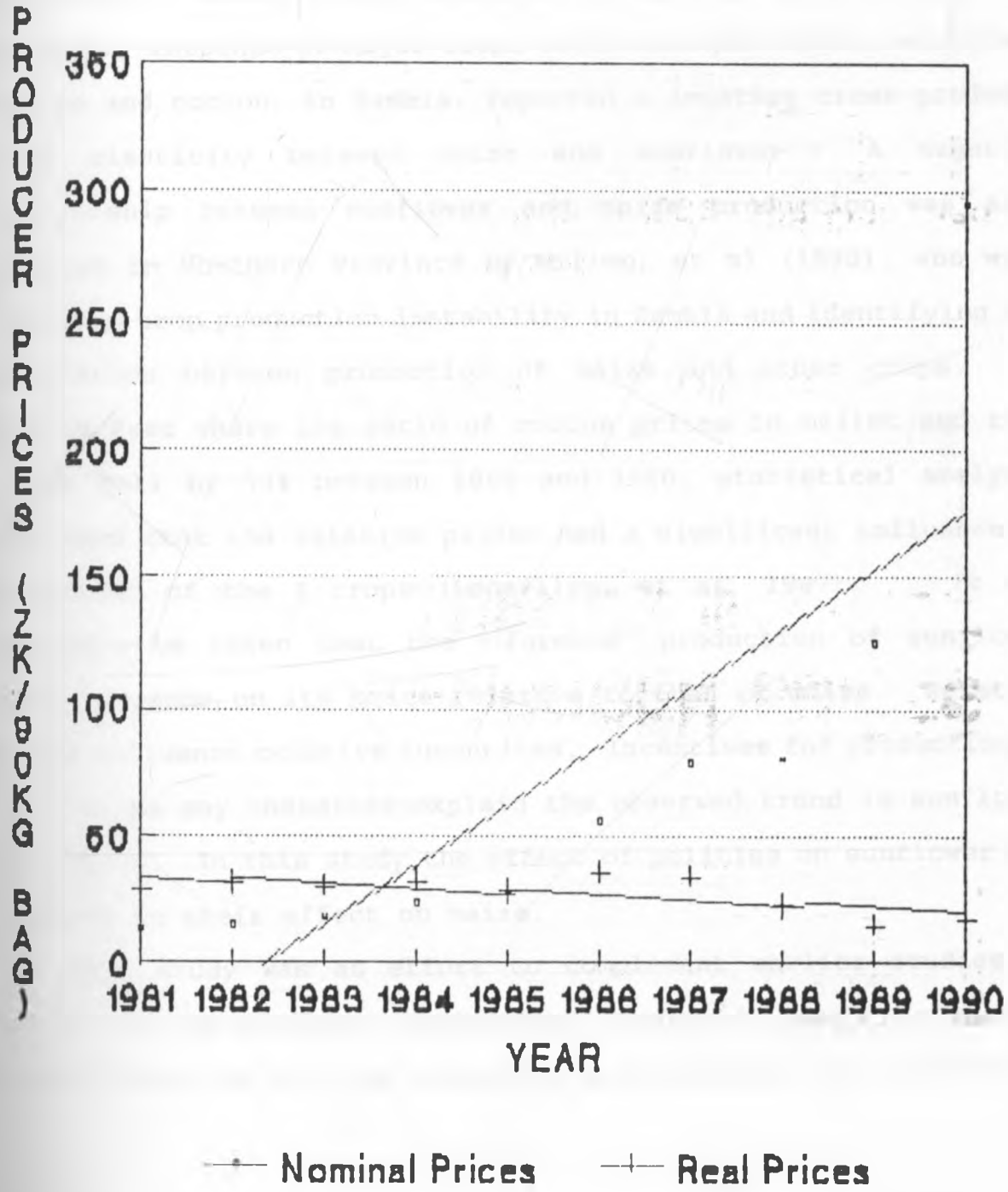
[b\] CPIs (1985 = 100) used to deflate the nominal prices.

FIG. 1.4: TREND IN MAIZE PRODUCTION



SOURCE: DRAWN FROM TABLE 1.3

FIG. 1.5: TRENDS IN MAIZE PRODUCER PRICES



SOURCE: DRAWN FROM TABLE 1.3.

Maize and sunflower have been subjected to the same policy objectives of self-sufficiency and low consumer prices. As farmers are concerned with maximisation of income besides food consumption maximisation, and maize is grown as both a cash and food crop, there is a possibility that maize and sunflower act as substitute cash crops. Mwansa, (1992) who used acreage equations to estimate the supply response of major crops which included maize, sunflower tobacco and cotton, in Zambia, reported a negative cross producer price elasticity between maize and sunflower. A negative relationship between sunflower and maize production was also reported in Southern Province by Milimo, et al (1990), who were measuring crop production instability in Zambia and identifying the correlation between production of maize and other crops. In Burkina Faso where the ratio of cotton prices to millet and rice prices fell by 50% between 1960 and 1980, statistical analysis confirmed that the relative prices had a significant influence on production of the 3 crops (Lecaillon, et al, 1987). It can therefore be taken that the farmers' production of sunflower partly depends on its price relative to that of maize. Relative prices influence relative incentives. Incentives for production of the 2 crops may therefore explain the observed trend in sunflower production. In this study the effect of policies on sunflower was compared to their effect on maize.

This study was an effort to complement earlier studies in explaining low sunflower production. The study sought to do this by analyzing the pricing, marketing and exchange rate policies as

they relate to sunflower production. It was an effort to analyze the effects of the policies on sunflower producer incentives. It went further and analyzed the efficiency of sunflower production in Zambia. This was expected to shed light on whether with the implementation of some of the SAP measures Zambia would become more dependent on imported sunflower and crude vegetable oil or it would attain self-sufficiency. With imminent foreign exchange rate, domestic and foreign trade liberalisation, there was need to know what effects the measures would have on sunflower production.

1.5. Objectives

The general objective of this study was to undertake an economic analysis of sunflower production in Zambia. The specific objectives were:-

(a) To determine the private and social profitability of sunflower for the small-scale and medium-scale farms.

(b) To determine the incentive effects of the government's policies on sunflower production as compared to maize production for the 2 categories of farms.

(c) To determine the efficiency of sunflower production in Zambia.

(d) To determine the effects of domestic currency devaluation and of sunflower input (seed) and producer price liberalisation on sunflower production.

1.6. Hypotheses

(i) H_0: Sunflower production in Zambia is not profitable for small-scale and medium-scale farms.

H_1: Sunflower production in Zambia is profitable for the 2 categories of farms.

(ii) H_0: The government's pricing policy has not created incentives for sunflower production for small-scale and medium-scale farms.

H_1: The government's pricing policy has created incentives for sunflower production for the 2 categories of farms.

(iii) H_0: The government's pricing policy has created the same incentives for sunflower and maize for the small-scale and medium-scale farms.

H_1: The government's pricing policy has created greater incentives for maize than for sunflower for the 2 categories of farms.

(iv) H_0: Zambia is not efficient in the production of sunflower.

H_1: Zambia is efficient in the production of sunflower.

This chapter introduced the study and gave the background information. The chapter that follows reviews the literature relevant to this study.

CHAPTER 2.

2. LITERATURE REVIEW

The lack of incentives for agricultural production in Africa is largely attributed to government intervention in food markets (Clay, 1981). Policies regulate price and commodity flows. Although policies can be used to overcome constraints in the economy, policies themselves sometimes create constraints which hinder the attainment of the government's objectives. Policies can be used to break market failures but they can also create market failures. Such outcomes are especially likely with policies that have conflicting objectives.

While pricing policy is an instrument for creating incentives, it is also an instrument for redistributing income (Tolley, et al, 1982). Unless consumption is subsidised, high food prices redistribute income against consumers and harm mostly the poor as these spend a greater proportion of their income on food. Where government has conflicting policy objectives such as self-sufficiency and cheap food for consumers, the pricing policy may produce disincentives for farmers. It may result in poor prices as has been reported for maize in Zambia. Using the Policy Analysis Matrix (PAM) methodology, Banda, et al, (1992) did an analysis of the effect of the price policy on maize production in Zambia. In their analysis, it was found that the pricing policy depressed the maize producer price and taxed fuel relative to their respective world market equivalents.

This study extended the analysis of the effect of policies to sunflower another important crop. In this study too, the PAM was used to analyze the effects of policies on sunflower production. The PAM is an approach to policy analysis which makes possible the conceptualisation and quantification of effects of current policy and the impact of future policy from available data (Sellen, 1992). The PAM methodology was adopted because it shows explicitly the effect of policy on input and output prices. By so doing the PAM indicates the effect of policies on incentives. Given the effect of policies on input and output prices, the effect of policies on production can be estimated by incorporating the elasticities. For example, the nominal protection coefficient on output could indicate that the observed output price was only a small fraction of what it would be without policies. The difference between 100 and the nominal protection coefficient on output (expressed as a percentage) would then give the percentage by which the output price was depressed by the policies. Multiplying this percentage depression of the output price by the output price elasticity would give the percentage depression of production by policies.

Due to its simple framework which shows profitability and divergences, the PAM results can easily be understood. The PAM allows communication of results and recommendations in a simple conceptual framework that facilitates understanding and acceptance by policy makers (Sellen, 1992). The PAM results serve as inputs into policy debates. PAM results can also be enhanced by the improvement in the quantity and quality of data. Another positive

attribute of the PAM is that it allows identification of information gaps, besides being a way of organising existing knowledge about agriculture.

The major limitation in the application of the PAM is determination of social values of inputs and outputs. Social valuation requires specific data which may be lacking in developing countries such as Zambia. Therefore, various assumptions have to be made and empirical estimates of social values are approximations. However, data limitations need not totally discourage social valuation. If the analyst provides enough information on the procedures used to estimate social values,

subsequent studies can improve on the results when data availability improves (Monke and Pearson, 1989).

Social valuation is important in the determination of the effect of policies. While analysis in private prices may show that a pricing policy is beneficial, analysis in social prices may show that the policy is non-beneficial to the economy as a whole. Analysis in private prices may show that a pricing policy that raises the producer price and lowers input prices is beneficial in that it raises farmers' profits and domestic production, and lowers imports. On the other hand, analysis in social prices (which are efficient prices) may show that the pricing policy is non-beneficial in that domestic production is more costly than obtaining the good from the world markets. If the good may be obtained more cheaply from the world markets, then the value of resources saved from lowered imports will be less than the value of

resources used to produce the good domestically leading to a net loss to society (Ellis, 1992). The resources saved from lowered imports will be less than the resources used to substitute them.

Like market failures, policies cause domestic prices to deviate from world market prices. According to international trade theory, world market prices are the efficient prices which lead to maximisation of national income. Therefore, where domestic prices deviate from the equivalent prevailing in world markets, there are inefficiencies in the allocation of resources and national income is reduced. Prices provide signals which guide the farmer's production decisions hence the farmer ends up getting the wrong signals when the prices are inefficient. The poor prices through their influence on income per hectare act as a disincentive on production and hinder the attainment of self-sufficiency which in the case of Zambia has been the declared government objective. This relationship between policies, prices and agricultural performance has been highlighted by Sharpley (1986) who has pointed out that due to the pricing policies in Africa, official prices for food crops are for various reasons set below market levels. In this study the world market equivalent prices were used as efficiency prices. These prices were incorporated in the estimation of the incentive effects of policies and the efficiency of sunflower production in Zambia.

Pricing policies effect income transfers between consumers and producers. For example, when producer prices of food crops are lowered, income is transferred from the producers to the consumers

unless the government subsidises production. As long as farmers are price responsive lower prices will reduce production. Rice production in Bangladesh declined in 1977 because of low prices (Tolley, et al, 1982). In Tanzania, a policy of self-sufficiency and import substitution resulted in lower than international prices for maize and rice during the 1960s and 1970s (Hayami and Ruttan, 1985). There was a transfer of incomes from producers to consumers and Tanzania's comparative advantage in maize and rice production was eroded. In its examination of the incentive effects of the policies this study measured the transfers, to and from producers, resulting from policies.

Though the government may have the same objective of stimulating production for a number of commodities, the set prices may still make some enterprises more profitable than others. Some enterprises may thus get more incentives than others. In his study to analyze the prospects of expanding cotton exports from Zambia, Shawa (1990) found that maize production was financially and economically more profitable than cotton. Maize thus had greater prospects for production expansion than cotton despite the government's objective of increasing production for both crops. Shawa pointed out that the Nominal Protection Coefficient on Output (NPCO) and the Effective Protection Coefficient (EPC) are some of the indicators of policy incentives. Monke and Pearson (1989) used the NPCO and EPC to analyze the incentive effects of policies affecting output and tradable input prices in the Portuguese wheat system. The NPC was also used by Jaeger and Humphreys (1988) to

assess the level of incentives for principle export commodities from thirty African countries. The measures of policy incentives are useful in understanding and explaining trends in crop production. Shawa (1990) also recognised the need to ascertain comparative advantage and used the Domestic Resource Cost Ratio (DRCR) to measure it. The NPCO, EPC and DRCR (which are discussed further in section 3.4) compare revenue in private prices to revenue in efficient prices, value added in private prices to value added in efficient prices, and measure the adequacy of value added in efficient prices to cover the domestic factor costs respectively. These indicators can easily be computed from entries in the PAM. They were thus among the measures that were used to determine comparative advantage and the incentive effects of policies for sunflower and maize in this study.

Policy analysis is crucial in determining the effect of economic policies on agricultural production. Tolley, et al, (1982) has pointed out that inadequate attention is paid to the effect of policies in developing countries. In most third world countries the link between macro policies and the farmers' responses is virtually unknown (Fox, et al, 1992). Knowledge of the effect of policies and its link to production could lead to more effective intervention to achieve the desired objectives. In Zambia sunflower production has been undertaken under various policy determined conditions and its production has remained low. It has actually been declining. However, very few studies that have been carried out consider the effects of policies nor

explicitly relate the trend in sunflower production to policies. Nevertheless, it should be realised, for example, that it is because of government policies that there are only a few produce buyers and most farmers sell to these, usually at the floor prices. For a long time prices have been controlled, exchange rates set by government, and there have been only a few institutions engaged in marketing of agricultural inputs and produce.

As stated in the paragraph above, very few studies that have been conducted in Zambia bring out the link between policies and agricultural performance. Clements (1989) did some work to come up with guidelines for determining economic costs and returns for Zambian crops. He came up with crop budgets showing both financial and economic profitability. Clements stopped at determining economic and financial profitability. His work did not involve explaining any scenario. The study did not explicitly relate the profitabilities to the policies. It did not explain why the profitability levels were the way they were. Additionally, the work did not relate the profitabilities to the production levels nor the production of one crop to another. This study, examined the link between policies and sunflower production. It analyzed the relationship of policies to agricultural marketing, prices, profitabilities and ultimately to production. The study went further and related sunflower production to production of maize.

Another of the studies that have been undertaken to analyze agricultural production in Zambia is Sichinga's (1992) work. The study was done in Mumbwa district to analyze the factors

contributing to the decline in sunflower production. The decline was attributed to the low producer price, poor marketing arrangements, use of poor quality seed and weak linkage between farmers, research and extension among other factors. Sichinga's approach to the problem was micro economic biased. While appreciating this approach, it should also be noted that incorporation of macro economic variables is equally important. It is important for example to know the effect of policies on prices and marketing arrangements. The prices may be considered low domestically but could be high when compared to world market prices. The crop may just be uncompetitive to produce domestically. Knowledge of the effects of policies becomes particularly important when significant changes in policies are eminent. This is applicable to the Zambian situation where a major policy reform is underway. Among other changes, there is liberalisation of domestic and foreign trade going on. World market prices may push sunflower prices further down or up depending on their current relative level. It may be that the country has just been wasting resources by engaging in sunflower production. Muhindi, et al (1992) did an analysis of cotton production in Busia district in Kenya using the PAM and found that cotton production in Kenya was efficient (not a waste of resources) although its private profitability was low. The study found that with output price liberalisation private profitability would increase and encourage farmers to intensify cotton production. The study recommended that Kenya should continue producing cotton as it

was efficient. It is relevant to know what the impact of the new policies will be so that the necessary precautions can be taken. This study analyzed what the effect of policies has been and also estimated the likely impact of further devaluation and of input and output price liberalisation.

CHAPTER 3.

3. METHODOLOGY

Among the methodologies used to measure the effects of agricultural price intervention on incentives are Gross Margin Analysis (GMA) and the Policy Analysis Matrix (PAM). Both are based on farm budgets. In GMA only the observed prices are used and the effects of the policy are determined on the basis of gross margin which is defined as total revenue less total variable costs. GMA does not give information on how the observed prices compare with reference points such as border prices (efficiency prices). It thus does not show explicitly the effect of policies on input and output prices and the transfers that result.

Details about the PAM are discussed in the section that follows. These include the theoretical foundation of the PAM, its components, and how they are calculated.

3.1. The Theoretical Foundation of the Policy Analysis Matrix.

The PAM methodology which has been developed and applied by Monke and Pearson (1989) is like GMA based on farm budgets. However, PAM analysis is based on the concept of economic profit, that is the difference between total revenue and total costs. According to micro economics, growth is a process of seeking and realising positive economic profit. The PAM analyses the various components of economic profit and how they contribute to it. The

PAM can thus lead to public intervention that assists economic growth. The PAM basically consists of 3 rows and 4 columns. The columns are headed revenue, tradable input costs, domestic factor costs and profit. A diagrammatic representation of the PAM is shown in table 3.1.

Table 3.1: The Schematic Framework of the Policy Analysis Matrix (PAM)

	REVENUE	COSTS		PROFITS
		Tradable inputs	Domestic factors	
Private prices	A	B	C	D
Social prices	E	F	G	H
Effects of divergences	I	J	K	L

Source: Monke and Pearson, 1989.

The first row of the PAM gives revenue, tradable input costs, domestic factor costs and profit in private prices. In this row the relevant prices are the observed market prices. The letter A is used to represent revenue in private prices. Revenue is

obtained by multiplying quantity with price. In this study observed per unit output price was multiplied by yield per hectare to obtain revenue per hectare. The letter B refers to the tradable input costs. The tradable inputs are those which are available in world markets and represent potential imports or exports (Sellen, 1992). The domestic factor costs are costs of inputs which are usually available in domestic markets only. These include costs of land, labour and capital. The domestic factor costs are represented by the letter C. Private profit is denoted by the letter D and is defined as A less (B+C). Private profitability indicates the competitiveness of the activity. If for a given crop such as sunflower private profitability is positive, then farmers of sunflower are earning super-normal profits and there should be expansion in sunflower production unless there are constraints in area, or substitute crops are more privately profitable.

The second row gives revenue (E), tradable input costs (F), domestic factor costs (G) and profitability (H) all measured in social prices. Social profitability is calculated in a way similar to the calculation of private profitability as E less (F+G). Social profitability is a measure of comparative advantage or efficiency of an activity because revenue and costs are calculated in prices that reflect opportunity costs or scarcity values.

The third row in the PAM gives the effects of divergences. The effects of divergences represent the effects of policy and market failure. The divergences are calculated as difference between private and social values (Monke and Pearson, 1989). The

divergences which are calculated for revenue, tradable input costs and domestic factor costs and are denoted by the letters I, J and K respectively. Divergences are a measure of transfers, to and from producers, resulting from deviation from efficiency values. They are thus measures of incentives. A positive (I) is an indication of a transfer of income to producers while positive (J) and (K) are indicators of transfer of income from producers. Positive (J) and (K) indicate that inputs cost more as a result of divergences. They are signs of disincentives. The aggregate effect of divergences on incentives is represented by L and can be obtained as the difference between private and social profitability or as the sum of effects from product and factor markets, that is, I less (J+K).

Profitabilities (private and social) and divergences constitute the 2 identities of the PAM. The identities of the PAM are useful in determining whether the activity is profitable due to the support of policy or because of natural comparative advantage. If the activity is profitable due to the support of policy it will be socially unprofitable (H<0) but privately profitable and hence the producer will receive incentives. The net transfer (L) will be positive. If the activity is naturally competitive the social profits will be positive (H>0). If the activity is unprofitable due to the distorting policy it will be socially profitable (H>0) but privately unprofitable. The net transfer will be negative.

As noted in the above discussion of the PAM, the PAM approach to policy analysis goes further and considers efficiency prices apart from observed prices. The PAM makes use of social values as reference points. Calculation of the social revenue and cost elements in the PAM hinges on international trade theory. Parity prices, which are adjusted world market prices, are used as efficiency prices for tradables. According to international trade theory, national income is maximised when domestic prices equal world prices as this enables the economy to exhaust potential gains from trade. The world market prices of importables provide the opportunity costs of domestic production of those commodities. Although world market prices are themselves distorted as a result of the absence of free world trade, they are the best available for use in such an analysis. These prices would prevail if there were no distortions in the domestic economy. International market prices determine the domestic prices of internationally traded commodities when there is no intervention. Policies therefore cause divergences between domestic and the underlying world market prices. Comparison of parity prices with domestic prices provides estimates of transfers which result from departures from free trade. By using parity prices as reference points, the PAM also makes the determination of comparative advantage possible.

3.2. Data Requirements

PAM analysis of commodities at farm level requires crop budgets. These should give data on output and on each of the inputs used to produce the output. For the analysis in private prices the actual prices farmers receive for their produce and pay for the inputs are used.

For the analysis in social prices world market prices, foreign exchange rates, transport costs, tariff rates and knowledge of the quality of produce are required to estimate the values of tradables. To estimate the social values of the non-tradables data on their composition is required so that they can be decomposed into tradables and domestic factors before their social values are obtained. Knowledge of the domestic markets is necessary for the estimation of the social values of domestic factors. The analyst should get data on observed interest rates, inflation rates, wages and taxes on wages.

The crop budgets used for the analysis can either be those already constructed or where they are not available data should be collected for their construction. Where budgets prepared by other institutions are used surveys should be undertaken to verify and modify the budget data where necessary.

3.3. Data Sources and Collection

In this study crop budgets for maize and sunflower for small-scale and medium-scale farms were collected from the Planning Division of the Ministry of Agriculture Food and Fisheries (MAFF) to construct the PAMs. All the budgets collected were for the 1989/90 season. The season refers to the 1989 planting and the 1990 harvest period. This period is referred to as 1990 in this study.

As the budgets represented secondary data, interviews had to be held with experienced people to verify them. Interviews were held with the people who used to prepare crop budgets. The Planning Division has stopped preparing crop budgets because the government no longer sets crop producer prices. From the interviews, it was learnt that budgets were based on a study which was done in 1987 to estimate production costs of major crops in Zambia. To ensure that cost estimates were up to date, surveys were held each year. These surveys provided latest information on input usage and costs.

To verify the information in the crop budgets on input usage and the prices, interviews were held with the 2 categories of farmers of sunflower and maize in Kalomo district. The farmers, were identified with the help of the District Agricultural Officer (DAO) and the camp officers. Before the farmers were interviewed, interviews were held with the extension officers. Ten farmers were targeted from each category. However, other farmers were also

present during the interviews. This was done to get the general impression about these categories of farmers and not specific farmers.

The import prices necessary for the calculation of import parity prices were collected from both parastatal and private companies. The data was obtained from institutions that import seeds, packing materials, lubricants, diesel and fertilisers. Where the prices were not available domestically, the South African export prices were collected. South African export prices were used in this study because South Africa is one of Zambia's major sources of imports. It accounted for 17% of the imports in 1990. Additionally, data on transport charges from South Africa to Lusaka was available.

The exchange rates were obtained from the Bank of Zambia while consumer price indexes and interest rates were collected from the Central Statistical Office. Data on oil content of sunflower was obtained from Premium Oil Industries and ZAMSEED. Data on railway transport charges from Lusaka to Kalomo was also collected. This was used to adjust the CIF_{Lusaka} prices for internal transport costs and to calculate the social transport costs.

3.4. Theoretical Analysis

World market prices are used in parity pricing. These prices are first multiplied by the shadow exchange rate before other adjustments are made. Since the prices may be available for ports

distant from the place (Kalomo) on which the analysis is based, the world prices are adjusted for handling and transport costs to the location of interest. The quality of the commodity in the world market may also be different from the commodity in the domestic market. To ensure that the parity price relates to the domestic commodity as closely as possible, adjustment for quality is made to the world market price. In this study oil content was used to adjust for quality of sunflower. This procedure of getting import parity prices is expressed in equation form as:-

$$P_x = (P_{cif} \times SER)QAF + IHT$$

where:-

P_x = Import parity price for commodity x at Kalomo.

P_{cif} = Cost, Insurance and Freight, per unit of commodity x at border point (Lusaka).

SER = Shadow foreign exchange rate.

QAF = Quality Adjusting Factor.

IHT = Internal Handling and Transport costs, that is, from the CIF point (Lusaka) to Kalomo.

Parity prices can only be used as efficient prices for tradables. For non-tradable costs such as internal handling and transport costs, their efficient values were obtained by first decomposing the non-tradable costs into components of tradables, labour and capital. This procedure has been used by Mukumbu, et al, (1990) in a study to estimate social prices for the analysis of Kenyan agricultural commodity systems. The social values of each

of the 3 components were then computed. After this was done, the 3 social values were summed to get the social value of the non-tradable. The social value of the tradable component of the non-tradable was obtained by multiplying its private value by the ratio of the parity price of the main item in the tradable to the private price of the main item in the tradable. This procedure is expressed in equation form as:-

$$SP_t = PP_t(PRP_m + PP_m)$$

where:-

SP_t = Social price of tradable component.

PP_t = Private price of tradable component.

PRP_m = Parity price (social value) of the main item in the tradable component.

PP_m = Private price of the main item in the tradable component.

The social value of capital which is a domestic factor was computed using the real interest rate. For skilled labour the social cost was obtained by removing social security contributions. As for farm labour which is unskilled labour, the private cost of labour was also used as its social cost. This was done because it was discovered that the price of labour per hour was the same for all crops. Additionally, unskilled farm labour engaged in the production of one crop, was more likely to move to the production of another crop (such as from sunflower to maize) than to move to mining for example. The price of labour in producing one crop

thus provided the opportunity cost of labour in producing another crop. As the price of labour per hour was the same for all crops, its private price was equal to its social price. Other factors considered in using the same value for the private and social cost of farm labour are discussed in section 4.1.9. As regards the social value of land the real interest rate was charged to the value of land to represent the opportunity cost of using land for sunflower production. Once the social prices were determined, the divergencies were calculated for the two categories of maize and sunflower production. The profitabilities of each category for each of the crops were also determined.

For comparison of identical outputs such as maize from different categories of farmers, competitiveness, efficiency and the extent of policy transfers can be obtained directly from the identities in the PAM, that is, from the profitabilities and the divergences. However, when comparing different outputs such as maize and sunflower ratios are required because the 2 commodities are produced differently using different inputs and their output prices are different (Monke and Pearson, 1989).

The DRCRs were calculated to determine how efficient sunflower production in Zambia was. The DRCR enables the determination of how competitive a domestically grown crop is on the world market. It gives an indication of whether the value added in social prices is less or greater than domestic factor costs (Monke and Pearson, 1989). If the value added is less than the factor costs, then the DRCR will be greater than one implying that the domestically

produced crop such as sunflower is socially unprofitable. It would mean that sunflower was produced at social costs that exceed the cost of importing. The value of domestic resources used to save foreign exchange was more than the value of foreign exchange saved. The Domestic Resource Cost Ratio is given by the formula:-

$$DRCR = \frac{G}{E - F}$$

where:-

G = Domestic factor costs in social prices.

E-F = Value added in social prices

If DRCR < 1, then domestic production is efficient. If DRCR > 1, then domestic production is inefficient. Care should be taken when interpreting a DRCR which is lower than zero (DRCR < 0). It might be an indication of efficiency or inefficiency depending on how it comes about. When the negative DRCR results from very low (negative) domestic factor costs, then domestic production is efficient. On the other hand when the negative DRCR is caused by very low (negative) value added, then domestic production is inefficient. Value added can not meet the domestic factor costs.

To compare the policy transfers for maize and sunflower the Nominal Protection Coefficients on Inputs and on Outputs (NPCI and NPCO), the Effective Protection Coefficients (EPC) and the Subsidy Ratio to Producers (SRP) were calculated for the 2 commodities.

The NPCO compares the observed output price with its social price.It is given by the formula:-

$$NPCO = \frac{A}{E}$$

where:-

A = Revenue in private price

E = Revenue in social price

NPCO shows whether policies and market failure raise or lower the output price relative to the social price. An NPCO of less than one is an indication of negative output transfers. It is an indication of depressed output prices.

On the other hand, NPCI gives tradable input transfers by contrasting observed tradable input costs with the social prices. It indicates whether the inputs are subsidised or taxed by policies. An NPCI of less than one is an indication of depressed input costs. It shows that inputs are subsidised that there are incentives in input use. The NPCI is given by the formula:-

$$NPCI = \frac{B}{F}$$

where:-

B = Tradable input costs in private prices

F = Tradable input costs in social prices

In this study separate NPCIs were also calculated for seed to determine what the effects of policies have been on the cost of seed.

The EPC contrasts value added in private prices to value added in social prices. By so doing, it measures the policy transfers from output and tradable input policies but does not incorporate transfer effects from the domestic factor market policies. An EPC greater than one indicates positive transfers to producers. The Effective Protection Coefficient is given by the formula:-

$$EPC = \frac{A - B}{E - F}$$

where:-

A-B = Value added in private prices

E-F = Value added in social prices

The NPCO, NPCIs and EPC can be complemented by the Subsidy Ratio to Producers to measure how much incentive each crop for each category of farmers has been receiving. The SRP gives the net policy transfer as a fraction of total social revenues. It gives the degree to which the policies subsidise each of the activities. This makes the SRP useful for comparing the effect of policy on different commodities. SRP provides a measure of incentives which is comparable across commodities. If for example, SRP is greater for sunflower than for maize, then policies will have created greater incentives for sunflower than for maize.

SRP is given by the formula:-

$$SRP = \frac{L}{E}$$

where:-

L represents the net policy transfer while E represents the total social revenue.

Comparison of the NPCO, NPCI, $NPCI_o$, EPC, and the SRP of sunflower to those of maize in this study enabled the determination of whether sunflower has received more incentives compared to maize or not. They measured incentives provided through the output price, tradable inputs as a group, seed, output and tradable inputs combined and for the activity as a whole.

3.5. Sensitivity Analysis

The results of the PAM were subjected to sensitivity analysis to simulate seed sunflower and producer price liberalisation. This was done by assuming liberalisation would raise the prices to competitive levels, that is levels close to social levels. To simulate further devaluation of the Kwacha, a devaluation of 50% was assumed and its effect on private profitability of sunflower analyzed. Simulation of liberalisation, and of devaluation were done separately to facilitate understanding.

CHAPTER 4.

4. EMPIRICAL ANALYSIS

Using crop budgets, revenue, costs and profit (social and private) were determined per hectare of sunflower and of maize for small-scale and medium-scale farms. To get the revenue in private prices, average yield per hectare for 1990 was multiplied by the producer price for the same year.

During the data verification exercise which was done to verify the figures on seed, fertilizer and agricultural chemical usage, crop yields and the prices of both inputs and output, it was found that the figures in the crop budgets were the appropriate ones to use. For output prices, the prices in the crop budget which were government set prices were used in this study because it was found that cooperatives which offered government set prices were the major buyers of produce. The cooperatives were also the main source of inputs. In the case of input usage rates, as reported by those experienced in crop budgeting, there were great variation in the rates reported during data verification. The yields reported by farmers also varied greatly. In the case of small-scale sunflower farms seed rates and yields ranged from 8.5kg/ha to 40kg/ha and six, 50kg bags/ha to twenty, 50kg bags/ha respectively. For maize for the same category, seed rates and yields ranged from 20kg/ha to 30kg/ha and eighteen, 90kg bags/ha to fifty-five, 90kg bags per/ha. None of the farmers interviewed reported use of agricultural chemicals on either sunflower or maize.

4.1. Social Valuation

Government intervention in the economy results in financial prices that do not reflect the real value of a good or service. Social valuation of goods and services becomes important in such cases to show the opportunity cost of goods and services. To get the social values in this study, import parity prices were used in the case of the tradables. As noted in section 3.4, calculation of parity prices requires use of a shadow exchange rate.

4.1.1. The Shadow Exchange Rate (SER)

Among the methods used to estimate the shadow exchange rate is that used by Clements (1989). This method is based on the differential inflation and the exchange rate in a base year, where the base year is defined as the year in which the rate reflects the real exchange rate as closely as possible. In this study 1986 is taken as the base year because in this year foreign exchange auctioning was in progress. During the auction period the exchange rates were determined on the basis of supply and demand conditions. The exchange rates that prevailed during this time therefore closely reflected the real exchange rates. Taking the 1986 exchange rate of ZK12 and the inflation rates in table 4.1, the method used by Clements (1989) yields the shadow exchange rate of ZK179.99 as computed below.

Table 4.1: Consumer Price Indexes (CPIs) and Inflation Rates for Zambia and the United States

YEAR	CPIs. 1985 = 100		INFLATION RATES	
	Zambia	US	Zambia	US
1985	100.0	100.0	-	-
1986	154.8	101.8	54.8	1.8
1987	227.6	105.6	47.0	3.7
1988	350.6	109.9	54.0	4.1
1989	800.3	115.2	128.3	4.8
1990	1,677.1	121.4	109.6	5.4

Source: United Nations Monthly Bulletin of Statistics. 1989 and 1992 issues.

Republic of Zambia, Consumer Price statistics. 1991. Central Statistical Office, Lusaka.

$SER = ER_b[(1 + (IZ_1 - IUS_1)(1 + (IZ_2 - IUS_2) \ldots\ldots\ldots\ldots$

$\ldots(1 + (IZ_t - IUS_t)]$ where:-

SER = Shadow Exchange Rate.

ER_b = Observed exchange rate in the base year.

IZ_1 = Rate of inflation in Zambia in year 1 (base year) .

IUS_1 = Rate of inflation in the United States in year 1 .

IZ_t = Rate of inflation in Zambia in year of analysis (1990) .

IUS_t = Rate of inflation in the United States in year of analysis.

$$SER = ER_{86}[1 + (IZ_{86} - IUS_{86})(1 + (IZ_{87} - IUS_{87}) \ldots\ldots\ldots\ldots$$

$$\ldots\ldots(1 + (IZ_{90} - IUS_{90})]$$

$$= 12[(1 + 0.530)(1 + 0.433)(1 + 0.499)(1 + 1.235)(1 + 1.042)]$$

$$= 12(14.999)$$

$$SER = \underline{ZK179.99}$$

The other method used to get the shadow exchange rate is to adjust the official exchange rate by the inflation adjustment factor (IAF). This methodology has been used by Pearson and Monke (1989) and Mulalami (1992). The inflation adjustment factor is obtained by dividing a country's price index in the base year by the weighted average index of the major trading partner countries for the same year. As in the method used by Clements (1989), this procedure of estimating the real exchange rate defines the base year as the year in which the exchange rate reflects the real exchange rate as closely as possible. Since the Kwacha is pegged to the dollar, in this study the price index in Zambia is divided by the index in the U.S. Taking 1986 as the base year and the 1990 official exchange rate of ZK42.79, the shadow exchange rate of ZK65.04 to a U.S. dollar is obtained for 1990 as calculated below.

$$Inflation\ Adjustment\ Factor = \frac{154.8}{101.8} = \underline{1.52}$$

$$SER = OER \times IAF = 42.79 \times 1.52 = \underline{ZK65.04}$$

Before liberalisation of the foreign exchange market in 1992, the trend was that the parallel market rate was about double the official exchange rate. The parallel market rate is known to over-estimate the shadow exchange rate because of the risk involved in engaging in this market as it is illegal. On the other hand the set official exchange rate under-estimates the shadow exchange rate. The shadow exchange rate falls between the official and the parallel market rate. Thus taking the 1990 official rate ofZK42.79 and the parallel market rate of ZK85.00 to a U.S. dollar it was found that the second estimate of the ZK65.04 to a U.S. dollar was more realistic than the first one. The rate of ZK65.04 to a dollar was thus used as the real exchange rate in this study. After getting the shadow exchange rate, social values of various items in the crop budgets were calculated. The private values and the calculated social values were later entered into tables for organisation and aggregation under the categories of revenue, tradables and factors. A table was drawn for each crop for each category considered in this study.

4.1.2. Determination of the Social Price of Sunflower

Sunflower is a tradable. It is an importable. Its social value is thus determined by its import parity price. Calculation of an import parity price requires import prices. These prices are shown in table 4.2 for the case of sunflower in this study.

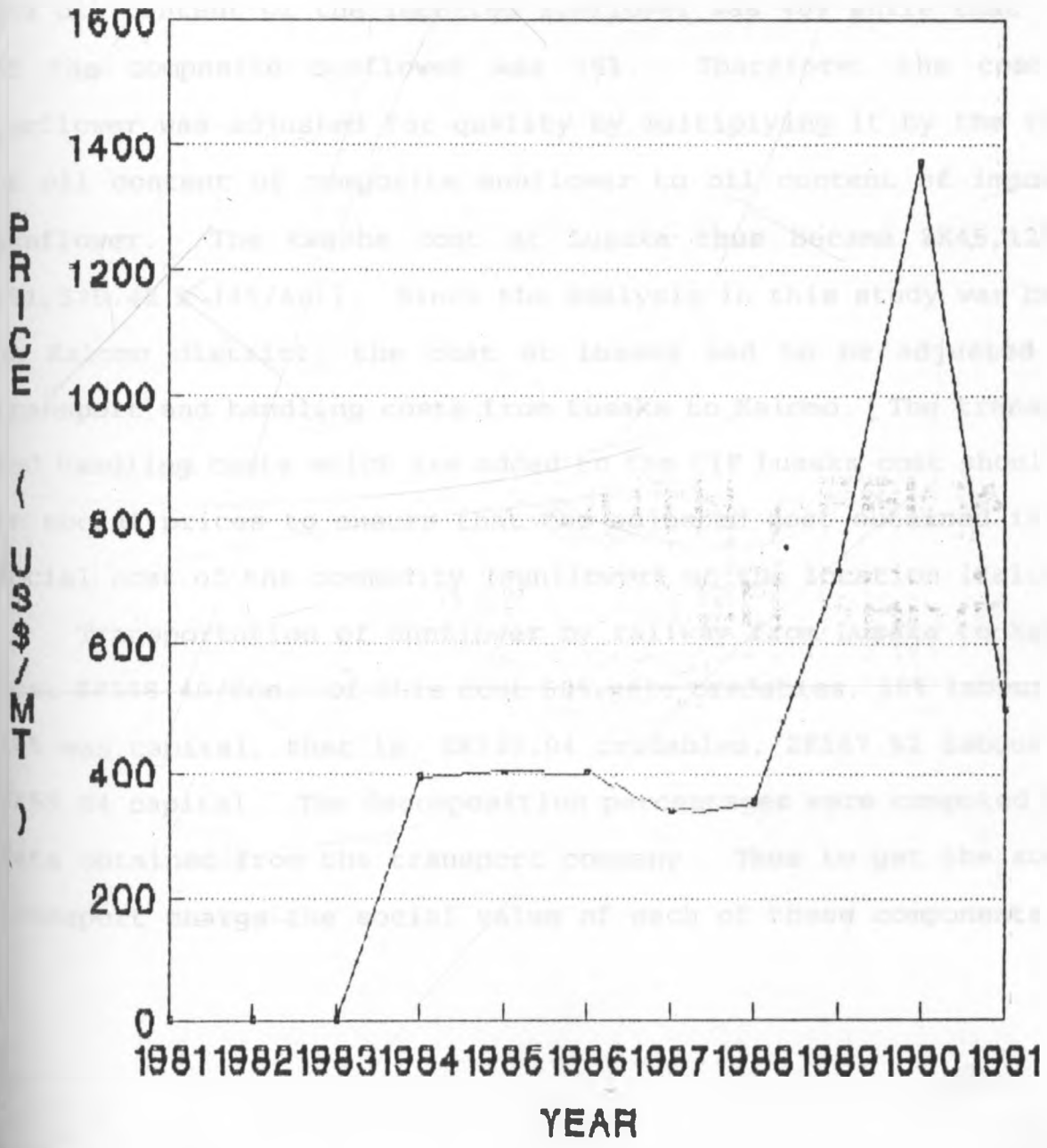
Table 4.2: **FOB South Africa Sunflower Price Series**

YEAR	PRICE (US$/MT)
1981	0.30
1982	0.24
1983	0.37
1984	390.90
1985	397.50
1986	400.00
1987	335.57
1988	349.93
1989	720.70
1990	1371.86
1991	497.21

Source: Food and Agriculture Organisation of the United Nations, FAO Trade Year books, 1983, 1986, 1989 and 1991. Rome, FAO.

Average FOB price over ten years (1981 - 90) is $ 396.74/MT.
Average FOB price over 5 (1986-90) years is $ 635.60/M.T
As is typical of agricultural prices there are fluctuations in the sunflower prices as indicated in table 4.2 and figure 4.1.

FIG. 4.1: FOB SOUTH AFRICA SUNFLOWER PRICE SERIES



SOURCE: DRAWN FROM TABLE 4.2

This calls for use of an average. However, the 10 year average deviates too much from the actual price in 1990. Consequently the 5 year average price was used for this analysis.

FOB price = US$635.60

Freight, insurance and handling to Lusaka US$157.38

Cost and Freight to Lusaka US$792.98

Kwacha cost at Lusaka 792.98 x 65.04

= ZK51,575.42

The oil content of the imported sunflower was 40% while that of the composite sunflower was 35%. Therefore, the cost of sunflower was adjusted for quality by multiplying it by the ratio of oil content of composite sunflower to oil content of imported sunflower. The kwacha cost at Lusaka thus became ZK45,128.49 [51,575.42 x (35/40)]. Since the analysis in this study was based on Kalomo district, the cost at Lusaka had to be adjusted for transport and handling costs from Lusaka to Kalomo. The transport and handling costs which are added to the CIF Lusaka cost should be in social prices to ensure that the adjusted cost obtained is the social cost of the commodity (sunflower) at the location (Kalomo).

Transportation of sunflower by railway from Lusaka to Kalomo cost ZK558.40/ton. Of this cost 60% were tradables, 30% labour and 10% was capital, that is, ZK335.04 tradables, ZK167.52 labour and ZK55.84 capital. The decomposition percentages were computed from data obtained from the transport company. Thus to get the social transport charge the social value of each of these components had

to be determined. The social values of the components were then aggregated to get the social transport cost.

i) **Determination of the Social Value of the Tradable Component in Transport.**

For the tradable component, its social value was obtained by multiplying its private value by the ratio of the import parity price of the dominant item in the tradables to the domestic price of the dominant item. In this case the dominant item in the tradable component of the railway transport charge was diesel accounting for about 50%. Therefore, the ratio of the import parity price of diesel to the domestic price of diesel was used to estimate the social value of the tradable component in the transport charge.

Using the import parity price formula, the following import parity price of diesel was obtained:-

P_{cif} of diesel is 140.85

$$P_x = (140.85 \times 65.04) + 458 + 515.83$$

$$= 9160.88 + 458 + 515.83$$

$$= 10,134.71/MT$$

1 metric tonne of diesel is approx. 1167 litres

$$P_x/\text{litre} = \frac{10,134.7}{1169}$$

$$P_x = ZK8.67/\text{litre}$$

Therefore, social price of tradable component

$$= \frac{8.67}{10.50} \times 335.04$$

= ZK276.65

(ii) **Determination of the Social Value of the Labour Component.**

The labour engaged in transportation is taken to be skilled. Therefore to get the social price of this labour, the 10% which was contributed to social security was deducted.

Social value of labour = 167.52 x 0.9

= ZK150.77

(iii) **Determination of the Social Value of the Capital Component.**

The opportunity cost of capital can be given by the interest rate, which gives the return expected if money is saved in the bank instead of being used in the enterprise under consideration. Where there is no inflation the nominal interest rate which also represents the real interest rate can be taken as the opportunity cost of capital. However, where there is inflation the nominal interest rate differs from the real interest rate. The real interest rate incorporates the purchasing power of the return.

Real interest rate is given by the formula:-

$$\text{Real rate of interest} = \frac{1 + i^n}{1 + I} - 1, \text{ where}$$

i^n = observed interest rate

I = inflation rate

(Source: Pearson and Monke, 1989)

Using the formula above, the 1990 nominal interest rate of 33% and the inflation rate of 109.6%, a real interest rate of -37% was obtained as computed below.

$$\text{Real rate of interest} = \frac{(1 + 0.33)}{(1 + 1.096)} - 1 = \frac{1.33}{2.096} - 1$$

$$= 0.63 - 1 = -0.37 = \underline{-37\%}$$

The real interest rate of -37% implies that capital is very cheap in Zambia. Farmers are better off getting loans than saving because at the end of the period their savings will buy less than they would have bought initially. Farmers should borrow as much as they can and invest in capital goods on the farm.

Probably due to the realisation of the real cost of capital in 1990, the transport institution used 10% in its calculation of the cost of capital instead of the market rate of 33%. The private

capital cost component was thus converted to the social cost by dividing the private cost by 10% and multiplying it by -37%. The social cost of the capital component therefore became:-

$$= \frac{55.84 \times -0.37}{0.1}$$

$$= -\underline{ZK206.61}$$

Social transport charge = ZK220.81

In this study handling costs to Kalomo were charged at 5% of the landed cost at Lusaka. The companies that were asked to give approximations of handling costs said it was about 5% of landed costs. The study had to use approximations because of lack of data exclusive to handling. The internal handling costs for sunflower were thus ZK2,256.42.

The social price of sunflower was therefore:-

45,128.49 + 2256.42 + 220.81

= ZK47,605.72/MT

= 47.61/Kg = ZK2,380.50 per 50Kg bag

4.1.3. Determination of the Social Price of Maize

The maize prices used to calculate the maize import parity price are given in table 4.3.

Table 4.3: FOB South Africa Maize Price Series

YEAR	PRICE (US $/MT)
1981	0.15
1982	0.13
1983	0.13
1984	127.75
1985	122.18
1986	93.89
1987	80.00
1988	115.44
1989	121.12
1990	117.36

Source: Food and Agriculture Organisation of the United Nations, FAO Trade Year books, 1983, 1986, 1989 and 1991. Rome, FAO.

As in the case of sunflower the ten year average (U.S.$77.82) deviates more from the actual in 1990. The 5 year average was consequently used in the estimation of the maize import parity price.

Five year (1986 - 90) average	105.56
	= 106/MT
Insurance	0
Freight to Lusaka	US$123/MT
Cost, Insurance and Freight at Lusaka	229/MT
Kwacha cost at Lusaka	229 x 65.04
	ZK14,894.16/MT
Internal handling costs (5%)	774.71

Transport to Kalomo = ZK558.40/MT of which 60% were tradables, 30% was labour and 10% was capital i.e. ZK335.04 tradables, ZK167.52 labour and ZK55.84 capital.

(i) **Determination of the Social Value of the Tradable Component**

The ratio of the import parity price of diesel to the domestic price of diesel (8.67/10.50) was used to estimate the social value of the tradable component in the transport charge as follows:-

(8.67/10.50) x 335.04

= ZK276.65

(ii) **Determination of the Social Value Labour Component**

The labour engaged in railway transportation is skilled. To get its social value, employer paid taxes on use of this labour and social security contribution are to be deducted. However, there were no employer paid taxes on use of railway transportation labour but 10% of the payment to this labour went to social security.

Therefore the social price of labour was 90% of its private price, that is:

0.9 x 167.52

= ZK150.77

(iii) **Determination of the Social Value of the Capital Component**

The private cost of capital (ZK55.84) in this case was converted to its social value by multiplying it by the real interest rate (-37%) and dividing by the nominal interest rate used to arrive at the private cost of capital (10%).

The social cost of capital was therefore:

$$\frac{55.84 \times -0.37}{0.1}$$

= -ZK206.61

The social transport charge was consequently equal to

ZK276.65 + ZK150.77 - ZK206.61

ZK220.81

The social price of maize was thus = 14,894.16 + 744.71 + 220.81

= 15,859.68 /Ton

= 15.86/Kg

= ZK1.427.37/90 Kg

4.1.4. Determination of the Social Cost of Seed Sunflower

Average FOB price was US$ 2370.80, Freight to Lusaka was US$300/MT for 1990.

CIF price = US$2670.80/MT

Like sunflower, seed sunflower imports are not insured in Zambia.

P_x = $(P_{cif}$ x ER) + IHT

= (2670.80 x 65.04) + IHT

= 173,708.83 + IHT

The CIF price was adjusted for oil content. This yielded the sunflower price at Lusaka of ZK151,995.23.

P_x = 151,995.23 + IHT

P_x = 151,995.23 + IHT

Transport to Kalomo by railway cost ZK602.77 of which 60% were Tradables, 30% labour and 10% capital that is ZK361.62 Tradables, 180.81 labour, and ZK60.27 capital. Using the procedures used in estimating the social cost of transporting sunflower the following social values were obtained as the components of the social cost of transporting seed sunflower.

Social value of tradable component = $\frac{361.62}{1} \times \frac{8.67}{10.50}$

= ZK298.59

Social value of labour component = $\frac{180.81}{1} \times 0.90$

= ZK162.73

Social value of capital component = $\frac{60.27 \times -0.37}{0.10}$

= -ZK222.999

= -ZK223

Social transport charge = ZK238.32/MT

Social price of seed sunflower = 151,995.23 + 7,599.76 + 38.32

= 159,833.31/MT

= ZK159.83/kg

4.1.5. Determination of the Social Cost of Seed Maize

Average CIF Lusaka price = US $670.25/MT

Kwacha cost at Lusaka =ZK43,593.06/MT

Handling costs (5%) =ZK2,179.65

The cost per metric tonne of transporting seed maize to Kalomo was the same as that of transporting seed sunflower.

Social cost of seed maize = ZK43,593.06 + 2,179.65 + 238.32

= ZK46,022.03/Mt

= ZK46.01/Kg

4.1.6. Determination of the Social Costs of Fertilizers

Farmers were interviewed about the types of fertilisers used and eighty-six percent of them who reported use of fertilizer in Kalomo used a fertiliser called compound R for basal dressing in maize production. The remaining 14% used a fertiliser called compound D. All the farmers who reported use of top dressing fertilizer said they used Urea. The import prices of compound R and Urea were thus used to estimate the social costs of Basal & top dressing fertilizer respectively in this study.

(1) Determination of the Social Cost of Compound R

CIF Lusaka price US$286/MT

Kwacha cost at Lusaka = 286 x 65.04

= 18,601.44

Internal handling cost 5% = 930.07

Transport cost to Kalomo was ZK586.80/MT of which ZK352.08 were tradable, ZK176.04 was labour and ZK58.68 was capital cost.

(i) Determination of the Social Value of the Tradable Component

Social tradable cost $= \frac{8.67}{10.50} \times 352.08$

= ZK290.72

(ii) Determination of the Social Value of the Labour Component

Social labour cost component = 0.9 x 176.04

= ZK158.44

(iii) **Determination of the Social Value of the Capital Component**

Social Capital Cost component = (58.68 x -0.37)/0.1

= -ZK217.12

Social transport charge = ZK232.04

Social cost of compound R = 18,601.44 + 930.07 + 232.04

= ZK19,763.55/MT

= ZK19.76/Kg

(2) **Determination of the Social Cost of Urea**

CIF Lusaka price US$211.18/MT

Kwacha cost at Lusaka 211.18 x 65.04

= ZK13,735.15/MT

Internal handling costs 5% = ZK686.76/MT

Transport cost to Kalomo = ZK232.04

Social cost of Urea = ZK14,653.95/MT

= ZK14.65/kg

4.1.7. **Determination of the Social Cost of Lubricating oil(20w/40)**

Average CIF Lusaka Price US$ 0.55/litre

Kwacha cost at Lusaka 35.77

Internal handling costs at 5% 1.79

Transport cost to Kalomo cost ZK142.80/210ltrs. Of this cost 10% (ZK14.28) of the transport charge went to payment of capital costs, 30% (ZK42.84) to labour and 60% (ZK85.68) to tradables.

As in section 4.1.2.(iii) the private capital cost component was converted to its social value by multiplying it by the real cost of capital and dividing by the nominal interest charge. That is:-

[(14.28 x -0.37)/0.1] = -ZK52.34

The social price of the labour component was obtained by deducting the social security contribution of 10% and thus multiplying the private cost by 90% to get the social cost of labour of ZK38.56 as calculated below.

0.9 x 42.84

= ZK38.56

The social cost of the tradable component was obtained by multiplying the private value of the tradable component by the import parity price of diesel and dividing by the domestic price of diesel. This resulted in the social tradable component cost of ZK70.75 as computed below.

[(85.68 x 8.67)/10.50]

= ZK70.75

Social transport charge = ZK56.97/ 210 litres

= 0.27/litre

Social cost of lubricating oil = ZK35.77 + 1.79 + 0.27

= ZK37.83

4.1.8. Determination of the Social Cost of Jute Bags

Jute bags are tradables, they are imported. The social price of a jute bag was thus estimated by its import parity price. The average CIF Lusaka price of jute bags between 1986 and 1990 was US$49.50 per 100 bags. This gave the kwacha cost at Lusaka of ZK3,219.48 (49.50 x 65.04) per 100 bags.

Internal handling costs (5%) 160.97

Transport from Lusaka to Kalomo cost 520.40/Mt in 1990. This was broken down into 60% (312.24) tradable 30% (156.12) labour and 10% (552.04) capital.

(i) Determination of the Social Value of the Tradable Component

As diesel accounted for the greater proportion of tradables, the ratio of its import parity price to its domestic price (8.67/10.50) was used to estimate the social value of the tradable component in the jute bag transport charge as shown below.

(8.67/10.50) x 312 = ZK257.82

(ii) Determination of the Social Value of the Labour Component

To get the social cost of labour engaged in transporting jute bags the 10% social security contributions were deducted.

Social cost of labour was thus = 0.9 x 156.12 = ZK140.51

(iii) **Determination of the Social Value of the Capital Component**

The social cost capital was obtained by multiplying the private cost of capital (52.04) by the real interest rate (-37%) and dividing by the nominal interest rate (10%) used to arrive at the private cost of capital.

Social Cost of the capital was therefore = (52.04 x -0.37)/0.1

= ZK192.55

The social jute bag transport charge was equal to:

257.82 + 140.51 - 192.55

= ZK205.78/MT

However, since the import price was quoted per 100 bags, the transport cost also had to be for the same quantity for the costs to be summed. Data collected showed that 10,000,000 jute bags weighed 150 metric tonnes. One metric tonne therefore comprised:-

$$\frac{10.000.000 \times 1}{150} = 66,667 \text{ bags}$$

The social transport charge per 100 bags was therefore:-

$$\frac{205.78 \times 100}{66,667} = ZK0.31$$

Consequently the social cost of a jute bag = ZK3,219.48 + 160.97 + 0.31

=ZK3,380.76/100 bags

= ZK33.81/bag

4.1.9. Social Values of Domestic factors

The domestic factors used by medium-scale and small-scale farmers in the production of sunflower and maize include machinery, land, and buildings, seasonal loans, labour and management. The compositions of machinery for the four activities are given in annex 1. The social values of the domestic factors were estimated as discussed below.

(i) Machinery

The social cost of machinery was obtained by multiplying its private cost by the ratio of the real interest rate to the nominal interest rate. For depreciation of machinery the social values of machinery were estimated and depreciation was then based on these social values as shown in annex 2. The social values of machinery repairs were obtained by decomposing the costs into labour, capital and tradables and getting the respective social values.

(ii) Land and Buildings

The private cost of land and buildings was calculated using the nominal interest rate. Therefore, the private cost was converted to the social cost by multiplying it by the ratio of the real interest rate to the nominal interest rate.

(iii) **Seasonal Loans**

Seasonal loans are given at the beginning of a cropping season and mature in 9 months time. Interest on seasonal loans was calculated using the nominal interest rate. Thus to convert this interest in private prices to interest in social prices, it was multiplied by the ratio of the real interest rate to the nominal interest rate.

(iv) **Management**

Management was provided by the owners of the farms on all the farms visited. Management is taken to be skilled labour. Although social security contributions were not made by farmers managing their own farms, where a farmer hired management social security contributions of 10% were made. The private cost of management was therefore multiplied by 90% to convert it to its social cost in this study.

(v) **Farm labour**

All farmers talked to used family labour while hired labour was only used occasionally for harvesting and weeding. The hired labour came from within villages, none of the farmers cited labour shortage as a problem. Labour is abundant in Kalomo. There are no minimum wages binding on the agricultural sector. Taking these factors into account, the private cost of labour was used to represent its social cost too in this study.

(vi) Oxen Death Loss

Oxen death loss is an allowance for losses resulting from death of oxen. Oxen deaths are common in Kalomo due to the prevalence of foot and mouth disease and corridor disease.

The market for oxen in Zambia is not controlled. The people are at liberty to buy and sell oxen anywhere. Prices of oxen are also market determined. Buyers are free to negotiate the prices with the sellers. Therefore the private cost of oxen death loss was taken as its social cost as well.

Oxen dipping costs like hauling costs paid to formal transporters accounted for a very small proportion of the total production costs. Most (over 60%) of the hauling was done by the farmers with their ox-carts or tractors. The costs associated with ox-cart and tractor haulage are included in the labour and machinery costs. The private costs of hauling (formal) and dipping which appeared in the crop budgets were also used as the social costs.

This chapter discussed the procedures used to get social values in this study. Social values for various items in the crop budgets were also estimated in this chapter. The next chapter uses the private values from the crop budgets and social values from this chapter to draw tables and discusses the results.

CHAPTER 5.

5. EMPIRICAL RESULTS AND DISCUSSIONS

The previous chapter provided the social values for each of the budget items. This chapter gives tables in the form of templates for each crop and for the two categories of farmers. The PAMs are derived from these templates.

5.1. The Template and PAM for Small-scale Sunflower production

Table 5.1. is a template for small-scale sunflower. The table gives both private and social values of revenue and costs for small-scale sunflower production. The values are assigned to the cost categories of unskilled labour (UL), skilled labour (SL), capital (K) and tradables (T) as shown by the decomposition coefficients. The decomposition coefficients give the proportion of the respective private value assigned to a cost category. The decomposition coefficient of one (1) under the tradables in the case of seed implies that the cost of seed is wholly assigned to the tradables category. For the same seed the social decomposition coefficient is 9.87 under tradables. This implies that the social cost of seed sunflower is 9.87 times its private cost. This cost is also wholly assigned to tradables. In the case of hauling of sunflower, 30% of its private cost is assigned to skilled labour, 10% to capital and 60% to tradables as shown by the decomposition coefficients of 0.3. under SL, 0.1 under K and 0.6 under T. The

basis of the decomposition coefficients for non-tradables such as hauling is information provided by the institutions that produce the non-tradable. The totals for each cost category are given in the total costs row.

LE 5.1. THE SMALL-SCALE SUNFLOWER PRODUCTION TEMPLATE

ED INPUTS	---private decomposition coefficients Unskilled Labor	Skilled Labor	Capital	Tradable Inputs	PRIVATE CAPITAL COST	---social decomposition coefficients--- Unskilled Labor	Skilled Labor	Capital	Tradable Inputs	SOCIAL CAPITAL COST
F OF MACHINERY			1.00		72.49			1.43		103.66
CHINERY INTEREST			1.00		823.44			1.00		-923.25
D AND BLDS INTEREST			1.00		1650.00			1.00		-1850.00
EN DEATH LOSS			1.00		209.44			1.00		209.44
			1.00		0.00			1.00		0.00
TALS					2755.37					-2460.15

BOUR	---private decomposition coefficients UL	SL	K	T	PRIVATE TOTAL	---social decomposition coefficients--- UL	SL	K	T	SOCIAL TOTAL
BOUR	1.00				1611.68	1.00				1611.68
AGEMENT		1.00			301.32		0.90			271.19
					0.00					0.00
TALS	1611.68	301.32	0.00	0.00	1913.00	1611.68	271.19	0.00	0.00	1882.87

ERMEDIATE INPUTS	---private decomposition coefficients UL	SL	K	T	PRIVATE TOTAL	---social decomposition coefficients--- UL	SL	K	T	SOCIAL TOTAL
ED				1.00	330.32				9.87	3260.26
EN DIPPING		0.20	0.10	0.70	30.45		0.20	0.10	0.70	30.45
CHINERY REPAIRS		0.25	0.25	0.50	58.23		0.42	0.42	0.83	97.24
LLING OF SUNFLOWER		0.30	0.10	0.60	16.00		0.30	0.10	0.60	16.00
XING MATERIALS				1.00	170.00				1.99	338.30
SONAL INTEREST			1.00		690.53			-1.12		-773.39
ER EXPENSES	0.45	0.05	0.10	0.40	367.92	0.45	0.05	-0.11	4.01	1601.25
TALS	163.76	43.64	746.12	705.92	1659.45	163.76	53.54	-784.32	5137.12	4570.11

N OUTPUT	PRIVATE TOTAL	SOCIAL TOTAL
FLOWER	1.00 3110.00	7.90 24569.00
AL REVENUE	3110.00	24569.00

L COSTS	1775.44	344.96	3501.49	705.92	6327.82	1775.44	324.73	-3244.47	5137.12	3992.83
IT					-3217.82					20576.17

5.2. The PAM for Small-scale Sunflower Production

From table 5.1, the costs are reclassified and aggregated into tradables and factors. These costs are then entered with the revenues into the PAM in table 5.2.

Table 5.2: PAM for Small-scale Sunflower Production

UNITS: '000 KWACHA PER HECTARE

	REVENUE	TRADABLES	FACTORS	PROFIT
PRIVATE	3.11	0.71	5.62	-3.22
SOCIAL	24.57	5.19	-1.15	20.53
DIVERGENCE EFFECT	-21.46	-4.48	6.77	-23.75

The PAM shows that small-scale sunflower production is privately unprofitable but socially profitable. Due to the negative profit in private prices of -ZK3,220 per hectare, null hypothesis number one was accepted for small-scale sunflower production. Sunflower production in Zambia was not profitable for

small-scale farms. The private unprofitability is largely due to the depressed price of sunflower. There is a negative divergence of ZK21,460 per hectare with respect to revenue. This indicates that there is a transfer of income from small-scale sunflower producers due to the deviation of the producer price in private prices from its world market equivalent. The nominal protection coefficient on output was estimated to be 0.13, implying that the producer price of sunflower in Zambia was only 13% of its social value. This is an indication of disincentives. As regards tradable inputs, the divergence of -ZK4,480 is a sign of a transfer of income to producers. Tradable inputs cost less than they would cost without distortions. The nominal protection coefficient on tradable inputs was 0.14 implying that the private tradable input costs were 14% of their social costs. The tradable inputs were subsidised. They cost 14% of what they would cost without distortions. The NPC for seed sunflower was 13%. The private cost of seed sunflower was only 13% of what it would be without distortions. The overall effect of output and tradable input price distortions as given by the EPC was estimated to be 12% in the case of small-scale sunflower. This meant that value added in private prices was only 12% of what it would be without the distortions.

The divergence of -ZK23,750 under profits shows that the aggregate effect of divergences is a reduction of profit per hectare by ZK23,750 from its without distortions level. The SRP for small-scale sunflower production was -0.97 an indication that the gross revenue was depressed by 97%. Null hypothesis number two

was thus accepted for small-scale sunflower production. It was found that the government's pricing policy had not created incentives for small-scale sunflower production.

The DRCR was found to be -6% indicating that small-scale sunflower production was efficient. This led to the rejection of null hypothesis number four. The negative DRCR resulted from the negligible domestic capital cost. The real interest rate in Zambia was found to be negative (-37%) as shown on page 67.

5.3. The Template and PAM for Small-scale Maize Production

Table 5.3 gives the template for small-scale maize production. The decomposition coefficients in the table give the proportion of private cost assigned to each cost category. The private decomposition coefficient for seed maize is one (1) under tradable while its social decomposition coefficient is 3.88. The social cost of seed maize is 3.88 times its private cost.

LE 5.3. THE SMALL-SCALE MAIZE PRODUCTION TEMPLATE

ED INPUTS	---private decomposition coefficients- Unskilled Labor	Skilled Labor	Capital	Tradable Inputs	PRIVATE CAPITAL COST	---social decomposition coefficients--- Unskilled Labor	Skilled Labor	Capital	Tradable Inputs	SOCIAL CAPITAL COST
. OF MACHINERY			1.00		157.42			1.40		220.39
HINERY INTEREST			1.00		906.25			1.00		-1016.10
& BLDS INTEREST			1.00		1650.00			1.00		-1850.00
N DEATH LOSS			1.00		155.09			1.00		155.09
ALS					2868.76					-2490.62

UR	---private decomposition coefficients UL	SL	K	T	PRIVATE TOTAL	---social decomposition coefficients--- UL	SL	K	T	SOCIAL TOTAL
UR	1.00				2986.80	1.00		0.00	0.00	2986.80
AGEMENT		1.00			481.17		0.90	0.00	0.00	433.05
ALS	2986.80	481.17	0.00	0.00	3467.97	2986.80	433.05	0.00	0.00	3419.85

RMEDIATE INPUTS	---private decomposition coefficients UL	SL	K	T	PRIVATE TOTAL	---social decomposition coefficients--- UL	SL	K	T	SOCIAL TOTAL
D				1.00	292.23				3.88	1133.85
OUND R.				1.00	840.00				2.93	2461.20
				1.00	960.00				1.91	1833.60
DIPPING		0.20	0.10	0.00	33.95		0.20	0.10	0.70	33.95
INERY REPAIRS		0.25	0.25	0.50	147.58		0.35	0.35	0.70	206.61
T. HAULING		0.30	0.10	0.60	17.10		0.30	0.10	0.60	17.10
E HAULING		0.30	0.10	1	85.50		0.30	0.10	1	85.50
NG MATERIALS				1.00	425.00				1.99	369.75
NAL INTEREST			1.00		1370.88			-1.12		-1535.39
R EXPENSES	0.45	0.05	0.10	0.40	722.47	0.45	0.05	-0.11	1.00	1004.23
LS	325.11	110.59	1493.68	2941.57	4894.71	362.01	110.59	-1527.41	28862.05	5610.41

UTPUT	PRIVATE TOTAL	SOCIAL TOTAL
	7380.00	35719.20
REVENUE	7380.00	35719.20
COSTS	11231.44	6539.64
T	-3851.44	29179.56

5.4. The PAM for Small-scale Maize Production

The totals in the total costs row are reclassified into tradables and factors. Unskilled labour, skilled labour and capital totals are summed to get the factor costs. These reclassified cost totals and the revenues are then entered into the PAM shown in table 5.4.

Table 5.4: The PAM for Small-scale Maize Production

UNITS: '000 KWACHA PER HECTARE

	REVENUE	TRADABLES	FACTORS	PROFIT
PRIVATE	7.38	3.20	8.27	-4.09
SOCIAL	35.72	7.18	-0.17	28.71
DIVERGENCE EFFECT	-28.34	-3.98	8.44	-32.80

The PAM shows that small-scale maize production is privately unprofitable but socially profitable. Maize production by this category of farms is thus efficient in Zambia. There are transfers from small-scale maize producers as regards revenue and domestic

factors. With respect to tradable inputs, there transfers to producers. These transfers are shown by the divergences of -ZK28,340 for revenue, ZK8,440 for domestic factors and ZK3,980 for tradable inputs. Tradable inputs are subsidised. There are incentives for tradable input use. The overall effect of divergences is a reduction of profit per hectare by ZK32,800, a disincentive to small-scale maize production. From the PAM the measures of incentives (NPCO, NPCI, $NPCI_o$, EPC, SRP) and the DRCR were calculated. These measures were later used in the comparison of sunflower to maize. The NPCO was estimated to be 0.21, an indication that the domestic output price of maize was depressed. It was 21% of what it would be without distortions. The NPCI was 0.45. The tradable input costs were 45% of what they would be without government intervention. The tradable inputs were subsidised. The nominal protection coefficient on seed maize was 0.26. This meant that the domestic cost of seed was 26% of what it would be without distortions. The EPC was 0.15. Domestic value added was thus depressed by 85% . The subsidy ratio to producers for small-scale maize production was found to be -0.92. This indicates that the divergences have depressed the gross revenue of small scale maize production by 92%. The total effect of divergences on small-scale maize production was the disincentive of 92% depression of revenue per hectare.

5.5. The Template and PAM for Medium-scale Sunflower Production

The template showing decomposition coefficients and totals for each cost category for medium-scale sunflower is given in table 5.5

LE 5.5. THE TEMPLATE FOR MEDIUM-SCALE SUNFLOWER PRODUCTION

ED INPUTS	---private decomposition coefficients Unskilled Labor	Skilled Labor	Capital	Tradable Inputs	PRIVATE CAPITAL COST	---social decomposition coefficients--- Unskilled Labor	Skilled Labor	Capital	Tradable Inputs	SOCIAL CAPITAL COST
OF MACHINERY			1.00		549.84			1.21		665.31
DINGS DEPRECIATION			1.00		30.84			1.00		30.84
NERY INTEREST			1.00		2041.27			1.00		-2286.22
AND BLDS INTEREST			1.00		1848.00			1.00		-2069.76
			1.00		0.00			1.00		0.00
			1.00		0.00			1.00		0.00
LS					4469.95					-3659.83

UR	---private decomposition coefficients UL	SL	K	T	PRIVATE TOTAL	---social decomposition coefficients--- UL	SL	K	T	SOCIAL TOTAL
UR	1.00				1285.35	1.00				1285.35
EMENT		1.00			438.20		0.90			394.38
					0.00					0.00
					0.00	0.00	0.00	0.00	0.00	0.00
LS	1285.35	438.20	0.00	0.00	1723.55	1285.35	394.38	0.00	0.00	1679.73

EDIATE INPUTS	---private decomposition coefficients UL	SL	K	T	PRIVATE TOTAL	---social decomposition coefficients--- UL	SL	K	T	SOCIAL TOTAL
D				1.00	243.00				9.87	2398.41
EL				1.00	651.00				0.83	540.33
OIL				1.00	171.10				0.66	86.53
NERY REPAIRS		0.25	0.25	0.50	515.47		0.30	0.30	0.60	618.56
DING REPAIRS		0.25	0.25	0.50	42.00		0.25	0.25	0.50	42.00
BAG		0.30	0.10	0.60	5.76		0.30	0.10	0.60	5.76
BAG MATERIALS				1	272.00				2	541.28
KING INTEREST			1.00		852.08			-1.12		-954.33
EXPENSES	0.45	0.05	0.10	0.40	449.05	0.45	0.05	-0.11	0.40	354.75
LS	202.07	163.55	1076.93	1758.91	3161.46	202.07	368.94	-766.16	3850.89	3633.29

OUTPUT	PRIVATE TOTAL	SOCIAL TOTAL
BER	4976.00	7.90 39310.40
REVENUE	4976.00	39310.40
COSTS	1487.42 601.75 5506.88 1758.91 9354.96	1487.42 763.32 -4425.99 3850.89 1653.19
IT.	-4378.96	37657.21

5.6. The PAM for Medium-scale Sunflower Production

As in the template for small-scale farms, cost category totals are re-grouped into tradables and factors. The totals of the new categories are entered into the PAM shown as table 5.6. The sum of UL, SL and K is entered under factors in the PAM while the total cost under T is entered under tradables.

Table 5.6: The PAM for Medium-scale Sunflower Production

UNITS: '000 KWACHA PER HECTARE

	REVENUE	TRADABLES	FACTORS	PROFIT
PRIVATE	4.98	1.76	7.60	-4.38
SOCIAL	39.31	3.89	-2.18	37.60
DIVERGENCE EFFECT	-34.33	-2.13	9.78	-41.98

As the PAM shows, medium-scale sunflower production is privately unprofitable but socially profitable. The unprofitability in private prices of -ZK4,380 leads to the acceptance of null hypothesis number one for medium-scale sunflower production. The positive social profitability of ZK37,600/ha indicates that without

distortions, medium-scale sunflower production would be competitive.

Disincentives exist for sunflower production as indicated by the transfer of income from producers with respect to revenue and domestic factor costs. There are transfers of ZK34,330 and ZK9,780 respectively as shown by the divergences. Tradable inputs are subsidised as shown by the divergence of -ZK2,130. However, the aggregate effect of divergences given by -ZK41,980 shows that on the whole there are disincentives for medium-scale sunflower production. From the PAM the NPCO, NPCI, EPC, SRP and DRCR were computed. The NPCO was found to be 0.13. This indicated that the sunflower producer price was only 13% of its without distortions value. It was depressed. The NPCI was 0.45, an indication that medium-scale sunflower tradable inputs were subsidised. They only cost 45% of what they would cost without distortions. However, the EPC which incorporates transfer effects from policies affecting both the output and tradable input prices was found to be 0.09. The EPC of 9% is a sign of disincentives. The distortions had resulted in value added which was only 9% of what it would be without distortions. The lower value added was caused by distortions in product markets. The SRP was estimated to be -1.07 indicating that divergences had decreased revenue by 107%. Null hypothesis number two was thus accepted for medium-scale sunflower production. It was found that the pricing policy had not created incentives for medium-scale sunflower production. The DRCR for medium-scale sunflower production was estimated to be -0.06. This

complements the positive profit (in social prices) in leading to the rejection of null hypothesis number four for medium-scale sunflower production. Zambia was efficient in the production of sunflower. The negative DRCR was caused by the negligible real capital costs which were large and negative. The large negative capital costs reduced the other factor costs such that total social factor costs became negative and thus a negligible proportion of value added in social prices. This indicates comparative advantage as domestic factor costs take up only a tiny proportion of value added.

5.7. The Template and PAM for Medium-scale Maize Production

Table 5.7 gives the template for medium scale maize from which the entries for the PAM in table 5.8 are drawn.

E 5.7. THE TEMPLATE FOR MEDIUM-SCALE MAIZE PRODUCTION

D INPUTS	---private decomposition coefficients--- Unskilled Labor	Skilled Labor	Capital	Tradable Inputs	PRIVATE CAPITAL COST	---social decomposition coefficients--- Unskilled Labor	Skilled Labor	Capital	Tradable Inputs	SOCIAL CAPITAL COST
OF MACHINERY			1.00		2094.95			0.75		1571.21
OF BUILDINGS			1.00		24.00			1.00		24.00
INERY INTEREST			1.00		7777.51			1.00		-8710.81
& BLDS INTEREST			1.00		1808.40			1.00		-2025.41
			1.00		0.00			1.00		0.00
LS					11704.86					-9141.01

UR	---private decomposition coefficients--- UL	SL	K	T	PRIVATE TOTAL	---social decomposition coefficients--- UL	SL	K	T	SOCIAL TOTAL
UR	1.00				2251.50	1.00				2251.50
GEMENT		1.00			1245.53		0.90			1120.98
					0.00			0.00		0.00
					0.00			0.00	0.00	0.00
					0.00			0.00	0.00	0.00
LS	2251.50	1245.53	0.00	0.00	3497.03	2251.50	1120.98	0.00	0.00	3372.48

RMEDIATE INPUTS	---private decomposition coefficients--- UL	SL	K	T	PRIVATE TOTAL	---social decomposition coefficients--- UL	SL	K	T	SOCIAL TOTAL
2				1.00	249.06				3.88	966.33
POUND R.				1.00	1344.00				2.93	3937.92
8				1.00	1536.00				1.91	2933.76
EL				1.00	745.50				0.83	618.76
OIL				1.00	148.20				0.66	97.81
INERY REPAIRS		0.25	0.25	0.50	1964.00		0.19	0.19	0.38	1492.64
REPAIRS		0.25	0.25	1	67.20		0.25	0.25	1	67.20
NG		0.30	0.10	0.60	49.50		0.30	0.10	0.60	49.50
NG MATERIALS				1.00	850.00				1.99	1691.50
NAL INTEREST			1.00		2619.96			-1.12		-2934.35
R EXPENSES	0.45	0.05	0.10	0.40	1380.74	0.45	0.05	-0.11	0.40	1090.74
LS	621.33	591.69	3270.78	6470.36	10954.16	621.33	473.85	-2691.33	11608.03	10011.88

OUTPUT	PRIVATE TOTAL	SOCIAL TOTAL
E	14760.00	71438.4
L REVENUE	14760.00	71438.4

L COSTS	2872.83	1837.22	14975.64	6470.36	26156.05	2872.83	1594.82	-11832.33	11608.03	4243.35
IT					-11396.05					67195.0

5.8. The PAM for Medium-scale Maize Production

The same procedure used in creating the PAM in section 5.6 was used here.

Table 5.8: The PAM for Medium-scale Maize Production

UNITS: '000 KWACHA PER HECTARE

	REVENUE	TRADABLES	FACTORS	PROFIT
PRIVATE	14.76	6.47	19.69	-11.40
SOCIAL	71.44	11.61	-7.36	67.19
DIVERGENCE EFFECT	-56.68	-5.14	27.05	-78.59

The PAM shows that medium-scale maize is privately unprofitable. This is an indication of disincentives for maize production. However, maize is a staple food crop and has received better marketing services. These factors may explain why maize production has increased despite its private unprofitability. Disincentives for medium-scale maize production are also indicated by the divergences. There are transfers of income from producers with respect to revenue and domestic factors. With respect to tradable inputs, there is a transfer of income to producers.

However, the overall effect is a depression of profits per hectare by ZK78,590 as indicated by the divergences under profit.

Without distortions medium-scale maize production was found to be efficient as indicted by the positive social profitability of ZK67,190 per hectare. The DRCR was estimated to be -12%. From the entries in the PAM the measures of incentives were also calculated. NPCO was the same as in small-scale maize production (21%) because in 1990 the maize producer price offered by the PCUs to which farmers sold the maize was uniform. The nominal protection coefficient on seed maize was also the same for medium-scale maize as for small-scale maize (0.26). This was because all the farmers reported use of hybrid seed. The NPCI was 56%, an indication of an incentive on tradable inputs. They cost only 56% of what they would cost without distortions. The EPC was 14%. This percentage was an indication of an overall disincentive for medium-scale maize from the product markets. Value added was just 14% of what it would be without distortions. It was depressed by 86%. The overall effect of factor as well as product markets as given by the subsidy ratio to producers was -1.10. This implies that medium-scale maize production revenue is depressed by 110%.

5.9. Comparison of Incentives for Sunflower to those for Maize.

The NPCO, NPCI, $NPCI_n$, EPC and SRP are used to compare incentives for sunflower to those for maize for the 2 categories of farmers. These measures are shown for each farm category in table 5.9

Table 5.9: Measures of Incentives for the 4 Categories of Farmers

Farmer Category	Measure of Incentives				
	NPCO	NPCI	$NPCI_s$	EPC	SRP
Small scale sunflower	0.13	0.14	0.13	0.12	-0.97
Small scale maize	0.21	0.45	0.26	0.15	-0.92
Medium scale sunflower	0.13	0.45	0.13	0.09	-1.07
Medium scale maize	0.21	0.56	0.26	0.14	-1.10

As table 5.9 indicates, the maize producer price is less depressed than the sunflower price. The maize producer price is 21% of what it would be without distortions while that of sunflower is 13% of its without distortion level as shown by NPCO. The maize producer price is depressed by 79% as compared to 87% for sunflower. Maize in this respect receives lower disincentives than sunflower.

The incentives on tradable inputs are higher for sunflower than maize. This is shown by NPCI of 14% for sunflower and 45% for maize for small-scale and 45% for sunflower and 56% for maize for medium-scale. This can be explained by the fact that fertilizer (a tradable) is not used on sunflower. The subsidy on fertilizer (e.g Urea) is not very high. The nominal protection coefficient on urea is 52% implying that it is only subsidised by 48% as compared to the 74% subsidy for seed maize. The lower subsidy (incentive) on

fertilizer contributes to the decline of the overall subsidy on tradable inputs for maize. Despite the lower tradable input incentives for maize than for sunflower, maize production has on the average increased while sunflower production has declined. Sunflower has been at a greater disadvantage of being grown because of other factors. Maize is Zambia's staple food crop hence even if it was unprofitable, it would still be grown for food needs. Additionally improved inputs (hybrid seed and fertilizers) for maize have been available at easily accessible places (primary societies). There has been greater use of improved inputs in maize than in sunflower production. All the farmers interviewed used hybrid seeds and fertilisers in maize production. None of the farmers used fertiliser in sunflower production and only 50% used improved seeds. Loan facilities have also been more easily available for maize.

In relation to seed the incentives on sunflower are higher than those on seed maize as the $NPCI_o$s show. The price of seed sunflower is only 13% of what it would cost without incentives while that of seed maize is 26% of its without distortion level. However, for farmers to enjoy the incentives on seed sunflower, the seed should be readily available. Composite seed sunflower was not available at primary societies which are easily accessible to farmers.

The overall effect of product market distortions on incentives is that maize receives greater incentives. For small-scale farms, value added is depressed by 85% for maize as compared to 88% for sunflower. Value added is depressed by 86% for medium-scale maize as compared to 91% for medium-scale sunflower. These values are calculated from EPC which gives the level of value added relative to its without-distortions level.

Taking both product market and factor market effects into consideration, the study found that small-scale maize received greater incentives than small-scale sunflower while medium-scale maize received less incentives than medium-scale sunflower. Revenue for small-scale sunflower was found to be depressed by 97% while that for small-scale maize was depressed by 92% as indicated by the SRP. Alternative hypothesis number three was thus accepted. Greater disincentives had been created for sunflower production. Although there were disincentives for maize particularly medium-scale production as well, it was concluded that sunflower production had been subjected to greater production disincentives than maize because maize has had better input provision in addition to that maize was a staple food crop.

5.10. Effect of Seed Sunflower and Sunflower Producer Price Liberalization on Sunflower Production.

(a) Effect of Producer Price Liberalisation

The impact of output price liberalization was estimated by assuming that liberalization would raise the sunflower producer price to a competitive level of ZK2,000 per 50kg bag. The price of ZK2,000 per 50kg bag was chosen for ease of computation and because it was close to the estimated import parity price of sunflower of ZK2,380. Simulating the competitive sunflower producer price of ZK2,000 per 50kg bag into the PAMS for small-scale and medium-scale farms yielded tables 5.10 and 5.11.

Table 5.10: Simulation of Producer Price Liberalisation into the Small-scale Sunflower PAM

UNITS: '000 KWACHA PER HECTARE

	REVENUE	TRADABLES	FACTORS	PROFIT
PRIVATE VALUES	20.00	0.71	5.62	13.67
SOCIAL VALUES	24.57	5.19	-1.15	20.53
DIVERGENCIES	-4.57	-4.48	6.77	-6.86

Table 5.11: Simulation of Producer Price Liberalisation into the Medium-scale Sunflower PAM

UNITS: '000 KWACHA PER HECTARE

	REVENUE	TRADABLES	FACTORS	PROFIT
PRIVATE VALUES	32.00	1.76	7.60	22.64
SOCIAL VALUES	39.31	3.89	-2.18	37.60
DIVERGENCIES	-7.31	-2.13	9.78	-14.96

Liberalization of the producer price which raises the depressed producer price results in increased private profitability. Private profitability rises but there is still a divergence of -ZK6,860 and ZK14,960 between private and social profit for small-scale and medium-scale sunflower production respectively. This is because only producer price distortions have been assumed removed in this case. Profitabilities rise to ZK13,670 per hectare for small-scale farms and ZK22,640 per hectare for medium-scale farms. Sunflower production moves from being unprofitable to profitable. This development is likely to encourage sunflower production considering that sunflower is producer price responsive. Raising the producer price to ZK2,000 is synonymous with raising the price by 543%. The sunflower producer price elasticity is 0.68. When this elasticity is

multiplied by the rise of 543% in producer price it translates into a rise in production by 369%. This implies that if liberalisation raised the sunflower producer price to its competitive level (ZK2,000), it would induce a 369% increase in sunflower production.

(b) Effect of Seed and Producer Price Liberalization

The impact of seed and producer price liberalization was estimated by assuming that while the sunflower producer price rose to ZK2,000 per 50kg bag the seed price also rose to the competitive level of ZK150/kg. Simulation of these changes into the PAMS for small-scale and medium scale farms gave rise to tables 5.12 and 5.13

Table 5.12: Simulation of Producer Price and Seed Price Liberalisation into the PAM for Small-scale Sunflower production

UNITS: '000 KWACHA PER HECTARE

	REVENUE	TRADABLES	FACTORS	PROFIT
PRIVATE VALUES	20.00	3.43	5.62	10.95
SOCIAL VALUES	24.57	5.19	-1.15	20.53
DIVERGENCIES	-4.57	-1.76	6.77	-9.58

Table 5.13: Simulation of Producer Price and Seed Price Liberalisation into the Medium-scale Sunflower PAM

UNITS: '000 KWACHA PER HECTARE

	REVENUE	TRADABLES	FACTORS	PROFIT
PRIVATE VALUES	32.00	3.77	7.60	20.63
SOCIAL VALUES	39.31	3.89	-2.18	37.60
DIVERGENCIES	-7.31	-0.12	9.78	-16.97

With both seed and producer price liberalization profits from sunflower production rise but not as much as when only the producer price is liberalised. For small-scale sunflower, profits rise to ZK10,950 per hectare with both seed and output price liberalization as compared to ZK13,670 per hectare when only the producer price is liberalised. The divergences of - ZK9,580 and -ZK16,970 in profits for small-scale and medium-scale farms respectively are also not as low as when only the producer price is assumed to rise with liberalisation. Although the rise in profits is less with liberalization of both output (producer) and input (seed) prices, sunflower production still gets more profitable with liberalisation. It becomes privately profitable. There are, therefore, chances of increased sunflower production even with both seed and producer price liberalization. Even if the producer price

and all input costs rose to their competitive level with liberalisation, sunflower production in Zambia would still be competitive. This is shown by the social profits of ZK20,530 and ZK37,600 for small-scale and medium-scale production respectively. The social profits are calculated using competitive prices.

5.11. The Effect of Devaluation on Sunflower Production

Assuming a 50% devaluation and consequently a 50% rise in the private value of tradables (inputs and output), the profitabilities changed as indicated in table 5.14.

Table 5.14: The Effect of Devaluation on Sunflower Profitability

FARM CATEGORY	PRIVATE PROFIT (ZK'000/HA.)		CHANGE (%)
	Base	After Devaluation	
SS SUNFLOWER	-3.22	-2.02	37
MS SUNFLOWER	-4.38	-2.77	37

Table 5.14 shows that devaluation will benefit the farmers as their profitabilities will increase. The profitabilities increase by 37% for both small-scale (SS) and medium-scale (MS) sunflower production. Devaluation like liberalisation is therefore likely to effect increases in sunflower production.

CHAPTER 6.

6. CONCLUSIONS AND POLICY IMPLICATIONS

There is a link between agricultural policies and low production in the developing countries. Policies create disincentives for production. There have been policies to stimulate sunflower production in Zambia but production has remained low. In an effort to establish the effect of policies on sunflower production this study:-

(a) Determined the profitability of sunflower production for small-scale and medium-scale farmers;

(b) Compared incentives for sunflower to those for maize for these 2 categories of farmers;

(c) Determined the efficiency of sunflower production in Zambia;

(d) Estimated the effect of seed sunflower and sunflower producer price liberalization and of further devaluation of the kwacha on sunflower production.

6.1. Profitability of Sunflower

The study found that both small-scale and medium-scale sunflower production were privately unprofitable. The policies had not created incentives for sunflower production by the two categories of farmers. The lack of incentives was mainly due to the depressed producer price. Although the tradable input prices were also depressed, the depression of the producer price

outweighed the depression of input prices. The overall effect was depression of value added by 88% for small-scale farmers and 91% for medium scale farmers.

The depressed producer price has a negative effect on sunflower production. Sunflower is producer price responsive. Mwansa (1992) estimated the sunflower producer price elasticity to be 0.68. This study estimated that the sunflower producer price was depressed by 87% relative to its world market equivalent. Using the elasticity of 0.68, it can be concluded that the sunflower producer price depression has resulted in the depression of production by 59%. Production is only 41% of what it would be without the divergencies which are mainly due to the agricultural pricing and marketing policies.

As regards social profitability both categories were profitable. The social tradable input costs were higher but social revenue was even higher. The real interest rates were found to be very low (-37%). This indicates that capital is very cheap in Zambia, although the nominal interest rate of 33% per annum indicates otherwise.

6.2. Comparison of Incentives for Sunflower to those for Maize.

It was found that both sunflower and maize production had been subjected to disincentives. However, maize had higher chances of being produced because input provision for it was better and maize is a staple food crop.

6.3. Efficiency of Sunflower Production in Zambia

Social profitabilities showed that sunflower production in Zambia was efficient for both small-scale and medium-scale farms. Social profitability per hectare was ZK37,600 for medium scale farms and ZK20,530 for small-scale farms. The DRCR was found to be the same (-6%) for both medium-scale and small-scale sunflower production. This indicates that factor costs for medium-scale sunflower production take up the same proportion of the respective value added as do factor costs for small-scale sunflower production. The DRCR of -6% also indicates that production of sunflower in Zambia is cheaper than importing.

6.4. Effect of Seed Sunflower and Sunflower Producer Price Liberalization on Sunflower Production.

The study found that seed sunflower and sunflower producer price liberalisation were likely to raise sunflower production. If liberalisation raised these prices to their competitive levels, sunflower production would shift from being unprofitable to profitable.

6.5. Effect of Devaluation on Sunflower Production

It was estimated that devaluation would make sunflower production more competitive. Although devaluation would raise the private values of both output and tradable inputs such as seed and packing materials, profitability would still rise by 37% with devaluation. Devaluation was therefore likely to effect increased sunflower production.

6.6. Policy Implications

With the technologies currently used, sunflower production in Zambia should be encouraged. It is cheaper to produce domestically than to import as shown by the estimated DRCR of -6%.

The SAP measures (liberalisation and devaluation) currently being implemented are likely to have beneficial effects for sunflower production. They are likely to turn sunflower into a profitable enterprise. Although input prices will also rise with liberalisation, the rise is likely to be outweighed if both the input and producer prices just rise to their respective competitive levels. The agricultural prices should be let to rise to their world market equivalents in order to stimulate sunflower production. Additionally, marketing services and input provision in particular should also be improved to supplement the price incentives for sunflower production. It was discovered during data verification for this study that non-availability of higher yielding and higher oil content composite and hybrid seeds at primary societies was one of the factors that made farmers use lower yielding and lower oil content local seed.

What has happened to maize production provides evidence of the importance of input provision. While both maize and sunflower have been subjected to producer price disincentives for example, maize production has on the average increased. As Chabala (1990) has also reported, the increase is partly attributed to availability and use of hybrid maize varieties and fertilisers .

As regards credit, farmers should be encouraged to borrow as much as they can now. The real interest rates are negative. Farmers will benefit by borrowing as what they pay back is worth less than what they borrow.

Due to data limitations this study did not include large scale farmers in its analysis. An analysis of this category will lead to better understanding of the effect of policies at farm level.

In order to understand the sunflower sub-sector much better analysis should extend from producer (farm level) to consumer (wholesale or retail level). This study could not be that extensive because of limitation of finances and time. An extensive study would provide an even greater contribution to existing knowledge about the sunflower sub-sector.

REFERENCES

Banda, A.K., et al. 1992. 'Impact of price policy and exchange rate policy on domestic maize production'. In Sellen, D. ed. Preparing and Communicating Policy Advice: Applications of the Policy Analysis Matrix to African Agriculture. EDI working papers, Economic Development Institute of the World Bank.

Brown, G.T. 1978 . 'Agricultural pricing policies in developing countries'. In Schultz, T.W. ed. Distortions of Agricultural Incentives. London, Indiana University Press.

Chabala, C. 1990. 'Implications of a liberalised agricultural marketing policy on crop utilisation and storage: Household, community and district levels'. In Ministry of Agriculture, Planning Division/ARPT Seminar on Adaptive Research, Planning and Policy. November 14-16, 1990, Siavonga, Kariba Inn.

Clay, E.J. 1981. Food Policy Issues in Low-Income Countries. World Bank Staff Working Paper No. 473. Washington DC, World Bank.

Clements, D.J. 1989. Guidelines for Determining the Economic Costs and Returns for Crops. Lusaka, Ministry of Agriculture and Cooperatives, Planning Division.

Ellis, F. 1992. Agricultural Policies in Developing Countries. Cambridge, Cambridge University Press.

FAO (Food and Agriculture Organisation of the United Nations). 1991. Zambia; Comprehensive Agricultural Development and Food Security Programme. Rome, FAO.

Fox, R., et al. 1992. 'Expanding the policy dimension of farming systems research'. In Sellen, D. ed. District Agricultural Development Strategies in Kenya: Policy Analysis of Commodity Systems. EDI working papers, Economic Development Institute of the World Bank.

Hayami, Y. and Ruttan, V.W. 1985. Agricultural Development: An International Perspective. London, Johns Hopkins University Press.

Jaeger, W. and Humphreys, C. 1988. 'The Effect of Policy Reforms on Agricultural Incentives in Sub-Saharan Africa'. American Journal of Agricultural Economics. Vol. 70 (5).

Lecaillon, J., et al. 1987. Economic Policies and Agricultural Performance of the Low-income Countries. Paris, OECD.

Lubozhya, B.M., and Chacko, C.A. 1991. Oilseeds Development in Zambia: Problems and Prospects. Position paper. National Oilseeds Development Programme, Lusaka, Zambia.

Milimo, J., et al. 1990. 'Regional crop production instability in Zambia and its implications for food security'. In Rukuni, M., and Wyckoff, J.B. eds. Market Reforms, Research Policies and SADCC Food Security. Proceedings of the sixth annual conference on food security research in Southern Africa. November 12 - 14, 1990. Harare, University of Zimbabwe.

Ministry of Agriculture. 1985. Agricultural Statistics Bulletin. Lusaka, Ministry of Agriculture, Planning Division.

Ministry of Agriculture. 1987. Estimated Costs of Production of Major Crops in Zambia. Lusaka, Ministry of Agriculture, Planning Division.

Ministry of Agriculture. 1988. Agricultural Statistics Bulletin. Lusaka, Ministry of Agriculture, Planning Division.

Ministry of Agriculture. 1991. Zambia National Census of Agriculture 1991/92: Supplementary Manual. Lusaka, Ministry of Agriculture, Planning Division, .

Monke, E.A., and Pearson, S.R. 1989. The Policy Analysis Matrix for Agricultural Development. London, Cornell University Press.

Muhindi, S.B. 1992. 'Effects of liberalisation of cotton marketing with special reference to Busia district'. In Sellen, D. ed. District Agricultural Development Strategies in Kenya: Policy Analysis of Commodity Systems. EDI working papers, Economic Development Institute of the World Bank.

Mukumbu, J.M., et al. 1990. Policy Analysis For Rural Development Working Paper No. 3 'Social Prices For The Analysis of Kenyan Agricultural Commodity Systems'. Kenya, Egerton University Research and Training in Agricultural Policy Analysis Project.

Mulalami, C.G. 1992. Policy Analysis of Soybean Production in Zambia. MSc. Thesis, University of Illinois, Urbana.

Muwamba, J. 1990. 'Some reflections on the recent changes in agricultural policy'. In Ministry of Agriculture, Planning Division, Report on Planning Division/ARPT Seminar on Adaptive Research Data, Planning and Policy. November 14-16, 1990, Siavonga, Kariba Inn.

Mwansa, J.N. 1992. Agricultural Supply Response for Major Crops in Zambia: A Cross Section - Time Series Approach. MSc. Thesis, University of Guelph.

National Commission for Development Planning. 1989. Fourth National Development Plan,1989-1993. Lusaka, Office of the President.

Peterson, W.L. 1979. 'International Farm Prices and Social Cost of Cheap Food'. American Journal of Agricultural Economics, Vol. 61 (1).

Republic of Zambia. 1990. Evaluation of the Performance of Zambia's Maize Sub-sector. Lusaka, Ministry of Agriculture, Planning Division.

Sellen, D. ed. 1992. Preparing and Communicating Policy Advice: Applications of the Policy Analysis Matrix to African Agriculture. London, Economic Development Institute of the World Bank.

Sharpley, J. 1986. Economic Policies and Agricultural Performance: The Case of Kenya. Paris, Organisation for Economic Cooperation and Development.

Shawa, J.J. 1990. Economic Analysis of Expanding Agricultural Exports: The Case of Cotton in Zambia. Msc. Thesis, University of Manitoba.

Sichinga, H.E.C. 1992. Economic Analysis of Factors Affecting Sunflower Production in Zambia: A Case Study of Mumbwa District. Msc. Thesis, Sokoine University of Agriculture.

Tolley, G.S., et al. 1982. Agricultural Price Policies and the Developing Countries. Washington, D.C., The World Bank.

ANNEX 1

MACHINERY COMPOSITIONS

a) SMALL-SCALE SUNFLOWER PRODUCTION

Plough
Zig-zag harrow
3-tyre cultivator
Planter
Ox-cart

b) SMALL-SCALE MAIZE PRODUCTION

Plough
Zig-zag harrow
3-tyre cultivator
Planter
Ox-cart

c) MEDIUM-SCALE SUNFLOWER PRODUCTION

39 hose power tractor
Plough
5-tyre cultivator
Planter
Trailer

d) MEDIUM-SCALE MAIZE PRODUCTION

39 hose power tractor
Plough
5-tyre cultivator
Harrow
Planter
Maize sheller
Trailer

ANNEX 2

DETERMINATION OF MACHINERY DEPRECIATION IN SOCIAL VALUES

To estimate depreciation in social values, the social values of machinery were first estimated as shown below.

I. Determination of the Social Cost of the Ox-drawn Plough

CIF Lusaka price = US $72.49

Kwacha cost at Lusaka = 72.49 x 65.04 = ZK4,714.75

Internal handling costs = ZK235.74

Transportation to Kalomo cost ZK155.59 per plough. To get the social cost of transportation, the private cost (ZK155.59) was decomposed into tradables, labour and capital. The social values of each of these components were then estimated after which the 3 social values were summed to get the social transport cost. Using this procedure the social transport cost was estimated to be 77.08 + 42.01 - 57.57 = ZK61.52

The social cost of the ox-drawn plough at Kalomo was thus ZK4,714.74 + 234.74 + 61.52 = ZK5.012.01

The same procedure of getting import parity prices described and used here was used for the remaining items below.

II. Determination of the Social Cost of a Disc Plough

CIF Lusaka price	= US $1,782.83
Kwacha cost at Lusaka	= ZK 115,955.26
Internal handling costs	= 5,797.76
Transportation to Kalomo	= 1,513.12
Social cost of a disc plough at Kalomo	= ZK123.266.14

III. Determination of the Social Cost of a Tractor (39 HP)

CIF Lusaka price	= US $8,918.80
Kwacha cost at Lusaka	= ZK8,918.80 x 65.04
	= ZK580,078.75
Internal handling costs	= 29,003.94
Transportation to Kalomo in social prices	= 7,569.53
Social cost of a tractor at Kalomo	= ZK616,652.22

IV. Determination of the Social Cost of a Harrow (zig-zag)

CIF Lusaka price	= US $58.65
Kwacha cost at Lusaka	= ZK 3,814.60
Internal handling costs	= 190.73
Transportation to Kalomo	= 49.77
Social cost of a Harrows at Kalomo	= ZK4,055.1

V. Determination of the Social Cost of a Harrow (12 disc)

CIF Lusaka price	= US $1,768.87
Kwacha cost at Lusaka	= ZK115,047.30
Internal handling costs	= 5,752.37
Transportation to Kalomo	= 1,501.26
Social cost of a Harrows at Kalomo	= ZK122.300.93

VI. Determination of the Social Cost of a Cultivator (3- Tyre)

CIF Lusaka price	= US $92.95
Kwacha cost at Lusaka	= ZK 6,045.47
Internal handling costs	= 302.27
Transportation to Kalomo	= 78.89
Social cost of a cultivator at Kalomo	= ZK6.426.63

VII. Determination of the Social Cost of a Cultivator (5- Tyre)

CIF Lusaka price	= US $100.01
Kwacha cost at Lusaka	= ZK6,504.65
Internal handling costs	= 325.23
Transportation to Kalomo	= 84.78
Social cost of a cultivator at Kalomo	= ZK6.914.66

VIII. Determination of the Social Cost of a Planter (1- row)

CIF Lusaka price	=	US $176.59
Kwacha cost at Lusaka	=	ZK11,485.41
Internal handling costs	=	574.27
Transportation to Kalomo	=	149.88
Social cost of a 1 row Planter at Kalomo	=	ZK12.209.56

IX. Determination of the Social Cost of a Planter (3- row)

CIF Lusaka price	=	US $3,284.50
Kwacha cost at Lusaka	=	ZK213,623.88
Internal handling costs	=	10,681.19
Transportation to Kalomo	=	2,787.61
Social cost of a 3 row Planter at Kalomo	=	ZK227,092.68

X. Determination of the Social Cost of a Maize Sheller

CIF Lusaka price	=	US $44.69
Kwacha cost at Lusaka	=	ZK2,906.64
Internal handling costs	=	145.33
Transportation to Kalomo	=	37.93
Social cost of a sheller at Kalomo	=	ZK3,089.90

The social costs of machinery calculated above were used to estimate depreciation in social prices as shown in tables I to IV.

TABLE I: DETERMINATION OF DEPRECIATION IN SOCIAL PRICES FOR SMALL-SCALE SUNFLOWER PRODUCTION

Machine Type	Machine size	No.per Farm	Social Cost/ Machine	%Use This Crop	Cost Alloc. this crop	Useful life(yrs.)	Annual Deprec'n.
Oxen	---	4.00	3000	20	2400	---	---
Plough	Ox-drawn	1.00	5012.01	15	752	20	30.07
Harrow	Zig-zag	0.25	4055.1	15	152	15	8.11
Cultivator	3-Tyre	0.75	6426.63	8	386	15	20.57
Planter	1-row	0.20	12209.56	18	440	15	23.44
Ox cart	1 tonne	0.62	8750	11	597	15	31.83
TOTAL PER FARM					4726		114.02
Hectares of sunflower per farm =	1.1			COST/HECTARE	4296		103.65

TABLE II: DETERMINATION OF DEPRECIATION IN SOCIAL PRICES FOR SMALL-SCALE MAIZE PRODUCTION

Machine Type	Machine size	No.per Farm	Social Cost/ Machine	%Use This Crop	Cost Alloc. this crop	Useful life(yrs.	Annual Deprec'n.
Oxen	---	4.00	2000	79	6320	---	---
Plough	Ox-drawn	1.00	5012.01	79	3959	20	158.38
Harrow	Zig-Zag	0.25	4055.1	79	801	15	42.71
Cultivator	3-Tyre	0.75	6426.63	85	4097	15	218.51
Planter	1-row	0.20	12209.56	79	1929	15	102.89
Ox cart	1 tonne	0.62	8750	68	3689	15	196.75
TOTAL PER FARM					20795		719.23
Hectares of maize per farm =	3.26			COST/HECTARE	6379		220.62

TABLE III: DETERMINATION OF DEPRECIATION IN SOCIAL PRICES FOR MEDIUM-SCALE SUNFLOWER PRODUCTION

Machine Type	Machine Size	No.Mach./ Farm	Social Cost/ Machine	%Use this Crop	Cost Alloc. this crop	Length of life(yrs.)	Annual Deprec'n.
Tractor	39 HP.	0.8	616652.22	6	29599	15	1579
Disk Plow	3B	0.8	123266.14	9	8875	15	473
Planter	3-row	1	227092.68	6	13626	15	727
Row-Cultivator	5-Tyre	1	6914.66	2	138	15	7
Trailer	3 tonnes	0.5	52500	15	3938	15	210
TOTAL PER FARM					56176		2996
Hectares of sunflower per farm =	4.5	COST PER HECTARE			12484		666

TABLE IV: DETERMINATION OF DEPRECIATION IN SOCIAL PRICES FOR MEDIUM-SCALE MAIZE PRODUCTION

Machine Type	Machine size	No.Mach./ Farm	Social Cost/ Machine	%Use This Crop	Cost Alloc. this crop	Length of life(yrs.)	Annual Deprec'n.
Tractor	39 HP.	0.8	616652.22	42	207195	15	11050
Disk Plough	3B	0.8	123266.14	40	39445	15	2104
Harrow	12 disk	0.25	122301	45	13759	15	734
Planter	3-row	1	227092.68	44	99921	15	5329
Row-Cultivator	5-Tyre	1	6914.66	55	3803	15	203
Maize-sheller	small	0.43	3089.9	100	1329	15	71
Trailer	3 tonnes	0.5	52500	30	7875	15	420
TOTAL PER FARM					373327		19911
Hectares of maize per farm =	12.6	COSTS PER HECTARE			29629		1580