Evaluating the gender and poverty impact of Malawi's fertilizer subsidy programme, 2009/2010

By

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DECLARATION

I Mbilire Rose Ndalama declare that the thesis, which I hereby submit for the degree of MSc (Agric) Agricultural Economics at the University of Pretoria is my own work and has not been previously submitted by me for a degree at this or any other tertiary institution.

Signature: MBILIRE ROSE NDALAMA

Date: April, 2015

DEDICATION

To Harry, Akuzike, Nonhlanhla and the entire Ndalama family, you people are so amazing!

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ABSTRACT

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Degree:	MSc (Agric): Agricultural Economics
Department:	Agricultural Economics, Extension and Rural Development
Study Leader:	Professor Chris Blignaut
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The research was carried out to establish whether Malawi's fertiliser subsidy programme of 2009/2010 had a positive effect on maize yields and whether this influence varied with the gender of the household head receiving the fertiliser subsidy coupon. Furthermore, the survey assessed whether in any case the targeting of beneficiaries of the programme had advanced its pro-poor aspect.

The expectation was that recipient households would obtain higher maize yields than non-recipients households. It was further anticipated that making inputs available to female-headed households through the fertiliser subsidy programme would reduce the production gap that normally exists between female- and male-headed households. Since the programme targets the poor, including female-headed households, it was assumed that more of these households would benefit.

Regression results indicated that the fertiliser subsidy programme had a positive effect on maize yields, although certain factors, like climate, also make significant contribution. Maize yields varied with the agro-ecological zone in which a household was located. Lower shire and lakeshore zones produced less maize than the medium altitude zone,

which is the reference agro-ecological zone (AEZ) and has more favourable conditions for maize production. Although maize yields of high altitude zones were less than those of medium altitude zones, the difference was not significant. Nevertheless, within each agro-ecological zone, recipient households produced statistically significant higher maize yields than did non-recipient households.

Irrespective of agro-ecological zone differences, recipient households produced 16 per cent more maize yields and had higher use of maize fertilisers and hybrid maize seeds than non-recipient households. The results further show that non-recipient male-headed households produced more maize yields than non-recipient female-headed households, confirming the usual production gap that exists between them. However, female-headed households which received fertiliser coupons obtained more maize yields than non-recipient male and non-recipient female-headed households.

A comparison of the maize yields between recipient male-headed and recipient female-headed households yielded insignificant results. Similar results were observed on the comparison of maize fertilisers and hybrid maize seed usage. Considering that female-headed households face constraints in accessing inputs, leading to low yields, the results would mean that the fertiliser subsidy to some extent improved their access to inputs and hence their maize yields. It was also evident in the survey that the change in maize yields was higher among female-headed households than male-headed households when the fertiliser subsidy was taken into account. This observation would imply that female-headed households were more efficient in using subsidised inputs than male-headed households were.

The results also illustrate that both male- and female-headed households were equally likely to benefit from the fertiliser subsidy programme, despite the fact that female-headed households were the main targets. It was also observed that farmers with large land holdings benefited from the programme. Although households with large family sizes benefited from the programme, this was insufficient to associate them with being poor. However, seeing that the number of female-headed households' receiving

coupons was not significant, and that recipient households had on average large farms and high asset values, the hypothesis that the programme was pro-poor could not be accepted.

The study proposes the need to reconsider the selection process for the beneficiaries of the programme so that more female-headed households are selected since they appear to be more efficient in using the fertiliser subsidy than the male-headed households are. The study also suggests targeting coupons for maize inputs to AEZs which favour the crop and considering subsidising inputs for food crops other than maize which grow well in the other AEZs. However these observations should be regarded in the short-term while planning for gradual exit strategy.

The study recommends that a similar study be carried out where the design and data collection will take into account similar characteristics of both beneficiaries and non-beneficiaries and that an observation is done for a period of more than one year to ensure that the treatment and control groups are equally represented and that fair comparisons are made. It would also be interesting to conduct a study on how the different gender categories share the benefits of the fertiliser subsidy.

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LIST OF ACRONYMS

ADB	African Development Bank
ADMARC	Agricultural Development and Marketing Cooperation
AEZs	Agro-Ecological Zones
AISP	Agricultural Input Subsidy Programme
AoA	Agreement on Agriculture
APIP	Agricultural Productivity Improvement Program
AU	African Union
CAADP	Comprehensive African Agriculture Development Programme
CAN	Calcium Ammonium Nitrate
CIA	Central intelligence Agency
COMESA	Common Market for Eastern & Southern Africa
DFID	Department for International Development
ETIP	Extended Targeted Input Programme
EU	European Union
FISP	Fertiliser Input subsidy Programme
FAO	Food Agriculture Organisation
GDP	Gross Domestic Product
GoM	Government of Malawi
IFPRI	International Food Policy Research Institute
IMF	International monetary Fund
LDCs	Least Developed Countries
MGDS	Malawi Growth and Development Strategy
MK	Malawi Kwacha
MoAFS	Ministry of Agriculture and Food Security
NEPAD	New Partnership for Africa's Development
NPK	Nitrogen Phosphorus Potassium
NSO	National Statistics Office
OECD	Organization for Economic Co-operation and Development
SADC	Southern Africa Development Community

SAPs	Structural Adjustment Programmes
SPSS	Statistical Package for Social Sciences
SSA	Sub Saharan Africa
TIP	Targeted Input Programme
TAMS	Total Aggregate Measure of Support
UN	United Nations
US	United States
USAID	United States Agency for International Development
VDCs	Village Development Committees
WB	World Bank
WEF	World Economic Forum
WTO	World Trade organisation

CHAPTER 1

INTRODUCTION

1.1 BACKGROUND

Agriculture continues to be the mainstay of Africa's economy, employing about 90 per cent of the rural work force and accounting for about 40 per cent of export earnings. Despite this, the sector's performance has not been adequate to transform the continent towards industrialisation (UN/AU 2012:120). Food production per capita has dropped, while output has not improved. This is partly due to limited infrastructure, limited access to credit, limited agricultural research and inability by farmers to use inputs, like fertiliser and improved seeds.

Furthermore, in Sub Saharan Africa (SSA) women produce about 60–80 per cent of the food crops, yet they have less access to productive resources compared with men (World Bank 2012:65). In addition, the sector has not been receiving much attention from national governments since the call for states to stop intervening in the market.

Under the Comprehensive African Agriculture Development Programme (CAADP), agriculture has once again been identified as the means to eliminate hunger and reduce poverty. African governments agreed to increase public investment in agriculture by a minimum of 10 per cent of their national budgets and to raise agricultural productivity by at least 6 per cent. Although it is not clear how these figures were arrived at, the known fact is that at the beginning of the programme, many African governments had been spending as little as 1 per cent of their budgets on agriculture. The World Bank’s lending to Africa for agriculture dropped to about 7 per cent in 2000. Since the majority of the population in the rural areas in Africa are engaged in subsistence agriculture, raising productivity and consequently profits for small farmers, should therefore be most beneficial to African economies.

Increasing expenditure in public goods and services, like irrigation, agricultural research and new technology, and providing support for input-related industries, such as fertilisers and seeds, are some of the measures to achieve this. However, for public spending to be effective in meeting its objectives, it has to target those that need it and ensure that the benefits are equitably distributed (Cuesta, Kabaso & Suarez-Becerra, 2012:2). Giving power to small-scale farmers to access production resources, land-ownership rights, credit and farming education, among others, is also of ultimate importance (UN/AU, 2012).

Malawi's economy, just like many African countries, depends on agriculture, employing about 80 per cent of the workforce and contributing over 40 and 90 per cent of Gross Domestic Product (GDP) and foreign exchange earnings, respectively. The tobacco sector is vital for growth, as it constitutes more than half of exports (World Fact Book, CIA, 2011). Despite this, agricultural yields are persistently low and stagnant, owing to over reliance on subsistence smallholder agriculture (which constitutes about 70 per cent) and rain-fed agriculture that makes it susceptible to weather related shocks and low use of improved farm inputs (GoM, 2010:17). The withdrawal of the state from intervening in the markets, as promoted by the structural adjustment programme (SAP), led to periods of declining trends in agricultural production, especially maize (Chirwa, 2007:2). Agricultural GDP per capita fluctuated from an average negative rate of -1.9 per cent between 1980 and 1995 to a positive rate of 11.55 per cent between 1995 and1999, which later fell to 0.36 per cent between 2000 and 2005 (Chirwa, Kumwenda, Jumbe, Chilonda & Minde, 2008:21). The SAPs put more emphasis on eliminating market imperfections than addressing issues of low technology uptake, declining land holdings and soil fertility (GoM, 2010:8-9) and this could be the reason why the programme was not effective.

Regardless of the agriculture sector's poor performance, the government of Malawi still recognises it as an engine for driving economic growth. This is demonstrated through a number of initiatives that the government has undertaken. For example, the

implementation of the starter packs programmes in the post-SAPs era (1998/1999–1999/2000) in a bid to provide every rural farmer with free, improved seed and fertiliser. This initiative resulted in increased maize production, at an average of about 125–150kg per household more than the estimated output at project design. Between 2001 and 2002, the government, due to donor pressure, scaled down the programme to the Targeted Input Programme (TIP), distributing fertiliser and seed to half the population of the smallholder farmers.

However, selection of beneficiaries remained a challenge and the programme was phased out in 2003 (GoM, 2010:9-10). In addition, in the Malawi Growth and Development Strategy (MGDS) (2006–2011), the Malawi government also emphasised increasing agriculture's contribution to economic growth through the increased production of food crops and the promotion of value addition to agricultural products for domestic and export markets (GoM, 2006a:38).

In pursuance of this, which is also in line with the CAADP principles, the Malawi government increased the percentage allocation of its budgetary resources to the agriculture sector from an average of 6.1 per cent between 2000 and 2005 to 13.4 per cent between 2006 and 2011 (GoM, 2010:37). Furthermore, since 2005/2006 the government of Malawi has been implementing the agricultural fertiliser subsidy programme in an effort to promote fertiliser use, tackle liquidity problems and enhance productivity for improved household food security and incomes of poor small-scale farmers (ADB Group, 2011:9).

Though this has met many criticisms, (Chirwa, Kydd & Dorward, 2006:21-22; SADC Today, 2008), countries are allowed to provide domestic support as long as it has no or minimal trade distorting effects (World Trade Organisation (WTO), 1994). The Malawi government can therefore provide assistance, given that it satisfies the developmental category, of which input subsidies to resource-poor producers are among such kinds of assistance (Sandrey, 2006:270).

There have been significant improvements in maize production and food security since the implementation of the fertiliser subsidy began. However, the question remains whether the changes in production are attributable to the programme or weather-related factors and whether the beneficiaries of the fertiliser subsidy are the intended beneficiaries. It is also important to know if these targeted poor households, of which female-headed households are a constituent, are able to obtain improved yields, given the fertiliser subsidy coupons.

1.1.1 Theoretical approach of the study

The basic micro-economic demand-supply model is used to illustrate the gender and poverty impact of fertiliser subsidy as shown in Figures 1.1 and 1.2 below. Holding other factors constant (gender of household head, household income and farmers' knowledge) and assuming elastic demand for fertiliser, a fertiliser subsidy would increase the farmers' demand for fertiliser.

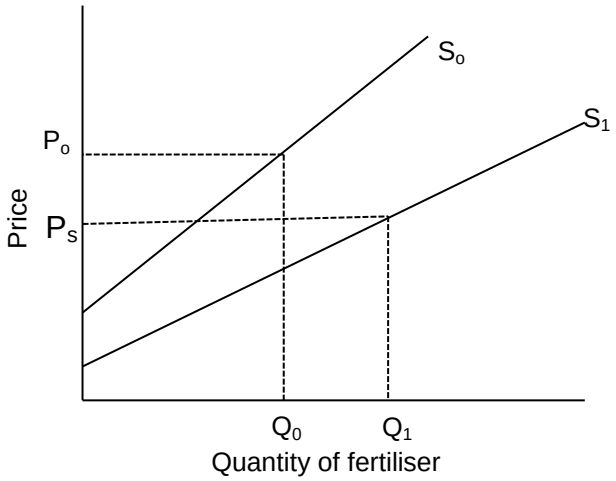

Figure 1.1: Effects of fertiliser subsidy on demand for inputs

Source: Takeshima & Lee, 2012

Thus the quantity of fertiliser demanded is expected to increase from Q_0 to Q_1 where Q_0 is the quantity demanded at commercial price P_0 and Q_1 is quantity demanded at subsidised price P_s (Figure 1.1). The government must therefore increase supply of the subsidised fertiliser from S_0 to S_1 to satisfy the new demand but at a cost.

Figure 1.2 below shows that before the fertiliser subsidy demand curve for the produce is D and supply curve is S_1 at a price of P_1 and the pre-subsidy equilibrium supply quantity is Q_1. With fertiliser subsidy farmers have a reduced cost of production and this increases production and the supply curve shifts to the right from S_1 to S_2 defining a new equilibrium at Q_2. Thus the fertiliser subsidy causes an increase in production from Q_1 to Q_2. It is worth noting that along the demand curve, a shift in the supply curve leads to a fall in price to P_2. This means that an increase in production with same demand available negatively affects the price of the commodity. This discussion however, is not within the scope of the study.

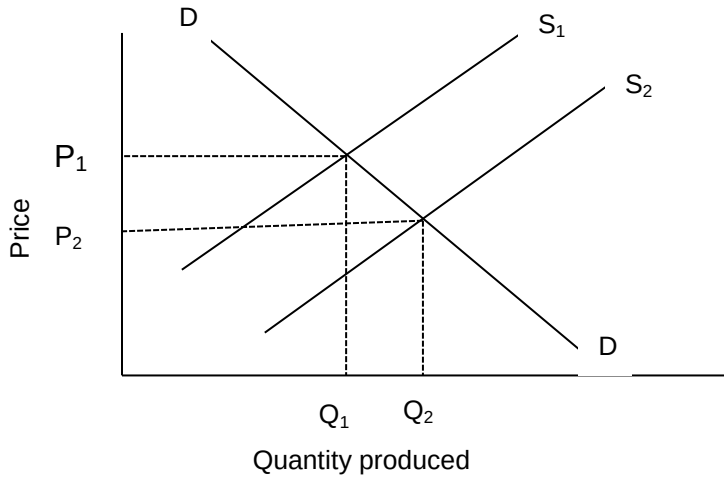

Figure 1.2: Effects of fertiliser subsidy on production

Source: Dwivedi, 2002

1.2 PROBLEM STATEMENT

Beginning in 2005/2006, when the government of Malawi started implementing the fertiliser subsidy programme, smallholder maize output and household food security has increased from 1.3 million tonnes in 2004/2005 to 3.66 million tonnes in 2009/2010, and from 66 per cent in 2004/2005 to 99 per cent in 2009/2010, respectively (ADB Group, 2011:8).

However, there is much debate on whether the improved food security in Malawi and surplus production obtained is due to the fertiliser subsidy programme or favourable

weather conditions (Chinsinga & Obrien, 2008). With the little scientific evidence available, it is difficult to attribute the increase in crop production to the fertiliser subsidy alone. Furthermore, as opposed to the fertiliser subsidies implemented before SAPs, the current fertiliser subsidy targets vulnerable households, which include female-headed households. Yet the perception that people have, is that they are entirely involved in household work and if they grow crops, it is for home consumption rather than cash (Mehra & Rojas, 2008:2).

Recent studies (Holden & Lunduka, 2010a; Holden & Lunduka, 2010b; Chibwana, Fisher, Jumbe, Masters & Shively, 2010; Dorward, 2007; Dorward, Chirwa, Kelly, Jayne, Slater & Boughton, 2008; Ricker-Gilbert, Jayne & Black, 2009; Ricker-Gilbert & Jayne, 2011, Ricker-Gilbert, 2011) provide relevant information about the impact of fertiliser subsidies in Malawi. However, either their analyses have concentrated on the effects of the programme on recipients, or both recipients and non-recipients, but with no regard to gender of household head. Yet this is a crucial aspect when targeting the beneficiaries.

A few of the studies highlighted above (Holden and Lunduka, 2010b; Dorward *et al*., 2008; Chibwana *et al.*, 2010) have attempted to assess whether the recipients of the fertiliser subsidies, especially the vulnerable female-headed households, are the intended beneficiaries, but the issue of how they have performed in the presence of the fertiliser subsidy has not been clearly tackled. There has been little analysis done on the distribution of fertiliser coupons based on landholding size, family size, asset values, gender and household incomes. This is important to ascertain, if the fertiliser subsidy is indeed pro-poor and a worthwhile public expenditure investment towards achieving equity among the farming households.

It is in this regard that this study seeks to assess the distribution of subsidised fertiliser, based on the biographic and economic factors stated above. This will give a consensus on whether the programme has helped to advance government's pro-poor objective. Understanding how female-headed households have performed, given the fertiliser

subsidy, will assist policy makers to assess whether including female-headed households in the target group is worthwhile.

1.3 RESEARCH OBJECTIVES

The main objective of the study is to assess the gender and poverty impacts of the 2009/2010 fertiliser subsidy programme in Malawi.

Specifically the study seeks to:

- Determine whether the fertiliser subsidy programme has a positive effect on maize yields.
- Establish whether maize yields differ significantly with regard to the gender of the household head receiving fertiliser subsidy coupons.
- Assess whether targeting of the beneficiaries of the fertiliser subsidy has been pro-poor.
- Identify shortcomings and formulate recommendations that can enhance performance and sustainability of the programme.

1.4 STATEMENT OF HYPOTHESIS

Agriculture subsidies have often been criticised for being costly, yet Wiggins and Brook (2010) ascertain that the subsidising of farmers who cannot afford agricultural inputs at the market price can lead to high incomes and improved food security. Nevertheless, it is questionable whether the subsidised inputs really reach the intended beneficiaries of the programme (Sharma & Thaker 2009:3).

Among the beneficiaries of the fertiliser subsidy in Malawi are the female-headed households. These households are characterised as poor and vulnerable and assessing

the distribution of the fertiliser subsidy among them will help provide information on the targeting of government expenditure (Mogues, Petracco & Randriamamonjy, 2011).

The study therefore assesses the effect of the fertiliser subsidy programme on maize yields, regardless of the gender of household heads, as well as its impact on the yields of female- and male-headed households' receiving coupons. Furthermore, it evaluates the targeting of the programme and the likelihood of households' receiving fertiliser subsidy coupons based on gender of the head of household, land holding size, family size, household asset values, and household income. These variables acted as proxies for household well-being. In this regard, the study tested the following hypotheses:

***Hypothesis 1*:** The fertiliser subsidy has a positive effect on maize yields.

***Hypothesis 2*:** The fertiliser subsidy programme targeted the intended (poor) beneficiaries, including female-headed households, thereby advancing its pro-poor objective.

Hypothesis 3: The fertiliser subsidy programme has improved female-headed households' maize yields by reducing the yield gap between them and the male-headed households.

1.5 IMPORTANCE AND BENEFITS OF THE PROPOSED STUDY

There is a growing demand for subsidies in SSA, as well as the need for information on which policy makers can base their decisions and justification for the huge expenditures in the programme. With so much criticism regarding the reintroduction of fertiliser subsidy programmes, this study is valuable because it will bring forth empirical evidence as to whether or not the targeted fertiliser subsidy is worthwhile. For policy makers and donors, the study will provide a basis for planning and directing public funds for implementing development policies in favour of the poor.

1.6 METHODOLOGY

The study used national household data which the Ministry of Agriculture and Food Security (MoAFS) in Malawi collected from all the districts, except Likoma, for the evaluation of the 2009/2010 Fertiliser Input Subsidy Programme (FISP). A sample size of 1 444 households was interviewed, which included both recipients and non-recipients of the fertiliser subsidy. Through key informant interviews, the study explored the shortcomings of the programmes and their possible solutions. Rainfall data was obtained from the Department of Climate Change and Meteorological Services.

The inclusion of the non-recipients helped to curb the attribution problem associated with impact studies. In addition, correlation and regression analysis determined the relationship between maize yields and the explanatory variables included in the household maize production model. The data obtained included household characteristics (gender of head of household, household size, and land holding size), total maize yields for 2009/2010 season, local and hybrid seed quantities, urea and Nitrogen Phosphorus and Potassium (NPK) quantities and household asset values, among others.

To integrate the climate aspect in the production model, rainfall data for the 2009/2010 was used and the respondents were grouped according to AEZs. Malawi has four agro-ecological zones, based on differences in the altitude, soil types and annual rainfall, which favour different types of crops namely lower shire; lakeshore and low-lying rain shadow; medium altitude; and high altitude plateau. The households were further categorised by gender of household head receiving fertiliser subsidy coupons. This helped to capture effects of both gender and the fertiliser subsidy on maize yields.

The study assumed that female-headed households have difficulties in accessing agricultural inputs like fertiliser and improved seed. The fertiliser subsidy was expected to improve their access to these inputs and hence their maize yields, which would be at least similar to, or higher than, those of the recipient male and the non-recipient male-

headed households. The yields obtained by non-recipient female-headed households depict the performance of the input-constrained female-headed households and are taken as a base from which changes in maize yields are measured when fertiliser subsidy coupons are received.

Disaggregating the respondents by gender and agro-ecological zone groups coupled with missing data owing to farmers' failure to recall information, resulted in insufficient observations and non-normality in the data. To cater for this, the study used non-parametric tests, being the Kruskal-Wallis, Mann-Whitney and Bonferroni adjustments, to test for differences in maize yields according to the gender of household head receiving fertiliser coupons and across AEZs.

Kruskal-Wallis test assesses whether three or more independent groups are the same regarding some variable of interest without considering the source of variation within the groups. This test is easier to calculate and apply since it uses mean ranks instead of original observations. However, the test leads to loss of information as regard the spread of data. It only indicates group differences but does not show which of the groups are different or if the difference is meaningful (Chan & Walmsley, 1997:1760).

If the Kruskal-Wallis test yields significant results, alternative tests that deal with pair wise comparisons are conducted. This study used the Mann-Whitney test which is a non-parametric equivalent of the student’s t-test. This test examines the null hypothesis of no difference in the median of two groups. Unlike the t-test for two samples, this test assumes neither normal distribution nor equality in the variance of the two samples. Thus, it is appropriate when the assumptions of t-test do not hold (Choudhury, 2010:1).

However, repeated independent tests during the Mann-Whitney test can lead to exaggerated significant differences between the groups (Morgan, 2007:34). To avoid this, the Bonferroni adjustment is used where each group comparison is performed at 0.05/m level of significance (‘m’ being the number of group comparisons). The

advantage of using the Bonferroni adjustment is that it can be applied in any multiple testing situations (Dallal, 2001:5).

The cross tabulations and chi-square test assessed the distribution and the relationship between recipient of fertiliser subsidy and gender of household head. An independent sample T-test evaluated the significance of the differences in mean land holding size, household income, family size and asset values between recipients and non-recipients of fertiliser coupons. According to the programme's objectives, the expectation was that households with small land holdings, low asset values, low incomes, and those headed by females, would constitute a large number of the recipients of the fertiliser coupons.

Logistic regression was also employed to assess the likelihood of a household receiving fertiliser subsidy coupon, based on specified characteristic associated with household well-being. To obtain normal distribution in the data, which is a requirement for conducting parametric analysis, the variable values were normalised by dividing each individual household value by the highest observed value within each variable. For example, in the case of maize yields, the divisor was the highest maize yields value observed within the sample, while the observed maize yields value for a particular household in the sample was the dividend and the quotient was the normalised value used in the analysis.

1.7 OUTLINE

The thesis has eight chapters, with the rest of Chapter 1 discussing the problem statement, objectives, hypothesis, justification of the study and the methodology used. Chapter 2 discusses an overview of the structure and performance of Malawi's agriculture sector and its history of fertiliser subsidies while Chapter 3 presents a literature review of various countries' experiences with agricultural subsidies including Malawi. Findings of the study are presented in Chapters 4, 5 and 6. Chapter 7 has the summary, conclusions and recommendations of the study.

CHAPTER 2

OVERVIEW OF THE STRUCTURE AND PERFORMANCE OF THE AGRICULTURAL SECTOR IN MALAWI

2.1 INTRODUCTION

Malawi's agriculture sector has lagged in development, despite previous efforts to boost it. Beginning in the mid-seventies and to the early nineties, the government of Malawi financed a universal fertiliser subsidy, subsidised smallholder credit and controlled maize prices. However, the system began to fail, partly because of cash flow difficulties (Dorward *et al*, 2008:8). This led to the implementation of the World Bank's sponsored SAPs from mid-1980, which included liberalisation of the input market and the removal of the fertiliser subsidies.

The outcomes of the SAPs were not as expected and that led to the re-introduction of some policies, such as the fertiliser subsidies, beginning in 1998 with the Starter Packs and then the Farm Input Subsidy Programme (FISP) in 2006. These changes in agricultural policies and other constraints have affected the performance of the sector in one way or another. This chapter, therefore, seeks to investigate these effects, especially on the maize subsector.

2.2 THE STRUCTURE OF THE AGRICULTURE SECTOR

The agriculture sector in Malawi is dual in nature, consisting of smallholder and estate agriculture. Smallholder agriculture is characterised by food crop production, mainly maize, to meet food security needs and cultivation of land holding sizes of less than one

hectare, which have no room for expansion to meet the growing population's demand (Tchale & Sauer, 2007:35; Chirwa *et al.*, 2008:9).

Other aspects of smallholder agriculture in Malawi include decreasing yields, cultivation of marginal lands and low input use, such as fertiliser (FAO, 2005). In addition, the subsector has a high dependency on family labour and use of traditional cultivation technology, like the hoe. Despite this, smallholder agriculture continues to be a source of livelihoods for many people in the rural economy of Malawi. It contributes about 84 per cent of total value added to agriculture and over 80 per cent of Malawi's agricultural production (Chirwa, 2011:9).

The estate agriculture, on the other hand, is the dominant producer of cash crops and is the country's principal foreign exchange earner. It contributes about 20 per cent of the total national agricultural production and provides over 80 per cent of agricultural exports, mainly tobacco, sugar, and tea, and, to a lesser extent, coffee and macadamia. The estate subsector operates on leasehold or freehold land (Chirwa *et al*., 2008; Kachule 2012).

2.3 TRENDS IN THE PERFORMANCE OF THE AGRICULTURE SECTOR

After gaining independence in 1964, Malawi followed an interventionist policy where the government was actively involved in the provision of extension services, agricultural technology development, production, and marketing of agricultural produce in the smallholder agriculture sector. Despite these efforts, the majority of the households in Malawi could not afford to buy maize, even at the reduced price offered by the state-controlled market Agricultural Development and Marketing Corporation (ADMARC).

The government's actions, as well as the agricultural policies, in the post-independence era resulted in the bias towards the estate sector, as well as in extended food insecurity periods (DFID, 2005:16). Such policies included heavily taxation of the smallholder

farmers and expropriating land from them in a bid to develop the estate sector (GoM, 2010:8-9).

By the mid-1980s, Malawi had experienced a deteriorating macroeconomic situation to such an extent that the government adopted the World Bank and International Monetary Fund (IMF) sponsored Structural Adjustment Programmes (SAPs) to even out the policy bias against smallholder agriculture. The SAPs involved, among other things, the liberalisation of burley tobacco production to allow smallholder farmers grow the export crop, and the removal of the fertiliser subsidy. The SAPs also supported the withdrawal of government intervention in agriculture to allow market-led growth.

Nevertheless, low agricultural productivity and negative growth rates have persisted since the SAPs in the early 90s. Considering that farmers had already been experiencing food shortages owing to various factors like drought, the removal of the input and credit subsidy had probably worsened the situation (Menon, 2007:3). It also became evident that the SAPs had failed to generate the sufficient supply response through the price incentives alone, while ignoring the technological, land and credit constraints issues. Chilowa (1998:553) attributed these outcomes to the fact that the SAPs placed more emphasis on promoting market efficiency than on dealing with production problems faced by farmers. The liberalisation took away the broad based agricultural credit system, which was to the advantage of a few privileged cash crop smallholder producers at the expense of the many subsistence smallholder farmers.

According to Table 2.1 below, Malawi's economy performed well, registering high growth rates (agriculture GDP per capita of 1.9 per cent) between 1970 and 1979, but it did experience negative growth in the adjustment period (1980-1984 up to 1990-1994).

Table 2.1: Growth in Malawi's agriculture sector output, 1970-2009

Indicator	1970-79	1980-84	1985-89	1990-94	1995-99	200-05	2006-2009
GDP per capita	2.40	-2.08	-0.20	-2.66	3.17	-0.28	13.63
Agricultural GDP per capita	1.90	-2.70	-1.89	-1.19	11.55	0.36	4.99
GDP	5.9	1	3.03	0.61	6.4	1.55	7.28

Source: GoM, 2010

The period between 1995 and 1999 saw a recovery to high growth rates, attributable to the implementation of the Starter Pack Programmes. The sector then experienced its worst growth rates in the period between 2000 and 2005, which could be because of the total withdrawal of government support, as well as the drought experienced within that period. The incremental growth registered from 2006 to 2009 has been ascribed to the implementation of the Farm Input Subsidy Programme, coupled with favourable weather patterns.

Figure 2.1 below shows that maize production declined and then stagnated during the adjustment period between 1983 and 1996/97.

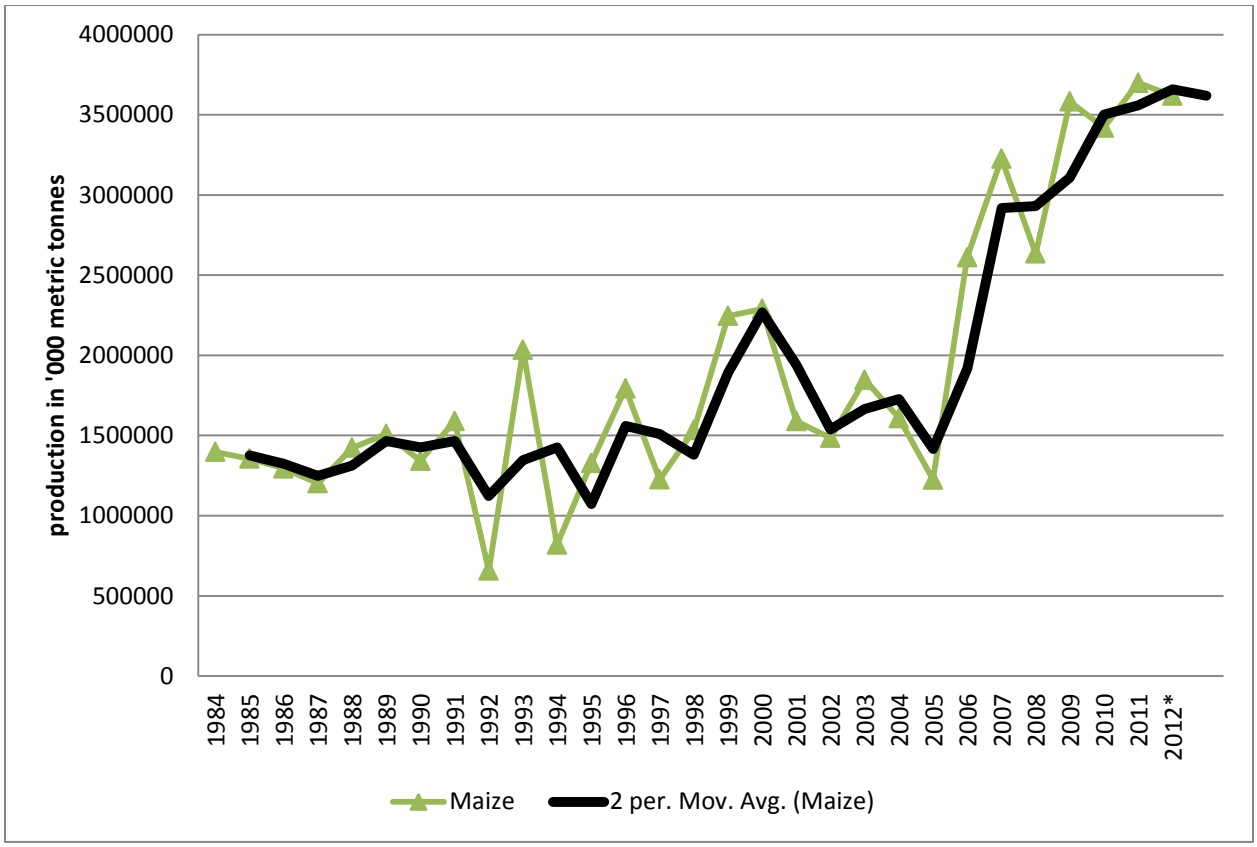

Figure 2.1: Trends in maize production in Malawi, 1983-2012.

Source: FAO, 2012

2.4 FACTORS INFLUENCING THE PERFORMANCE OF MALAWI'S AGRICULTURE

As noted in the previous section, agricultural productivity in Malawi has been inconsistent over the past three decades. It appears that the changes in agricultural policies, i.e. withdrawal of government support and the consequent reduced spending on the sector, have played a role in the observed trends (GoM, 2010:20-21)

In addition, factors such as overdependence on rainfall for farming, low use of improved farm inputs, small land holding sizes, low agricultural incomes, gender disparities, and weak links to the markets, have also contributed to the poor performance of the sector (GoM, 2010:20).

2.4.1 Weather factors

Agriculture in Malawi is rain-fed and as such it is prone to weather-related shocks, which in turn affects production. Figure 2.2 below, for instance, indicates that during the years of drought –1991/92, 1994/95, and 2004/05 – maize yields were extremely low, while during the years of good rains, Malawi has had bumper maize harvests This indicates the importance of weather in Malawi's agriculture. Surprisingly, when rainfall has been at its highest, maize production has not been at its maximum, which is an indication that there is more to increased maize production than just rainfall. For instance the subsidy programme has led to increased adoption of improved maize varieties.

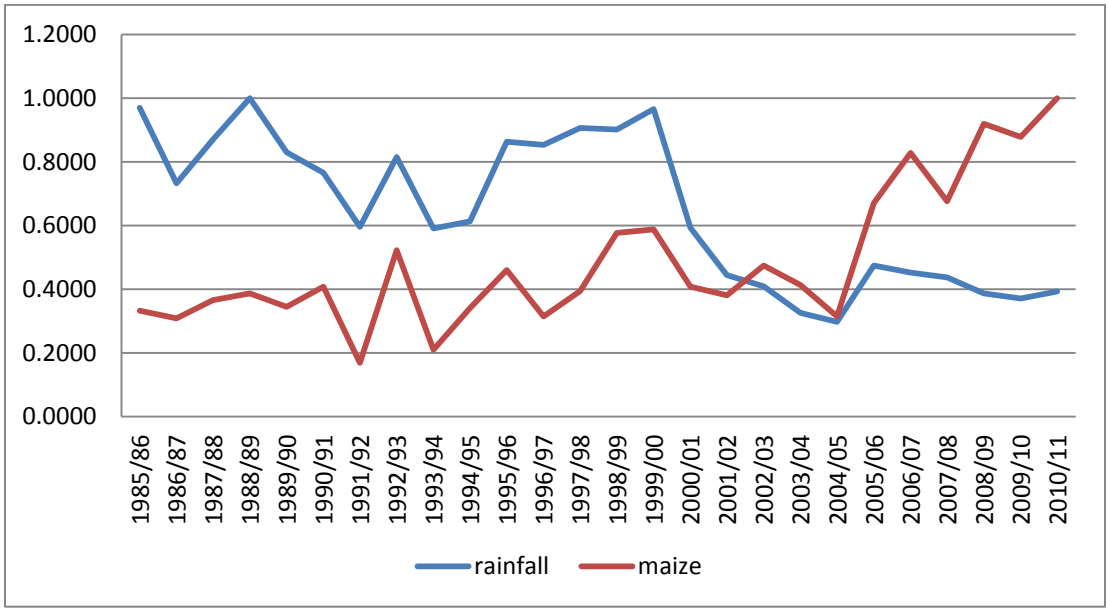

Figure 2.2: Relationship between maize production and rainfall in Malawi, 1985/86-2010/11.

Source: FAO & Department of Climate Change and Meteorological Services, 2012

Table 2.2 below, shows the four agro-ecological zones of Malawi and the main crops grown in these AEZs. However, maize being the staple food crop for Malawi, almost all farming households, regardless of their agro-ecological zone, grow the crop. This to some extent may affect the overall production and profitability of the maize crop.

Table 2.2: Characteristics of agro ecological zones in Malawi.

	Lower Shire Valley	Lakeshore	Medium altitude	High plateau
Number of districts	2	8	11	7
Altitude (m)	300-500	400-1000	1000-1500	>1500
Average annual rainfall (mm)	<600	600-800	800-1200	>1200
Population (million)	0.2	0.8	1.5	0.8
Major crops	Sorghum, millet, cotton	Maize, cassava, rice,	Maize, tobacco	Maize, potatoes, wheat, coffee, tea
Major livestock	Small stock	Fish, small stock	Cattle	Cattle, small stock

Source: Masanganise (2009) & Jere (2007)

Apart from maize, the majority of the rural poor households derive incomes from growing and selling cash crops (tobacco, cotton, and tea), as well as food crops such as cassava. However, the types and production levels of food and cash crops grown differ with the agro-ecological zone where the household is located.

2.4.2 Small land holding sizes

Per capita land holding size in Malawi has been declining since the 1970s, partly because of population growth. Even in a 'good year' in terms of agricultural production, most farmers in rural areas do not produce enough maize for their own consumption. The majority of smallholder farmers cultivate less than one hectare of land (GoM, 2010:1).

With such small land holdings, farmers prioritise maize production to meet their subsistence needs at the expense of the cash crops, like tobacco (Benin, Thurlow, Diao, McCool & Simtowe, 2008). It appears as though the inverse relationship between farms size and productivity does not hold for Malawi, as crop yields from these small farms have remained extremely low. Continuous cultivation, with little or no replenishment of the nutrients through the use of fertiliser, has also contributed to the low crop yields (Dorward, Chirwa & Jayne, 2011:209).

2.4.3 Low fertiliser use

In Malawi the rate of fertiliser use by smallholder farmers is approximately 34 kilograms per hectare, which is far lower than that of the estate sector (150 kilograms per hectare) (GoM & World Bank, in Chirwa, Matita & Dorward, 2011:2). The decision on whether to use fertiliser or not partly depends on household and farm characteristics, social and human aspects and farmers' understanding of the effect of fertilisers on soil (Mapila, Njuki, Delve, Zingore & Matibini, 2012). Government policies aimed at increasing farmers' access to fertiliser tend to promote fertiliser use among the resource-poor farmers (Denning *et al*., 2009:3).

Until the SAPs, the government of Malawi took a leading role in supporting smallholder farmers, especially those in the maize subsector, through the provision of subsidies on agricultural credit and imported farm inputs, such as fertilisers, pesticides and seeds (Face of Malawi, 2011). The removal of government support in the early 1990s was followed by sharp increases in fertiliser prices (Minot, Kherallah & Berry, 2000:11), leading to reduced use of the input and hence reduced productivity.

The impact has been more prominent among female-headed households who constitute the greater percentage of the smallholder farmers in Malawi (GoM, 2006b:43). It is therefore apparent that increasing the use of fertiliser and improved seed among smallholder farmers (especially female-headed households) would increase maize yields by 11 to 16 per cent in Malawi (World Bank, 2012:4).

2.4.4 Gender disparities

The role of women in Malawi's agriculture has increased over the years, with about 90 per cent of the female population being employed in the sector (van Klaveren, Tijdens, Hughie-Williams & Martin, 2009:14), yet gender inequalities in the agriculture sector are prevalent. For example, female-headed households have low access to agricultural assets, such as land, labour, and cash, loans, and inputs (FAO, 2011:5).

In Malawi, about 14.7 per cent of male-headed, compared with 8.3 per cent of female-headed, households have access to extension services, and 59 per cent of the people living in female-headed households are poor, compared with 51 per cent in male-headed households (GoM, 2006b:21). Unlike female-headed households, male-headed households have higher incomes and greater means to move out of poverty. In addition, female-headed households consume 14 per cent less per capita and spend 30 per cent less than male-headed households (UN, 2010:65). This, therefore, limits their contribution to the overall agricultural output.

2.4.5 Reduced government spending in agriculture

There exists a relationship between government spending in agriculture and agricultural productivity. A study conducted in Ghana by Benin, Mogues, Cudjoe and Randriamamonjy (2009) showed that public spending on the agriculture sector had a significantly positive impact on agricultural productivity, thus a one per cent increase in agricultural public expenditure was associated with a 0.15 per cent increase in the value of agricultural production per capita.

This observation seems to be synonymous with Malawi's situation. For instance, the agricultural share in the total budget declined from 32.2 per cent in the 1970s to 6.1 per cent from 1999 to 2005, mainly owing to government's withdrawal of support, i.e. subsidised fertiliser, from the sector under the SAPs (GoM, 2010:21). Moreover, it was during the same period of economic reforms which started in the mid-1980s that Malawi experienced severe food shortages and increased maize imports. Notwithstanding other factors, such as poor weather conditions and a rapid increase in human population, the low maize productivity was also part of the cause of the growth in maize imports (Mkwara & Marsh, 2011:4).

Table 2.3 below shows that government spending on agriculture has been on the rise, averaging about 16 per cent, for the period between 2006 and 2009. This is partly due to the implementation of the fertiliser subsidy.

Table 2.3: Government spending trends in Malawi's agriculture, 1970–2009

Indicator	1970-79	1980-84	1985-89	1990-94	1995-99	2000-05-	2006-09
Agriculture share in budget (%)	32.15	24.83	10.08	11.17	8.98	6.13	15.96
Agriculture budget ($m)	21.3	43.98	29.05	41.9	36.12	37.48	233.11
Agriculture spending /capita($)	4.03	6.88	3.85	4.77	3.51	3.21	16.25

Source: GoM, 2010

Since the re-introduction of the fertiliser subsidy, Malawi has enjoyed bumper maize harvests and has been able to export about 0.4 million metric tons to Zimbabwe.

2.5 A HISTORY OF FERTILISER SUBSIDIES IN MALAWI

From the attainment of independence in 1964 to the mid-1990s, the Malawi government implemented a universal fertiliser subsidy whereby it paid about 25 per cent of the commercial price of fertiliser (Mkwara & Marsh, 2011:4; Chinsinga & O'Brien, 2008:39). During this time, the country used to be self-sufficient in maize production, partly because of these subsidies which made the inputs affordable and accessible by poor farmers. The self-sufficiency in maize has also been attributed to the availability of large areas of farm land in the early 1960s when the population was still small (about 3.9 million), compared with recent times (GoM, 2010:12; DFID in Chinsinga & O'Brien, 2008:18; NSO, 2008:3).

Apart from supplying agricultural inputs, the state also acted as a buyer of agricultural produce at below average price, which was to the disadvantage of smallholder farmers. This, to some extent, explains why smallholder farmers remained poor and agricultural growth declined. It was in response to this that between 1981 and 1986 the government of Malawi took efforts to liberalise the market and remove the state monopoly to allow farmers to sell to other buyers at a competitive market price (Chinsinga & O'Brien, 2008:40; Mkwara & Marsh, 2011:4).

These reforms did not manage to improve the agriculture sector, as maize production and growth in agriculture kept declining owing to, among other things, high input prices (GOM, 2010:8). Malawi experienced the worst scenario of a national food deficit in 1987, and in response the government had to import about 140 000 metric tons of maize (Stambuli, cited in Mkwara & Marsh, 2011:4). By 1996, fertiliser and hybrid maize seed subsidies were totally removed (Levy, 2005:6). Years of serious food deficits followed, and the proportion of smallholder farmers that could afford to buy fertiliser fell to about 15 per cent and about 80 per cent of the rural households became net purchasers of the staple crop – maize (Chinsinga & O'Brien, 2008:45).

With the fear of encountering another food crisis, the government of Malawi implemented an Agricultural Productivity Investment Programme (APIP). This denoted the beginning of another era of fertiliser subsidies. In the 1998/1999 and 1999/2000 seasons, the government distributed starter packs – tiny bags of agricultural inputs (about 10 kilograms of urea or NPK and about 2.5 kilograms of maize and legume seeds), enough for 0.1ha of land, to all smallholder farmers (Levy, 2005:4). The programme was, however, trimmed down in 2000/2001 to target the poorest farmers, as donors viewed it as a waste of resources and its name was changed from the Starter Pack Programme to the Targeted Input Programme (TIP).

As opposed to starter packs, which saw Malawi registering a total maize production of 2.48 million and 2.50 million metric tonnes in 1999 and 2000, respectively, the TIP recorded an average of 1.5 metric tonnes, against an average demand of 1.9 million metric tonnes, between 2001 and 2002 (Mkwara & Marsh, 2011:6). The decline in maize production during the TIP was partly attributable to the bad weather experienced during the 2000/2001 season and the reduction in the number of beneficiaries (Levy, 2005:8).

To deal with the situation, the Malawi government, with support from DFID, implemented the Extended Targeted Input Programme (ETIP) in 2003. The ETIP had about 2 million beneficiaries, compared with the 1.5 million that benefited from TIP, and

the programme registered a total maize production of 2 million metric tonnes, compared with the 1.5 million tonnes of the TIP (GoM in Mkwara & Marsh, 2011:6).

However, donors' negative perceptions of fertiliser subsidies and the continued decline in maize output in the presence of the fertiliser subsidies, resulted in reduced funding and beneficiaries for the programme.

Just as in many countries where fertiliser subsidies have been implemented, the programme has had a political association in Malawi, as well (Chinsinga, 2008:1-2; Minot & Benson, 2009:3,6; Gurara & Sala, 2012:2; Wiggins & Brooks, 2010:4; Chinsinga & O'Brien, 2008:8; Banful, 2011:2).

This association to some extent played a large role in the recommencement of fertiliser subsidies in Malawi. In 2004, the fertiliser subsidy became part of the election manifesto. Although the then ruling party wanted to implement a fertiliser subsidy for maize only, it ended up extending it to tobacco as well, owing to pressure from the opposition parties. Thus, in the 2005/2006 growing season, the government of Malawi implemented the FISP across the country (Gurara & Sala, 2012:2), marking the start of the current phase of the fertiliser subsidy.

2.6 CORE ELEMENTS OF THE CURRENT FERTILISER SUBSIDY IN MALAWI

The programme's main objective is to increase the food and cash crop production of poor smallholder farmers by enhancing their access to agricultural inputs, thereby realising food self-sufficiency and increased incomes (Dorward & Chirwa, 2011:4). The current fertiliser subsidy has a number of features that make it different from the previous subsidies.

Unlike the universal subsidies that existed before the SAPs, the current subsidy is targeted towards those smallholder farmers who own land, are residents of the village and are not able to buy fertiliser at the prevailing market price (vulnerable groups)

(Chibwana, Fisher & Shively, 2012:1). Village heads and Village Development Committees (VDCs) carry out the identification of the beneficiaries (Chinsinga & O'Brien, 2008:65). By targeting the poor farmers, the current fertiliser subsidy aims at advancing equality in accessing fertiliser between the resource-poor and non-resource-poor farmers.

Approximately 50 per cent of the smallholder farmers are beneficiaries in the current fertiliser subsidy (Dorward & Chirwa, 2011:4). These subsidies are voucher/coupon based, where selected farmers receive voucher/coupons to redeem in exchange for fertiliser and seed at reduced prices. The voucher system ensures that the available subsidised fertiliser and seed quantities are accessible to the selected beneficiaries (Ricker-Gilbert, 2011:16).

Another special feature of the current programme is the involvement of the private sector in the distribution and sale of the inputs. The state previously acted as supplier, distributor and seller of subsidised subsidies during the time of universal subsidies. On the contrary, farmers can now buy fertiliser from private traders at a subsidised price, and the traders claim the difference from the government under the current programme (Dorward & Chirwa, 2011:13: Baltzer & Hansen, 2011:2). According to Ricker-Gilbert (2011:106), involving the private sector minimises the displacement of commercial fertiliser sales and improves input distribution.

Another aspect of the current fertiliser subsidy was the inclusion of coupons for the purchase of tobacco inputs, although it only lasted for four years. A complete subsidy package include coupons for fertilisers for maize production (50 kg bag of NPK and urea), coupons for tobacco fertiliser (Calcium Ammonium Nitrate, CAN and Compound D) and coupons for improved maize seed (Dorward & Chirwa, 2011:4).

2.7 SUMMARY

The agriculture sector continues to be the mainstay of the economy of Malawi and has two subsectors, namely smallholder and estate, which contribute about 70 and 30 per

cent of total agricultural GDP, respectively. The performance of the agriculture sector in Malawi has varied according to the prevailing policies that the government has implemented from time to time since the country obtained its independence.

Increased government participation and spending in the sector immediately after the country's independence saw the sector thriving, though at the expense of the poor smallholder farmers. The result was widespread poverty, which led to the government of Malawi implementing the SAPs in a bid to even out the policy bias against smallholder agriculture. The SAPs, among other things, included liberalisation of tobacco production by smallholder farmers and removal of fertiliser subsidies. Yet these efforts did not manage to bring about significant improvements in the sector as agricultural output continued to be low and many farmers remained vulnerable.

The removal of fertiliser subsidies and reduced government spending in agriculture has partly led to reduced fertiliser use among smallholder farmers. This, coupled with the weather aspect, gender disparities, and small landholding sizes, has contributed to the underperformance of the sector. It is in this regard that the government of Malawi reintroduced the programme to address these factors. The next chapter, therefore, discusses the impacts of input subsidy initiatives.

CHAPTER 3

A GENERAL REVIEW OF COUNTRY EXPERIENCES WITH AGRICULTURAL INPUT SUBSIDY INITIATIVES

3.1 INTRODUCTION

As a way of developing the agriculture sector, most developing country governments support their farmers by providing agricultural inputs at subsidised prices (Iyoha, 2005:11). However, these subsidies have been blamed for the poor functioning of the economy, hence resulting in their elimination (Munthali, 2004:9). During recent years, fertiliser subsidies have been resurrected and this has brought about hot debate on whether or not promoting them is beneficial. As opposed to the previous fertiliser subsidies, these new ones are dubbed as "smart" as they target the poor and are designed to help the development of private input distribution markets (Minot & Benson, 2009:2). These subsidies also tend to have least distortionary effects on the market. This chapter therefore presents a discussion of the impact of the agricultural subsidies implemented in different countries including Malawi, and of the cases for and against subsidies.

3.2 STUDIES ON IMPACT OF AGRICULTURAL SUBSIDIES IN AFRICAN AGRICULTURE AND BEYOND

A recent study conducted in Indonesia by Osorio, Abriningrum, Armas and Firdaus (2011) showed that there was an increase in rice yields attributable to the agricultural subsidy. However, the increment varied with a given level of fertiliser use, beyond which the yield declined. Despite targeting small farmers (holding less than two hectares of land), the study revealed that large farmers captured up to 60 per cent of the subsidy.

Mason, Jayne and Mofya-Mukuka (2013) noted that more households with large land holdings benefited from the fertiliser subsidy in Zambia. In addition, farmers coming from a constituency won by the ruling party and those owning livestock were more likely to benefit from the programme. The effect of the programme on maize production was positive but quite small.

Although the fertiliser subsidy in Ghana has brought about an increase in fertiliser use and higher crop yields (Benin, Johnson, Jimah, Taabazuing, Tenga, Abokyi, Nasser, Ahorbo & Owuusu, 2012), just as in Zambia, the programme has been heavily politicised (Banful, 2011), with more vouchers being allocated in areas where the government faced strong opposition. On the other hand, Vondolia, Eggert and Stage, (2012) noted that most beneficiaries of the fertiliser subsidy invested less in soil and water conservation, suggesting the likelihood of the programme resulting in a degrading the soil.

Fertiliser subsidies in Nigeria have resulted in a reduction in demand for commercial fertilisers and most of the beneficiaries have been households closer to urban centres, as well as those headed by highly-educated males (Takeshima, Nkonya & Deb, 2012). This could be an explanation for the insignificant increase in the level of fertiliser use in the country, despite the subsidy programme (Charles, 2011).

In India, fertiliser subsidies yielded benefits that were two to four times the amount spent. Furthermore, they promoted the adoption of new technologies and reduced poverty during the first two decades of implementation, but later became unproductive. Thus, continued subsidies led to inefficiencies in the Indian economy (Fan, Gulati & Thorat, 2007:20-21).

Another study by Chand and Pandey (2008) revealed that removing a fertiliser subsidy was likely to increase fertiliser prices by 69 per cent and reduce grain production by approximately 9 per cent. In addition, Sharma and Thaker (2009) observed that small and marginal farmers received a larger share of the fertiliser subsidy and that a

reduction in the subsidy was likely to negatively affect the farm production and incomes of small and marginal farmers.

In Bangladesh, some types of fertiliser received a higher subsidy than the other types. In this regard, fertiliser subsidies led to an unbalanced use of nutrients, thereby reducing yield and soil fertility (Mujeri, Shahana, Chowdhury & Haider, 2012).

In Tanzania, fertiliser subsidies implemented before the adjustment period enhanced farmers' fertiliser consumption such that when the Tanzanian government phased out the programme, fertiliser use declined (Skarstein, 2005). Similarly, the recent fertiliser subsidy programme has led to an increase in maize and rice production, as well as in incomes for the targeted households of the input subsidy in Tanzania. However, instances of corruption, and of powerful and well-to-do households capturing the vouchers, compromised the outcomes of the programme (Kato, 2013).

A study by Ekanayake (2006) revealed that a change in fertiliser price had no significant effect on fertiliser use in paddy cultivation in Sri-Lanka. This meant that the fertiliser subsidy was not a determinant of whether paddy-growing farmers would use fertiliser or not. Owing to the lack of substitutes for fertilisers, farmers bought the input regardless of the prevailing market price in order to increase their paddy yields.

Huang, Wang, Zhi, Huang and Rozelle (2011) made a similar observation in a study in China where fertiliser use was not influenced by a fertiliser subsidy, leading to the conclusion that the intervention was non-distorting and therefore justified according to WTO rules.

In Iran, the reduction of a chemical fertiliser subsidy negatively affected bread consumers. Thus, the removal of the subsidy led to increased cost of production, which translated to high prices for bread paid by the consumers (Najafi & Farajzadeh, 2010).

Water subsidies in the United States of America have had significant impacts on agricultural crops, especially cotton. The importance of such subsidies became evident when the removal of the Crow subsidy presented farmers with a financial crisis and some sectors of the economy also became worse-off (Schmitz, Highmoor & Schmitz, 2002).

A study by Keszthelyi, Nemeth and Pesti, (2005) indicated that agricultural subsidies in Hungary made an enormously positive input to farm profitability. The profits from the farms that were not subsidised were small, and even negative in some cases. However, Lopez and Hathie (2000) reported that as the share of agriculture to GDP got higher, the more expensive it became to subsidise the sector. This means developing countries are likely to face higher costs of subsidisation, since a greater proportion of their GDP comes from agriculture.

Economies in Europe and East Asia have flourished through government support in both farm and non-farm sectors. In South Korea and Taiwan, government policies, which involved subsidising agricultural inputs, reduced the risks related to production, price and adoption of new technologies. The main reasons for ineffective state intervention can be the wrong targeting or lack of complementary policies. For example, in some instances governments have struggled to keep agricultural prices as low as possible (indirect taxes) without investing in rural development and research. Yet these areas have been shown to have high potentials to increase agricultural productivity, and hence exports (Wade in Bezemer & Headey, 2008:1346).

Bezemer and Headey (2008:1342-1346) noted that from time immemorial, government support in agriculture has been a key factor and essential for economic growth. However, Binswanger and Deininger, cited in Bezemer and Headey (2008:7), noted that the frequent market failure in least-developed countries (LDCs) might to some extent be attributable to information differences, high operation costs and indivisibility of rural infrastructure, rather than government intervention in the market.

3.3 EFFECTS OF FERTILISER SUBSIDY ON MALAWI'S AGRICULTURE

Malawi was self-sufficient in maize production from mid-1970s to early 1990s and during this time, the government implemented a universal fertiliser subsidy. However, the period after the abolition of the fertiliser subsidies was characterised by huge maize importation and a fall in maize output by nearly 10 per cent (GoM, 2010:12; Mkwara & Marsh, 2011:4). Despite other factors, such as poor weather conditions and population growth, the removal of the subsidies was also the likely cause of the increase in maize imports. Even Minot and Benson (2009:14) have noted that despite being costly, the universal subsidies promoted crop production.

Furthermore, agricultural annual average growth rate fell from 6.6 per cent in the 1970s to two (2) per cent in the first decade of SAPs (Chirwa *et al*., 2006:3). When the government started implementing the Starter Pack and the TIP, between 1998 and 2002, the country registered high maize outputs of about 2.48 and 2.50 million metric tons in 1999 and 2000, respectively, which were above the national requirements (Mkwara & Marsh, 2011:5). According to Levy, Barahona and Chinsinga, (2004:6), the Starter Packs reduced smallholder farmers' limitations in accessing inputs and cut back Malawi's maize production deficit by about 350 000 tonnes. The impact of the programme was evident in the drop in maize output during the 2001/2002 season to about 1.5 million metric tonnes when the government reduced the number of beneficiaries to the programme owing to financial constraints (Levy *et al.,* 2004:3).

The years of food shortage and hunger that followed the phasing out of the TIP in 2003 also explain the positive impact of the initiative on maize output (GoM, 2010:10). During the 2004/2005 season, total maize production was 24 per cent lower than the 2003/2004 season (FAO in Denning *et al*., 2009:8). In response to the continuous food shortages, the government went ahead to implement the smallholder fertiliser subsidy where resource-poor/vulnerable farmers would buy inputs such as fertiliser at subsidised prices.

Since the inception of the programme in the 2005/2006 growing season, Malawi has been able to generate a maize surplus above the annual maize requirement of about 2.8 million metric tonnes (Chinsinga, 2012:14). Malawi switched from a 43 per cent food deficit in 2005 to a 53 per cent surplus in 2007 and exported about 300 000 tons to Zimbabwe (Dorward *et al*., 2008:7). Maize yields per hectare increased from 1.06 tons to 2.27 tons in 2000/2005 and 2009/2010, respectively. Although one can argue that the improvement in maize yields was attributable to favourable weather conditions, Denning *et al*. (2009:6) found that only a 25–32 per cent increase in maize yields in 2005/2006 and 2006/2007 season was attributable to rainfall.

A number of studies have assessed the effect of the current fertiliser subsidy programme on various aspects, namely recipients, input supply system, fertiliser use and government budget. The following section gives a brief discussion of the findings of these studies.

3.3.1 Impact on recipients

According to Dorward *et al*. (2008:83), the current fertiliser subsidy programme has increased access to cash and use of technologies among the farm families and hence resulted in growth in investment. Indirectly, the programme has reduced maize prices through the surplus production in the crop. Many households have become food secure and this has led to reduced risks of crop theft. Similarly, Chibwana *et al.* (2010:1) found that the mean increase in maize yields attributable to receipt of a full package of coupons (including seed and fertiliser) was 447 kg/ha, of which over half (249kg/ha) was attributable to the fertiliser subsidy, and the remainder to seed subsidy.

Furthermore, Holden and Lunduka (2010a:45) observed significant positive trends in maize production for both hybrid (from 1 440 to 2 040 kg/ha) and local (1 120 to 1 680 kg/ha) for the period between 2006 and 2009. In another study, Holden and Lunduka (2010b:15-16) found that households that received coupons had a higher probability of being net sellers of maize than those that did not. This implies that the

fertiliser subsidy has the capacity of enhancing maize production and creating surplus for sale for those households that had access to the fertiliser coupon.

While controlling for other factors, Ricker-Gilbert *et al.* (2009:1) observed that maize plots that applied subsidised fertiliser had a higher yield response to fertiliser than those that did not. In another study, Ricker-Gilbert and Jayne (2011:21) noted that fertiliser subsidies received in a particular year enhanced tobacco and maize production, as well as the net value of the rainy season crop production within that year.

Furthermore, receiving subsidised fertiliser in the previous three years increased maize production in the current year. However, the study did not provide enough proof that the fertiliser subsidy enhanced total household income and quality of life of the farmers. Mkwara and Marsh (2011:11) noted that fertiliser subsidies had a positive effect on mean maize yields, such that a one (1) per cent increase in the number of fertiliser subsidy recipients resulted to 0.2 per cent increase in mean maize yields per hectare.

On the other hand, Chibwana, Fisher and Shively, cited in Baltzer and Hansen (2011:11) observed that the fertiliser subsidy brought about changes in land allocation among different types of crops. For example, farmers who received the fertiliser subsidy put about 16 per cent more land to maize production. This also concurs with the Holden and Lunduka (2010a:45) findings that 70 per cent of plots were allocated to maize and on average 0.71 ha out of 1.17ha were allocated to maize production. This to some extent explains the significant increase in the national maize production since the inception of the programme.

Regardless of the positive outcomes of the current fertiliser subsidy, the programme's impact has varied among the recipients by maize production and value of total crop output distribution. For instance, an additional kilogram of subsidised fertiliser led to additional maize production of 2.61 kg and 0.75 kg at the 90th and 10th percentile, respectively. Similarly, an extra kilogram of subsidised fertiliser added US$0.80 to the total crop output value at the 90th percentile, while having an insignificant effect at the

10th percentile (Ricker-Gilbert and Jayne, 2012:4). This is an indication that households at the top of the maize distribution are accumulating more benefits from the subsidies than those at the bottom.

Ricker-Gilbert (2011:81-82), also observed that the fertiliser subsidy had a negative impact on the amount of off-farm labour supplied by the households' receiving subsidised fertiliser coupons, but had a positive impact on the wage rate. For every extra kilogram of subsidised fertiliser, the households supplied 2.5 days less off-farm labour, while the median wage rate increased by 0.2 per cent.

3.3.2 Impact on fertiliser supply systems and use

Apart from the fertiliser price, Minot *et al*. (2000:37-38) and Chibwana *et al.* (2010:12) noted that factors, which include plot size, type of farming system, type/variety of crop, family headship, farm size, access to credit, and income from off-farm employment, affected fertiliser use.

Among other things, the current fertiliser subsidy aims at improving fertiliser use among resource-poor farmers by reducing its price and in so doing making it easily accessible to these farmers. A study by Chibwana *et al*. (2010) has shown that there is a positive association between participating in the fertiliser subsidy programme and the amounts of fertiliser used, especially among those farmers who grew improved maize varieties. This implies that the fertiliser subsidy has potential to increase fertiliser usage.

According to Holden and Lunduka (2010:45a), fertiliser use intensity, especially on hybrid maize, was higher for households that accessed subsidised fertiliser than those that did not. In addition, the study noted that households which did not receive subsidised fertiliser were very unlikely to use fertiliser at all.

In general, total fertiliser sales in Malawi have portrayed an increasing trend. However, a remarkable increase has been observed between the 2004/2005 and the 2006/2007

seasons, which is the fertiliser subsidy programme period. Dorward *et al*. (2008:11) reported that fertiliser sales rose from 228 to 296 metric tons, representing a 30 per cent increase.

On the other hand, the private sector's market share in fertiliser sales has dropped from roughly 80 per cent to 60 per cent since the inception of the fertiliser subsidy programme. During the first year of implementation, the government captured approximately 60 per cent of the private sector's share in fertiliser sales (Denning *et al*., 2009). A study by Dorward *et al*. (2008) found a significant negative correlation between private sector and parastatal sales. State involvement in selling inputs led to a 32 per cent and 26 per cent fall in private sector sales in 2005/2006 and 2006/2007, respectively (Dorward *et al*, 2008:10, 52).

Furthermore, Ricker-Gilbert (2011) observed that a one-kilogram increase in subsidised fertiliser reduced commercial fertiliser purchases by 0.22 kilograms. The reduction, however, was more (0.30kg) among farmers who purchased subsidised fertiliser, yet were capable of buying commercial fertiliser (those with high asset values) than among the resource-poor farmers (0.18kg). This is an indication that fertiliser subsidies crowd out commercial fertiliser sales, especially where there is poor targeting of beneficiaries and parastatal involvement is high. Even though the fertiliser subsidies increased total fertiliser use and sales, commercial fertiliser use has decreased and this has implications on the private sector's fertiliser sales.

3.3.3 Impact on government's budget

Fertiliser subsidies have once again become popular in Malawi, despite being costly to the government. For instance, the programme has led to an increased share for the agriculture sector in the total national budget, as well as on agricultural spending per capita of total population, up from 8.98 per cent between 1995 and 1999 to 15.96 per cent between 2006 and 2009, and from 3.51 per cent to 16.25 per cent during the same period, respectively (GoM, 2010). During the 2008/2009 season, the government spent

about 16 per cent of the total national budget on subsidising fertiliser and seed alone (Dorward & Chirwa, 2011:8).

High world fertiliser prices and expansion of programmes in terms of beneficiaries and crops (tea, coffee) have led to an increase in the programme budget by 100 per cent (Logistic Unit, cited in Holden & Lunduka, 2012:7) in the 2008/2009 season. Following the commencement of the programme, expenditure on agriculture has been above the recommended 10 per cent of the AU/NEPAD (Dorward *et al*., 2008:92).

However, Druilhe and Barreiro-Hurlé (2012:38) have argued that the programme is costly and does not deserve the amount of resources allocated to it, since its effects are not obvious. For instance, the money spent on the fertiliser subsidy for the 2008/2009 season alone was equivalent to 147 per cent and 175 per cent of the total spending on health and education, respectively (Aid Thoughts, 2011:1). Nevertheless, there is no evidence that other social sectors have been side-lined.

The success story of the fertiliser subsidy in Malawi thus supports the argument that governments in Africa might consider providing agricultural services, while ensuring a reasonable level of technical and financial efficiency.

3.4 FACTORS THAT ENHANCED SUCCESS OF SUBSIDIES

Compared with Asia, African agriculture's growth rate is lower than that of its population. This is a result of poor infrastructure, leading to high transport costs, political instability, low fertiliser use and poor institutions, among others. Asia's green revolution succeeded because, apart from subsidising inputs, the governments complemented it with increasing access to credit, improved infrastructure, research and extension services (Denning, Kabambe, Sanchez, Malik & Flor, 2009:2; Fan *et al*., 2007:20-21).

Minde, Jayne, Crawford, Ariga and Govereh (2008:2) are in harmony with the above report that, for subsidies to be successful, complementary actions such as investment in

roads and information technologies should be executed, alongside the promotion of private sector partnership with farmers. This, together with a stable policy environment which encourages foreign investment and use of fertilisers, will determine the success of subsidies.

Opponents of state intervention in the LDCs argue that African states have weak capacities to repeat what the Asian governments have done. Another reason is that the policies used to promote the Asian Green Revolution are no longer applicable. Even if they were, compared with Africa, Asia had a more advanced level of development in terms of infrastructure, macroeconomic policies and agricultural expenditure when it followed the state-led agricultural growth programmes (Ellis, 2005:2-5).

Although government involvement in the running of the economy is subject to rent seeking and corruption, the above arguments and findings indicate the importance of government intervention based on good governance principles in agricultural transformation. Failure of some previous state actions should not be an out-right reason to condemn government intervention (Bezemer & Headey, 2008:1346).

3.5 CASE AGAINST SUBSIDIES

Despite their abolition during the SAPs, some developing countries have revived agricultural subsidies. For example, the Malawi government during the 2005/2006 agricultural season, and amid a hot debate, went ahead to implement an agricultural input subsidy programme. Among other reasons, the purpose of the input subsidy was to boost food security and incomes of poor farmers (Chirwa *et al*., 2006:31). However, the question of whether these poor farmers are really the beneficiaries of the programme remains.

Furthermore, there is fear that such programmes would lead to government borrowing and also discourage farmers from producing maize because of low prices resulting from surplus production (Chinsinga, 2007:11). The argument exists that input subsidies,

mainly on fertilisers, are a necessary, but not a sufficient, condition to bolster Africa's agricultural development. Africa needs to address, among other things, issues regarding land, political empowerment, irrigation, communication systems, modern farm technologies and soil management (Africa Focus, 2009).

Another case against subsidies is that some smallholder farmers may not be willing to use fertiliser because of risks associated with crop failure (Minde *et al*, 2008:2). According to Dorward, Hazell and Poulton (2007:2), farmers tend to take advantage of a low priced input and overuse it, which may bring negative results on yield and on the economy as a whole. There is also a high probability of subsidies destroying the private sector's input markets.

According to Swain (2009:226), subsidies destabilise world prices, thereby making the export sector unsustainable. Furthermore, a fertiliser subsidy programme is perceived to be costly, to deter private sector participation, and be subject to mismanagement and fraud (Minot & Benson, 2009:2). On the other hand, there are fears that subsidies would lead to overdependence, thereby hindering smallholder agricultural growth (Africa Focus, 2009).

The standpoint exists that the state's involvement in the market is politically motivated and often implemented to buy political support from individuals in various groups. This therefore leads to the tendency of channelling resources to where they are least needed, hence hindering development (Chirwa *et al*., 2006:5). Thus, the 'non-smart' targeting is focused more on social and political bases than on the capacity to benefit from them, thereby making such interventions more in the nature of 'hand outs', and not 'hand ups'.

Furthermore, the amounts spent on subsidies are simply too large and benefit large-scale farmers, thereby largely defeating the pro-poor purpose of the programme (Swain, 2009:227). Despite playing a major role in the achievement of the green revolution in Asia and being a good way to kick-start markets, short-term agricultural input subsidies

are not possible in the African context. With time, these subsidies tend to expand because of political pressure, making it difficult to reduce or eliminate them at a later stage. They are also possible cases of rerouting subsidies, whereby targeted smallholder farmers sell the subsidised inputs to large-scale farmers or cross-border farmers (Dorward *et al*., 2007:1).

3.6 CASE FOR SUBSIDIES

While others perceive state intervention as a distortion in the economy, some feel it is necessary and that a fertiliser subsidy, in particular, is the only way to kick-start African agriculture (Minot and Benson, (2009:2). Dhar, (2007:217) has stated that it is sometimes good to maintain strategic interventions that aim at dealing with issues regarding food security and rural development. "… Government has to play a role in subsidising African farmers … we are calling for smart subsidies ..." (Adesina in Africa Focus, 2009).

Minot and Benson (2009:2) refer to these smart subsidies as those intended to target the poor and to help the development of private input distribution markets. Thus it might be necessary for LDCs to consider implementing input subsidies on certain strategic agricultural products as a way of gaining an equitable share in the international market and so combat the developed countries who themselves apply high import tariffs to protect their own farmers. After all, policies like input subsidies to resource poor farmers are not included in the Total Aggregate Measure of Support (TAMS) reduction commitments of the Agreement on Agriculture (AoA) under the WTO (Sandrey, 2006:5).

Henningsen, Kumbhakar and Lien (2009:2) indicated that even developed countries subsidise their farmers to enable them to compete in international markets and keep them in the farming business.

3.7 SUMMARY

This chapter discussed the effects that agricultural subsidies have had in different countries in an effort to justify their implementation or not. These effects have varied among different economies. Although it is difficult to attribute improved agricultural productivity and incomes to agricultural subsidies alone, the empirical evidence has indicated the important role that agricultural subsidies have played in different economies. Evidence exists from many countries across the globe that well-managed and goal-oriented subsidy programmes in agriculture can deliver positive results. However, a generalisation in this regard is wrong.

In Malawi, the fertiliser subsidy has increased food availability, real wages, fertiliser use, wider economic growth and improved input supply and delivery, among other things. Most of the studies have found that the subsidised fertiliser has had a significant positive effect on maize production and fertiliser usage. Although the programme is blamed for increased government expenditure and the crowding out of commercial fertiliser supply for agriculture, it has enabled smallholder farmers to produce their own food, rather than depending on food imports. The current fertiliser subsidy has brought positive results to household livelihoods by increasing average levels of individual incomes and the participation of the private sector in input marketing.

Despite the positive effects, some of the studies have revealed that some of the beneficiaries are the non-poor farmers and this defeats the objective of the programme. As stated earlier, the recent programme targets the poor and vulnerable smallholder farmers, i.e. the female-headed households. It is, therefore, important to see how the programme has affected these targeted households to ascertain whether targeting them is worthwhile. While the cases against subsidies might be true, knowing them well in advance will help the designers of such programmes to internalise them, where possible. This study accordingly examines the gender and poverty impact of the fertiliser subsidy on maize yields. It also investigates implementation challenges and their possible solutions. Chapters 4, 5 and 6 presents the findings and discussion of the

results, based on data collected by MoAFS for the evaluation of the 2009/2010 fertiliser subsidy.

CHAPTER 4

THE PRODUCTION IMPACTS OF THE FERTILISER SUBSIDY PROGRAMME

4.1 INTRODUCTION

As indicated earlier, the government of Malawi has been implementing the fertiliser subsidy programme in an effort to promote fertiliser use and enhance productivity for improved household food security of poor, small-scale farmers. Therefore, this chapter provides the results on the nature of the impact of the programme on maize yields. The analysis also took into account the effects of rainfall amounts on maize yields, as well as differences in the AEZs, considering that climate is an influential factor on production.

4.2 METHODOLOGY

Impact evaluations are associated with attribution problems where one is required to isolate and estimate the contribution of the intervention to the changes in the outcome of interest. To address this, the respondents were categorised into recipients and non-recipients of the fertiliser subsidy coupons. Using Statistical Package for Social Sciences (SPSS), the study used descriptive statistics, such as means, to compare maize yields between recipient and non-recipient households. Kruskal-Wallis and Mann-Whitney tests were employed to compare yields across the AEZs. A multiple linear regression helped to ascertain whether the fertiliser subsidy contributed to the increase in maize yields.

The study used the binary fashion where a household receiving fertiliser subsidy coupon had a representation of one, and zero otherwise. Households were also grouped into those from the lower shire, medium altitude, lakeshore, and high altitude

zones. Three dummy variables were created for lower shire, lakeshore and high altitude zone and the medium altitude zone was used as the reference group. By running a multiple regression, the study endeavoured to address the problem of an unobservable nature that arises owing to the omission of other variables.

4.3 MODEL ESTIMATION

Agricultural production is affected by agronomic, biographic and economic factors. Literature reviewed has shown that Malawi's agriculture is influenced by climatic factors, level of input use (inorganic fertiliser and improved crop varieties) gender of household head and household incomes (GoM, 2010:20). To correctly measure the impact of fertiliser subsidy on maize yields, these factors need to be taken into account. The study estimated a household level production function to compare maize yields of households which received, and those which did not receive fertiliser coupons. This function also assessed the effects of climatic differences on maize yields. The study assumed that households that received fertiliser coupons and those located in the medium altitude zone were likely to obtain greater maize yields than those that did not receive coupons and greater than those located in the lower shire, high altitude and lakeshore zones.

The proposed model is described as follows:

$$Y = F(income, NPK\ urea, sexhh, coupon, hybrid, local, loshire, lkshore, high, rain,)$$

where Y is the dependent variable, maize yields measured in kilograms per hectare, and the independent variables are:

Income

This represents the total household income measured in Malawi Kwacha (MK). This was obtained by summing up household income from crop sales, small business and

salary or wages for the period under review. The expectation was that this variable would have a positive relationship with yield.

NPK

This represents the amount of NPK fertiliser used by a particular household, measured in kilograms per hectare. The coefficient for the variable is likely to be positive to indicate that maize yields and fertiliser amounts increase together.

Urea

This variable represents the amount of urea fertiliser used by a particular household, measured in kilograms per hectare. It is hypothesised that the coefficient of this variable will carry a positive sign, indicating a positive relationship between maize yields and fertiliser amount.

Sexhh

This is a dummy variable for gender of household head, carrying a value of 1 for male-headed households and 0 for female-headed households. Since male-headed households have better access to agricultural production inputs, they are likely to produce more maize than female-headed households.

Coupon

This represents a dummy variable for the fertiliser subsidy, carrying a value of 1 for all households' receiving fertiliser subsidy coupons, and 0 elsewhere. It is assumed that maize yields for the recipient households would be more than that of the non-recipient households. This is mainly attributable to the improved access to cheap fertiliser as a result of the subsidy programme.

Hybrid and Local

These variables represent the amount of hybrid and local seed used, measured in kilograms per hectare, respectively. These variables are modelled separately because they have varied effects on yield. Hybrid seed is assumed to have a larger effect than local seed.

Lower shire, lake shore and high altitude

These are dummy variables to capture the effects of rainfall variations on maize yields. Lower shire takes a value of 1 for households in the lower shire zone and 0 elsewhere. Lake shore has a value of 1 for households in the lakeshore zone and 0 elsewhere, whereas high altitude has a value of 1 for households in the high altitude zone and 0 elsewhere. The dummy variable for households in the medium altitude zone was not included for comparison purposes. This zone has more favourable climatic conditions for maize production and constitutes the major maize producing areas, such as the Kasungu-Lilongwe plain and Mzimba. It is therefore hypothesised that the medium altitude zone will have higher maize yields than the other three zones.

Rain

The rain variable represents the amount of rain received per district, measured in millimetres during the 2009/2010 growing season. Water being a requirement for maize production, it is expected that rainfall amount will positively affect maize yields.

4.4 A DESCRIPTIVE ANALYSIS OF HOUSEHOLD CHARACTERISTICS BASED ON FERTILISER SUBSIDY COUPON

This section presents the results of mean differences in a number of household variables, between households that received fertiliser subsidy coupons and those that did not. According to Table 4.1 below, households that received fertiliser coupons

obtained higher average maize yields (2 211.3 kg/ha) than those that did not (1 857.6 kg/ha). The T-test indicated that mean maize yields for recipient households differed significantly from those of non-recipient households at a 5 per cent level of significance.

The study also found that recipient households registered higher use of both urea and NPK fertilisers (103 kg/ha and 105 kg/ha, respectively) than non-recipient households (53 kg/ha and 51 kg/ha, respectively). In addition, recipient households had a higher average usage of hybrid seed (12.6 kg/ha) than non-recipient households (7.6 kg/ha).

The T-test indicated that the differences in both fertiliser and maize hybrid seed usage were statistically significant, at 5 per cent level. This implies that making fertiliser and seed available at subsidised prices improves their usage among the recipient farming households, which in turn increases maize yields. This interpretation though needs to be taken with caution since there is a possibility that some of the NPK or urea could have been procured by other means than the subsidy program.

Table 4.1: Mean, distribution and significant test results of household characteristics, 2009/2010

Variables		Mean	Standard deviation	T-value
Maize yields (kg/ha)	Recipients Non-recipients	2,211.3 1,857.6	0.328 0.275	10.40***
Hybrid seed (kg/ha)	Recipients Non-recipients	12.6 7.6	0.063 0.038	7.15***
Local seed (kg/ha)	Recipients Non-recipients	62.4 67.6	0.833 0.902	8.14***
Urea (kg/ha)	Recipients Non-recipients	103.3 52.5	0.021 0.041	8.73***
Household income (MK)	Recipients Non-recipients	30,506.9 26,391.3	0.059 0.051	1.53

Source: Ministry of Agriculture and Food Security survey data, 2010.
*** Significant at 1 per cent, ** significant at 5 per cent and * significant at 10 per cent

A higher mean usage of local seed was also observed among households which did not receive fertiliser subsidy coupons (67.6 kg/ha) than those which received coupons (62.4 kg/ha) and the difference was statistically significant at 5 per cent level of significance. The observed high use of fertiliser and hybrid seed and the consequent lower use of local seed among recipient households have implications for the objectives of the programme in promoting the use of improved inputs.

Recipient households recorded higher average incomes than did non-recipient households, but the difference was not statistically significant. This was contrary to the expectation that recipient households would have significantly lower incomes as per targeting criteria of the programme. However, this observation illustrates that household income for smallholder farmers in Malawi are generally low being subsistence farmers (GoM, 2010:20). Due to data limitations, it was not possible to calculate net incomes for the household groups

Apart from the fertiliser subsidy effect, the study further observed that maize yields varied with AEZs. This was revealed in the Kruskal-Wallis test, the results of which are presented in Table 4.2 below. The medium altitude zone, with climatic conditions more favourable for maize production, registered the highest median maize yields of 2 000 kg/ha. Lower shire had a median yield of 1 800 kg/ha, lakeshore recorded a median yield of 1 883 kg/ha, and high altitude a median yield of 1 910 kg/ha. Since the probability that maize yields among the four AEZs were not different was smaller (0.000) than 5 %, the hypothesis of no difference was not accepted. This implied that differences in climatic conditions had an effect on maize yields, as well.

Table 4.2: Kruskal-Wallis test results for the difference in median maize yields (kg/ha) across the agro ecological zones, 2009/2010

Maize yields in 2009/2010 (kg/ha)	Lower shire	Lakeshore	Medium altitude	High altitude
Descriptive				
Mean (kg/ha)	1,703.0	2,018.9	2,095.2	2,070.9
Median (kg/ha)	1,800.2	1,882.6	2,000.0	1,910.3
N	96	432	636	280
Kruskal-Wallis test				
Mean rank	517.9	711.8	759.7	724.7
X^2 (df),p-value	28.5(3), 0.000			

Source: Ministry of Agriculture and Food Security survey data, 2010.

Given that the above test was significant, pairwise comparisons among the four AEZs, using the Mann-Whitney U test, were conducted. Taking into account the fact that the procedure involves making multiple pairwise comparisons, the likelihood of incurring a type 1 error (rejecting the null hypothesis when it is true) is high. To prevent this error, the study used a Bonferroni correction instead of the critical value of 0.05 to measure level of significance. The Bonferroni was obtained by dividing the critical value of 0.05 by the number of comparisons, in this case 0.05/6 = 0.0083.

According to the results in Table 4.3 below, households in the lower shire obtained the least median maize yields compared with the other three zones and the difference was statistically significant at 5 per cent level. This was not surprising as the zone has the least favourable climatic conditions for maize. Although the medium altitude zone obtained greater maize yields than the lakeshore and high altitude zones, the difference was not significant. While a significant difference was expected based on the differences in climate, some factors could have influenced the yield gap. For instance, there has lately been development and use of hybrid seeds adapted for a particular climatic zone. On the other hand, the medium altitude zone is a tobacco growing zone

and there is a high likelihood of competition for inputs and labour between the two crops, which might affect total output of both crops.

Table 4.3: Results for the Mann-Whitney pairwise comparison on median maize yields (kg/ha) across the agro ecological zones, 2009/2010

Maize yields (kg/ha) for 2009/2010 season		
Agro ecological zone	**Mann-Whitney U**	**Asymptotic sign, (2-tailed)**
Lowershire+Lakeshore	15,042	0.000
Lowershire+Medium altitude	20,239	0.000
Lowershire+High altitude	9,690.5	0.000
Lakeshore+ Medium altitude	127,973	0.057
Lakeshore +High altitude	59,580	0.737
Medium altitude + High altitude	85,014	0.275

Source: Ministry of Agriculture and Food Security survey data, 2010.
** Significant at 0.05/6 =0.0083.

4.5 IMPACT OF THE 2009/2010 FERTILISER SUBSIDY ON MAIZE YIELDS: RESULTS FROM THE ECONOMETRIC ANALYSIS

The correlation results in Table 4.4 below show positive and significant relationships between maize yields and receiving fertiliser coupons, hybrid seed, NPK, urea, rainfall amount, households headed by males, household income, and being a household from medium altitude AEZ. This implies that as these variables increase, maize yields also increase. However, when more households use local maize seed, maize yields are seen to decrease and this is not surprising. There was also no strong correlation among the regressors in the model.

As anticipated, a positive and statistically significant relationship was observed between fertiliser subsidy and urea, and NPK, as well as hybrid maize seed. A negative and statistically significant relationship between fertiliser subsidy and local maize seed was also noted. This is desirable since the programme seeks to promote the use of hybrid maize seed and inorganic fertilisers, and less use of local seeds.

Table 4.4: Correlation matrix between variables in the regression, 2009/2010

		NPK	urea	hybrid	local	gender of hh	income	rain	lower shire	medium	high	lake shore
Maize yields	Pearson Correlation	0.509	0.434	0.156	-0.169	0.095	0.204	0.127	-0.135	0.071	0.021	-0.022
	Sig. (2-tailed)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.420	0.400
income	Pearson Correlation	0.047	0.005	-0.050	0.050	0.129	1.000	-0.112	-0.135	-0.071	-0.049	-0.030
	Sig. (2-tailed)	0.036	0.422	0.030	0.028	0.000	-	0.000	0.003	0.053	0.030	0.127
Fertiliser subsidy	Pearson Correlation	0.298	0.224	0.186	-0.210	-0.028	0.040	0.016	.028	-0.019	0.015	-0.008
	Sig. (2-tailed)	0.000	0.000	0.000	0.000	0.280	0.126	0.544	0.284	0.473	0.560	0.758

Source: Ministry of Agriculture and Food Security survey data, 2010.

A multiple regression analysis, results of which are presented in Table 4.5 below, revealed a low adjusted R^2 of 0.37, indicating that the explanatory variables in the model explained 37 per cent of the total variation in maize yields. However, the variables have a joint effect on maize yields, as indicated by the significant F-statistic (F=78.15, p=0.000) at 5 %.

As envisaged, the results indicate that households which received fertiliser coupons produced, on average, 155 kg more maize per hectare than those which did not receive fertiliser coupons. The results were also statistically significant at 5 % level, implying that the fertiliser subsidy is likely to increase the maize yields of those benefiting from the

programme. The positive effect of the fertiliser subsidy on maize output corresponds with findings of Gilbert *et al*. (2009) who in their study in Malawi noted that, holding other factors constant, the beneficiaries of the fertiliser subsidy obtained significantly higher maize yields in the subsidy year than the non-beneficiary farmers.

Table 4.5: Results of the linear regression analysis for maize yields (kg/ha), 2009/2010

Variable	Estimate	Std error
income	0.02***	0.021
NPK	2.9***	0.026
urea	1.3***	0.056
sexhh	81.0**	0.005
coupon	155.3***	0.004
hybrid	15.9*	0.125
local	13.5***	0.052
lower shire	-276.8***	0.009
high altitude	-33.8	0.006
lake shore	-202.5***	0.005
rain	0.16***	0.013
R^2	0.375	
Adjusted R^2	0.370	
Prob>F	0.000	

*** Significant at 1 per cent, ** significant at 5 per cent, * significant at 10 per cent.
Medium altitude zone is the base reference for agro-ecological zone dummy variables, and male-headed households are the reference group for gender dummy variable. Dependent variable is maize yields

Furthermore, holding other factors constant, for every additional kilogram of urea and NPK, maize yields per hectare increased by 1.3 kg and 2.9 kg, respectively. Similarly, an additional kilogram in local and hybrid maize seed raised maize yields per hectare by 13.5 kg and 15.9 kg, respectively. These coefficients were statistically significant at 5 per cent, except for hybrid maize seed which was significant at 10 per cent.

The magnitude of the coefficients for hybrid and local maize seed revealed that households that used hybrid maize seed were likely to produce more maize yields per

hectare than those which used local maize seed, and this is consistent with empirical evidence.

This is not surprising since hybrid maize seed is high yielding. The positive effects that both hybrid maize seed and fertiliser have on maize yields could explain why recipients of fertiliser coupons obtained more yields than non-recipients did. The study found a positive correlation between receiving fertiliser subsidy coupons and the use of urea, NPK and maize hybrid maize seed. Thus, if recipient households use their fertiliser subsidy coupons to purchase subsidised inputs, they are likely to obtain more maize per hectare than non-recipients.

As expected, male-headed households produced 81 kg more maize per hectare than female-headed households did and this was statistically significant at 5 per cent level of significance. This was regardless of whether they had received fertiliser coupons or not. Irrespective of the fertiliser subsidy, households in the lower shire and lakeshore AEZs produced 276.8 kg and 202.5 kg less maize per hectare, respectively, than those in the medium AEZ and this was statistically significant at 5 per cent level. Although the high altitude zone produced less maize per hectare than the medium altitude zone, the difference was not statistically significant. The variation in maize yields across the AEZs indicates the effect of climate (rainfall amount variation) on maize production. This, therefore, denotes a relationship between rainfall variations and maize yields.

According to Table 4.6 below, recipient households had higher median maize yields (2 000 kg/ha) in all the four zones than non-recipient households, who had median yields of 1 250 kg/ha, 1 750.3 kg/ha, 1 800 kg/ha and 1 741.5 kg/ha for lower shire, lakeshore, medium altitude and high altitude, respectively. This finding indicates that recipient households produced more maize, regardless of the AEZ in which they were located, and the differences were statistically significant at 5 %. Thus the effect of the fertiliser subsidy was still evident in the varying climatic conditions. Without a subsidy maize yields varied by agro-economic zone with low rainfall areas producing lower median yields. This seems to concur with the findings of Holden and Mangison, (2012)

who observed that drought had a general reduction effect on maize yield. However, this effect was not statistically significant among the recipient households.

Table 4.6: Mann-Whitney pairwise comparison on maize yields (kg/ha) between recipients and non-recipients within agro-ecological zones, 2009/2010

Maize yields (kg/ha) for 2009/2010 season				
Agro-ecological zone	**Recipient Median**	**Non recipient Median**	**Mann-Whitney U**	**Asymptotic sign, (2-tailed)**
Lower shire	2,000	1,250	167.5	0.000
Lakeshore	2,000	1,750.3	1,4245	0.000
Medium altitude	2,000	1,800	32,433	0.000
High altitude	2,000	1,741.5	6,134	0.000

Source: Ministry of Agriculture and Food Security survey data, 2010.
** Significant at 0.05/6 =0.0083.

4.6 SUMMARY

Both descriptive and regression analyses indicate that households that received the fertiliser subsidy used more fertiliser and hybrid maize seed, and also obtained more maize yields, than those which did not receive the subsidy. Furthermore, maize yields varied with the agro-ecological zone in which a household was located, suggesting the importance of climate in maize production. However, regardless of the climatic zone, recipient households managed to achieve higher maize yields than non-recipient households did.

It can therefore be deduced that fertiliser subsidy coupons have led to increased maize yields by promoting the use of improved seed and inorganic fertiliser among recipient households, which is in accordance to the programme's objective. Moreover, hybrid maize seed and the two types of maize fertilisers have indicated positive effects on maize yields.

Compared to the households in the medium altitude AEZ, those in lower shire and lakeshore AEZs produced statistically significant less maize. It is worth noting, therefore, that the extent of the effect of fertiliser subsidy coupons on maize yields in each of these AEZ will likely be offset by differences in climatic conditions.

The observations on the effect of fertiliser subsidy coupons on maize yields give enough evidence to accept the hypothesis that the fertiliser subsidy has a positive effect on maize yields.

CHAPTER 5

ASSESSING THE GENDER IMPACT OF THE 2009/2010 FERTILISER SUBSIDY PROGRAMME IN MALAWI

5.1 INTRODUCTION

The role of women in agriculture has increased over the years, yet they constitute a large proportion of the vulnerable group. The term 'vulnerability' is broad, and as such, this concept has various definitions. For the purpose of this study, vulnerability will be defined as the likelihood or danger of being in a state of poverty, or fall into deeper poverty in the future (The World Bank Group, 2011). Vulnerability is difficult to assess, thus the use of proxies is necessary, such as income and consumption differences. The vulnerable are often characterised by a lack of economic access to food, lesser access to production resources (land and inputs), lesser knowledgeable, and an inability to voice their concerns and exercise their rights (Cromwell and Kyegombe, 2005:16).

In Malawi, women are more vulnerable than men, and female-headed households are often worse off; 59 per cent of the people living in female-headed households are poor, compared with 51 per cent in male-headed households (Government of Malawi, 2006). Unlike female-headed households, male-headed households have higher incomes and more means to move out of poverty (UN, 2010:65). Thus, the current fertiliser subsidy is targeting these female-headed households to help them access inputs, like fertiliser. This chapter presents and discusses the findings of the analysis of the gender effects of the fertiliser subsidy programme on maize production.

5.2 METHODOLOGY

The study assessed whether the effect of the fertiliser subsidy on maize yields varied with gender of the household head receiving the fertiliser subsidy coupon, or

whether female- and male-headed households achieved similar gains in yield in the presence of fertiliser subsidy. Households were categorised into those which received fertiliser coupons and those which did not, and were further grouped into those headed by females and those headed by males.

The study assumed that the recipient households were resource constrained and unable to purchase fertiliser at the commercial price and that the fertiliser used was subsidised. Furthermore, it was assumed that female-headed households had limited access to agricultural inputs such as fertiliser and improved seed, which results in low yields. The expectation was that the fertiliser subsidy would improve their access to these inputs and hence improve their maize yields. It was further hypothesised that with fertiliser subsidy coupons, the maize yields gap between male- and female-headed households would be eliminated or reduced significantly.

The research used non-parametric tests, being the Kruskal-Wallis, Mann-Whitney and Bonferroni adjustment, to test for differences in median maize yields and median input across the four household categories, i.e. recipient female, recipient male, non-recipient male and non-recipient female-headed households. These non-parametric tests, however, compared yields and input use with regard to the gender of a household receiving fertiliser subsidy coupons, although production is affected by a number of factors.

Women are less productive than men but there are also several factors that contribute to this difference. Therefore, to effectively measure the influence of gender of household head on maize yields, these factors as stated in Chapter 4 need to be taken into account. A regression model which included a dummy variable for gender of household head receiving fertiliser coupons and another variable for household asset value was formulated and run. The dummy variable was created to compare the difference in maize yields between male- and female-headed households, with and without fertiliser subsidy coupons. In particular, the coefficients of the dummy variables were used to

assess how the maize yield gaps between female- and male-headed household varied with the introduction of the fertiliser subsidy coupon.

5.3 A DESCRIPTIVE ANALYSIS OF HOUSEHOLD CHARACTERISTICS BASED ON GENDER OF HOUSEHOLD HEAD

This section presents the results of differences in mean for a number of household variables between male and female household heads. According to Table 5.1 below, male-headed households produced more maize (2 078.3 kg/ha) than female-headed households (1 929 kg/ha), irrespective of whether they received fertiliser coupons or not. Furthermore, urea and NPK use was high for male-headed households (84 kg/ha and 83 kg/ha, respectively) than female-headed households (64 kg/ha and 68 kg/ha, respectively).

Table 5.1: Descriptive analysis of household characteristics based on gender of household head, 2009/2010

Variables		Mean	Standard deviation	T-value
Maize yields (kg/ha)	Female-headed households	1,929.8	0.286	3.88***
	Male-headed households	2,078.3	0.308	
Hybrid maize seed (kg/ha)	Female-headed households	10.1	0.05	1.23
	Male-headed households	10.2	0.051	
Local seed (kg/ha)	Female-headed households	65.3	0.871	0.687
	Male-headed households	64.8	0.864	
Urea (kg/ha)	Female-headed households	64.0	0.026	2.87***
	Male-headed households	83.8	0.034	
NPK (kg/ha)	Female-headed households	68.3	0.079	2.69***
	Male-headed households	83.2	0.097	
Household income (MK)	Female-headed households	17,028.3	0.033	5.65***
	Male-headed households	32,256.1	0.063	
Household asset values (MK)	Female-headed households	55,691.8	0.073	-3.787***
	Male-headed households	81,260.2	0.104	

Source: Ministry of Agriculture and Food Security survey data, 2010.
*** Significant at 1 per cent, ** significant at 5 per cent and * significant at 10 per cent

As expected, male-headed households registered higher average household incomes of MK32 256, and asset values of MK81 268, than female-headed households, with MK17 028 and MK55 691, respectively. This is in harmony with empirical evidence that female-headed households tend to be poorer than male-headed households.

The observed differences in input use, household incomes, asset values and maize yields between male and female-headed households support the programme's targeting of female-headed households, who by implication are poor and vulnerable.

5.4 GENDER VARIATIONS IN INPUT USE AND MAIZE YIELDS WITH AND WITHOUT FERTILISER SUBSIDY.

One of the factors that led to production gaps between female- and male-headed households in Malawi is the inequitable access to agricultural inputs, with male-headed households having more access than female-headed households (IFPRI in Murphy, Erickson, & Chima, 2013:5). Kilic, Palacios-Lopez and Goldstein (2013) observed that male-managed plots had an estimated agricultural productivity of 25.2 per cent more than female-managed plots. In addition, their study found that about 80 per cent of that gap was attributable to differences in noticeable characteristics, such as input use, crop choice, and household characteristics.

The findings of the study in Table 5.1 above have also confirmed these differences between male- and female-headed households. These results, however, hold when the fertiliser subsidy variable is not taken into account. Notwithstanding this, it was observed in Chapter 5 that regardless of gender, recipients of fertiliser subsidy coupons obtained higher maize yields and used more maize fertilisers and hybrid maize seed than non-recipient households did. Up to this point, it has not been shown how gender and receiving fertiliser subsidy coupons together impact on maize yields and input use.

This section, therefore, seeks to assess how input use and maize yields differed according to gender of household head, with and without receiving fertiliser subsidy coupons.

5.4.1 NPK use across the gender of household head with and without fertiliser subsidy coupon

Using the Kruskal-Wallis test, the study evaluated the hypothesis that median NPK use among the four household categories was the same. According to the results in Table 5.2 below, recipient male- and recipient female-headed households had similar NPK usage of 83.4 kg/ha, which was the highest. There was also enough evidence to conclude that the amount of NPK fertiliser used was statistically significantly different among the four household categories (X^2 (3) =256.8, p<0.05).

Table 5.2: Kruskal-Wallis test results on NPK use (kg/ha) among the four household categories, 2009/2010

NPK usage 2009/2010	RFHH	NRFHH	RMHH	NRMHH
Descriptive				
Mean (kg/ha)	97.2	33.5	108.4	56.7
Median (kg/ha)	83.4	0.0	83.4	62.3
N	194	162	557	531
Kruskal-Wallis test				
Mean rank	842.1	440.1	897.5	581.4
X^2 (df),p-value	256.8 (3), 0.000			

Source: Ministry of Agriculture and Food Security survey data, 2010.
R=recipient; F=female; HH=household; M=male. N=non and N=number of households in each category

Following the significant results obtained from the Kruskal-Wallis test shown in Table 5.2 above, a *post hoc* test using Mann-Whitney with Bonferroni correction was conducted. The results in Table 5.3 below show that non-recipient male-headed households used more NPK fertiliser (62.3 kg/ha) than non-recipient female-headed

households (0.0kg/ha). The difference was statistically significant at 5 % level of significance. The results were as expected, since fertiliser use in Malawi is higher in male-headed households than in female-headed households. This is attributable, among other factors, to lack of access to credit to procure inputs. It was also observed in the study that female-headed households have low incomes and household asset values.

Table 5.3: Mann-Whitney test for difference in NPK use (kg/ha) across the household categories, 2009/2010

NPK usage (kg/ha) for the 2009/2010 season			
Household categories	**Mann-Whitney U**	**Asymptotic sign, (2-tailed)**	**Median difference in NPK use**
RFHH+NRFHH	6,758	0.000**	83.4
RFHH+RMHH	49,487	0.078	0
RFHH+NRMHH	32,722	0.000**	21.1
RMHH+NRFHH	16,494	0.000**	83.4
RMHH+NRMHH	83,604	0.000**	21.1
NRMHH+NRFHH	34,848	0.000**	62.3

Source: Ministry of Agriculture and Food Security survey data, 2010.
** Significant at 0.05/6 = 0.0083. R=recipient; F=female; HH=household; M=male. N=non

However, female-headed households which had access to fertiliser through fertiliser subsidy coupons registered a median NPK use of 83.4 kg/ha, which was higher than the 62.3 kg/ha and 0.0 kg/ha for non-recipient male-headed households and non-recipient female-headed households, respectively. Taking into account the fertiliser subsidy coupons, the median change in NPK use was higher in female-headed households (83.4 kg/ha) than in male-headed households (21.1 kg/ha). A comparison between recipient male- and recipient female-headed households yielded insignificant results. This indicates that the fertiliser subsidy closed the NPK use gap that exists between male- and female-headed households.

5.4.2 Urea use across the gender of household head, with and without fertiliser subsidy coupons

A Kruskal-Wallis test, the results of which are presented in Table 5.4 below, revealed that urea use was similar (83.4 kg/ha) for recipient female- headed households and recipient male-headed households, and was the highest among the four household categories. The Chi-square value of (X^2 (3) =251.4, $p<0.05$) gave enough evidence to conclude that there was a statistically significant variation in the amount of urea fertiliser use among the four household categories.

Table 5.4: Kruskal-Wallis test on urea use (kg/ha) among the four household categories, 2009/2010

Urea usage (kg/ha) 2009/2010	RFHH	NRFHH	RMHH	NRMHH
Descriptive				
Mean (kg/ha)	94.3	27.8	106.3	60
Median (kg/ha)	83.3	0.0	83.3	27.8
N	194	162	557	531
Kruskal-Wallis test				
Mean rank	833.1	424.1	895.0	592.3
X^2 (df),p-value	251.4 (3), 0.000			

Source: Ministry of Agriculture and Food Security survey data, 2010.
R=recipient; F=female; HH=household; M=male. N=non and N=number of households in each category

Owing to the significant results of the Kruskal-Wallis test shown in Table 5.4 above, a follow-up Mann-Whitney test with a Bonferroni correction test was conducted. The *post hoc* results in Table 5.5 below show no statistically significant difference in urea use between the recipient male-headed households and recipient female-headed households, as they both had a median of 83.4 kg/ha.

Table 5.5: Mann-Whitney test for difference in urea use (kg/ha) among the household categories, 2009/2010

Urea use (kg/ha) for the 2009/2010 season			
Household categories	**Mann-Whitney U**	**Asymptotic sign, (2-tailed)**	**Median difference**
RFHH+NRFHH	6,721	0.000**	83.3
RFHH+RMHH	49,149	0.058	0
RFHH+NRMHH	34,172	0.000**	56.3
RMHH+NRFHH	15,785	0.000**	83.3
RMHH+NRMHH	86,038	0.000**	56.3
NRMHH+NRFHH	32,988	0.000**	27.8

Source: Ministry of Agriculture and Food Security survey data, 2010.
** Significant at 0.05/6 =0.0083. R=recipient; F=female; HH=household; M=male. N=non

However, recipient female-headed households had a higher median urea use of 83.3 kg/ha, compared with both non-recipient female (0.0 kg/ha) and non-recipient male (27.8 kg/ha) headed households. The differences were statistically significant at 5 % level.

As expected, median urea usage was statistically significantly higher among the non-recipient male-headed households (27.8 kg/ha) than the non-recipient female-headed households (0.0 kg/ha). Since male-headed households have, on average, more household income, it means that, without the fertiliser subsidy coupons, they can still afford some fertiliser at the market price, whereas the female-headed households cannot.

There was no statistically significant difference in use of urea between recipient female-headed households and recipient male-headed households. This could be an indication that fertiliser subsidy coupons had possibly narrowed down the urea usage gap between the two household categories.

5.4.3 Hybrid maize seed use across gender of household head, with and without fertiliser subsidy coupon

According to Table 5.6 below, there were similarities in hybrid maize seed use (6.6 kg/ha) between recipient male- and recipient female-headed households and this was also the highest amount among the four household categories. The Kruskal-Wallis test revealed that the differences in median hybrid maize seed use among the four household categories were statistically significant (X^2 (3) =217, p<0.05).

Table 5.6: Kruskal-Wallis test on hybrid maize seed usage (kg/ha) among the four household categories, 2009/2010

Maize hybrid seed (kg/ha) 2009/2010	RFHH	NRFHH	RMHH	NRMHH
Descriptive				
Mean	7.5	2.2	8.5	3.9
Median	6.6	0	6.6	2.2
N	194	162	557	531
Kruskal-Wallis test				
Mean rank	881.2	473	867.5	588.5
X^2 (df),p-value	217 (3), 0.000			

Source: Ministry of Agriculture and Food Security survey data, 2010.
R=recipient; F=female; HH=household; M=male. N=non and N=number of households in each category

Given the significant results shown in Table 5.6 above, a Mann-Whitney test was run to establish the pairs of household categories which were statistically different in the use of hybrid maize seed. According to Table 5.7 below, non-recipient male-headed households used 2.2 kg/ha of hybrid maize seed more than non-recipient female-headed households (0.0 kg/ha) and the difference was statistically significant at 5 per cent level of significance. This confirms empirical evidence that, without any intervention, male-headed households are more likely to use high yielding maize varieties than female-headed households.

Furthermore, recipient female-headed households used 6.6 kg/ha of hybrid maize seed more than non-recipient female-headed households (0.0 kg/ha) and non-recipient male-headed households (2.2 kg/ha). Among the recipients, the study showed that there were no statistically significant differences in hybrid maize seed use between female- and male-headed households. The substantial change in hybrid maize seed use among the female-headed households could be attributed to the fertiliser subsidy enabling female-headed households to access hybrid maize seed at a lower than market prices.

Table 5.7: Malawi: Mann-Whitney test for difference in hybrid maize seed use (kg/ha) between the household categories, 2009/2010

Urea use (kg/ha) for the 2009/2010 season		
Household categories	**Mann-Whitney U**	**Asymptotic sign, (2-tailed)**
RFHH+NRFHH	6,557.5	0.000**
RFHH+RMHH	52,759	0.624
RFHH+NRMHH	31,054	0.000**
RMHH+NRFHH	19,528.5	0.000**
RMHH+NRMHH	91,481	0.000**
NRMHH+NRFHH	37,229	0.000**

Source: Ministry of Agriculture and Food Security survey data, 2010.
** Significant at 0.05/6 =0.0083. R=recipient; F=female; HH=household; M=male. N=non

Where households are not in receipt of fertiliser subsidy coupons, the male-headed households use more inputs (fertilisers and hybrid maize seed) than female-headed households do. However, when fertiliser subsidy coupons are received, the difference in input use (both fertiliser and seed) between female- and male-headed households is not statistically significant. Lack of significant difference in input use between recipient male- and female-headed households could imply that the fertiliser subsidy has altered the input use gap that existed between these household categories.

Within the gender of household head category, and in a comparison of those with and without fertiliser subsidy coupons, female-headed households showed a bigger change in input use than in male-headed households. This suggests that the effect of fertiliser subsidy on input use was more pronounced on of female-headed-households than male-headed-households.

5.4.4 Maize yields across the gender of household head with and without fertiliser subsidy coupon

According to Table 5.8 below, median maize yields were higher for recipient male-headed households (2 000.7 kg/ha) compared with the other three household categories. A Kruskal-Wallis test shows that there was enough evidence to conclude that median maize yields across the four household categories were statistically significant (X^2 (3) =181.7, p<0.05).

Table 5.8: Kruskal-Wallis test results on variations in maize yields (kg/ha) among the four household categories, 2009/2010

Urea usage (kg/ha) 2009/2010	RFHH	NRFHH	RMHH	NRMHH
Descriptive				
Mean (kg/ha)	2,116.8	1,706.4	2,244.4	1,903.5
Median (kg/ha)	2,000	1,624.7	2,000.7	1,800
N	194	162	557	531
Kruskal-Wallis test				
Mean rank	823.8	464.9	869.4	610
X^2 (df),p-value	181.7 (3), 0.000			

Source: Ministry of Agriculture and Food Security survey data, 2010.
R=recipient; F=female; HH=household; M=male. N=non and N=number of households in each category

With the above results, a Mann-Whitney test was conducted to assess the pairs of households whose maize yields were statistically different from the other. The results in

Table 5.9 below show that there were no statistically significant differences in maize yields between recipient female- and recipient male-headed households.

Table 5.9: Mann-Whitney pairwise test results for difference in maize yields (kg/ha) between the household categories, 2009/2010

Maize yields in kg/ha for the 2009/2010 season			
Household categories	**Mann-Whitney U**	**Asymptotic sign, (2-tailed)**	**Median maize yields difference**
RFHH+NRFHH	7,553.5	0.000**	375
RFHH+RMHH	50,408.5	0.163	0.7
RFHH+NRMHH	177,625	0.000**	200
RMHH+NRFHH	19,516.5	0.000**	376
RMHH+NRMHH	32,719.5	0.000**	200.7
NRMHH+NRFHH	35,032.5	0.000**	175.3

Source: Ministry of Agriculture and Food Security survey data, 2010.
** Significant at 0.05/6 =0.0083. R=recipient; F=female; HH=household; M=male. N=non

On the other hand, recipient female-headed households obtained statistically significant higher median maize yields (2 000 kg/ha) than non-recipient male- (18 00kg/ha) and non-recipient female-headed (1 624.7 kg/ha) households. With respect to non-recipient male-headed households, it was a bit surprising that the recipient female-headed households produced significantly more than them. Perhaps women being the key cultivators of food crops like maize (World Bank, 2008:522), they might had a comparative advantage and coupled with improved access to inputs, which led to a greater yield increase

Owing to the vulnerable nature of female-headed households, non-recipient male-headed households produced statistically significant higher median maize yields (1 800 kg/ha) than non-recipient female-headed households (1 624.7 kg/ha). Unsurprisingly, recipient male-headed households obtained statistically significant high

(2 000.7 kg/ha) median maize yields than both non-recipient female and non-recipient male-headed households.

The non-parametric tests indicate that there is a relationship between gender of household head receiving a fertiliser subsidy coupon and the amount of maize produced. It is also evident that the fertiliser subsidy has more noticeable effects on both input usage and maize yields of female- than on male-headed households.

The descriptive analysis compared maize yields based on gender of the household head receiving fertiliser coupons alone, yet there other factors that affect maize yields. The study therefore performed a regression analysis to model the relationship between maize yields and gender of household receiving fertiliser coupons in the presence of other factors. The regression function used is described below:

$$Y = F\begin{pmatrix} income, NPK, urea, hybrid, local, rain, loshire, lkshore, high, dummyFNR, dummyMNR, \\ dummyFR, dummyMR \end{pmatrix}$$

Where the variables Y, income, urea, NPK, local, hybrid and rain are as described in Chapter 4. The model included four dummy variables representing the four household categories created according to gender of household head receiving fertiliser coupons.

DummyFNR represented non-recipient female-headed households, taking the value of 1, and 0 otherwise. DummyMNR represented non-recipient male-headed households, taking the value of 1, and 0 otherwise, and dummyFR represented recipient female-headed households, taking the value of 1, and 0 otherwise. DummyMR represented recipient male-headed households and was used as a reference group.

The adjusted R-square value in Table 5.10 below indicates that 37 per cent of the total variation in maize yields is explained by the model. Keeping all things equal, non-recipient male- and non-recipient female-headed households obtained about 142 kg/ha

and 243 kg/ha lower maize yields, respectively, than recipient male-headed households. These differences were statistically significant at 5 per cent level.

As expected, there was a bigger difference in maize yields between recipient male-headed households and non-recipient female-headed households than between recipient male- and non-recipient male-headed households. This was so because, generally, male-headed households tend to afford a minimum amount of inputs at market price to improve their production, whereas female-headed households cannot.

Table 5.10: Results of the linear regression analysis for maize yields (kg/ha), 2009/2010

Variable	Estimate	Std error
income	0.01***	0.023
lower shire	-283.5***	0.009
lakeshore	-216***	0.005
high altitude	-40.5	0.006
rainfall	0.16***	0.013
NPK	2.91***	0.026
urea	1.33***	0.056
hybrid	16.2*	0.125
local	13.68***	0.053
dummyFNR	-243***	0.007
dummyMNR	-141.75***	0.005
dummyFR	-60.75	0.007
hhasset	2.93**	0.023
constant	681.75*	0.053
R^2	0.378	
Adjusted R^2	0.372	
Prob >F	0	

*** Significant at 1 per cent ** significant at 5 per cent, * significant at 10 per cent, Dependent variable is maize quantity produced, normalised at 6 750 kg/ha. DummyMR as reference group

Surprisingly, recipient male-headed households produced maize yields that were not statistically significantly different from those of recipient female-headed households. It was expected that with the added benefit from receiving fertiliser subsidy, the recipient male-headed households would obtain statistically significantly greater maize yields than the previously disadvantaged recipient female-headed households. Probably, the recipient male-headed households' prior access to inputs resulted in a low contribution to total yield of additional cheap inputs brought by fertiliser subsidy (decreasing return to scale).

Alternatively, it means that, with no prior access to inputs, every additional input from the fertiliser subsidy which the recipient female-headed households applied resulted in increased output (increasing returns to scale), thereby closing up in the production gap.

Table 5.11 below presents the results of the same model as in Table 5.10 above, but with recipient female-headed households as the reference group for estimate 1, and non-recipient female-headed households as the reference group for estimate 2. This was done to make other comparisons which were not feasible under Table 5.10.

The findings show that recipient female-headed households produced 182 kg more maize per hectare than non-recipient female-headed households, and the difference was statistically significant at 5 per cent level. On the other hand, non-recipient male-headed households obtained 81 kg less in maize yields per hectare than recipient female-headed households, with the difference statistically significant at 10 per cent level of significance.

Non-recipient male-headed households, however, produced 94.5 kg more in maize yields per hectare than non-recipient female-headed households, and this was statistically significant at 5 per cent level of significance. These results represent the scenario for Malawi where production gaps exist between male- and female-headed households.

Table 5.11: Results of the linear regression analysis for maize yields (kg/ha), 2009/2010

Variable	Estimate 1	Estimate 2
income	0.01*** (0.023)	0.01*** (0.023)
lower shire	-283.5*** (0.009)	-283.5*** (0.009)
lake shore	-216*** (0.005)	-216 (0.005)
high altitude	-40.5 (0.006)	-40.6 (0.006)
rainfall	0.16*** (0.013)	0.16*** (0.013)
NPK	2.91*** (0.026)	2.91*** (0.026)
urea	1.33*** (0.056)	1.33*** (0.056)
hybrid	16.2* (0.125)	16.2* (0.125)
local	13.68*** (0.053)	13.68*** (0.053)
dummyFNR	**-182.25***** **(0.009)**	-
dummyMNR	**-81.0*** **(0.007)**	**94.5**** **(0.007)**
dummy MR	60.75 (0.007)	243 (0.007)
dummyFR	-	182.25
hhasset	2.93** (0.023)	2.93** (0.023)
R^2	0.378	
Adjusted R^2	0.372	
Prob>F	0	

*** Significant at 1 per cent, ** significant at 5 per cent, * significant at 10 per cent, Dependent variable is maize quantity produced, normalised at 6750 kg/ha. Figures in parentheses are standard errors.

The difference in maize yields between recipients and non-recipients was higher for females (182 kg/ha) than for males (141 kg/ha). Female-headed-households which received fertiliser coupons were able to obtain maize yields in excess of those of non-recipient male, and similar to those obtained by recipient male-headed households. These observations, therefore, imply that the fertiliser subsidy was more effective among female- than male-headed households. Lack of significant differences in maize yields between recipient male- and recipient female-headed households could also mean that the fertiliser subsidy also reduced the yield gap between male- and female-headed households.

5.5 SUMMARY

According to the results presented in this chapter, non-recipient male-headed households tend to produce higher maize yields than did non-recipient female-headed households. When both male- and female-headed households received fertiliser subsidy coupons, the difference in maize yields is not statistically significant. Furthermore, recipient female-headed households obtained more maize than non-recipient male-headed households, although this was only significant at 10 per cent level of significance.

It was also observed that the fertiliser subsidy was more effective among recipient female-headed households than recipient male-headed households. This was based on the fact that recipient female-headed households obtained maize yields that were similar to recipient male-headed households, who are assumed to have greater access to inputs, regardless of the fertiliser subsidy. In addition, the increase in yields among female-headed households was greater than those of male-headed households, when fertiliser subsidy coupons were taken into account. This is in accord with the FAO (2011) which stated that increasing access to agricultural inputs for women would increase yields on their farms.

As expected, usage of maize fertilisers and hybrid maize seed was higher among male-headed households than the female-headed households who did not receive fertiliser subsidy coupons. However, when the fertiliser subsidy was taken into account, the difference in input use between male- and female-headed households was not statistically significant. The results, therefore, reveal that the impact of the fertiliser subsidy varies with the gender of the household receiving the subsidy coupon. The fertiliser subsidy appears to have a higher impact on recipient female-headed households than on recipient male-headed households. The implications of these findings are further discussed in Chapter 7.

CHAPTER 6

PRO-POOR TARGETING OF THE FERTILISER SUBSIDY PROGRAMME

6.1 INTRODUCTION

As stated earlier, studies have revealed that wealthier farmers are the likely beneficiaries from fertiliser subsidy programmes. The Malawi subsidy programme is deemed pro-poor in that it targets poor households, which includes female-headed households.

Land ownership is also being used as one of the selection criteria for beneficiaries of the fertiliser subsidy programme, where smallholder farmers are the targets. The maize fertiliser subsidy coupons are intended for the purchase of urea and NPK fertilisers, sufficient for about 0.5 ha of land.

This chapter accordingly presents findings on whether the beneficiary targeting of the programme has been pro-poor. It further reports on the challenges experienced when targeting beneficiaries and distributing the inputs, as well as on the suggested solutions to curb these challenges.

6.2 METHODOLOGY

The study used gender of household head, household land holding size, household income, household size, and household asset value as indicators for household well-being to measure the extent to which the programme met its pro-poor targeting. Independent sample T-tests were used to statistically compare recipients and non-recipients of fertiliser coupons for the 2009/2010 growing season, based on certain household characteristics.

In addition, the study assessed the factors that are related to fertiliser coupon distribution. A logistic regression model was run where the fertiliser coupon was a dependent dummy variable with a value of 1 for a recipient and 0 otherwise. On the other hand, the study used frequencies and percentages to identify problems faced during the implementation of the fertiliser subsidy programme and their possible solutions.

6.3 TARGETING OF THE FERTILISER SUBSIDY COUPONS

The T-test results presented in Table 6.1 below indicate that recipient households had, on average, larger farms (1.49 ha) and more family members (6) than the non-recipient households (1.16 ha and 5 family members). These differences were statistically significant at 5 per cent level of significance.

Table 6.1: Distribution of fertiliser subsidy about some household characteristics, 2009/2010

Received coupon 2009/2010		Farm size (ha)	Household income (MK)	Household asset values (Mk)	Household size
No	**Mean**	**1.16**	**0.051**	**67950**	**5.08**
	Std. error	0.05	0.004	0.003	0.004
	N	693	693	693	693
Yes	**Mean**	**1.49**	**0.059**	**81540**	**5.58**
	Std. error	0.07	0.004	0.004	0.004
	N	751	751	751	751
All	**Mean**	**1.33**	**0.055**	**0.055**	**5.24**
	Std. error	0.041	0.003	0.003	0.003
T-test for difference		-4.11	-1.53	-1.90	-2.68
P-value		0.00	0.126	.058	0.007

Source: Ministry of Agriculture and Food Security survey data, 2010

In addition, recipient households had higher asset values than non-recipient households, and the difference was significant at 10 % level of significance. Having households with more family members receiving fertiliser coupons could be a significant observation, considering that demand for food is likely to be high in such households. With reference to farm size and asset values, there is evidence that most of the recipient households were better off than the non-recipients.

According to Table 6.2 below, 74.2 per cent of the households which received fertiliser coupons were male-headed and 25.8 per cent were female-headed households. Furthermore, 54.5 % of female-headed households received fertiliser subsidy coupons, while 45.5 % did not. Similarly, 51.2 % of the male-headed households received fertiliser subsidy coupons, compared to 48 % which did not. Although it appears that more female-headed households than male-headed households were likely to receive fertiliser subsidy coupons, the chi-square test yielded insignificant results at all levels.

Table 6.2: Allocation of fertiliser subsidy coupon by gender of household head, 2009/2010

Sex of household head			**Gender of household head**		**Total**
			Female	Male	
Received fertiliser coupon	No	**Count**	**162**	**531**	**693**
		Row %	23.4	76.6	100
		Column %	45.5	48.8	48
		Adjusted. residual	-.1.1	1.1	
	yes	**Count**	**194**	**557**	**751**
		Row %	25.8	74.2	100
		Column %	54.5	51.2	52
		Adjusted. residual	1.1	-1.1	
Total		Count	356	1088	1444
		Total %	100.0%	100.0%	100.0%
Chi-square test X^2(df), p-value		1.17(1). 0.279			

Source: Ministry of Agriculture and Food Security survey data, 2010.
*** Significant at 1%, ** significant at 5% and * significant at 10%

The Chi-square value of 1.17 was not statistically significant, at 5 per cent level, indicating no association between the gender of household head and receiving fertiliser subsidy coupons. This means that the gender of household head did not matter during the distribution of fertiliser subsidy coupons, or that both male- and female-headed households were likely to receive fertiliser subsidy coupons. This was contrary to the targeting criteria of the programme.

A further analysis of the factors associated with receiving fertiliser subsidy coupons was conducted using a logistic regression model, where the receiving of fertiliser subsidy coupons was the dependent variable. The results in Table 6.3 below indicate that for each unit increase in the household land size and number of people in a household, the odds of a household receiving fertiliser coupons increased by 1.16 and 2.9, respectively, and this was significant at 5 per cent level.

Table 6.3: Logistic regression for factors related to receiving fertiliser subsidy coupon, 2009/2010

Predictor	Wald statistic	P-value	Odds
Household land size	10.38	.001	1.157
Household total income	.051	.822	.869
Household asset values	.239	.625	1.354
Household size	5.347	.021	2.901
Gender of household head	1.745	.186	1.181
Constant	9.242	.002	.626

Source: Ministry of Agriculture and Food Security survey data, 2010.
Dependent variable 1 if received fertiliser subsidy coupon 0 otherwise, male-headed household was the base reference in gender of household head variable

Thus, households with large land holdings and those with more household members were more likely to receive fertiliser subsidy coupons than those with small land holdings and with fewer household members. Although the odds of receiving fertiliser subsidy coupons were also high for households headed by males and those with high asset values, the Wald statistic for both variables was not significant, at 5 per cent level

of significance. This suggests that gender of household head as a selection criterion was dominated by other equally important elements.

6.4 CHALLENGES RELATED TO THE IMPLEMENTATION OF THE FERTILISER SUBSIDY

Challenges in the implementation of the fertiliser subsidy programme would hinder the performance of the programme in meeting its objectives regarding the targeting of beneficiaries and increasing maize yields and incomes of the farmers. The identification of these problems, therefore, will help policy implementers to make informed decisions on the future of the programme in as far as meeting its objectives is concerned. From the results in Table.6.4 below, it will be seen that the most-cited problems were the low number of beneficiaries, thereby leaving out the needy (14 per cent), inadequate number of coupons (12 per cent), insufficient production inputs on the market (12 per cent), and delayed replenishment of stocks at the market (9 per cent).

Table 6.4: Implementation challenges of the 2009/2010 fertiliser subsidy programme in Malawi.

Problem	Frequency	Valid percentage (%)
Delayed replenishment of stock	4	9
Inadequate coupons	5	12
Fewer beneficiaries, leaving out the needy	6	14
Insufficient inputs on the market	5	12
Long distances to the markets	2	5
Early closure of markets	2	5
Lack of supervision	2	5
No challenge	17	39
Total	**43**	**100**

Source: Ministry of Agriculture and Food Security survey data, 2010

Respondents reported that many households were registered, but a few coupons were distributed which resulted into less number of beneficiaries. The implications of inadequate coupons and insufficient inputs at the market are that farmers obtained an incomplete package of inputs and hence inadequate amounts of inputs were applied. Only 39 per cent of the respondents indicated that they faced no challenges as regards the implementation of the programme.

Table 6.5 below shows that the majority (69.8 per cent) of the respondents were of the opinion that no malpractices regarding the issuing of coupons and selling of subsidised fertiliser occurred during the 2009/2010 fertiliser subsidy programme. However, for those who indicated that some form of malpractices took place, about 85 per cent cited the fact that sellers requested them to pay extra money in order to purchase the subsidised inputs. This, coupled with insufficient inputs at the market, explains why some of the farmers were still in possession of unredeemed coupons at the closure of the subsidised input markets.

Table 6.5: Observed malpractices in coupon distribution and selling of the 2009/2010 subsidised fertiliser in Malawi.

Malpractice	**Frequency**	**Percentage (%)**
No malpractice	30	69.8
Malpractices observed	13	30.2
Total	**43**	**100**
Type of malpractice		
Coupon selling	1	7.7
paying extra money above the subsidised cost of inputs	11	85.6
Re-selling subsidised inputs	1	7.7
Total	**13**	**100**

Source: Ministry of Agriculture and Food Security survey data, 2010.

Since poor farmers find it hard to purchase fertiliser, even at subsidised prices (Dorward, 2009:6; and USAID, 2005:4), asking them to pay extra money could have been a hindrance to them.

According to Table 6.6 below, the community felt that increasing the number of beneficiaries (69 per cent), timely implementation of the programme (12 per cent), and frequent supervision (7 per cent) would help to resolve some of the challenges and curb malpractices in the programme. However, some of these suggestions should be taken with caution since they have a bearing on the cost of the programme which is already huge.

Table 6.6: Suggested solutions to the problems and malpractices cited in Tables 6.4 and 6.5, 2009/2010

Solution	Frequency	Percentage (%)
Increase number of beneficiaries	30	69
Timely implementation of the programme	5	12
Frequent supervision	3	7
Increase number of coupons	5	12
Total	**43**	**100**

Source: Ministry of Agriculture and Food Security survey data, 2010.

6.5 SUMMARY

From the analysis above, there was not enough evidence of an association between receiving fertiliser subsidy coupons and the gender of household head. This was further corroborated by the logistic regression where it was observed that the gender of household head did not have an impact on the likelihood of receiving a fertiliser subsidy coupon. Both the T-test and the logistic regression showed that household size and farm size significantly affected the distribution of fertiliser coupon.

Households with more members and those with larger farms were more likely to receive fertiliser subsidy coupons. Based on land size, it can be concluded that recipients of fertiliser subsidy coupon were better off than the non-recipients. Although Makoka (2008) reported that poor households tend to have large families, this was not established in this study. The data used in this analysis did not specify the family composition in terms of adults and children. Knowledge of the number dependants and the economically active members in a household can have implications on the poverty status of the household.

It is worth noting that both male and female headed households could be poor but empirical evidence has shown that female headed households tend to be poorer. The expectation of this analysis was therefore that poor households (low asset values, low income, small farm holders and female-headed households) would be the likely beneficiaries of the programme. The fact that there were no statistically significant results concerning these aspects casts doubt on the ability of the programme in meeting its pro-poor objective.

While most of the respondents recommended an increase in the number of beneficiaries, what might be needed is re-targeting so that more of the effectively disadvantaged, i.e. female-headed households benefit. The next chapter provides a conclusion to the study and draws recommendations, as well as highlighting areas for further study.

CHAPTER 7

SUMMARY, CONCLUSION AND RECOMMENDATIONS

7.1 INTRODUCTION

The study determined the effect of the 2009/2010 fertiliser subsidy programme on Malawi's maize yields and how these effects varied with the gender of household head. It further assessed whether or not the targeting of the programme has been pro-poor and identified its implementation challenges. This chapter gives a brief summary of the study, conclusions, and recommendations for policy changes and gives suggestions for future studies.

7.2 APPROACH FOLLOWED

The analysis used survey data collected by the Ministry of Agriculture and Food Security for the evaluation of the 2009/2010 fertiliser subsidy programme. A sample of 1 444 households (751 recipients and 693 non-recipients) was interviewed using a structured questionnaire. Information from key informants' discussions was also analysed to obtain insights into implementation challenges faced by the programme.

Descriptive and econometric analyses were carried out with SPSS to compare maize yields of recipient and non-recipient households, as well as that of male- and female-headed households. By comparing maize yields across the agro-ecological zones, the study also sought to capture the climate effects on production.

The study also assessed fertiliser subsidy coupon distribution according to household characteristics, such as land holding size, family size, household income, asset values and gender of household head, using T-tests to ascertain the pro-poor effects. Based on the above-cited household characteristics, the survey predicted the likelihood of a

household receiving fertiliser subsidy coupon by using logistic regression. It further identified challenges facing the implementation of the programme and their possible solutions.

7.3 SUMMARY OF THE STUDY

Malawi depends on agriculture for economic growth, yet agricultural production has remained low, owing to low input use, among other things, since the withdrawal of state intervention in the sector. However, beginning in 2005/2006, the government started implementing the fertiliser subsidy programme, which has seen smallholder maize output and household food security increasing. Whether this surplus production has been due to the fertiliser subsidy programme or favourable weather conditions is subject to debate. The study was, therefore, based on the assumption, among others, that the fertiliser subsidy has had a positive effect on maize yields.

The study sought to evaluate whether the gender of the household head influences the effects of the programme on maize yields. In addition, it endeavoured to examine whether the beneficiaries of the programme were the poor and vulnerable households, as intended by its objective. It was expected that female-headed households which are poorer than male-headed households will constitute a large proportion of the beneficiaries.

7.4 CONCLUSIONS

7.4.1 Conclusion regarding the effect of fertiliser subsidy on maize yields

The findings showed that households which received fertiliser coupons produced higher maize yields than those which did not receive fertiliser coupons. Both regression and Mann-Whitney tests showed a positive coefficient of 155 kg/ha and higher median

maize yields of 2 211.3 kg/ha for recipient households, respectively, than the median maize yields of 1 857.5 kg/ha for non-recipient households (Table 7.1 below).
Regardless of the fertiliser subsidy, the medium altitude zone, which has more favourable climatic conditions for maize production, registered higher maize yields of 2 095.2 kg/ha than the lakeshore (2 018.9 kg/ha) and lower shire zones (1 703 kg/ha). No statistical differences in yield were observed between the medium (2 095.2 kg/ha) and high altitude zones (2 070.9 kg/ha). This may well suggest the need to target the more efficient zones for positive and significant gains from the fertiliser subsidy.

As much as maize yields varied with agro-ecological zone, indicating the importance of climate in production, it was noted that within each zone recipients of fertiliser subsidy coupons produced more maize than non-recipients. For instance, the lower shire zone has less favourable conditions for maize, yet the recipient households still produced median maize yields of 2 000 kg/ha, which is higher than non-recipient households (1 250.1 kg/ha).

Similarly, recipient households in the medium altitude, lakeshore and high altitude zones registered higher median maize yields of 2 000 kg/ha each, higher than those of non-recipients households, being 1 800.2 kg/ha, 1 750.3 kg/ha and 1 741.5 kg/ha, respectively. This indicates the dominant effect of the fertiliser subsidy, even in less favourable climatic conditions (Table 7.1 below).

Table 7.1: Summary of maize yields (kg/ha) between recipients and non-recipient with and without regard to variations in AEZs, 2009/2010

Table number		Maize yields (kg/ha)		
		Recipients	Non-recipient	H_0:No difference[1]
4.1 (T-test for mean)		2,211.3	1,857.5	Not accepted
4.5 (regression analysis)		155.3 (more)	-155.3 (less)	Not accepted
4.6 (Mann-Whitney test for median)	Lower shire	2,000	1,250.1	Not accepted
	Lakeshore	2,000	1,750.3	Not accepted
	Medium alt.	2,000	1,800.2	Not accepted
	High altitude	2,000	1,741.5	Not accepted

7.4.2 Conclusion regarding the influence of gender on the fertiliser subsidy's effect on maize yields

The study found that, irrespective of receiving fertiliser subsidy coupons, male-headed households produced a higher average yield of maize (2 078.5 kg/ha) than that of female-headed households (1 929 kg/ha) (Table 7.2 below). This was not surprising since male-headed households tend to have more access to agricultural inputs than female-headed households do.

However, when female-headed households received fertiliser subsidy coupons, their maize yields were similar to those of recipient male-headed households (2 000 kg/ha and 2 000.7 kg/ha, respectively) and more than that of non-recipient male-headed households (1 800 kg/ha). This entails that the fertiliser subsidy led to an increase in yield of female-headed households, thereby closing the yield gap between them and the recipient male-headed households to an insignificant level (Table 7.2 below).

Furthermore, the difference in maize yields between recipient and non-recipient female-headed households was larger (182.3 kg/ha) than that between recipient and non-recipient male-headed households (141 kg/ha). This indicates a much bigger response

[1] H_0: No difference in the mean/median maize yields. H_0 not accepted if $p < 0.05$ for regression, Kruskal-Wallis and T-tests, and when the Bonferroni adjustment value is larger than the Mann-Whitney test statistic.

to the fertiliser subsidy among female-headed households than among male-headed households when fertiliser subsidy coupons are received. The differences in input use between male- and female-headed households, with and without the fertiliser subsidy, were also demonstrated in the study (Table 7.2 below).

Table 7.2: Summary of maize yields (kg/ha) between male and female-headed households with and without fertiliser subsidy coupon, 2009/2010

Table number	Maize yields (kg/ha) between male and female-headed households				
	Male-headed		Female-headed		H_0:No difference[2]
5.1 (T-test for mean)	2,078.3		1,929		Not accepted
	RFHH	NRFHH	RMHH	NRMHH	
5.8 (Kruskal-Wallis test for median yield)	2,000	1,624.7	2,000.7	1,800	Not accepted
5.9 (Mann-Whitney test for median)	2,000	1,624.7			Not accepted
	2,000		2,000.7		Accepted
	2,000			1,800	Not accepted
		1,624.7	2,000.7		Not Accepted
			2,000.7	1,800	Not Accepted
		1624.7		1,800	Not Accepted
5.10 & 5.11 (regression analysis)	Ref	182.3(less)			Not accepted
	Ref			81(less)	Not Accepted
	Ref		60.8(more)		Accepted
	-	243(less)	Ref		Not Accepted
	-		Ref	141(less)	Not accepted
	-	Ref		94.5(more)	Not Accepted

Among the non-recipient households, median uses of NPK, urea and hybrid maize seed were higher for male-headed households (62.3 kg/ha, 27.8 kg/ha and 2.2 kg/ha, respectively) than female-headed households, which registered a zero median use of

[2] H_0: No difference in the mean/median maize yields. H_0 not accepted if $p< 0.05$ for regression, Kruskal-Wallis and T-tests, and when the Bonferroni adjustment value is larger than the Mann-Whitney test statistic. R=recipient; F=female; HH=household; M=male. N=non, Ref is reference group.

each of these improved inputs. However, when fertiliser subsidy coupons were taken into account, the use of these inputs among recipient female-headed households was almost similar to that of recipient male-headed households (Table 7.3 below). It is, therefore, likely that the fertiliser subsidy improved the recipient female-headed households' access to inputs, which in turn increased their maize yields.

Table 7.3: Summary of urea, NPK and hybrid maize seed use (kg/ha) between male and female-headed households with and without fertiliser subsidy coupon, 2009/2010

Table number	NPK, urea and hybrid maize seed use(kg/ha)				
	RFHH	NRFHH	RMHH	NRMHH	H_0:No difference[3]
5.3 (Mann-Whitney test for median NPK use)	83.4	0.0			Not accepted
	83.4		83.4		Accepted
	83.4			62.3	Not accepted
		0.0	83.4		Not Accepted
			83.4	62.3	Not Accepted
		0.0		62.3	Not Accepted
5.5 (Mann-Whitney test for median urea use)	83.3	0.0			Not accepted
	83.3		83.3		Accepted
	83.3			27.8	Not Accepted
		0.0	83.3		Not Accepted
			83.3	27.8	Not accepted
		0.0		27.8	Not Accepted
5.7 (Mann-Whitney test for median hybrid maize seed use)	6.6	0.0			Not accepted
	6.6		6.6		Accepted
	6.6			2.2	Not Accepted
		0.0	6.6		Not Accepted
			6.6	2.2	Not accepted
		0.0		2.2	Not Accepted

Another possible explanation could be that recipient female-headed households used the subsidised inputs more efficient than recipient male-headed households, which have

[3] H_0: No difference in the median urea, NPK and hybrid maize seed use. H_0 not accepted if the Bonferroni adjustment value is larger than the Mann-Whitney test statistic. R=recipient; F=female; HH=household; M=male. N=non,

a prior advantage in accessing inputs. This therefore implies that targeting more female-headed households is worthwhile.

7.4.3 Conclusion regarding the pro-poor nature of the fertiliser subsidy and the implementation challenges of the programme

Findings of the study revealed that 74.2 % of the recipients of fertiliser subsidy coupons were male-headed households, while 25.8 % were female-headed households. However, there was no association between the gender of household head and the receiving of fertiliser subsidy coupons (Table 7.4 below). Yet, according to the programme's objectives, it was expected that female-headed households would constitute a greater proportion of the beneficiaries.

Table 7.4: Fertiliser subsidy targeting between recipients and non-recipients based on certain biographic and economic indicators, 2009/2010

Table number	Fertiliser subsidy coupon targeting				
	Variable	Recipients	Non-recipient	H_0:No difference[4]/equal probability	Affect/not affect
6.1 (T-test for mean)	Farm size	1.49	1.16	Not accepted	Affect
	Household income (MK)	0.059	0.051	Accepted	Not affect
	Asset values (MK)	81,540	67,950	Not accepted	Affect
	Household size	6	5	Not accepted	Affect
6.2 (Chi-square test)	Male-headed	74.2%	76.6%	Accepted	Not affect
	Female-headed	25.8%	23.4%	Accepted	Not affect
6.3 Logistic regression	Farm size	1.157		Not accepted	Affect
	Household income (MK)	0.869		Accepted	Not affect
	Asset values (MK)	1.354		Accepted	Not affect
	Household size	2.901		Not accepted	Affect
	Male-headed households	1.181		Accepted	Not affect

[4] H_0: No difference in the means/expected and observed counts or in the odds of receiving fertiliser subsidy coupon. H_0 not accepted if $p < 0.05$

The T-test showed that recipients of fertiliser subsidy coupons owned land parcels 0.33 hectares larger than non-recipient households (1.49 ha and1.16 ha, respectively). In addition, households which received fertiliser coupons had higher average asset values (MK81 540) than those which did not receive the coupons (MK67 950), although it was significant at 10 % level. Recipient households also had a higher average household size (6 people per household), than did non-recipient households (5 people per household) (See Table 7.4 above).

Based on the logistic regression analysis, household size and farm size affect the probability of receiving fertiliser coupons. Households with more land and more family members were more likely to receive fertiliser subsidy coupons, with odds of 1.157 and 2.901, respectively. However, gender, income and asset values did not have any effect (Table 7.4 above). This implies that households were equally likely to receive fertiliser subsidy coupons, regardless of the gender of household head, their asset values and income. These observations have policy implications, considering that the programme targets poor households, including female-headed households. Moreover, female-headed households have proved to be more efficient than male-headed households with regard to the fertiliser subsidy.

7.4.4 Conclusion on the hypotheses of the study

The results in Chapter 4 and Table 7.5 below show a positive impact of the fertiliser subsidy on maize yield. The T-test indicates that recipient households obtained a higher mean maize yield than non-recipient households, and the difference was statistically significant. Even when differences in agro-ecological zones were taken into consideration, recipient households performed better than non-recipient households in all the zones. The econometric analysis also showed that recipient households produced higher maize yields than non-recipient, holding other factors constant. The hypothesis that the fertiliser subsidy has a positive effect on maize yield could, therefore, not be rejected.

According to the T-test, male-headed households obtained higher mean maize yields than female-headed households, regardless of the fertiliser subsidy. More so, among the non-recipient households, male-headed households had higher median maize yields than female-headed households. Furthermore, the Mann-Whitney test revealed that, without fertiliser subsidy coupons, female-headed households used less improved inputs and this could possibly be the cause for differences in yields.

However, when fertiliser subsidy coupons were taken into account, both input use and maize yields of recipient female-headed households increased. Maize yields and input use differences between male- and female-headed households became insignificant when fertiliser subsidy coupons were accounted for.

With these observations, the null hypothesis that the fertiliser subsidy has improved female-headed households' maize yields could not be rejected. The acceptance of the hypothesis put into consideration the point that it was not known how these recipient female-headed households performed before the subsidy. Nonetheless, based on the performance of their non-recipient counterparts and the fact that female-headed households, which received the fertiliser subsidy coupon have poor access to inputs, which results in poor yields, the hypothesis holds.

Table 7.5: Summary of tests used to investigate the hypotheses of the study, 2009/2010

H_0: Null hypothesis	Test applied	Test for	Hypothesis not rejected/rejected	Table & Page Number
Fertiliser subsidy has positive effect on maize yield	T-test	Difference in mean maize yields between recipient and non-recipient households	Not rejected	4.1 page 45
	Linear regression	Relationship between receiving fertiliser subsidy coupon and maize yield	Not rejected	4.5 page 50
	Mann-Whitney	Difference in median maize yield between recipients and non-recipients within the same AEZ	Not rejected	4.6 page 52
Fertiliser subsidy programme targeted the intended (poor) beneficiaries thereby advancing its pro-poor objective.	T-test	Difference in mean land holding size, income, asset values and family size between recipient and non-recipient households	Rejected	5.1 page 56
	Chi-square	Test for association between receiving fertiliser subsidy coupon and gender of household head	Rejected	5.9 page 65
	Logistic regression	Predict odds of receiving fertiliser subsidy coupon given household asset values, land holding size, income and family size	Rejected	5.10&5.11 pages 67 &69
Fertiliser subsidy has improved female-headed households' maize yield by reducing the yield gap between them and the male-headed households	T-test	Difference in mean maize yields between male and female-headed households	Not rejected	6.1 page 73
	Mann-Whitney	Pairwise differences in median maize yields among the four households categories based on gender and receiving fertiliser subsidy coupon	Not rejected	6.2 page 74
	Linear regression	Relationship between maize yield and gender of household head receiving fertiliser coupon	Not rejected	6.3 page 75

***Hypothesis 1*:** The fertiliser subsidy has a positive effect on maize yields.
***Hypothesis 2*:** The fertiliser subsidy programme targeted the intended (poor) beneficiaries thereby advancing its pro-poor objective.
Hypothesis 3: The fertiliser subsidy has improved female-headed households' maize yield by reducing the yield gap between them and the male-headed households.

The Chi-square test revealed a lack of association between receiving the fertiliser subsidy and the gender of the household head. That is, both female- and male-headed households were equally likely to benefit from the programme. It was also revealed by the T-test, and further echoed by the logistic regression analysis, that households with large land holdings and family sizes were likely to benefit from the programme. Based on income, asset values and gender of household head, the chances of receiving fertiliser subsidy coupons were the same. These observations, therefore, led to the rejection of the null hypothesis that the fertiliser subsidy programme targeted the intended poor households, which include female-headed households.

The study has shown that the fertiliser subsidy has a positive impact on maize yields, regardless of the differences in agro-ecological zones. This effect is more pronounced among the female-headed households, who are inferred to be poorer than male-headed households. However, the targeting of the programme has not been pro-poor which is contrary to its objective. This, therefore, is likely to affect the overall impact of the programme, which is aimed at improving food security and raising incomes of the poor.

The failure to target the intended households could be attributed to implementation challenges such as:

- Corruption where households were asked to pay extra money in order to be included in the list of beneficiaries, as well as to purchase the subsidised inputs.
- Insufficient numbers of fertiliser subsidy coupons, which resulted in a reduction in the overall number of registered beneficiaries, with most of those left out being the needy.
- Lack of proper supervision during identification, registration and distribution of fertiliser subsidy coupons, which gives room for certain malpractices.

The communities recommended, among other things, an increase in the total number of beneficiaries to ensure that most poor households are included and frequent supervision to curb malpractices in the programme.

7.5 RECOMMENDATIONS

7.5.1 Recommendations for government and policy-makers

The study has made a number of recommendations based on gender and poverty impacts of the fertiliser subsidy on maize yields. The fertiliser subsidy had a significantly positive effect on maize yields. Although maize yields varied according to agro-ecological zone, with the lower shire being the worst-performing zone, in each zone recipient households still performed well. In this regard:

It is recommended that in the short-term the fertiliser subsidy be sustained as it has proved to be worthwhile. Since other agro-economic zones tend to be more suitable for maize than others, there is need to reconsider distributing fertiliser subsidy coupons for maize fertiliser and seed in these areas and find alternative food crops suitable for the other zones to subsidise.

Some beneficiaries gain more from the fertiliser subsidy than others do.

It is recommended that the government should endeavour to revise the selection criteria so that more vulnerable female-headed households, who have proved to be better users of the subsidised fertilisers, obtain fertiliser subsidy coupons.

However, to avoid over dependence on this programme by farmers and considering its cost implications, there is need start to developing an exit plan from this programme so the farmers can stand on their own feet

Corruption, right from beneficiary identification up to purchase of inputs, constrains the current subsidy programme, as does the untimely replenishing of stocks, and the long travelling distances to markets, among others.

It is recommended that proper monitoring and supervision of the programme be improved to ensure timely replenishing of stocks and the control of malpractices. Opening up markets in close vicinity to the beneficiaries will also help women in accessing the inputs easily, since they are mostly faced with transport problems.

7.5.2 Recommendations for further research

The quality (use of recall data) and the scope of the data used were not exactly according to the design of this study and this might have affected the validity of the results, to some extent. This is largely attributable to the fact that the intervention and the control groups were identified after data had been collected and this had implications for having on average similar comparison groups. Furthermore, the grouping of households into zones after data collection led to some zones having fewer respondents than others, hence the use of non-parametric tests.

In order to increase the validity of the survey results, it is *recommended* that a similar study be conducted, where data for maize yields for the beneficiaries and non-beneficiaries of the fertiliser subsidy will be collected for a period longer than one year. This will help to make better comparisons on their performance, since being based on one year's data; it is not known how they performed before or during the first years of the fertiliser subsidy programme.

This study should also take into account similar characteristics of both beneficiaries and non-beneficiaries at the design stage. Disaggregating households into agro-ecological zones at the design stage of the study will ensure that each zone is equally represented and that fair comparisons are made. Observing the households for a longer period will help avoid reliance on recalled data. It would also be interesting to conduct a cost-benefit analysis to assess how high the yields of the recipient households are and at what price and also the impact of the programme on the non-recipient. A stratified sample taking into consideration the geography, gender and poor farmers of Malawi is necessary.

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